

# LORE

Capturing  
Traditional  
Environmental  
Knowledge



Edited by  
Martha  
Johnson

*LORE*

*Capturing Traditional Environmental Knowledge*



Our culture is something that surrounds us, something that is part of us, and is inextricably linked with the land upon which we have lived for thousands of years. Our culture has a past, and it is that past – especially as we find it embodied in our elders – that we are pledged to preserve. It also has a present – a present that threatens our culture, which we are pledged to protect. Our culture lives, and must have a future. We are pledged to promote our culture, especially among our young people, to ensure that they will identify themselves as Dene, in the full meaning of the term. The mission of the Dene Cultural Institute is to work with the people of the Dene Nation, and with other institutions and organizations, to preserve, protect, and promote the Dene culture, languages, spirituality, heritage, traditions, and customs.



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# **LORE**

*Capturing Traditional Environmental Knowledge*

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Martha Johnson

DENE CULTURAL INSTITUTE



INTERNATIONAL DEVELOPMENT RESEARCH CENTRE

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Johnson, M.

Dene Cultural Institute, Hay River, NWT, CA

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## Foreword

In recent years, the value of the traditional knowledge of indigenous peoples, and particularly their traditional environmental knowledge, has been recognized. This has unleashed a flood of research. Some of the research has been undertaken by scientists working alone, but the most innovative responses to this trend have been developed by indigenous researchers working in collaboration with Western scientists. They recognized early on that the main objective was not simply to collect reels of audio or video tape as a form of folklore, but to catalogue this information so that it could be compared from one region and one culture to other regions and other cultures, and, even more, so that it could be brought to bear on policies for sustainable development in remote and typically fragile ecosystems.

This book presents the results of a workshop on the documentation and application of traditional environmental knowledge through community-based research. Organized and hosted by the Dene Cultural Institute (DCI) based in Fort Hay, Northwest Territories, Canada, and supported by Canada's International Development Research Centre (IDRC), the workshop brought together a small number of teams, each composed of indigenous and nonindigenous researchers from Northern Canada, Europe, Africa, Southeast Asia, the South Pacific, and South America. Their primary goal was to discuss effective methods for documenting the unique

environmental knowledge and understanding that characterizes the heritage of all indigenous peoples around the world.

In many ways, the workshop was unique. It represented an important initiative on the part of a Canadian aboriginal organization (DCI) and a Canadian development agency (IDRC) working together toward a common goal. The workshop was held in a traditional Dene camp along the shores of the Deh Cho (Mackenzie River) in the Canadian North. Participants flew to Canada from around the globe. Upon arrival in Canada, they faced another extended flight to Yellowknife in the Northwest Territories. From there, they were taken by bush plane and boat to the Dene camp. Daily life and workshop sessions took place in tents, which both represented typical living conditions during actual collection of indigenous knowledge and, unhappily but typically for the North, provided protection from the cold and rainy summer weather.

This book examines the process of collecting traditional environmental knowledge while using a participatory action or community-based approach. It looks at the problems associated with documenting traditional knowledge problems that are shared by researchers around the world and it explores some of the means by which traditional knowledge can be integrated with Western science to improve methods of natural resource management.

We hope that this book will assist others to develop effective, culturally appropriate research methods at a time when alternative understandings and approaches to sustainable development are increasingly critical to the survival of our planet.

**Joanne Barnaby**  
*Executive Director*  
*Dene Cultural Institute*

**David B. Brooks**  
*Director*  
*Environment and Technology Program*  
*International Development Research Centre*

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Martha Johnson

*Research Director*

*Dene Cultural Institute*

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# ***Research on Traditional Environmental Knowledge: Its Development and Its Role***

*By Martha Johnson, Dene Cultural Institute,  
Yellowknife, NWT, Canada.*

## ***What is Traditional Environmental Knowledge?***

For thousands of years, aboriginal peoples around the world have used knowledge of their local environment to sustain themselves and to maintain their cultural identity. Only in the past decade, however, has this knowledge been recognized by the Western scientific community as a valuable source of ecological information. Today, a growing body of literature attests not only to the presence of a vast reservoir of information regarding plant and animal behaviour but also to the existence of effective indigenous strategies for ensuring the sustainable use of local natural resources.

This knowledge is variously labeled as folk ecology, ethno-ecology, traditional environmental or ecological knowledge, indigenous knowledge, customary law, and knowledge of the land. Traditional environmental or ecological knowledge is probably the most common term; however, there remains no universally accepted definition of the concept. As a field of study, traditional environmental knowledge is much more comprehensive than either conventional anthropology or ecology. Berkes (1992) points out that the use of the term traditional is ambiguous and raises questions regarding the cultural dynamics of such knowledge systems.

In the dictionary sense, traditional usually refers to cultural continuity transmitted in the form of social attitudes, beliefs, principles and conventions of behaviour and practice derived from historical experience. However, societies change through time, constantly adopting new practices and technologies, making it difficult to define just how much and what kind of change would affect the labelling of a practice as traditional.

For this reason, some scholars prefer the term indigenous ecological knowledge. This helps avoid the debate about tradition and explicitly emphasizes indigenous people. However, similar knowledge is found among nonindigenous groups such as outport fishermen and farmers. These groups have also acquired their knowledge and skills through hands-on experience living in close contact with their environment

Traditional environmental knowledge, or TEK, can generally be defined as a body of knowledge built up by a group of people through generations of living in close contact with nature. It includes a system of classification, a set of empirical observations about the local environment, and a system of self-management that governs resource use. The quantity and quality of traditional environmental knowledge varies among community members, depending upon gender, age, social status, intellectual capability, and profession (hunter, spiritual leader, healer, etc.). With its roots firmly in the past, traditional environmental knowledge is both cumulative and dynamic, building upon the experience of earlier generations and adapting to the new technological and socioeconomic changes of the present.

### ***The History of TEK Research***

The systematic investigation of traditional environmental knowledge began with a series of studies on the terminologies that people of different cultures use to classify objects in their natural and social environments. These early studies by anthropologists and natural scientists revealed that all cultures recognize natural classes of animals and plants, and that traditional cultures are as concerned with classifying their world as are Western scientists (Bulmer 1970;

Berlin 1973; Hunn 1975). Much of this knowledge appeared to be clearly esoteric: many of the named species served no obvious useful purpose. Also, there was often a close correspondence between scientific taxa and the categories of plants and animals established by aboriginal peoples (Snyder 1957; Irving 1960; Diamond 1966; Bulmer 1970; Berlin 1973; Hunn 1975; Johnson 1987).

Early studies by anthropologists and natural scientists also recorded indigenous knowledge of plant and animal behaviour. Local interpretations of natural phenomena were often at odds with scientific explanations (possibly rooted in a spiritual ideology); nevertheless, they revealed a wealth of underlying empirical knowledge (Feit 1973, 1986, 1988; Nelson 1983; Berkes 1988; Jones and Konner 1989; Nakashima 1990).

Concurrent with these early studies was a rising political pressure to recognize the rights of aboriginal peoples and a growing environmental movement searching for alternative approaches to Western science and technology. This changing social and political climate resulted in a shift away from theoretical studies to more applied research. Recent emphasis has been on understanding the ecologically sound practices that contribute to sustainable resource use among indigenous peoples and ways that this knowledge can be successfully integrated with the scientific resource management of the West (Brody 1981; Berkes 1988; Feit 1988; Gunn et al. 1988; Johannes et al. 1991).

Traditional environmental knowledge gained international recognition through such documents as the *World Conservation Strategy* (OUCN et al. 1980) and *Our Common Future* (WCED 1987). Both reports emphasized the need to use directly the environmental expertise of local people in managing natural resources. They stressed that sustainable management of natural resources could only be achieved by developing a science based on the priorities of local people and creating a technological base that blends both traditional and modern approaches to solving problems.

Increased appreciation of TEK has produced a burgeoning field of research. At the forefront of this research are aboriginal peoples.

They are demanding primary involvement in the direction of TEK research. Participatory community or action research has become the accepted approach in studying traditional environmental knowledge. In such an approach, the host aboriginal community participates directly in designing and implementing the project, community members are trained in research methods and administration, and the community retains control over the research results.

### ***Comparing TEK and Western Science***

Traditional environmental knowledge is generated, recorded, and transmitted differently than Western scientific knowledge. The following list, compiled and adapted from several works on the subject (such as Usher 1986; Osherenko 1988; Johnson and Ruttan 1991; Berkes 1992; Wolfe et al. 1992), outlines some of these differences. These statements are generalizations. The different modes of thinking, transmitting, and expressing knowledge are not mutually exclusive for either system. Dominance of one mode within a cultural group does not prevent many individuals in that same group from being highly functional in another mode. Social change is occurring within Western society and among aboriginal cultures such that new values and ways of thinking are emerging for both.

- TEK is recorded and transmitted through oral tradition (often through stories); Western science employs the written word.
- TEK is learned through observation and hands-on experience; Western science is taught and learned in a situation usually abstracted from the applied context.
- TEK is based on the understanding that the elements of matter (earth, air, fire, and water), which are classified as inanimate, also have a life force. All parts of the natural world – plant, animal, and inanimate element – are therefore infused with spirit.
- TEK does not view human life as superior to other animate and inanimate elements: all life-forms have kinship and are interdependent. Unlike Western science, humans are not given

the inherent right to control and exploit nature for their own interests at the expense of other life-forms.

- TEK is holistic; Western science is reductionist. Western science deliberately breaks down data into smaller elements to understand whole and complex phenomena. For TEK, all elements of matter are viewed as interconnected and cannot be understood in isolation.
- TEK is intuitive in its mode of thinking; Western science is analytical. Intuitive thought emphasizes emotional involvement and subjective certainty of understanding. Analytical thought emphasizes abstract reasoning and the need to separate oneself from that being observed and to learn about it through various replicable measurements.
- TEK is mainly qualitative; Western science is mainly quantitative. In TEK, detailed qualitative knowledge about wildlife is gained through ongoing intimate contact with the resource. Aboriginal harvesters are more concerned with trends, such as whether a population is increasing or decreasing, than with actual numbers. The indigenous system makes population predictions based on detailed behavioural observations and the principle of harvesting at a level in accordance with individual and community needs. Western scientists gather quantitative information to build mathematical models of population dynamics. The models are then used to calculate sustainable yields for the resource. The yields are then recommended for implementation to decision-makers as wildlife harvest regulations.
- TEK is based on data generated by resource users. As such, it is more inclusive than Western science, which is collected by a specialized group of researchers who tend to be more selective and deliberate in the accumulation of facts.
- TEK is based on diachronic data (long time series of information on one locality); Western science is largely based on synchronic data (short time series over a large area).

- TEK is rooted in a social context that sees the world in terms of social and spiritual relations between all life-forms. Relations are based on reciprocity and obligations toward both community members and other life-forms and communal resource-management institutions are based on shared knowledge and meaning. Western science is hierarchically organized and vertically compartmentalized. Managers become distinct from harvesters; authority becomes centralized and flows from the top down. The environment is reduced to conceptually discrete components that are managed separately.
- TEK explanations of environmental phenomena are often spiritual and based on cumulative, collective experience. It is checked, validated, and revised daily and seasonally through the annual cycle of activities. In direct contrast, Western science employs methods of generating, testing, and verifying hypotheses and establishes theories and general laws as its explanatory basis.

There are exceptions to these generalizations. For example, Feit s (1986) work with subarctic beaver trappers indicates that TEK can be (or appear to be) quantitative (Berkes 1992). Also, Berkes (1977) showed that the Cree fishermen of the subarctic are perfectly capable of carrying out controlled field experiments. In terms of recording and transmitting the traditionally oral knowledge, aboriginal researchers are now experimenting with the use of film and the written word.

Western scientists are largely skeptical of TEK. Much of this skepticism stems from the belief that, although TEK may have been impressive in its earlier forms, it is being irreversibly eroded by the assimilation of aboriginal peoples into Western culture and by the failure of elders to pass on the traditional knowledge to younger generations. Undoubtedly, some erosion of TEK has occurred. However, both social scientists and aboriginal peoples confirm the continued vitality of traditional cultures and note that TEK is evolving, not dying (Osherenko 1988).

By the same token, critics often ignore the significant changes that are occurring within Western science. Over the past 20 years, the fundamental tenets of Western science—rational analytical thinking, objectivity, reductionism, and the Judeo-Christian ethic of human domination over nature—have been challenged for being ethnocentric, antiecological, and ignorant of the cultural dimension of technological development. As a result, Western science is becoming increasingly interdisciplinary in response to today's globally interconnected world, in which biological, psychological, and social phenomena are recognized as belonging to interdependent systems (Capra 1982). The contemporary ecological movement—particularly deep ecology, ecofeminism, bioregionalism, Lovelock's Gaia hypothesis, and the concept of sustainable development—finds many parallels with TEK (Booth and Jacobs 1990; Johnson and Ruttan 1991; Wolfe et al. 1992).

Neither TEK nor Western science should be judged for its worth according to a rigid set of generalizations or a static image of the past. For, as Howes and Chambers point out (quoted in Mulvihill 1988, p. 12), the knowledge system of any culture is constantly changing through the assimilation of outside knowledge and synthesis and hybridization with existing knowledge. Ultimately, both approaches have their strengths and limitations in solving environmental problems and both are now inseparably interlinked (Johnson and Ruttan 1991).

### ***Integrating TEK and Western Science***

Most scientists, governments, and aboriginal peoples agree that, given the pluralistic nature of modern society and the ecological interdependence among nations, TEK and Western science must be integrated. Despite much discussion on the need to integrate the two systems and a few attempts to establish comanagement institutions, however, the effective use of TEK in decision-making has yet to be fully tested.

Why are TEK and Western science so difficult to integrate? First, there is the urgent problem of the disappearance of TEK and the lack of resources to document it before it is lost. Second, there are the

practical problems of trying to reconcile two very different world views and trying to translate ideas and concepts from one culture into another. Third, there is an attitude problem. Cultural barriers and misunderstandings prevent both Western scientists and aboriginal peoples from acknowledging the value of each other's knowledge system. Among Western scientists, the problem of attitude is extended to include disagreements between social and natural scientists regarding appropriate methods to document and integrate TEK. Finally, the integration of TEK and Western science is clearly linked to the question of political power. Under the majority of existing state systems of resource management, TEK is usually subordinate to Western science.

### ***Documenting TEK***

The first and most urgent problem associated with integration is the rapid disappearance of TEK with the passing of elders. Orally based knowledge systems lost in this way cannot be retrieved. It is only through documentation that the usefulness of TEK can become apparent and an improved understanding can be gained of the practices and conditions that lead to the breakdown and reestablishment of TEK management systems. For example, what does TEK have to say about the use of modern technology for harvesting? What can it tell us about the allocation of resources and commercial incentives in the current sociopolitical context? How would traditional institutions of authority operate and enforce traditional laws in a modern context? If TEK is to be revitalized, research must be initiated by aboriginal peoples themselves. The guidance of the elders and the cooperation of the youth are needed to make TEK relevant again.

One of the problems experienced by TEK researchers is that funding agencies often require concrete examples of how the information gathered will be applied. It is difficult to obtain funds to gather data solely for the purpose of preservation. Further, participatory action approaches to TEK research, which involve training local people to carry out the work themselves, are lengthy and expensive. Of the studies that have been conducted, most have tended to concentrate

on a specific topic, such as harvesting or the ecological knowledge of one species. Consequently, a broad overview of the range of environmental knowledge available among aboriginal peoples has not been well documented.

For many aboriginal peoples, however, TEK is at the heart of their cultural identity and remains a viable aspect of their way of life. For the rest of the world, apart from the ethical imperative of preserving cultural diversity, TEK is important for many tangible and practical reasons (IVCN 1986, cited in Berkes 1992).

- *New biological and ecological insight:* Fresh insight can be derived from perceptive investigations of traditional environmental knowledge systems.
- *Resource management:* Much traditional knowledge is relevant for contemporary natural resource management in areas such as wetlands, tropical moist forests, circumpolar regions, and dryland, high-altitude, and coastal areas.
- *Protected areas and conservation education:* The protected area concept may be promoted to allow resident communities to continue their traditional lifestyles, with the benefits of conservation accruing to them. Traditional knowledge may be used for conservation education, especially where the local community benefits from the protected area.
- *Development planning:* The use of traditional knowledge may benefit development agencies in providing more realistic evaluations of production systems, natural resources, and the environment.
- *Environmental assessment:* The time-tested and in-depth knowledge of indigenous peoples about their habitat is a valuable resource in assessing the social and environmental impacts of proposed development projects.

## ***Reconciling World Views***

The second problem of integration is that of reconciling two profoundly different world views. Western science and TEK are generated and validated according to a different set of assumptions.

Western science has the following fundamental assumptions (Wolfe et al. 1992):

- *Reductionism*: the understanding of complex phenomena by breaking down data and reassembling it in different ways;
- *Objectivism*: the belief that the observer must deliberately separate oneself from that being observed; and
- *Positivism*: the belief that what is measurable is scientifically real and what is scientifically real is measurable.

Scientists are often reluctant to accept TEK as valid because of its spiritual base, which they may regard as superstitious and fatalistic. What they often fail to recognize is that spiritual explanations often conceal functional ecological concerns and conservation strategies. Further, the spiritual aspect does not necessarily detract from the aboriginal harvester's ability to make appropriate decisions about the wise use of resources. It merely indicates that the system exists within an entirely different cultural experience and set of values, one that paints no more and no less valid a picture of reality than the one that provides its own frame of reference (Johnson and Ruttan 1991). The spiritual acquisition and explanation of TEK is a fundamental component and must be promoted if the knowledge system is to survive.

Western science also judges the intellectual achievements of its members according to a rigidly defined set of institutions. As Nakashima (1990, p. 23) points out,

University degrees, journal publications and conference presentations are the milestones which mark the narrow path to knowledge. Guided by these inflexible norms, environmental scientists reject the TEK of Native hunters as anecdotal, nonquantitative and amethodical.

Even among those scientists who do acknowledge the existence of TEK, they generally apply scientific categories and methods to collect, verify, and validate it. As described by Wolfe et al. (1992, p. 5),

They seek to recognise their categorizations in native systems, and apply their typologies to what they think indigenous knowledge systems are. Few western scholars are able to accept indigenous knowledge as valid in and of itself.

Too often, information is translated directly into English without examining whether or not the scientific terminology accurately reflects the indigenous concepts being described. Scientific terminology may not be able to capture the subtleties expressed in the indigenous languages; hence, some of the insight traditional knowledge may have to offer about indigenous plants, animals, and elements may be lost through translation (Johnson and Ruttan 1991).

In contrast to Western science, TEK is more holistic than reductionist, subjective rather than objective, and experiential rather than positivist (Wolfe et al. 1992). Because it is an oral-based knowledge system, it is often difficult to transmit ideas and concepts to those who do not share the tradition and the experience. For example, aboriginal hunters develop their concepts through their own experience as well as shared and familiar experiences with other members of the community. Any instruction they receive would be oral instruction from another person and rarely from pictures or the written word. Consequently, hunters find it difficult to describe their observations and ideas to someone versed in scientific explanation and unfamiliar with the traditional, cognitive system.

Often, TEK is revealed through stories and legends, making it difficult for nonaboriginal people to understand. Even the younger members of an aboriginal community may not know the proper way to approach an elder to discuss certain subjects. Likewise, they may be unfamiliar with all of the subtleties and sophisticated terms of the aboriginal language. Consequently, when speaking with an elder, a younger person may not know how to ask the proper questions to obtain specialized knowledge of the ecology, medicines, and spiritual matters (Colorado 1988; Johnson and Ruttan 1991).

Like Western science, TEK has its limitations. Unfortunately, some researchers tend to be overly romantic and uncritical of TEK. For example, although claims that spiritual explanations conceal conservation measures may be true in most cases, there are undoubtedly examples where a taboo on the hunting of a species may have a detrimental effect, perhaps by putting increased pressure on some other, more easily depleted species. Methods to improve fishing or hunting that focus on appeasing the spirits or counteracting the effects of sorcery may divert attention from the real and often correctable causes of the problem (Johannes 1992).

Aboriginal peoples are often reluctant to accept Western science because of what appears to be its fundamental need to control and interfere with nature. Scientists are viewed to be constantly tagging and capturing animals or digging holes in the ground. There is no denying the socially and ecologically destructive impact of Western science and technology on aboriginal cultures. However, in some instances, the technology of Western science may be able to provide information that is otherwise unavailable through TEK—for example, the ability to view phenomena at the microscopic level or over large distances.

To remedy this situation, local people must become directly involved in the research. In doing so, they will better understand the reasons for the experiments. This leads to the third problem of integration, the need to break down cultural barriers through collaboration between aboriginal and nonaboriginal researchers.

### ***Cultural and Disciplinary Barriers***

Traditional environmental knowledge must be documented by aboriginal peoples themselves. This inside perspective is essential if the information is to be interpreted accurately. Moreover, it is a fundamental right of aboriginal peoples, or any local people for that matter, to have control over research that directly affects them. At the same time, if the goal is to integrate TEK and Western science, both social and natural scientists must assist in interpreting results from a Western scientific perspective.

Perceptual and language barriers between aboriginal and nonaboriginal researchers are often significant. To overcome these obstacles, training for both aboriginal and nonaboriginal researchers is necessary. All too often, it is the aboriginal researcher who is taught the scientific method and forced to adapt his or her cultural reality to that model. Western scientists need the same exposure to the knowledge system of the aboriginal group they are working with. Only when both groups develop an appreciation of, and sensitivity to, the strengths and limitations of their respective knowledge systems can integration begin to occur.

In addition to the cultural barriers between aboriginal and nonaboriginal researchers, methodological barriers exist between social and natural scientists. The traditional anthropological methods of interviewing and participant observation are often perceived by natural scientists as lacking scientific rigour in their analyses. Even though it is essential that TEK research involve people with appropriate backgrounds in biology, ecology, and resource management, it is also essential to include people with social science skills. Traditional environmental knowledge cannot be properly understood if it is analyzed independently of the social and political structure in which it is imbedded. The social perspective includes the way people perceive, use, allocate, transfer, and manage their natural resources (Johannes 1992). Traditional environmental knowledge is based on an oral tradition and concerned primarily with qualitative observations. Gathering both biological data and information about the local sociopolitical structure can best be accomplished through talking with people and participating directly in harvesting activities. Social scientists bring these skills to TEK research along with their ability to help translate information from one culture to another.

### ***Political Power***

The final problem of integration is to develop institutional arrangements that recognize the validity of both TEK and Western science and are just in their distribution of authority. Currently, comanagement regimes represent the most widespread attempt to

integrate TEK and Western science. Osherenko (1988, p. 13) defined comanagement as follows:

A co-management regime is an institutional arrangement in which government agencies with jurisdiction over resources and user groups enter into an agreement covering a specific geographic region and spelling out: 1) a system of rights and obligations for those interested in the resource; 2) a collection of rules indicating actions that subjects are expected to take under various circumstances; and 3) procedures for making collective decisions affecting the interests of government actors, user organizations, and individual users.

For aboriginal peoples, comanagement represents an incremental step toward local self-government. There are now seven wildlife comanagement regimes in the North American arctic; several others are in various stages of conception (Osherenko 1988). These include the James Bay and northern Quebec hunting, fishing, and trapping regime; the Alaskan whaling regime (Bering and Beaufort seas; Alaskan whaling communities); the Beverly and Kaminuriak caribou management regime (central Canadian Arctic); the Inuvialuit wildlife harvesting and management regime Inuvialuit Settlement Region within the Northwest Territories); the beluga management regime (northern Quebec); the Canadian porcupine caribou herd management regime (northwestern Canada, Yukon Territory, and Northwest Territories); and the Pacific walrus regime (coastal areas of northwestern Alaska). These regimes vary in their structure and in the degree of power accorded the participating groups.

Most of these comanagement regimes have existed for less than a decade; hence, it is difficult to draw any firm conclusions regarding their degree of success or failure. From her evaluation of the Beverly-Kaminuriak Caribou Management Plan, the Northern Quebec Beluga Management Plan, and the Yukon Kuskokwim Delta Goose Management Plan in Alaska, Osherenko (1988) concludes that comanagement has at least improved the communication and understanding between aboriginal and nonaboriginal authorities. In addition, the cases suggest that comanagement has changed hunting practices in the interests of protecting declining species.

Nevertheless, despite the obvious step forward in bringing Western science and TEK together to help solve environmental problems, these boards have only an advisory capacity. The question remains to what extent they actually incorporate new innovative strategies to problem solving, as opposed to using TEK merely to provide data for a decentralized state system, which continues to adhere to the scientific paradigm and to do the managing. Will these boards serve as a model for comprehensive wildlife management under land claims settlements? If they do, there are many problems they will have to resolve. What will be the framework for making decisions, including the measures that will be used to evaluate any data collected? Who will have the ultimate authority, the state or the local resource users?

### **Conclusions**

It is clear that the integration of the two knowledge systems TEK and Western science remains a distant goal. However, if it is to occur, the following conditions must be met:

- *Support for the comprehensive documentation of TEK:* Sufficient financial and adequate administrative support at the political, bureaucratic, scientific, and local levels must be made available to support the documentation of TEK before it is lost.
- *Recognition of alternative knowledge systems:* Governments and the scientific community must work to develop an environmental assessment and management process that is flexible enough to accommodate new ideas and methods and that accepts Western science as only one method of seeking new knowledge and new interpretations of that knowledge. New and innovative resource-management programs must be given the necessary financial and administrative support to allow them to flourish.
- *Support for cross-cultural education of both Western scientists and aboriginal peoples:* Training programs and hands-on learning must be available to both groups to introduce them to each other's knowledge system.

- *Political recognition of aboriginal claims to land and resources*: Aboriginal peoples must be fully involved in the design and production of any future resource-management schemes; they must be recognized through their participation with equal authority and legal standing.

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