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## Policy Reviews and Essays

# Traditional Environmental Knowledge in Practice

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*Realizing the potential of comanagement requires that resource managers and First Nations learn to work together more effectively. This is a distant objective unless negative preconceptions of traditional environmental knowledge and management systems are examined and overcome. This article attempts to foster understanding by exploring and dispelling three myths about aboriginal peoples' relationships to the environment: the primitive technology myth, the indiscriminate harvesting myth, and the "disappearing Indian" myth. We argue that each is unfounded and illustrate our views with a case study of Vuntut Gwitchin ideology, resource use, and management practice.*

**Keywords** aboriginal, comanagement, First Nation, natural resources, resource management, traditional environmental knowledge, Vuntut Gwitchin

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We are indebted to our First Nations and resource management colleagues who contributed to our growing understanding of the challenges and promises of TEKMS and comanagement. The lead author is particularly appreciative and respectful of her interactions with Vuntut Gwitchin elders and traditional resource users, and their willingness to share time and knowledge. We thank Dr. W. Kessler, Chair of Forestry, University of Northern British Columbia, and three anonymous reviewers for valuable comments provided on earlier versions of this article. The research resulting in this publication was supported in part by the Social Sciences and Humanities Research Council, the Canadian Forest Service, Natural Resources Canada, and the Northern Scientific Training Program.

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In aboriginal communities, comanagement represents a potentially important element in the future stewardship of living resources, a means of blending aboriginal and state management approaches, gaining greater community support, and enhancing the effectiveness of resource management. Comanagement regimes are institutional arrangements covering a specific geographic area, where local users and the state agree to a system of reciprocal rights and obligations, rules of behavior, and processes for decision making (Osherenko 1988). These agreements balance the relationships between individual resource users, user groups, and the state (Pinkerton and Weinstein 1995). Too often, comanagement or state-user cooperation is thwarted by the existence of differing ways of knowing. In many aboriginal communities, traditional knowledge underlies attitudes to resource use and management. For comanagement to work, this traditional knowledge must be better understood and respected, in concert with Western scientific approaches. This article examines traditional knowledge and practice among the Vuntut Gwitchin First Nation in Yukon, Canada. It seeks to elaborate an example that shows the currency and potential of traditional knowledge as an underpinning for comanagement and to discuss important misconceptions about aboriginal people and resource management that potentially impede these partnerships.

The new political and legal landscape in Canada encourages state and aboriginal cooperation. Comanagement regimes are promoted as a means to enable this cooperation and are arising because of several factors: aboriginal dissatisfaction with state management systems that overlook traditional approaches and undermine local stewardship and harvesting interests; problems of overexploitation and crises in wildlife populations; aboriginal claims to land and resources; and concerns over economic and industrial development pressures. Though many other local resource user groups wish for greater comanagement, for instance, in the salmon fishery on the West Coast of North America, and in fact, many nonaboriginal groups are involved in comanagement initiatives, aboriginal groups must be considered because of legal requirements.

Resource managers around the world are finding that conservation is more effective when it includes local interests (Freeman 1997). However, the ambitious goals of power sharing and integration of knowledge systems and values remain elusive. In some cases, comanagement has improved communication and understanding between aboriginal and nonaboriginal groups (Osherenko 1988) and has functioned as an effective dispute resolution mechanism, but thus far, Western science and state management priorities and procedures tend to predominate. Aboriginal people "have found limited purchase for their traditional knowledge and ideology in bureaucratic institutions little changed in structure and orientation from their antecedents" (Nakashima 1991, 4). It is our contention that before fair, honest relationships develop and mutual resource management goals are realized, aboriginal peoples and state resource managers must learn to understand and respect their different worldviews.

This article challenges perceptions that traditional environmental knowledge and management systems (TEKMS) are anecdotal, nonquantitative, nonecological, narrowly pragmatic, irrational, unsubstantiated, or in the process of disappearing (Wolfe et al. 1992). We examine these and other assumptions that make cooperation between aboriginal people and the state difficult. We demonstrate, based on extensive fieldwork with the Vuntut Gwitchin, the foundation and current practice of TEKMS in their region. We suggest that TEKMS are credible worldviews; respecting their basis and value will enhance the validity and viability of resource management partnerships.

## **Two Worldviews**

From a simplified perspective, two models of resource management are in active use throughout Canada: the aboriginal system and the state system. Several authors have characterized and compared these two models (Osherenko 1988; Berkes et al. 1991; Johnson 1992; Berkes 1994; Dyer and McGoodwin 1994; Kofinas 1998).

Aboriginal management is a local or regional-level system based on customary authority, traditional ecological knowledge (TEK), and communal management principles. Kofinas (1998, 122) defined local aboriginal systems of management as consisting of the following elements:

- An information base and paradigm or set of mental constructs that organizes and interprets information into useful knowledge.
- A set of practitioners with a distinctive worldview or culture that includes both this paradigm and certain normative values.
- A system of rules, norms, and customs concerning rights and responsibilities that are intended to govern the behavior of all who partake of resources and their benefits.
- An overall set of objectives that are embedded in the situations and ideology of the society.

State management of natural resources tends to be implemented by a centralized authority (a federal, provincial, or state agency) to control public property resources, and is enforced through written laws and regulations (Berkes et al. 1991). Management activities are conducted not by resource users, but by professional administrators and scientists. According to Usher (1986, 92), the state manages for “certain levels of abundance on a technical basis and allocates shares of this abundance to users on an economic and political basis.” The state knowledge system is based on scientific data, and management problems are resolved in a technical, value-free framework (Usher 1986). It tends to be implemented by a top-down bureaucracy that is hierarchically organized and compartmentalized.

Two fundamental tenets of state-style management (Wolfe et al. 1992) contribute to problems when dealing in cross-cultural situations because they are based on Western assumptions regarding resource use and human nature: the predatory model of hunter behavior and the tragedy of the commons model. The predatory model maintains that resource users are self-interested and, as predators, will stop at nothing to catch the last “prey item” if “[they] are hungry enough for food or money” (Pinkerton and Weinstein 1995, 15). The tragedy of the commons model suggests that all shared resources will be degraded or overexploited at the hands of users unable to cooperate for their mutual benefit, oriented only to short-term self-interest. Hardin’s (1968) paradigm assumes that individual interests are unchecked by social relations and that only competition shapes interactions between resource users. These paradigms reject the notion of collective action for the common good, or of different cultural values underlying human–resource relationships. Both have profoundly influenced state management and attitudes toward aboriginal resource users.

State resource management is founded on culturally specific ideas about competition, individuality, property, and control. It relies on procedures, generally defined and enforced by outsiders, that may be impractical in remote or aboriginal communities (licenses, fees, reporting); individual/seasonal limits that may be at odds with community subsistence needs; gear restrictions that may be at odds with traditional practices; and enforcement by fine, seizure, or confinement (Osherenko

1988). Institutionalized Western systems of resource management are founded on professional and technical disciplines demanding rigor, objectivity, and mutually exclusive specializations (Berkes 1994). However, there is rising awareness that specialization cannot solve the complex problems of our society. To date, lack of baseline data, poor predictive ability, and a compartmentalized approach that overlooks the interconnectedness of human and ecological systems have led to oversimplified approaches to natural resource management.

On the other hand, aboriginal management systems rely on social sanctions and extensive teaching to reinforce expectations about wise resource use. Observation, management, and harvesting are inseparable enterprises, and acquired knowledge is shared constantly within the community. Continuity and flexibility are fundamental characteristics of any traditional knowledge system. Aboriginal management is validated and revised both daily and seasonally through the annual cycle of activities. Furthermore, aboriginal management relates not just to resource use but also to relationships with the community and the environment. Admittedly, some aboriginal management systems are breaking down under the impacts of modern technology, competition, globalization, education, population growth, and resource depletion (Murphree 1993; Dyer and McGoodwin 1994). In addition, commercial, sport, and nonrenewable resource interests are beyond the direct influence of most aboriginal users, who must rely on state regulation to control the actions of outside individuals and agencies. But while aboriginal resource management systems are having to adapt in order to survive, there are still many examples of continuing traditional beliefs and good management practices: for instance, Dene healers (Johnson 1992), Inuit whalers (Freeman 1997), Aborigine grassland managers (Young 2000), Cree trappers (Berkes 1994), and Gitxsan salmon fishers (Pinkerton and Weinstein 1995).

Of course, aboriginal harvesters may abuse resources—or respect them—as may nonaboriginal users. But such abuses under a TEKMS should no more be used to dismiss that system than to dismiss Western scientific management systems when abuses or mistakes occur under them. It is not helpful to set up false dichotomies. But it is important to try to understand the characteristics of traditional knowledge systems. Fundamentally, the goal is to create locally acceptable management approaches; recognizing traditional knowledge is part of that.

### ***Powerful and Persistent Myths***

Acceptance of TEKMS is hampered by a persistent question. Did aboriginal people manage the natural resources on which they subsisted? Previous attempts to answer this question have ended in erroneous divisions and culturally biased representations of subsistence peoples as either simple-minded angels or ruthless predators (Slobodkin 1968; Kofinas 1998; Krech 1999). We suggest that these attitudes are based largely on three myths about aboriginal peoples' relationships to the environment: primitive technology, indiscriminate harvesting, and the "disappearing Indian." While each myth may have some elements of truth—and rhetoric—generalizations obscure the reality of indigenous cultures and obstruct development of comanagement.

It is often argued that primitive technology limited the need for aboriginal resource management (Parker 1972). Unable to overharvest or threaten resource viability, aboriginal people did not require management systems or develop knowledge of the environment. A contemporary corollary is that aboriginal resource

users with modern technology tend to unrestrained resource exploitation; they do not consider questions of conservation from a “developed” point of view. Resource managers have denounced aboriginal people as reckless, irresponsible, and improvident, promoting the decline of species including caribou, moose, and salmon (Kelsall 1968). Examples are cited of overkill, incomplete use of carcasses, failure to pursue wounded animals, harassment, and improper storage techniques. Though such instances occur, aboriginal communities do not condone them—and they are not limited to aboriginal harvesters. But the stereotype persists that aboriginal people, having gained control over nature, still lack control of themselves (Nakashima 1991). Skeptics also suggest that traditional knowledge and management systems are irreversibly eroding because of the acculturation of aboriginal people, their assimilation into the dominant society, and the failure of elders to transmit traditional knowledge to younger generations (Johnson 1992). The “imminent disappearance” of traditional wisdom allows resource managers to discount it. While aboriginal communities do differ in their ability to implement TEKMS as a result of many factors, this does not dismiss the potential for TEKMS to be useful in many comanagement situations.

In the following sections we examine these myths with particular reference to Vuntut Gwitchin resource use and management, and show that each is unfounded. The research reported here results from a 2-year community-based project in Old Crow, Yukon, to document Vuntut Gwitchin TEKMS. It drew on archival materials, ethnographic fieldwork, and participatory action research (Maguire 1987; Frideres 1992; Johnson 1992). Individual interviews, mapping, group trips to special sites, and participation in resource uses contributed to the researchers’ understanding of Vuntut Gwitchin traditional knowledge. For more information, see Sherry and Vuntut Gwitchin First Nation (1999).

### **The Vuntut Gwitchin Traditional Environmental Knowledge and Management System**

The Vuntut Gwitchin First Nation (VGFN) is centered in the community of Old Crow, Yukon, and consists of 250 people, living 750 km by air from Whitehorse and 150 km north of the Arctic Circle. Vuntut Gwitchin describe themselves as “people of the caribou” because of their subsistence and cultural ties to the Porcupine Caribou Herd. VGFN settled a comprehensive land claim and self-government agreement under the Yukon Umbrella Final Agreement in 1993 and now have the formal right and responsibility to manage a portion of their traditional territory (DIAND 1993). For millennia, the tundra, forests, lakes, rivers, and mountains of the north Yukon sustained the ancestors of modern Vuntut Gwitchin (Sherry and VGFN 1999). People maintained a seasonal round of activities that tied them economically, spiritually, socially, and politically to each other and to the land (Cruikshank 1974). Understanding of the natural environment, and people’s relationship to it, was a prerequisite for survival and continuity of the Vuntut Gwitchin in a demanding subarctic climate where resources were widely dispersed and fluctuating (Slobodin 1981). An ideology and system of social organization regulated land use and guided human behavior toward natural, physical, and spiritual realms (Vanstone 1974). Now, local management “practitioners” include people of all ages. The “objectives” of this local system center on community and individual well-being, continuation of the resource base, and cultural survival.

***Vuntut Gwitchin Management Ideology: Everything Is Alive, We Are All Relatives***

Control and manipulation of the environment to meet societal goals is the pre-occupation of Western resource managers. By contrast, Vuntut Gwitchin feel that their use of the environment is a privilege, not a right, governed by the maxim, “take only what you need and use everything that you take.”

In the Vuntut Gwitchin worldview, there is no distinction between animate and inanimate elements of the earth, the supernatural and the tangible, humans and nature—all are tightly interlinked. The entire cosmos is viewed as alive.

We are all derived from the land . . . . You have to live it to actually understand it . . . . We're all equal on the land. We all belong together. We all need to share . . . people are part of that cycle and part of that life. (Sherry and Moses 2000)

Vuntut Gwitchin are obligated, individually and collectively, to act responsibly toward the land for the benefit of future generations. For instance, a pervasive rule is that harvesting must occur at a level accordant with the abundance of a resource and with individual or group need. This constrains human use of the environment and promotes sustainability. In the past, for example, there was no law limiting the number of fish a person could take, but if a fisher took too many fish for the size of his group or status of the resource, there were community sanctions as well as more intangible consequences such as a “loss of luck.”

From a Vuntut Gwitchin perspective, humans and the natural world are kin, and cohabitants of the land; all living things are “persons” (Fienup-Riordan 1990). Animals are recognized as sentient beings with souls, intelligence, perceptiveness, and ability to act freely. Sacred narratives commonly describe humans and animals communicating, transforming into one other, intermarrying, cohabiting, and having offspring. For instance, humans visited the world of animals and, in the case of the caribou, traded places. Each learned the difficulties and rewards of the other’s life and retained a vestige of the old relationship afterward. Each caribou retained a portion of a human heart, and each human retained a portion of a caribou heart (Slobodin 1981). This explains why it can be difficult or easy to harvest caribou. People will know what caribou are thinking or feeling, and caribou will have the same understanding of people. There are other human–animal ties, such as matrilineal inheritance of a special relationship with one or more animals associated with a clan, or special individual relationships in the form of guardian animal spirits (Slobodin 1981).

Traditional Gwitchin, not viewing human life as superior, assert they do not have the right to control nature for their own interests (Vanstone 1974); elders say, “We are not the boss of wildlife.” The special power and authority humans assume in conducting modern wildlife management, using techniques such as tranquilizing, netting, radio collaring, and tagging, are viewed as disrespectful. Similarly, trophy hunting and sport fishing are alien and disharmonious concepts. To elders, kin cannot be “played with” and they worry that such lack of mutual respect will have dramatic consequences. Animals may become difficult to catch or leave the people altogether. Family members may become sick or even die.

Kinship does not prevent people from harvesting animals for food, medicine, and material needs, but these privileges do require the maintenance of reciprocal relationships. Animals give themselves willingly to hunters. In turn, detailed

customary rules for showing respect and propitiation must be followed, such as covering up blood on the landscape, returning bones and carcasses to the original environment, making prayers before butchering, and respecting the meat; otherwise, animals will avoid harvest. Plants are also viewed as gifts from the Creator and, in the Gwitchin perspective, should not be overexploited or misused. Acknowledging the power of plants, giving them personal gifts of special foods, or matches and tobacco, and offering prayers and words of praise after picking them, all help to maintain balanced relations, ensuring the continued availability and quality of plant resources. Failure to reciprocate will manifest in a physical event such as a severe rainstorm. Thus, respectful human conduct is a key determinant of sustainability, and violations lead to sanctions imposed by the community and the “conscious forces of the environment” (Nelson 1983, 27).

### ***Vuntut Gwitchin Resource Management in Practice***

Contributing to Vuntut Gwitchin resource use and management are rules regarding communal property, behavior and stewardship, kinship ties, and sharing. These existed before European contact (1840), during the contact-traditional period (1840–1950), and continue to the present day (Slobodin 1981). In the Vuntut Gwitchin TEKMS, standards take on three forms (Kofinas 1998): written or *de jure* rules, customary laws, and unspoken assumptions. Formally stated rules were absent historically but now, with the Vuntut Gwitchin First Nation Final Agreement and the Vuntut Gwitchin Self Government Agreement (DIAND, 1993), they are becoming more prominent. Customary laws are informal rules institutionalized in the traditional system, while unspoken assumptions are reflected in local language, ideology, and mental models that govern local thinking. The latter two types of community standards continue to be reinforced through oral tradition, ritual, spiritual beliefs, taboos, and social celebrations (Wolfe et al. 1992).

In the Vuntut Gwitchin system, every individual in the community has the right to harvest, and family territories are plastic, but in practice, specific rights of access to lands and resources are observed. For example, at the turn of the century, individual ownership of caribou fences was common and continuous occupancy of a fishing site or a hunting ground gave groups limited territorial rights in the form of continued use (in case of interrupted occupation, another group could move in). Neither individuals nor the community “owns” resources in the Euro-Canadian sense of the word; for example, holders of traplines or fishing eddies are, more accurately, caretakers. People have the right to use their traditional territory but do so as a privilege from the Creator, and must carefully manage their relationship with each other and the natural world or risk having these privileges revoked by a higher authority.

Land, water, and plant and animal populations are considered nonexclusive resources. As did many northern aboriginal groups, the Vuntut Gwitchin solved their “commons dilemma” by cooperation, “communitarianism, strong group coherence, emphasis on social obligations, consensus-based decision-making, a high degree of social conformity, and strong social sanctions within the group” (Berkes et al. 1991, 14). While no one can prohibit other community members from taking what is needed from the land, people are bound individually and collectively to compliance with, and enforcement of, accepted norms of behavior.

Decisions about where, when, and how resources were used and shared were controlled by leaders who possessed great knowledge and were exemplars of correct

practice and good decision making. Leadership was transient—different land use activities had different “heads.” Slobodin (1981) explains that the authority conveyed to leaders required knowledge broader than understanding the natural environment and being adept at survival skills. They also needed “soft skills” related to group dynamics, such as coordinating camp movements, facilitating consensus decision making, resolving internal issues, and equitably distributing resources (Kofinas 1998). Like current state resource management, it seems that traditional resource management had much to do with managing the users of the resource.

Breaking Gwitchin community norms may lead to censorship and punishment in the form of gossip, ridicule, and shaming but, more importantly, usually results in attempts at reeducation by direct instruction and modeling of appropriate behavior. Punishment and remonstrance are also perceived in nature. For example, Kofinas (1998) relates a story of two young boys hunting for caribou. One joked about the caribou he shot. An early winter storm arose soon after, killing one of the boys and leaving the other close to dead. In another instance, a Vuntut Gwitchin man shot at a flying loon in hopes of making a stew. The man hit the bird with a shotgun blast to its hind end but did not kill it. “When out of town, the hunter learned that local vandals had damaged the rear of his boat, untied it, and set it adrift” (Kofinas 1998, 141). Thus, Vuntut Gwitchin see external forces as reinforcing the importance of respect and reciprocity, and the integration of community and nature.

The concept of luck illustrates Gwitchin stewardship ethics; luck is achieved and maintained through a complex set of actions including *chyrzi* (sharing), showing proper *yinjigwihile* (respect), demonstrating humility, and communicating deference. Lucky hunters are described as *vitive gwinzi* (his ways are well). According to Gwitchin harvesters, and many other aboriginal groups, animals give themselves in the hunt as a gift, the consequence of quality relations between hunters and caribou as well as hunters and their community. Success in bringing home caribou is a function not of outsmarting or mastering the animal but of thinking like the animal, becoming sensitive to the animal’s decisions, and pleasing the animal enough to receive it as a gift (Kofinas 1998). As Nelson (1983, 27) explains:

Luck . . . can be lost, transferred, and recovered. Luck binds people to the code of proper behaviour towards the natural world. And so success in living on the land involves far more than a mastery of technical skills. It requires that a sensitive balance be maintained between each person and the conscious forces of the environment.

Vuntut Gwitchin identify and harvest specific animal types; for instance, 19 types of caribou are defined by observations of condition and behavior (Kofinas 1998). Associated rules and taboos govern their harvest and use. Knowledge about caribou movement and migration also dictates hunting behavior. For example, at *nehttui* (river crossings), caribou are not pursued or hunted until they have initiated swimming, ensuring that other migrating caribou will continue to move through at this point. Community conventions also instruct that lead caribou groups in the spring and fall migration must be allowed to pass and settle, respectively, into their calving or wintering grounds to increase the likelihood that the herd’s migratory pathways are not interrupted nor animals deflected to other areas.

Caribou fences or *vutzui thulh*, a remarkable aspect of prehistoric Gwitchin technology, were employed seasonally by groups of hunters to steer, ensnare, and dispatch caribou; they illustrate a traditional approach to community and land

stewardship. A caribou fence hunt and the social relations surrounding it were coordinated by a *gwitshid* or head person, the leader by virtue of his skill, experience, knowledge, and luck (his ethical conduct toward nature) (Sherry and VGFN 1999). Site selection, fence construction and access, the harvest, and its allocation were all controlled by its "owner." Cooperation was needed in directing the herds, operating and repairing the fence, handling large quantities of caribou meat, and accommodating unsuccessful groups by sharing the take with other families. Numerous features of Vuntut Gwitchin caribou hunting contributed to the stewardship of this essential resource and illustrate key elements of VGFN resource management practice: continuity of use through time leading to commitment; detailed, local environmental knowledge; use of suitable methods and technology to exploit the resource; controlled resource access and allocation; a rational management system (planning, execution, and results); integration of social values including resource security for community members; use guided by "experts" who enforced Gwitchin environmental ethics regulating exploitation rates and human-human and human-animal relations; and reinforcement of cultural values including respect, reciprocity, equity, and relationship with the Creator (Sherry and VGFN 1999).

According to customary law, harvests should conform to perceived needs, to avoid waste. Waste management requires harvesting no more animals than can be properly handled and stored; caribou takes during summer and early fall are limited because temperatures are too warm and chances of spoilage high. When waste does occur, the community responds to expose and correct the impropriety. For example, when an incident of overharvest and waste of caribou occurred, a public meeting was held, signs were posted community-wide, community members helped to retrieve wasted meat, and elders offered to teach the offenders proper techniques for meat preparation, use, and storage. There was extensive public discussion of the infraction, and the young men involved were essentially subject to intensive direct and indirect censure. It is more typical, however, that harvested animals are efficiently and completely used. All parts of the caribou are consumed or have other useful functions (clothing, tools, dog food, shelter, medicine, and hygiene products). Some elders even continue to hang hooves and lower leg tendons to dry in trees: insurance, in former times, against starvation. The elders say that the land must be kept "clean," manifest in taboos regarding handling of blood in caribou country; processing should be carried out on a bed of willows in the summer and blood-stained areas covered with moss in the summer or snow in the winter.

There are many examples of Vuntut Gwitchin hunting, trapping, and fishing practices where harvesters forego short-term benefits in return for long-term sustainability. Although outside influences such as the commercialization of trapping or the introduction of modern technology may have had effects on resource use, culturally encoded traditions remain central to contemporary life in the bush.

The rotation of traplines is one such practice. Trapping areas are rested by rotation so they become more productive as populations rejuvenate and age/sex classes return to a dynamic balance. Gwitchin carefully monitor the populations they harvest. When declines in furbearers are observed, resource use is shifted to new locations and the original area is left for 1 to 3 years to renew itself. For animals like beaver and muskrat, known as density-dependent species, trappers say continuous annual harvesting is needed to achieve a productive population and sustainable harvest. Harvesting in this manner prevents animals' overuse of the food supply and reduces competition for space, leading to increased

reproduction and survival of young. As one Vuntut Gwitchin elder said, “you gotta trap to conserve.”

## **Dispelling the Myths About Aboriginal Management**

By combining an ideology of respect and reciprocity with resource use practices that provide for self-regulation, Vuntut Gwitchin managed their relationship with the human, natural, and spiritual world. Using this basic picture of one aboriginal management system, assumptions about the ability of indigenous people to manage themselves and the living resources on which they depend can be revisited. In reality, both aboriginal and Western management systems aim at similar goals—respectful, moderate relations between humans and animals.

### ***Primitive Technology—Limited Harvests***

Traditional technology is assumed to have limited historic harvests by aboriginal peoples, with primitiveness being associated with ignorance and ineptitude. However, hunter-gatherer cultures throughout the world have developed “sophisticated hunting tools and strategies whose diversity and ingenuity defy their dismissal as primitive” (Nakashima 1991, 300).

Gwitchin harvesting technology was complex and effective. A study from Alaska demonstrated that killing efficiencies of the bow/arrow and dart/throwing complexes rivaled Western technology until the invention of the repeating rifle in the late 19th century (Townsend 1983). Vuntut Gwitchin elders report that a man on snowshoes could reliably kill game from a distance of 70 m with a bow and arrow. Penetrating power was great; at a distance of 35 m, arrows routinely pierced the thorax or abdomen of adult caribou (Sherry and VGFN 1999). Archers were capable of accurately releasing 20 arrows per minute, which surpassed the 3 shots per minute of European muzzle-loading muskets (Townsend 1983). One cannot question the efficacy of Western weaponry—indeed, aboriginal people quickly recognized its benefits—but we cannot characterize aboriginal and Western technologies as simple versus advanced.

Little evidence supports contentions that primitive technology prevented aboriginal people from overexploiting; productive, precontact harvesting technologies such as caribou fences and fishnets were used, yet evidence also indicates that harvest levels were controlled by numerous rules (Sherry and VGFN 1999). For example, long before cotton nets with floats and sinkers or store-bought lures were available, Vuntut Gwitchin made fish nets from willow bark or “skinny babiche” rope. Different lengths and mesh sizes were used to control the number, species, and age of fish caught (Sherry and VGFN 1999). Gwitchin elders indicated that 3-inch mesh is used for herring, 4- to 4.5-inch mesh for char, and 5- to 5.5-inch mesh for inconnu or whitefish. Mesh size was rarely smaller than 3 inches; otherwise, too many juvenile fish were captured. The length and number of nets set corresponded with the number of individuals at a fish camp, a group’s projected winter food requirements, the number of dogs kept by a family, and the abundance of target species (Sherry and VGFN 1999). At peak run times, production was high. Hundreds of fish were caught each day, and nets were checked at regular intervals to avoid waste in the form of softened, waterlogged, and thus inedible fish. Once processing capacity or group needs were filled, or the productivity of the run declined, nets were pulled from the water. This example illustrates that not only tools and materials but also traditional knowledge and beliefs were critical components of Aboriginal technology.

### ***Indiscriminate Harvesting—Carelessness and Waste***

The breakdown of traditional aboriginal management structures has many causes related to rapid modernization and cultural homogenization: loss of resource access and control; disruption of social systems defining rights and responsibilities; interference with intergenerational education; acquisition of new values and lifestyles; and introduction of cash economies and wage employment. As a partial result, it is true that some aboriginal hunters overharvest or waste. But it is not true that these behaviors broadly characterize aboriginal communities. As in any society, there are prudent and imprudent resource users—the actions of a minority should not cloud judgment of the whole. As described in an earlier example, Vuntut Gwitchin were offended by an incident of wasted caribou meat, and took action to deal with the young men responsible.

Gwitchin elders promote renewed relationships between young and old generations, foster learning of traditional ways, and promote community and outside sanctions against those who violate traditional norms of behavior. Vuntut Gwitchin are not unaware of the challenges to customary law and the adaptations required to adjust to these perturbations, and are determined to deal with them. The stereotype of aboriginal people as indiscriminate harvesters is suffused with a strong ethnocentrism and must be evaluated for whether it reflects nonaboriginal values and belief systems (Nakashima 1991). It must be recognized that aboriginal cultures are capable of adapting to new conditions and devising new institutions while preserving a basis in old values, beliefs, and practices. For instance, it is common Vuntut Gwitchin practice now that people undertaking regular work, such as supplying camps along the rivers, will take young people along to “job shadow” the corollary hunting or fishing activities.

### ***“Disappearing Indians”—The Last of the “True Elders”***

The expectation that the passing of the last “true” elders will lead to complete loss of traditional knowledge is defied by the experience of aboriginal communities across Canada. In the face of drastic change, TEKMS are still vital and active. They may not consist entirely of the earlier traditions because, as in all cultures, “the knowledge system . . . is constantly changing through the assimilation of ‘outside’ knowledge and synthesis and hybridisation with existing knowledge” (Johnson 1992, 10).

TEKMS are still at the heart of modern Aboriginal communities. Vuntut Gwitchin hunters, fishers, trappers, and gatherers continue to consult older and wiser community members—recognized authorities—to interpret observations or experiences out on the land. Information, values, and beliefs are shared with younger generations, along with extensive training by experienced resource users. Many Vuntut Gwitchin point to their grandparents, aunts, uncles, and parents as their teachers, both in childhood and throughout their lives. During the period of this research, a group of young boys accompanied a younger boy on his first caribou hunt; upon their return in the early morning, parents and community members expressed great pride in the boys, who had properly observed rules of harvesting and meat handling.

Despite the passing of elders, TEKMS live on, carried on by the community in general and by the maturation of “new” elders in particular (Nakashima 1991). Despite the loss of some traditional knowledge, aboriginal people and social scientists confirm the continuity and vitality of traditional cultures and assert that TEKMS are evolving, not dying (Berkes 1994; Johnson 1992).

## **Implications for Using TEKMS in Comanagement**

Vuntut Gwitchin environmental knowledge, ideological perspectives, and management practices remain vital, well integrated into community life, and openly expressed. They provide a solid cultural basis for establishing new regimes of resource management adapted to contemporary settings. Similarly, the Alaska Eskimo Whaling Commission and other new organizations have been found to provide new means to reinforce traditional concepts and practices of conservation (Rettig et al. 1989). While not every community is fortunate enough to be able to reinforce and practice their TEKMS in comanagement processes, where this does occur they can be an important component of community pride, self-reliance, and effective resource management.

Though this case study focuses on the Vuntut Gwitchin First Nation, it suggests some implications for strengthening comanagement and promoting successful aboriginal/state partnerships. First, state managers must throw out the myths and be more open to traditional knowledge, recognizing it as a different way of explaining the world, but one that can reflect a deeply held set of beliefs, values, and practices based on long-term experience in an area.

Usher (2000) has argued that TEK can make a clear and positive contribution to environmental assessment, recognizing different types of information: knowledge of the environment, knowledge of past and current uses of the environment; values about the environment, or the knowledge system itself. This knowledge must be collected, organized, and communicated, along with scientific knowledge, and must be testable or validated. In environmental impact assessment, such knowledge has been useful, complementing scientific knowledge, adding layers of detail to it, suggesting outcomes and predictions, or contributing norms and values to decision making. In this study of Vuntut Gwitchin TEKMS, it is clear that knowledge exists in the four types that Usher (2000) describes. These can contribute to resource management through factual knowledge about resource/environmental patterns, human uses, and impacts; accepted conservation (wise use) practices; and the community values needed to inform decisions. This will also be an important element in preventing the dissolution of indigenous institutions, authority, and culture. Documentation of TEKMS, preferably by aboriginal communities themselves, will be important to both effective comanagement and cultural survival; as Usher (2000) notes, this must be organized and systematic, so that scientists do not discount the observations as anecdotal or unreliable.

TEKMS not only can contribute new knowledge and values, but can provide a local framework for workable comanagement. Custom-made solutions particular to a specific resource and setting are needed; they require recognition and inclusion of a specific traditional knowledge system and the community standards, ideology, and social relations that underlie it. Face-to-face partnerships should involve aboriginal people in the design and implementation of comanagement. If comanagement institutions are to work, the role of the state must be redefined to support and complement, rather than replace, local or regional self-management systems. While neither system of management is infallible, mutual respect is a necessary precondition for effective resource management. Fundamentally, state and aboriginal resource managers have similar goals in mind—the respectful use and conservation of the resource base.

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