The Relevance of Indigenous Knowledge to Contemporary Sustainability

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Abstract: The subject of Traditional Ecological Knowledge (TEK) is currently attracting interest from many quarters, including biologists and philosophers as well as the more traditional mix of anthropologists and other social scientists. Given rapid contemporary rates of change, as well as the novel species and environments being created by six billion humans, what is the relevance of TEK for today's world? Why would a working ecologist be interested in this area, and are there implications for practitioners in other fields related to contemporary resource analysis and management?

This essay will discuss three of many possible related answers to these questions. First, most ecologists only encounter their study systems over very limited time spans. Thus, there is a wealth of local observations at the level of populations and species that can be contributed by astute observers whose lives and livelihoods are tied to the land in complex ways. Second, conventional science, particularly ecological science, is not well-tooled for recognizing, analyzing, and responding to emergent properties of complex systems such as ecosystems. TEK, however, is holistic by nature, and so can clearly complement conventional science, which can only study whole system behavior using models that extrapolate from known conditions and processes. Third, it seems particularly counterproductive to fail to include the broadest possible diversity of problem-solving approaches during these times of emerging novel problems.

The literature on TEK is voluminous, and it is not the intent, in this brief essay, to provide anything approaching a comprehensive review. Rather, I hope to provide both food for multidisciplinary thought, and a few references that may open the way for readers interested in pursuing these ideas.

1. Local observations

It would be surprising indeed if local subsistence cultures with transgenerational relationships to particular landscapes did not have more particular and detailed information about local species and environmental patterns than the itinerant biologist and crew who may show up for a couple of months in each of a few years. Field seasons are usually limited to certain times of year. Academic investigators in particular are often constrained by the academic calendar. Researchers affiliated with local or federal agencies face fewer seasonal constraints, but "immersion learning" is not generally an accepted model for environmental research.

Many authors have published on the detailed knowledge that indigenous residents possess about wildlife (e.g., eider ducks (Nakashima, 1993); beluga whales (Huntington, 1999; Mymrin, 1999), fisheries (e.g., Berkes, 1977; Johannes, 1981; Ruddle, 1985; Yan, 1989), agroforestry (e.g., Posey, 1985), and root vegetables (e.g., Turner, 2000)). Cogent arguments are being made for the incorporation of indigenous knowledge into conservation and restoration planning (e.g., Nabhan, 2000), and there is strong international movement towards institutionalization of such arrangements (e.g., Mauro, 2000).

A recent example of conservation-relevant indigenous relates to bowhead whale census work (Huntington, 2000). In 1977, the International Whaling Commission imposed a ban on the harvest of bowhead whales, curtailing traditional activities of Alaskan Inuit. The Inuit argued that the population estimates made by western scientists (ca. 2000 – 3000 whales) were entirely inadequate, and that their culturally important whaling activities should not be limited. At that time, census counts were made by visual observations from pressure ridges or ice cliffs along the open lead that scientists thought was the migratory path of the bowhead. The assumption, then, was that all migrating bowheads passed within sight of the census locations, and when the lead closed due to moving pack ice, bowhead migration necessarily ceased. Inuit whalers, however, travel extensively on ice when leads are closed and routinely observe migrating whales far from census points. In the past, scientists and policy makers tended to dismiss these observations as simple self-interest directed towards trying to harvest more whales than "sustainability" would allow. However, twenty years of research involving both aerial reconnaissance and acoustic profiling (to detect whales migrating underneath the broken pack ice) demonstrated that bowheads do in fact migrate on a front broader than the confines of the nearshore lead. Consequently, population estimates have been greatly increased (ca. 6000-8000 whales), and subsistence harvest continues. Interestingly, the western Arctic population of bowheads is the only one of five populations that is harvested, and it is also the only one whose population appears to be recovering following the cessation of commercial harvesting in the late 19^{th} century (Gerber, 2000).

One arena in which dominant cultures struggle with incorporation of TEK is in the emerging activity known as "co-management". The goal of co-management is to recognize and use information from both Native peoples and state agencies in resource management, typically management of wildlife populations (e.g., the Beverly-Kaminuriak Caribou Management Board of Canada). The success (or not) of such efforts aside (e.g., Morrell, 1989), the very existence of co-management boards reflects a concern among indigenous peoples that conventional wildlife management strategies may not be sufficient to sustainably maintain the wildlife populations on which their cultures depend. There is an insistence that there are different ideas that can and should be incorporated into wildlife management policies.

Local observations are not limited to numbers, condition, or behavior of individual species, however. For example, Nabhan (2000) discusses species interactions that are recognized, named, and interpreted by indigenous observers of the Sonoran desert, whether or not they directly benefit from those species. He points out that much ecological knowledge is encoded in local language, lending a new dimension to concerns about the rapidity of language extinctions (currently about 10x the rate of species extinctions). It follows logically that indigenous communities are perhaps uniquely situated to assist in integrated conservation/restoration management for rare, threatened, and endangered species (Nabhan, 2000).

<u>2. Whole systems/emergent properties</u>

Local communities are in an ideal position to comment on early warning signals of environmental collapse. In plenary comments to the 1998 American Fisheries Society meeting (Western Division), Larry Merculieff reported that Aleuts of the Pribilof Islands had noted anomalous behavior of seabirds and marine mammals as early as 1977, some 15 years before western scientists became aware of impending cumulative impacts on the famously productive Bering Sea fisheries. Observations of severe food stress and declining populations were common. These included protruding bones of adult murres and kittiwakes, thinning of the skin of northern fur seal pups, and increased predation on fur seals by Stellar sea lions. Two decades later, the National Research Council responded to increasingly vocal concerns by seating a panel that issued the report providing the basis for much scientific research on the causes of and possible mitigation for the collapsing Bering Sea ecosystem (National Research Council, 1996). Both Aleut (L. Merculieff) and Central Yup'ik (C. Pungowiyi) representatives were members of the NRC panel.

Increasing numbers of projects are now documenting indigenous observations of recent change (e.g., Alaska Native Knowledge Network (http://www.ankn.uaf.edu/index.html), International Institute for Sustainable Development video on Inuit observations on climate change (http://iisd.ca/casl/projects/inuitobs.htm)). These generally provide additional evidence for processes such as climate change that are well known to disciplinary scientists but that are still controversial for the larger populace. In time, there may be an audience for similar kinds of projects in which indigenous observations can serve directly as early warning signals of change, affecting research priorities at a much earlier stage of the trajectory.

To provide an example of potentially important holistic TEK observations of ecosystem change, I will turn to the word of a Yup'ik Elder, Mr. Matthew Bean, from his 1985 remarks to the International Symposium on Arctic Air Pollution at the Scott Polar Research Institute in Cambridge, England (Bean, 1986). By 1985 the phenomenon of arctic haze had been identified as transient annual event resulting from the buildup of industrial pollutants in the stagnant polar air mass during polar night. It is most evident in the several weeks following polar sunrise. Atmospheric chemists had begun to characterize Arctic haze as a sulfate aerosol from long-range atmospheric transport that raised transboundary pollution issues. In his brief comments 15 years ago Mr. Bean said, among other things:

> *The more I am hearing of arctic haze and its actions, the more confused I become. Questions continually pop up in my mind. For example, if the sulphur particles are deteriorating in a certain length of time, where are the spent particles going? Are they going out into space, or are they going into the water and the ground? If they are falling to the ground, what effect is the plant life getting from the fallout; if they fall in the sea, how are the particles affecting the food chains leading up*

to the sea mammals? Since we have to depend on plant life to survive, we in Alaska are constantly wondering what is happening to our health. Our bodies are not adapted to domestic livestock, therefore we have to depend on the wildlife and the plant life in our immediate area. And the marine mammals that are in our areas are of great importance to us, as they provide the fats and the protein to keep warm in the harsh winters.

Every year this arctic haze is more noticeable in our area. The sky is never deep blue any more. It is very pale in colour. In this present day we never hear or see anyone get snowblind, and it seems on some day – even on semi-cloudless days – we have to keep our lights on. Our plants are not so healthy it seems. The leaves are not as green as they used to be. In recent years the leaves are turning pale green. Some are withering, such as Labrador tea and the water lilies; also in some areas our spruce trees are red in color.

And the behaviour of our sea mammals is getting odd. Ordinarily we don't see sea mammals dead on the beaches when they die a normal death. Now we are seeing more mammals dead on the beaches, such as Bowhead whales, Killer whales, walruses. Clams are floating, washed ashore with empty stomachs. Our wildlife are constantly being found with some of the fur missing from their pelts, and their behaviour is odd. Some of the wildlife are not afraid of humans. In fact some go after humans, which was never seen like that in early times.

In early times our forefathers would go outdoors in early mornings and were able to read the weather forecast, and on certain days they would warn us not to travel. They read the stars, the moisture and the visibility – how clearly they could see an object as visible. Now we can't see in the distance because of the haze obstructing visibility, nor can we predict what the day will be like….

(Bean, 1986)

It should be obvious, but it is important to note that there are specialists in indigenous societies just as there are specialists in technological societies. It is important to be talking to the right people. Local communities can easily identify the local experts on particular subjects. Mr. Bean is a highly respected Elder in his community who e made the long journey to England in order to be of service to the scientific community interested in arctic air pollution issues. His paragraphs could serve as the fruitful basis for much, and perhaps much-needed, research. Why is it, for example, that the Alaskan tundra was not as green as it used to be, even in 1985?

3. Conserving a diversity of problem-solving approaches

Indigenous communities have, over time, come up with many resource management practices that build on detailed knowledge of species biology (Berkes et al., 2000). For example, many authors (e.g., (Gadgil, 1993) note that polyculture systems are ubiquitous, from forest islands rich in medicinal species, palms, and vines that produce water in the Brazilian Amazon (Posey, 1985) to integrated fish/vegetable/tree cropping systems in Indonesia (Costa-Pierce, 1988).

Berkes et al. (2000) extend this discussion to include resource rotation, management of specific successional patterns, management of landscape patchiness, and "other ways of responding to and managing pulses and ecological surprises". In fact, one robust area of current research focuses on identifying the social mechanisms that lead to sustainable resource use (e.g., Berkes et al., 1998). Sacred groves, for example, fulfill many critical ecosystem functions, such as providing seed banks for local species, providing habitat and recruitment areas for seed dispersing animals, and providing habitat for predators on local agricultural pests. Social taboos may also have the effect of contributing to resource sustainability, although they may not have specific conservation origins (Colding, in press). These include such elements as specific food taboos, harvesting method taboos, taboos against harvesting in certain seasons or under certain conditions, and the like (Colding, in press).

It can be argued that such small-scale approaches to resource utilization are inefficient and inappropriate for today's global markets. Mechanization is crucial to achieving the necessary levels of production to meet market needs. It may be, however, that there are intermediate options between the fully mechanized models of profitable agribusiness (for example) and the labor intensive approaches of family-scale subsistence harvest. Design of hybrid systems could profit from the input of knowledgeable subsistence harvesters. Some progress along these lines appears to be occurring with respect to fisheries (Dyer and McGoodwin, 1994), at least on the conceptual side. In fact, large development projects often have had unintended repercussions, with the result that modern technologies often prove to be less sustainable than the existing, smaller scale technologies. For example, Stephen Lansing has found that the Balinese water temples manage the timing of water and regulation of pests so that they provide greater productivity than Green Revolution techniques (Lansing, 1987; Lansing et al., 1993).

Berkes has been in the forefront of trying to depolarize the contentious polarized caricatures of indigenous communities as either Noble Ecologists or Invader Wastrels (Berkes, 1999). The key is in recognizing that conservation practices are often produced as a byproduct of cultural practices that are not necessarily focused on conservation. One interesting example concerns the conventional wisdom that African pastoralists and their livestock are responsible for overuse of woody plants leading to desertification throughout arid and semiarid zones. Reid and Ellis (1995) examined this hypothesis in the dry woodlands of south Turkana, Kenya, a region where nomadic pastoralists harvest precious woody biomass (in this case, *Acacia* trees) for fuel, housing, fencing, tools, and utensils. Then they move on. Trees play a pivotal role in the structure and function of these arid ecosystems because their deep roots provide access to soil water, their shade slows the desiccation of understory herbs, and their longer-lasting foliage provides high quality browse to herbivores. Reid and Ellis concluded that, contrary to conventional wisdom, pastoralist land-use practices in their study area result in *Acacia* becoming more reliably present, and may enhance the size of *Acacia* populations (Reid and Ellis, 1995). The conventional wisdom appears to be based on the 5% of the land use near villages and towns where human and livestock densities are relatively high. Reid and Ellis then asked if the conditions they documented pertained beyond their small area of study. They found evidence from the literature that *Acacia* trees were present abandoned corrals built by Maasai pastoralists over 30 years earlier. Similar situations occurred in southern parts of Ethiopia and Kenya. Further, patches of this nutrient rich, moisture-retaining remediation species have been found on Iron Age Tswana livestock corrals in the middle of nutrient-poor savanna dominated by other tree species. This suggests that the influence of nomadic pastoralists on these landscapes may be many hundreds of years old, and in fact may be linked with increased water retention, soil fertility, and islands of biodiversity. Reid and Ellis conclude that perhaps it is time to rethink our generalizations about how pastoralists and livestock affect arid ecosystems.

Conclusion

Many ecologists, perhaps beginning with Garrett Hardin (Hardin, 1968) claim that it is entirely human to overexploit natural ecosystems to the point of collapse, and that the only thing that keeps cultures from doing so on a regular basis is the lack of access to appropriate (or inappropriate?) technologies. Proponents of this position apparently do not believe that sustainability is even theoretically possible, which implies that we as a species are doomed to do ourselves in. Anthropologists, however, say that this position simply reflects a lack of familiarity with the anthropological literature.

Both positions are largely theoretical. There is an urgent necessity for us to work at sustainability if we are to in fact become sustainable. At a minimum, we need to be using all the tools in our toolkit to address issues of sustainability. This includes epistemological tools as well as bricks-and-mortar tools. It is unwise to dismiss the potential contributions of indigenous knowledge out of hand. Welcoming indigenous experts to collective problem-solving endeavors seems like a good step towards successful sustainability planning.

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