ARCTIC
VOL. 53, NO. 2 (JUNE 2000) P. 183–193

Traditional Ecological Knowledge in Environmental Assessment and Management

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(*Received 2 November 1999; accepted in revised form 24 January 2000*)

ABSTRACT. It is now a policy requirement that “traditional ecological knowledge” (TEK) be incorporated into environmental assessment and resource management in the North. However, there is little common understanding about what TEK is, and no guidance on how to implement the policy in public arenas where knowledge claims must be tested. The problems are inconsistent and unclear definitions of TEK, and insufficient attention to appropriate methods of organizing and presenting it for assessment and management purposes. TEK can be classified as knowledge about the environment, knowledge about the use of the environment, values about the environment, and the knowledge system itself. All categories are required for environmental assessment, but each must be presented and examined differently. TEK and “Western” science provide partially different information, based on different sets of observations and procedures, and sometimes on different knowledge claims. It is important that TEK be comprehensible and testable as a knowledge claim in public reviews, and usable for ongoing public monitoring and co-management processes. To this end, certain procedures are recommended for recording, organizing, and presenting TEK, with particular emphasis on the need to differentiate between observation and inference or association. Documenting TEK as recommended usually requires trained intermediaries, but they in turn require the support and cooperation of those who have TEK. One consequence is that it is often both impractical and inappropriate to require development proponents to incorporate TEK into their environmental impact statements. However, the environmental assessment process must facilitate the use of TEK in the public review phase.

Key words: traditional ecological knowledge, environmental assessment, co-management, research methods, public policy, Canada

RÉSUMÉ. Les politiques publiques exigent maintenant que le «savoir écologique traditionnel» (SÉT) soit inclus dans les évaluations environnementales et la gestion des ressources du Nord. On ne s’accorde toutefois pas très bien sur la nature du SÉT et il n’existe pas de principes directeurs sur la façon d’appliquer la politique dans la sphère publique où la revendication du savoir doit être mise à l’essai. Les problèmes sont dus au fait que le SÉT est défini en termes vagues et contradictoires, et que les méthodes appropriées à l’organisation et à la présentation de ce savoir à des fins de gestion ne sont pas toujours suivies. On peut placer le SÉT dans les catégories de connaissance de l’environnement, de connaissance de l’utilisation de l’environnement, de valeurs concernant l’environnement et du système de savoir lui-même. Toutes les catégories sont requises pour l’évaluation environnementale, mais chacune doit être présentée et étudiée sous un angle différent. Le SÉT et la science dite occidentale offrent des renseignements en partie divergents, qui s’appuient sur des ensembles d’observations et de procédures différents, et parfois sur des revendications du savoir différentes. Il est important que le SÉT puisse être compris et testé en tant que revendication du savoir lors des examens publics, et qu’il puisse être utilisable dans les processus permanents de contrôle public et de cogestion. À cette fin, certaines procédures sont recommandées pour consigner, organiser et présenter le SÉT, procédures qui insistent tout particulièrement sur le besoin de différencier entre l’observation et l’inférence ou l’association. La documentation du SÉT telle qu’elle est recommandée exige d’ordinaire des intermédiaires qui ont reçu une formation, mais eux-mêmes, à leur tour, ont besoin de l’appui et de la coopération des individus qui possèdent le SÉT. Une des conséquences est qu’il s’avère souvent à la fois peu pratique et inapproprié d’exiger que les adeptes de la mise en valeur intègrent le SÉT dans leurs énoncés des incidences environnementales. Le processus d’évaluation environnementale doit toutefois faciliter l’utilisation du SÉT dans la phase de l’examen public.

Mots clés: savoir écologique traditionnel, évaluation environnementale, cogestion, méthodes de recherche, politique publique, Canada

Traduit pour la revue *Arctic* par Nésida Loyer.

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THE POLICY ENVIRONMENT

The Policy Requirements

It has become a policy requirement in Canada, and especially in northern Canada, that "traditional knowledge" (TK) or "traditional ecological knowledge" (TEK) be considered and incorporated into environmental assessment and resource management. All comprehensive claim agreements in Canada's territorial North call for aboriginal beneficiaries to be involved directly in wildlife management. For example, the Inuvialuit Final Agreement (IFA) of 1984 states as a principle that "the relevant knowledge and experience of both the Inuvialuit and the scientific communities should be employed in order to achieve conservation" (Canada, 1984: article 14.5). In 1993, the Government of the Northwest Territories adopted a Traditional Knowledge Policy, which recognized 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 undertook to "incorporate traditional knowledge into Government decisions and actions where appropriate" (GNWT, 1993:11). Two recent federal environmental assessment panels (for the BHP diamond mining project in the Northwest Territories and the Voisey's Bay nickel mining project in Labrador) were instructed to give, respectively, "full and equal consideration to traditional knowledge" (MacLachlan et al., 1996:74), and "full consideration to traditional ecological knowledge whether presented orally or in writing" (Griffiths et al., 1999:203).

Forthcoming federal legislation on species at risk is expected to include explicit requirements to take account of TEK, and the draft terms of reference for the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) already require the status of species to be assessed according to criteria "based on science and to include traditional and local knowledge" (Anon., 1999:1). At the international level, the *Convention on Biological Diversity* refers to the knowledge of indigenous and local communities (article 8[j]), and the recently amended Canada-United States *Migratory Birds Convention* requires the "use of aboriginal and indigenous knowledge" for migratory bird management (article II).

The requirement that the environmental knowledge of aboriginal people be given admissibility and weight in quasi-judicial proceedings and by co-management and other stakeholder bodies, is the outcome of several developments over the last two decades. These include a growing recognition that aboriginal people have knowledge that can usefully contribute to these processes; advocacy from many quarters, including the Royal Commission on Aboriginal Peoples (RCAP, 1996:678–680), that aboriginal knowledge be so utilized; the negotiation of comprehensive claims across the North; and evolution of formal environmental assessment and review processes. There are also related legal developments. The Supreme Court of Canada has decided that the rules of evidence must allow for the consideration of oral history in the proof of aboriginal rights and titles (*R. v. Van der Peet*, 1996; *Delgamuukw v. British Columbia*, 1997), and that consultation is a key requirement to justify the infringement by governments of those rights (*R. v. Sparrow*, 1991; *Delgamuukw v. British Columbia*, 1997). A number of lower court rulings have set standards for consultation and for the consideration of advice given by a body constituted in the context of aboriginal rights (e.g., *Nunavut Tunngavik Inc. v. The Minister of Fisheries and Oceans*, 1997).

The Problem

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. This suggests an insufficient understanding on the part of policymakers of what TEK actually is, and hence of the implications and practicalities of incorporating it into formal decision-making processes.

Neither the Canadian Environmental Assessment Agency, nor the co-management bodies established by the comprehensive claims, nor COSEWIC, nor the Supreme Court has given specific instructions in guidance documents, operating procedures, or judgements on how to implement this requirement. For example, in both of the environmental assessments cited above, it was left to the panels themselves to decide how to implement this requirement and how to instruct proponents to respond to it in their Environmental Impact Statements (EIS). This lack of guidance and clarity has been problematic for regulators, adjudicators, proponents, and intervenors alike (see, for example, MacLachlan et al., 1996:14–16; Stevenson, 1997). All parties need to know in practical terms what TEK is, what information it provides, how this information can be documented and brought into the environmental assessment process, and how it should be expected to affect both the process and the outcome.

Inconsistent definition is a key problem with the policy requirements cited. Some refer to "traditional ecological knowledge" or TEK, and some to "traditional knowledge" or TK. Some refer specifically to aboriginal knowledge, others only to local knowledge. It appears that TEK is conceived of as something specific to place, if not also to particular people, and it is differentiated presumably in both form and content from other types of knowledge generally and from science specifically. The BHP Panel was instructed to consider TK, which according to GNWT policy (1993) includes "knowledge and values… acquired…from spiritual teachings." This instruction led Howard and Widdowson (1996) to assert that requiring the use of TEK in environmental assessment is inappropriate, and even unconstitutional, in a secular context. The subsequent controversy (viz. Berkes and Henley, 1997; Howard and Widdowson, 1997; Stevenson, 1997) demonstrates the problem of applying a well-intended but ill-defined policy. There has also been insufficient attention to appropriate methods of organizing and presenting TEK for the required purposes.

This discussion considers how to remedy these deficiencies, and it shows how TEK and science can be presented and judged in comparable terms in the public arenas of environmental assessment and management. My observations are informed by my experience as a member of an environmental assessment panel and as chair of a wildlife co-management body, as well as by my own research and practice. My purpose is not simply to advocate the use of TEK. That case has already been made, and the appropriate institutional framework has already undergone significant change. My objective is rather to address the problem of implementation. If the unconvinced are to become convinced, then TEK must be seen to make a clear and positive contribution where it is already mandated to do so.

The Context of Implementation

Environmental assessment and co-management are public policy-making tools that are open and responsive to both public opinion and stakeholder rights and interests. The present system is the outcome of years of advocacy and negotiation, and it is within that framework that the key participants have agreed to work. This is not necessarily to say that these are the only or the best possible arrangements, and no doubt they will continue to evolve. For the existing system to work, however, there is an overriding requirement for common rules and protocols, transparency of procedure, and clarity of outcome for all parties.

Of the various policy arenas noted at the outset, the environmental assessment process is the most structured and visible, in which participants can contribute both information and opinion on a wide range of matters. Environmental assessment also has been implemented across Canada for over two decades. To a greater degree than the other policy arenas, it has formal procedures, including public hearings, for obtaining and adjudicating information and opinion. (However, in the case of federal environmental assessment, at least, these procedures are not strictly judicial, as evidence is neither led nor cross-examined by legal counsel, and panels have some discretion in setting and applying their procedures.) Environmental assessment panels are accountable for how they gather and use information, and their recommendations must be based transparently on that information. Panel reviews are always subject to public scrutiny and may also be subject to legal challenge if they violate the principles of administrative fairness. I therefore focus this discussion on environmental assessment, although it applies more generally to a variety of resource management issues.

Environmental assessment and management involve human intervention: deliberate actions whose consequences, intended or unintended, must be understood and predicted, so far as is possible, to ensure the most desirable (or avoid the most undesirable) outcomes. To integrate science and TEK for this purpose, information from both sources must be collected, organized, and communicated. This must be done systematically, using established protocols, so as to minimize the dangers of overgeneralizing from limited information and untested assumptions (Wenzel, 1999:120). Neither opinions alone, however firmly or sincerely held, nor facts alone, however accurately recalled or precisely recorded, are sufficient. The policy arenas in which these matters are resolved are ones in which knowledge claims must be tested and validated, not merely asserted. Thus, no information, no form of knowledge, and no knowledge claim can be undisclosed or kept privileged from examination.

DEFINING TEK FOR ENVIRONMENTAL ASSESSMENT AND MANAGEMENT

Definitions

Many commentators have attempted to dichotomize TEK (or sometimes TK) and Western science in terms of their respective ideological underpinnings, substantive content, methods, epistemology, and context (e.g., Bielawski, 1992; Freeman, 1992; Johnson, 1992; Berkes, 1993; Mailhot, 1993; Stevenson, 1996). While constructing archetypes of the two can be instructive, Agrawal (1995) rightly notes the practical and philosophical limits of posing them as pure categories. Contemporary TEK explanations can hardly be unaffected by aboriginal people's knowledge (scientific or otherwise) of the wider world. For example, field science programs have been employing aboriginal Northerners since at least the 1960s, including some who are elders today. They are aware of what scientists actually do and find out, and even if they do not agree, they have considered scientific knowledge critically against their own. While there are indeed differences between TEK and science, their essential similarity may be more important for the purposes of this discussion.

I use the term "TEK" here because it has passed into common usage, and also, in the same way as Wenzel (1999:114), in preference to "TK" because it is more specific. Stevenson (1996:280–283) likewise distinguishes among traditional *ecological* knowledge, other traditional knowledge, and nontraditional knowledge, as various forms of indigenous knowledge that can contribute to environmental assessment. For this discussion, then, TEK refers specifically to all types of *knowledge about the environment* derived from the experience and traditions of a particular group of people. TEK is, nonetheless, a problematic descriptor of that knowledge. By using the term "traditional," one risks implying a static or archaic form of knowledge that is inherently nonadaptive, whereas the acute observations and sophisticated knowledge that some aboriginal people have of their environment are both evolving and current.

Although it is appropriate in this context to use "traditional" as though it were interchangeable with "aboriginal," TEK as defined below is not restricted by genetics or heritage to aboriginal persons (for a discussion of the use of local harvesters' knowledge in fisheries management, for example, see Neis et al., 1999). TEK could be characterized as the knowledge claims of those who have a lifetime of observation and experience of a particular environment and as a result function very effectively in that environment, but who are untutored in the conventional scientific paradigm.

I also refer to "science" (or "Western science," as used by some commentators, even though it is not exclusively Western), as the chief knowledge claim conventionally contrasted with TEK, even though it is also an ambiguous term. There are, of course, competing knowledge claims within the realm of "science," based not only on differing interpretations of the same evidence but also on differing paradigms and premises. What is loosely called science in the public policy arena (including technology, engineering, and management) combines a particular set of values with systems of knowing based on empirical observation, rationality, and logic, as opposed to received or felt truths or, exclusively, sensory perception or "lived experience" (viz. Fernandez-Armesto, 1999).

A Classification of TEK

The concept of TEK has been applied to at least the following categories of information, which are distinguishable on substantive and epistemological grounds.

Category 1: Factual/rational knowledge about the environment. This includes statements of fact about such matters as weather, ice, coastal waters, currents, animal behaviour, traveling conditions and the like, which are typically based on (a) empirical observations by individuals of specific events or phenomena; (b) generalized observations based on numerous experiences over a long time; or (c) generalized observations based on personal experience reinforced by the accounts of others both living (shared experience, stories, and instruction) and dead (oral history and customary teachings).

In practical terms, this broad category of TEK is largely about what works, and sometimes about how and why it works. It also includes, for example, indicators of ecosystem health, such as the appearance or behaviour of animals, the taste and texture of country food, or unusual occurrences or conditions. Category 1 TEK thus ranges from specific observations to explanatory inferences, constituting explanations of what people observe and the relations and connections among them, or more broadly, an understanding of why things are as they are. As observations accumulate, both in frequency and over time, raw data become information about patterns and associations of phenomena. The boundary between observation and inference is not always evident, however, because people may state as fact or consequence what scientists would characterize as inference or deduction. But, in principle, what is not a statement of fact is a potentially testable hypothesis.

Category 2: Factual knowledge about past and current use of the environment (e.g., patterns of land use and occupancy, or harvest levels), or other statements about social or historical matters that bear on the traditional use of the environment and hence the rights and interests of the local aboriginal population in the regional environment. Statements of fact are based on a range of knowledge from personal experience and observation to oral history. I refer to information about past and current use of the environment as a separate category here because it is so often relied on in environmental assessment and management (Usher, 1993; Duerden and Kuhn, 1998), but this information constitutes a different *body* of knowledge rather than being a different *form* of knowledge. While oral history information is included in this category, it is important to note that oral history in its largest sense—which includes such matters as the history, traditions, and origins of the people, their identity, and their assertions of their rights and titles—goes well beyond any conventional definition of TEK.

Category 3: Culturally based value statements about how things should be, and what is fitting and proper to do, including moral or ethical statements about how to behave with respect to animals and the environment, and about human health and well-being in a holistic sense.

Category 4: Underlying the first three categories is a culturally based cosmology—the foundation of the knowledge system—by which information derived from observation, experience, and instruction is organized to provide explanations and guidance. It is the framework with which people construct knowledge from facts. This foundation may include systems of classification of natural phenomena that differ from Western scientific approaches such as the Linnaean ordering of species. While this category is the least articulated and hence the least accessible to outsiders, some understanding of it may be needed to interpret or understand the other three categories of knowledge.

From a Western scientific perspective, TEK includes empirical facts or associations based on observation and experience, explanations of fact, a culturally specific way of organizing and understanding information, a set of values, and—in a very broad sense—cultural norms about how to do things. From an aboriginal perspective, TEK is what people learn from experience, from family and community, and from stories handed down about how to live fully and effectively in their environment. It is thus both knowledge of how things work and a guide to action.

To sum up, I have distinguished four categories of TEK: (1) Knowledge about the environment; (2) Knowledge about the use of the environment; (3) Values about the environment; and (4) The knowledge system. Each of these categories has a place in environmental assessment, although where and how they do so will vary. However, I will focus on factual knowledge about the environment (Category 1) because it is in principle testable in the same way that scientific knowledge is, and because it can be used for prediction and monitoring of environmental effects.

Some Characteristics of TEK

Any reasonably aware and competent person who regularly engages in small-scale artisanal activity in a natural environment year after year—whether it be farming, husbandry, or fishing—is likely to accumulate a wealth of observations that will enable him or her to make certain generalizations, comparisons, and conclusions about natural phenomena. (I specify "artisanal" in this context to distinguish from industrial activities in which individuals engage in only a particular component of the work and have neither opportunity for comprehensive observation, nor a requirement for comprehensive environmental knowledge. It is perhaps this artisanal characteristic that has given rise to the suggestion that TEK is "holistic," in contrast to "reductionist" Western science.)

Several factors enhance this knowledge among aboriginal people, however. Their harvesting activities often occur over a very large area, and over long periods of the year. Thus the geographical and temporal scope of their environmental knowledge is generally much greater than that of a farmer or coastal fisherman, whose scope of operation is bounded by legal or customary property rights or by highly restricted harvesting periods. The diversity of activities, of animals and plants harvested, and of types of landscapes or coastal areas used is generally greater, and consequently the breadth of aboriginal environmental knowledge and the scope for drawing connections among phenomena is greater. The fact that human activity on the land typically occurs within a framework of communal rather than private property relations, as well as mutual aid, facilitates continuity and sharing of experience. Long continuity of practice and of the geographic extent of land use greatly increase the likelihood that information will be transmitted and accumulated over generations.

In contrast, where the levels of socioeconomic diversification and personal mobility, and the rate of social change, are high (as typically occurs with industrialization and urbanization), knowledge of useful particularities about the local environment is less likely to be widely shared. And where property and access rights are commonly bought and sold, intergenerational knowledge of the same place is the exception rather than the rule. While TEK is thus not unique to aboriginal culture or ethnicity, it is far more likely to be prevalent among aboriginal people who continue to participate in a mixed, subsistence-based economy because of the property relations and continuity of practice that typify their communities. Such circumstances may nonetheless also exist among nonaboriginals, such as the settler families of long residence in Labrador and in Newfoundland outport communities.

The circumstances that foster TEK are neither uniformly distributed nor permanent among aboriginal communities. In places where, for whatever reason, few if any members of the community have recent or current experience of a particular area or phenomenon, there may not be much TEK that will be useful to environmental assessment. However, TEK does not always need to be of great antiquity to be valid or useful. New and evolving environmental knowledge may also contribute to environmental assessment.

In TEK, factual observations may be very precise and recalled in extraordinary detail. Typically, people are careful to distinguish between what they actually saw and what they were told by someone else, and hesitate to generalize beyond their personal experience. This type of knowledge tends to be localized and restricted to personal, uninstrumented observations, with little concern for precision in measurement, and it is normally unrecorded. The emphasis is on observing conditions, trends, and variations (especially extreme or abnormal ones), rather than on establishing norms and averages or testing the strength of associations. Conclusions based on this information tend to be verified or reinforced through trial and error, rather than by experimental design and formal hypothesis testing.

TEK confirms inferences and associations when repeated experience shows that they work, but the situation is less clear when such confirmation does not occur. Even unassailable observations may lead to an incorrect inference or association, and such erroneous conclusions may persist when TEK cannot actually verify them. On the other hand, even widely used scientific methods of verifying and interpreting data, including statistical tests, do not preclude erroneous conclusions, and are not without controversy and uncertainty (Johnson, 1999).

Category 1 TEK has a substantial time-depth, ranging from "living memory" (personal experience), to the memory of several generations, preserved as oral history. It thus provides a diachronic or "natural history" perspective, rather than synchronic perspective. Hence a "baseline" is not conceived as a static, snapshot phenomenon but as a more fluid and evolving one that offers a clearer perspective on deviations from "normal" conditions. TEK can thus contribute to environmental assessment by providing a broader and deeper understanding of baseline conditions and a fuller understanding of local environmental processes, at a finer and more detailed geographical scale, than conventional scientific knowledge can offer. Category 1 TEK is also important because it deals with outcomes and prediction: what people think will happen and why.

It makes good sense to involve people who spend a lot of the time on the land in environmental assessment and management, for the obvious reason that they get to see things more often, for longer, and at more different times and places than is normally the case for scientists. These observations, and the resulting hypotheses, can complement observations that contemporary scientists are in a position to make (but aboriginal people are not) through such techniques as magnification, remote sensing, or chemical or genetic analysis. Scientists' observations are instrumented, quantified, and recorded, and are more likely to be guided by a specific hypothesis, but are otherwise in principle similar to those of aboriginal observers.

Category 1 TEK, particularly that based on direct observation, can be unique to the individual, especially if the particular areas of use or types of activity are highly specialized, for example in a family harvesting area such as a trapline or fishing site. Such TEK is likely to be specialized by gender (for example, where men harvest and women process food, they observe different things) and by age and experience. TEK for a large region may in these circumstances emerge as a mosaic of individual or family knowledge, whose totality may not be known by any single individual. Where no members of the group are in a position to observe something (for example, what happens in places that are seasonally inaccessible or at depth in the ocean), there is no Category 1 TEK, except perhaps some inferences or speculations.

Although TEK is based on careful and repeated personal observation, it does not consist merely of personal observation or opinion. Some persons are more knowledgeable and experienced and wiser than others, and they are widely acknowledged as such in their communities. TEK becomes authoritative in aboriginal communities through continuity and sharing of experience, through telling and retelling: hence the importance of the oral tradition. The fact that human activity on the land typically occurs within a communal framework facilitates this continuity and sharing of experience. TEK is more than just isolated or unconnected personal observations: it is cumulative and shared experience validated by testing in practical circumstances for its effectiveness. TEK is part of a pool of knowledge particular to a group of people, and the more durable and widely agreed-upon elements are part of their cultural heritage. Finally, TEK is not privileged or secret knowledge in the way that certain other cultural phenomena, such as ritual, healing, or spirituality, may sometimes be.

INTEGRATING TEK IN ENVIRONMENTAL ASSESSMENT AND MANAGEMENT

Types of TEK Required for Environmental Review

In considering how TEK contributes to each of these phases of an environmental assessment, it is essential to distinguish among facts based on observation, which can be verified; inferences or hypotheses, which can be tested; and values and norms, which are matters of personal preference, community consensus, or cultural standards. Any or all of these can legitimately be brought forward and considered in a public review, but who brings each type forward, and the way each will be treated, is different. The first two types must be subject to verification and testing, but the third cannot be subject to such tests, although it can and should be authenticated as representative. Environmental assessment often presents a new challenge to TEK, as it does to science, precisely because it tries to predict the outcome of what is at least partly a novel and untested situation.

Under the federal environmental assessment regime, there are four phases of a typical public review of a development proposal that would involve TEK.

Phase 1: Scoping, or identification of issues, which leads to the guidelines for the review. This phase may involve scoping hearings at which participants identify the key concerns regarding the proposed development. The guidelines identify what are sometimes termed the "Valued Ecosystem Components" (VECs), which focus the review around the values at risk (Beanlands and Duinker, 1983). This phase requires TEK from Categories 2 and 3. Category 2 TEK helps to establish "the current use of lands and resources for traditional purposes by aboriginal persons" that may be adversely affected (this is mandated by the definition of "environmental effect" under the *Canadian Environmental Assessment Act*, Article 2[1]). Category 3 TEK identifies, from the aboriginal perspective, the key phenomena, places, and processes that may be adversely affected, and why they are important. While Category 4 TEK is more difficult to present in the assessment process, it may provide different perspectives on the ecosystem and human-environment interrelations and hence on what might constitute a VEC. It is the responsibility of affected parties, acting as intervenors, to bring TEK from Categories 2, 3, and 4 to the public review process.

Phase 2: Preparation of an Environmental Impact Statement (EIS) by the proponent, in response to the guidelines. The EIS includes a description of the proposed project, a description of the existing environment (certainly consisting of a baseline description and ideally identifying key environmental processes), predictions of the effect of the project on the environment, and proposals for mitigating adverse effects. While all categories of TEK may be useful for the EIS, for practical reasons elaborated below it may sometimes be either impossible or inappropriate for the proponent to fully incorporate TEK into the EIS.

Phase 3: Public review of the EIS, which may include public hearings. The factual and explanatory aspects of TEK (Category 1) can be applied both to baseline description (or profiling) and, in certain respects, to impact prediction. Category 1 TEK can also include prior experience with development impacts, and hence can contribute to understanding cumulative effects. Public hearings generally involve separate technical and community sessions. Category 3 TEK is appropriate to community sessions, while Category 1 and Category 2 TEK can be introduced in both types. How this information is introduced, and by whom, is discussed further below.

Phase 4: Monitoring and follow-up, if the project is approved and proceeds. A follow-up program, as defined in Article 2(1) of the *Canadian Environmental Assessment Act* of 1992, has two purposes: to verify the accuracy of the environmental assessment and to determine the effectiveness of mitigation measures. Such programs have been established by multi-party agreement to monitor the effects of both the BHP diamond mine in the Northwest Territories and low-altitude military flights in Labrador and Quebec. The Voisey's Bay Panel recommended that the parties negotiate an environmental co-management mechanism for the ongoing requirements of permitting and regulatory review of the project as it evolves, and the administration of the follow-up program (Griffiths et al., 1999:155–160). Category 1 TEK can and should be used for monitoring impacts on VECs and for testing impact hypotheses and predictions in a follow-up program (see LGL et al., 1986 for an outstanding example of integrated TEK and science construction of indicators and hypotheses for monitoring).

Stevenson (1996:283) proposes a similar phased use of TEK in the environmental assessment process.

The Need for Equivalency

Mobilizing science for specific environmental assessments is a highly organized and structured process. The proponent engages scientists to gather baseline data, test hypotheses, or answer certain questions according to recognized methods; to communicate the results in consulting reports and peer-reviewed journals; and to appear as expert witnesses. Regulators and intervenors engage scientists for similar purposes, or at least to review the work of the proponent's scientists. Specific questions are asked and answered by research programs directed to the problem at hand.

This is in contrast to TEK, in which a lifetime's experience is drawn upon to consider whatever problem arises (Gunn et al., 1988:25). TEK exists in people's heads; even if some aspects of it have been written down, that information may not apply directly to the specific project or question. Mobilizing TEK for environmental assessment is, to date, not a well-organized or structured process, and it is certainly not a straightforward or unambiguous exercise.

For Category 1 TEK to be given full and equal consideration as a knowledge claim in a public forum, it must be documented in a way that is equivalent or comparable to (although not necessarily the same as) scientific claims about environmental assessment and management. Such documentation has at least two requirements. The first is to compile and assemble TEK in an organized and systematic way. Not everything every aboriginal person utters is TEK, and it is both inappropriate and unhelpful to present TEK as a random collection of utterances. Random or opportunistic recording of whatever individual aboriginal persons might say about environmental conditions in the course of casual conversation, or even at public meetings, does not provide useful information for assessment, any more than miscellaneous and unorganized scientific observations do. The second requirement is to distinguish clearly between observations and inferences, in the same way that in scientific reports, results are separated from conclusions. If scientists (and, more importantly, adjudicators) who are not familiar with TEK do not accept its inferences or conclusions, they are liable to discount the observations on which they are based as anecdotal—or worse, as unreliable.

Without these precautions, the use of Category 1 TEK in environmental assessment can be seriously compromised. The risk is that TEK will be seen as a haphazard collection of sometimes conflicting and apparently unreproducible observations that are not clearly grounded in space and time, resulting in untestable statements about the environment and about the environmental effects of a particular activity. If individual assertions of TEK conflict, then whose are authoritative? And how does one go behind what is said in order to establish the basis of a knowledge claim? It follows that TEK is most likely to assist an environmental assessment if it is presented as a study report, i.e., a written document that organizes and synthesizes TEK for the purpose of the assessment and specifies the basis of the knowledge presented. (Technical sessions of public hearings normally require written presentations submitted in advance.)

Documenting and Presenting TEK in Environmental Assessment

When TEK has been used for environmental assessment, it has almost always been recorded, organized, and presented by trained persons who use accepted social scientific methods, and who are employed by aboriginal organizations for that purpose. (The exception is of course Category 3 TEK, which is generally presented directly by aboriginal persons or organizations in nontechnical hearings.) The use of technical reports by trained intermediaries does not and should not preclude, or take precedence over, direct statements of TEK by those who have it, at public hearings. However, such reports provide an essential communications bridge by converting what appear (to those unfamiliar with TEK) to be anecdotes or opinions to usable and testable data and hypotheses within a widely recognizable framework.

Methods for obtaining and organizing Category 2 TEK are already well established (e.g., Freeman, 1976; Ellanna et al., 1985; Usher and Wenzel, 1987). There are also emerging norms for TEK research specifically directed to assessment and management issues (Neis et al., 1999). A key method of data collection is the semidirected interview (Nakashima, 1990; Ferguson and Messier, 1997; Huntington, 1998; Fienup-Riordan, 1999), although focus group methods can also be used. Interviews are generally conducted using maps as a recall and recording aid, because Category 1 TEK is geographically specific. The use of chronologies as recall aids to ground TEK data in time is also recommended. A competent interviewer must have a good working knowledge of the geography and chronology of the region, and of local environmental processes and harvesting practices, to be able to ask questions that follow up and probe further the information offered by informants, without the aid of an interview guide. This is especially important for establishing sources of knowledge and the basis of individual knowledge claims (Wenzel, 1999:117). The normal methods of controlling (or at least accounting) for response bias and recall failure must be adhered to.

Interviews should be conducted in the preferred language of the participant, and if the interviewer does not have this capacity, an interpreter is required. The interviewer or interpreter must be proficient enough to know specific environmental terminology and taxonomy, place names, and the like, and this is not necessarily the case with younger members of the community. Such interviews can take several hours to complete and may require more than one session.

Taken together, these methods help to ensure the authenticity and validity of TEK obtained through interviews. For the purposes of impact assessment, the question of validation applies only to TEK Categories 1 and 2, because it is these specific knowledge claims that are being compared (or contrasted) to scientific knowledge claims. A cooperative or synthetic approach to integrating scientific and traditional environmental knowledge requires validation through independent corroboration, internal consistency of evidence, and similar approaches.

Validation, or corroboration, is required of any fact or conclusion brought before a public review, and in this respect TEK is not privileged. However, any panel, and any proponent, is well advised to approach this question in a careful and respectful manner. Challenges to specific facts or conclusions can appear to bring TEK of Categories 3 and 4 into question as well, not to mention the personal integrity and competence of those who have TEK.

TEK documentation requires time and money. However, research programs along the lines described above can usually be completed within a year, which is less time than many scientific baseline programs for environmental assessment require. Early examples of scholarly documentation of TEK (viz. Nelson, 1969; Usher, 1971; Freeman, 1985; Feit, 1988) used the method of participant observation. However, TEK documentation does not necessarily require extended periods of participant observation (and the apparently nonsystematic approach sometimes associated with that method). TEK research can be faster, and certainly cheaper, than a typical biophysical science program (Freeman, 1979:358), and with shrinking science budgets in the public sector, these are important considerations. True, it is rare to find much existing literature or relevant databases for TEK when it comes time to prepare or review a EIS. But it is often the case that scientific baseline information and understanding of environmental processes at the local scale are similarly deficient. If introduced early in the process, TEK can be used to guide scientific research on impacts by identifying key locations and processes that can inform hypothesis testing and focus sampling programs.

Documentation and communication of TEK, regardless of who does it, require the support, cooperation, and involvement of the community involved. Individuals from outside the community who seek TEK need to negotiate the basis for doing so. This is a standard requirement of ethical research guidelines, and is sometimes also a permitting requirement. Researchers must gain the trust of and be accountable to the persons providing TEK. They do this by, among other things, fully disclosing the objectives and uses of the research, obtaining informed consent of individual participants, involving the community in the design and conduct of the research, and entering into an agreement about data ownership and access.

The most effective way of obtaining verifiable and generalizable knowledge begins by interviewing the most knowledgeable persons in the community, who are the proper sources of TEK. The community consultation process must therefore include the identification of those persons, although it is ultimately the individuals' prerogative as to how and with whom they will share TEK, and thus whether they wish to participate in the project. TEK research is not an opinion poll, and mass sampling methods are neither required nor appropriate.

The fact that TEK research must be under community control raises a key question for proponents and regulators in project review. Not only may the proposed development itself be controversial: its review may occur in the context of larger political concerns, for example, unresolved land claims or the negotiation of impact and benefit agreements. Under such circumstances, an affected aboriginal community is unlikely to choose proponent-designated researchers to act as intermediaries in encoding, analyzing, and presenting local TEK, and indeed, if the community were opposed to the project, it could hold up the review by simply failing to provide TEK. Even if the project itself is viewed favourably by the local population, there is often a reluctance to share TEK with outside researchers or agencies because of a concern that it will be misinterpreted or decontextualized (Stevenson, 1996, 1997). It is therefore neither reasonable nor appropriate to require a proponent to incorporate TEK directly into its EIS.

An Example: The Voisey's Bay Environmental Assessment

In 1996, the Voisey's Bay Nickel Company Ltd. (VBNC) filed an application to proceed with a mine and mill project in northern Labrador. This application triggered an environmental review under federal and provincial legislation. A joint environmental assessment panel was constituted in

January 1997 to review the proposal. Scoping hearings were conducted in 1997, and the proponent submitted an EIS in December. Public hearings were conducted in 1998, and the panel submitted a report in March 1999 (Griffiths et al., 1999).

Recognizing the problems that would arise in obtaining TEK under the controversial circumstances of the project (relating chiefly to unresolved land claims and benefits agreements), the panel's guidelines provided the proponent (Voisey's Bay Nickel Company) with two options for ensuring that TEK (and TK in general) would be given full consideration in the review. The company could either (1) "make best efforts, with the cooperation of other parties, to incorporate into its EIS aboriginal knowledge to which it has access or which it may reasonably be expected to acquire through appropriate diligence, in keeping with appropriate ethical standards and without breaching obligations of confidentiality," or (2) "facilitate the presentation of such knowledge by aboriginal persons and parties themselves to the Panel during the course of the review" (Anon., 1997:6–7).

Neither the Labrador Inuit Association nor the Innu Nation (the two primary affected aboriginal parties) was willing to provide TEK directly to the proponent. The Voisey's Bay Nickel Company had already provided financial support to both to undertake issue identification (INTFMA, 1996; Williamson, 1996). Their reports, which provided primarily Category 3 TEK, assisted the panel during the scoping phase, and VBNC used these reports, as well as the Labrador Inuit Association's documentation of land use and ecological knowledge (Williamson, 1997), in its EIS. However, as neither party chose to provide Category 1 TEK directly to VBNC, the company chose the panel's second option, to ensure that TEK that it could not otherwise obtain would in fact be made available for the review. Proponents anticipating a public review may be well advised to engage in similar processes at the same time they begin their own scientific research program.

Both aboriginal parties opted to minimize the use of trained professionals as intermediaries at the public hearings, but in different ways. The Labrador Inuit Association provided TEK chiefly through the innovative procedure of assembling panels of Inuit experts (established as such through their long experience) at technical hearings. These individuals provided information on the local estuarine, marine, and sea-ice environments, and predicted certain effects of the proposed marine and air transport systems on those environments, in conformity with the Panel's Public Hearings Procedures (Anon., 1998). These experts, selected by the Labrador Inuit Association, provided Category 1 TEK with specific reference to the project description. Their evidence was presented, questioned, and considered in the same way as other expert evidence at the public hearings.

The Innu Nation used trained intermediaries to assist in the preparation of a report on Innu TEK (Clement, 1998), and video documentation of Innu circumstances and concerns. The former included Category 1 and Category 4 TEK, although its impact predictions appeared to be based on general knowledge (or opinions) of previous industrial development, with no reference to VBNC's description of its proposed project. The video addressed the concerns and views of Innu regarding the project, thus restating issues identification and concerns noted at the scoping hearings, rather than addressing Category 1 TEK regarding specific project effects. The chief difference between the LIA and Innu presentations of TEK was that the LIA's addressed the effects of the project actually described by the proponent (to the best of the LIA's understanding of that description), while the Innu presentations referred to the effects of other developments that Innu had experienced, without reference to the specifics of VBNC's proposed project.

Category 1 TEK was particularly relevant to the Panel's findings and recommendations regarding the proposed marine and air transport systems. This information went well beyond both the proponent's EIS, and the evidence of nonaboriginal technical experts. The Voisey's Bay case shows that the use of professional intermediaries to organize and present TEK can be minimized. However, I believe that the need for professionals is best assessed in each case, on the basis of the technical requirements of the particular arena, how adversarial the proceedings are likely to be, what other requirements for that information may exist, and what resources are available to those who would put it forward. Certainly, the primary role of the professional for this purpose is not to verify or improve on TEK, but to organize it and make it accessible. Interpretation, while to some extent unavoidable (and not necessarily undesirable if it is clearly stated as such), should be kept to a minimum in an environmental review, so that adjudicators receive the benefit of local TEK with a minimum of filtering by the researcher.

CONCLUDING OBSERVATIONS

Many aboriginal people regard TEK as unique and particular to their culture and locality, and as a positive and empowering attribute of their aboriginal identity. For them, the use of TEK in environmental assessment and management affirms the validity and relevance of their knowledge, experience, and competence, and reverses a long history in which those attributes were ignored or discounted. Yet many people, both aboriginals and researchers, have expressed concerns about the use of TEK in this context. One such concern is that TEK, and those who present it, be treated with respect. Another is the risk of appropriation and dispossession of TEK (Stevenson, 1997; Wenzel, 1999). Aboriginal people are often resistant to the idea that TEK can be codified in writing and thus taken away, removed, or separated from the cultural context in which it operates.

There has been considerable discussion in some legal and human rights arenas on issues of "intellectual property rights" with regard to TEK, but no firm principles have been established. Questions have been raised about whether Western legal principles of intellectual property rights properly or adequately apply, whether other legal concepts are required, and whether more restrictive regimes would be effective, or have desirable outcomes in a broader sense (viz. Brown, 1998; Wenzel, 1999). In the international development field, some proponents of the use of indigenous knowledge advocate collecting and archiving TEK as though it were a data set, although as Agrawal (1995) notes, this entails processes of codification and reification that contradict the very qualities that some TEK advocates maintain are the crucial differences between TEK and science. The data set approach appears to have few advocates in Canada, at least in the context of environmental assessment and management.

Wenzel (1999:118) poses the question: "Who has the right to access and interpret traditional ecological knowledge?" and cites a range of views from different commentators. However, once such knowledge is placed in the public arena in support of a public policy choice, the answer must be that everyone has the right to interpret it, just as all have that right with respect to any other knowledge claim. Some have observed that courts of law, or even panel reviews, are not the best places to judge the merits of scientific claims, and that scientists are best qualified to do that. There is a risk that any knowledge, taken out of the context in which it was generated, can be misinterpreted or even deliberately misused. Achieving transparency and accountability in public policy-making processes is a better way to minimize that risk than withholding knowledge and information from them. Ethical treatment of TEK does not and should not include sole control over interpretation.

The public (including the aboriginal public) is increasingly aware that there are competing knowledge claims within the realm of science, and that each may be accompanied by inherent limitations and risks of error. TEK, as a form of science, is not infallible in this regard, and its use and acceptance in public policy making will not be enhanced by assertions that TEK is above critical examination of its premises, data, methods, and conclusions. Some might observe that I have sought to fit TEK to existing environmental assessment and management processes, rather than the other way around. I would respond that it is in the interests of all to demonstrate the power of TEK in the arenas and by the processes that have already been negotiated, as so many have advocated, before moving on.

ACKNOWLEDGEMENTS

I wish to thank Frances Abele, George Wenzel, Pamela White, and two anonymous reviewers for their comments on earlier drafts. I am also grateful to my fellow members of the Joint Environmental Assessment Panel for the proposed Voisey's Bay Mine and Mill Project—Lesley Griffiths, Sam Metcalfe, Lorraine Michael, and Charles Pelley—with whom these ideas were tested in practice.

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