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Ecological Risk Assessment and Management: Their Failure to Value Indigenous Traditional Ecological Knowledge and Protect Tribal Homelands

JEANETTE WOLFLEY

INTRODUCTION

A tribal land base or homeland is the *sine qua non* of sovereignty. Tribal territories form the geographical limits of each tribe's jurisdiction, support a residing population, are the basis of the tribal economy, and provide an irreplaceable forum for cultural vitality based on religious practices and cultural traditions premised on the sacredness of land. Today, fully functioning Indian nations possess four distinct yet interwoven and interdependent attributes of sovereignty: secure land base, functioning economies, self-government and cultural vitality.¹ Some describe these attributes as geographic and political independence. In short, the tribes' land bases are the linchpin to tribal existence and autonomy as sovereign nations.² Moreover, a priority implicit in Indian land tenure is maintaining a homeland in which both present and future generations of the tribes may live and flourish, since tribal individuals and families reside on

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secure land bases which have supported and nourished their ancestors for thousands of years past, and continue to be the core and integral foundation of tribal existence.

For most indigenous tribal peoples of the United States,³ creation stories, songs, prayers, and traditional ecological knowledge and wisdom teach us to visualize and understand the connections between the physical environment, the spiritual values that create and bind a tribal community, and the social welfare of the community. We are taught a system of values that induces a profound respect for the natural forces which give life to the complex world of which we are but a small part. The wisdom and knowledge that indigenous people possess of the ecosystems and their homelands is based upon millennia of observation, habitation, and experience, all utilizing a balance of human interaction and intervention with the environment. It is the traditional ecological knowledge—an interactive natural world science—which has preserved many tribal homelands in pristine condition and protected the many medicines and foods for generations. This traditional ecological knowledge held by indigenous peoples of the United States will continue to be the beacon for tribal ways of life to guide us into the next century.

In sharp contrast, the majority of the mainstream non-Indian people in the United States have lost their sense of reliance on nature for survival, and therefore have lost their respect for the world we inhabit. Many non-Indians no longer possess the stories, songs, and prayers which helped them see their connections to the natural world and the impacts of their actions. Essentially, the relationship among the spiritual world, the physical world, and the social world has disintegrated, having changed to one based on exploitation and commodification of natural resources for economic gain. The stories, songs, and prayers have been replaced by a kind of institutionalized science and technology that attempt to justify human actions to manipulate, contaminate, and deteriorate the environment. With the advent and wholesale embracing of an institutionalized science and technology, can non-Indians imagine why preserving biological diversity is something deeply connected to who and what we are in the world? And what can tribal people do to decolonize the institutional supposition that indigenous values and knowledge have no place at the table to begin to solve the ever-pressing environmental dilemma facing the United States and the world?

This article discusses the critical role that indigenous ecological knowledge can and should play in protecting and preserving ecosystems and tribal communities. Cultural values and diversity are as urgent as biological diversity and must be manifested in scientific methods of valuing lands, resource ecosystems, and human rights, or cultural knowledge must be considered equally in evaluating and planning for future projects or activities impacting tribal rights and resources. This article explores the threats to tribal homelands and treaty rights, and explains the role tribes should play in their protection. This article also seeks to present a tribal perspective to the area of ecological risk assessment and risk management by identifying and suggesting three major appropriate areas which must be addressed by federal agencies to start to protect tribal homelands and resources. This article, however, is no substitute for direct consultation with Indian tribes and communities. Risk assessment cannot be undertaken and risk management cannot be adequately implemented in a vacuum without tribal input.

RISK ASSESSMENT AND RISK MANAGEMENT

Federal and state governmental officials and decision-makers resolve national and local environmental and/or waste-management issues by performing risk assessments⁴ and risk management⁵ on an ongoing basis. Risk assessment, as the foundation for formal decision analysis, is viewed as the preferred tool to systematically and explicitly consider issues affecting the environmental decision-making process. In short, risk assessment is a scientific and technical process. It uses scientific information derived from past experience or other scientific information to quantitatively or qualitatively evaluate the potential consequences and risk associated with a given situation, action, or alternative. Risk management is the ranking of different risks, development of strategies to eliminate or mitigate the risks, decision on which risks are to be eliminated or mitigated, and implementation of selected strategies.

TRIBAL HOMELANDS AND OFF-RESERVATION RIGHTS

Any discussion of ecological risk assessment and risk management and their impact on tribal homelands must be premised

on an understanding of tribal land tenure in the United States and off-reservation treaty-guaranteed rights. There are 557 federally recognized Indian tribes in the United States.⁶ Tribes and individual tribal members in the lower forty-eight states own approximately 56.6 million acres of land,⁷ which roughly amounts to only 3 percent of the original tribal land base.⁸ Alaska Natives pursuant to the Alaska Native Claims Settlement Act own another 44 million acres.⁹ At least half of the 1.9 million tribal people in the United States live on or adjacent to one of 310 reservations.¹⁰ The size of tribal reservations ranges from the largest landholding of approximately 15 million acres (the Navajo Nation) to others of about 100 acres.¹¹

Since the beginning of federal-tribal relations, Indian tribes have fought in war, in Congress, in courts, and in public forums to maintain a separate existence apart from the majority. Indeed, the United States' promise of separatism in perpetuity was a fundamental premise underlying the treaty negotiations with the tribes of the lower forty-eight states.¹² Although tribes did not want to give up their lands, tribes across the country relinquished millions of acres of land in exchange for assurances of a retained homeland of smaller size in which they would remain free from federal and state interference and the intrusions of non-Indian settlers. In many respects, the promise of tribal sovereignty has survived only because of the separatism made possible by the retained tribal land base.

This tribal separatism withstood the most devastating attack by Congress in the late 1800s under the General Allotment Act of 1887, also known as the Dawes Act.¹³ Under the allotment policy, Congress attacked the basic tribal value and cultural practice of holding land in common. For tribes whose reservations were allotted, the basic approach was to take land out of tribal ownership and divide it into parcels for allotment to individuals. Congress ultimately repudiated this allotment policy when it enacted the Indian Reorganization Act in 1934, but by the end of the allotment era Indian tribes and individuals held only a third of the land that the tribes had held in 1887.¹⁴ Viewed from the late twentieth-century perspective, the General Allotment Act can be seen for what it was—an attempt to carry out cultural genocide against indigenous people.¹⁵

The continuing pressure to exploit the remaining tribally owned lands is ever present. Private enterprise and the federal government covet the vast Indian land resources, which includes 6.3 million acres of commercial timberland,¹⁶ 43 mil-

lion acres of range land, and three million acres of agricultural land.¹⁷ Approximately one-third of the low sulfur coal in the western states, more than one-half of all uranium deposits, and 20 percent of all known U.S. reserves in oil and natural gas are located on tribal homelands.¹⁸ More recently, tribal lands also have been viewed as sites for waste disposal.¹⁹

Under the same treaties that reserved tribal homelands, tribes also reserved and were guaranteed access to crucial off-reservation hunting, fishing, and gathering rights on lands ceded by the tribes to the United States. Some of the major law cases have involved fishing in the Pacific Northwest²⁰ and the Great Lakes,²¹ and inland fishing and hunting in the Midwest.²² Tribal off-reservation treaty rights have also been recognized in at least seven states.²³ The court cases have made clear that numerous treaties and agreements secure rights to harvest fish and game that are different than those held by non-Indian citizens generally, and that while the states can regulate the exercise of Indian hunting and fishing rights, they can only do so in limited circumstances.

The treaty resources now stand vulnerable to the development and pollution that plagues nearly every sector of the United States. Throughout the country there are numerous instances of tribal lands and water resources contaminated with pollution originating from off-reservation sources. Moreover, treaty rights to take wildlife and gather foods and medicines, while integral to maintaining a traditional economy and fulfilling a promise of separatism, are quickly fading into paper rights largely because of the destructive actions of the majority, industrial society. Rampant development, the construction of dams and flooding, mining, and the continuing storage and transportation of nuclear waste adjacent to reservations are increasingly destroying wildlife habitat and pushing species into extinction at an accelerating rate. Even in cases in which wildlife remains available for Native use, health risks associated with contamination of the flesh from toxins present in the habitat are mounting.

The federal government is often involved in off-reservation activities through its role as manager of vast tracts of public lands and resources located off-reservation. Much of the public lands ceded by indigenous people passed into the public domain and is managed as national forests, national parks, or range land. A variety of federal agencies²⁴ play a role in regulating private activities such as grazing, mining, recreation, oil

and gas production, and timber harvesting, all of which seriously impact tribal rights. Other federal agencies manage natural resources such as water and wildlife that are vital to tribal people.²⁵ Many of the lands, resources, and sites upon which tribal people have lived for thousands of years are now in peril due to environmental degradation. In many instances, federal agencies bear responsibility for these threats through their actions in managing public lands and regulating polluting activities, managing shared water and wildlife resources, and approving new development on federal lands. For example, the federal government has engaged in nuclear weapons testing near reservation lands inhabited by the Western Shoshone Nation in Nevada. And for years, the Department of Energy engaged in open dumping of highly radioactive waste at the Hanford site, located along the banks of the Columbia River near the boundary of the Yakama Indian Nation's reservation.²⁶ This waste has found its way into the Columbia River, a major waterway to the Pacific Ocean.²⁷ In addition, another federal agency, the U.S. Army Corps of Engineers, operates a line of dams along the Columbia River that kills up to 95 percent of the migrating salmon.²⁸ Indeed, for the first time in the memory of tribal people of the Pacific Northwest, there are not enough harvestable fish to support even the most basic cultural needs.

The various approaches to ecological risk assessment and management developed and employed by the federal agencies are critical areas to tribal people. As we move into the twenty-first century these approaches will substantially determine the future ecological viability of our separate land bases and the subsistence rights guaranteed under treaties and agreements executed more than a century ago. Risk assessment methodologies and risk management utilized in the realm of environmental and natural resources will determine in many instances the future of traditional Native existence. The myriad of ecological risk assessment approaches and decision-making strategies will guide governmental regulation and management of federal lands. This will have significant environmental consequences for tribal people as they work to influence the federal government's responsibility over resource development such as oil and gas production, mining, logging, and storage and processing of nuclear waste. The impacts are particularly evident for tribes that reside in states which have a large percentage of federal lands, and for the tribal nations that reside in states which have enormous sections of fed-

eral lands being utilized by Department of Energy and Department of Defense activities.

TRIBAL ROLES IN ECOLOGICAL RISK ASSESSMENT AND MANAGEMENT

Indian tribes are significantly absent from ecological risk assessments and risk management due to the particular federal regulations, guidelines, and federal assessors and managers conducting the assessments. Usually, these assessments and management strategies do not mention the impacts that certain federal, state, local, and private sector activities will have on tribal homelands or treaty-guaranteed hunting, fishing, and gathering rights. Indeed, most risk assessment analyses are void of any mention of tribal governments, Indian lands, treaty rights, or tribal cultural values. Instead, the standard approaches identify decision-making officials in federal, state, and local governments, as well as private-sector leaders in commercial, industrial, and private organizations, but omit or exclude representatives from tribal government whose reservation lands and/or aboriginal territories include the areas being assessed.

Indian tribes have the power to regulate persons and property within their territorial boundaries to fully protect their homelands. This tribal regulatory power stems from three sources: inherent tribal authority, treaties and executive orders, and federal statutory delegation of authority to tribes.²⁹ In general, tribal governments retain inherent sovereign powers to regulate conduct of tribal members and non-members which threatens or directly affects public health and safety or the economic security of the reservation community.³⁰ This jurisdiction includes activities that degrade the environment.

Tribes are in the best position to regulate and to be intimately involved in risk assessment, environmental activities, and management affecting tribal lands and natural resources. Accordingly, Congress has supported tribal efforts to do so in amendments to various federal environmental statutes.³¹ Indeed, states have never been granted authority by Congress to regulate conduct of Indians or non-Indians relating to environmental regulation within reservations.³² Thus, as recognized by Congress and the courts, Indian tribes can adequately preserve, protect, and perpetuate the rights and resources under tribal control for all people located on their treaty-guaranteed

homelands.

President Clinton's directive of April 29, 1994 sets the tone for his administration's approach to Indian affairs. In a memorandum to heads of executive departments and agencies, President Clinton requires all federal agencies and departments to implement their programs in a "sensitive manner respectful of tribal sovereignty," and sets forth several principles to guide agency dealings with Indian tribes.³³ These principles include: (1) operate within a "government-to-government relationship" with tribes; (2) consult "to the greatest extent practicable" with tribal governments prior to taking actions that affect them; (3) "assess the impact" of federal actions on "tribal trust resources" to "assure that tribal government rights and concerns are considered during the development of such plans, projects, programs, and activities"; and (4) take "appropriate steps to remove any procedural impediments" to working with tribes. These policies significantly direct the dealings between tribes and federal agencies on environmental issues such as the development of ecological risk assessment guidelines and approaches, and implementations by decision-makers.

Moreover, the current ecological risk assessments and risk managers are totally inconsistent with the established case law, congressional, and executive policies relating to tribal involvement in the protection of environmental quality. Most agencies such as the Department of Energy, Department of Defense, Forest Service, and Bureau of Reclamation undertaking risk assessments disregard the well-established policies to work with tribes on a government-to-government basis, to recognize tribes as the primary decision-makers for environmental matters on reservation lands, and to encourage tribal, state, and local cooperation in areas of mutual concern. Indeed, tribes are the most appropriate non-federal parties for making decisions and carrying out program responsibilities affecting Indian reservations, their environments, and the health and welfare of the reservation populace.

Tribal governments should be included as risk managers and be included in the dialogue between federal risk managers and risk assessors. Additionally, in order to effectuate the government-to-government relationship fully, federal agencies must communicate with tribal governments regarding ecological risk assessments, thoughtfully consider tribal concerns, recognize and give due respect to tribal governments' efforts to

incorporate tribal values in risk assessments, and adequately design alternative approaches that protect tribal lands, resources, and treaty rights. Accordingly, pursuant to the administration's strong policy of government-to-government relations, it would be appropriate for agencies to form a tribal working group on ecological risk assessment and management to gain tribal knowledge and expertise on the issue to assist in and formulate decision-making approaches that fully protect and preserve the treaty-guaranteed reservations and resources.

TRADITIONAL TRIBAL CULTURAL VALUES IN RISK ASSESSMENT AND RISK MANAGEMENT

The modern-day risk assessment and risk decision-making process purports to estimate acceptable harm to a given species, food web, population, or ecosystem. Accordingly, conducting an ecological risk assessment in areas affecting tribal homelands or ancient tribal boundaries involves a basic understanding of a large regional ecosystem. However, the understanding of such a large and complex ecosystem impacting tribal people under existing approaches is limited to institutional technological knowledge. For example, under the current scientific approach, numbers and studies are plugged into models and frameworks of risk assessment by people who may never view the particular site or ecosystem where the proposed activity will occur or toxin will be released. Thus, only a few activities can be measured or estimated that will affect tribal communities. The approaches consider very few consequences in an artificial isolated environment and in controlled experiments based on method assumptions and date-set characteristics, which do not analyze the range of impacts on each other or the impacts on ecological and cultural attributes. Finally, the modern-day risk assessment processes are set on a short time scale and assess a limited geographic area.

In stark contrast, at the heart of tribal cultures and other indigenous cultures of the United States is the inseparability of the health and welfare of the tribal people and the natural ancient indigenous environment, encompassing all other organisms and their habitats. Most indigenous peoples in the United States understand that the environment is a harmonious blend of what is known as science and management. Indeed, tribal communities have persevered for centuries

because so many have knowledge of the natural, spiritual, and ecological world, and understand and respect the interconnectedness among humans and all other living things. Additionally, tribal people possess a culture-based knowledge of ecosystems that has evolved and accumulated over thousands of years and is continually tested and improved for the lasting maintenance of the tribal existence. The collection and use of this complex knowledge of the physical world—including values, histories, stories, ethics, and the culture of indigenous ways of life—is an integral part of any tribal decision-making process.³⁴

The incorporation of values, meaning what we believe in and care to achieve, is essential to risk assessment and risk management processes. From the Native American perspective, the values embodying our cultural and religious beliefs are necessary in any engagement process with other distinct cultural groups for the purpose of conflict resolution in risk assessment and risk management. Not all tribal cultural values are quantifiable, nor must they be quantified in order to obtain recognition in ecological risk assessments and risk management.³⁵ The time has come for federal agencies to develop and institute systematic procedures and interactive processes to make the values explicit, by direct and indirect means, and communicable to improve the proposed risk assessment and risk management decisions.

Tribal cultural wisdom can assist in the ecosystem characterization and context of species interdependence, particularly within the naturally proper boundaries of the ancient native landscape. In the absence of predisturbance/experimental field data, traditional tribal knowledge associated with a particular scenario can be employed to discern the spatial and temporal distribution of endemic ecological components under characterization. True characteristics of the ecosystem can affect the ultimate nature and distribution of the stressors³⁶ and may only initially be estimated through site-specific tribal cultural knowledge. Local microbial communities and environmental fate processes can transform the chemical stressors, the remaining of which can in turn influence the level of exposure of the ecological components³⁷ of concern. Without a formal process for the incorporation and integration of the cultural and scientific values essential to the exposure characteristic phase,³⁸ risk assessments cannot meet the obligation of optimally utilizing all available means to determine the long-term ecological risks.

Examples of the characteristics of the ecological components that affect their exposure to the stressors are the habitat needs, food preferences, reproductive cycles, and seasonal activities such as migration and selective use of indigenous natural resources.³⁹ Thus, the cultural and traditional resources of indigenous peoples can be immediately brought to bear on the exposure-information gathering and processing phase under mutually agreed upon formal engagement conditions.

Characterization of exposure and ecological effects often requires the application of statistical methods. Given the complexity and uncertainty extant in the information about potential impacts on the indigenous native landscape by the introduced stressors and the method assumptions, the data cannot be fully trusted to the interpretation based on the controlled experiments and limited scientific analyses. Statistical significance does not always reflect biological and ecological significance, and profound ecobiological changes may not be detected by statistical tests or manifested in any measurable way. The employment of tribal elders' wisdom and traditional knowledge of the key variables pertinent to the native landscape can assist in the evaluation between statistical and ecobiological significance, and to discern the level of intrinsic uncertainty.⁴⁰

A decision process that is inclusive of and interactive with Native cultural values will result in greater trust in the decision-makers by tribal governments and the public. Consequently, federal agencies can more effectively deliberate why one alternative is chosen and why other alternatives are not. Additionally, conceptual ideas for incorporating cultural value models should be explored by federal agencies. Such decision-making processes of mutual, respected engagement with Native cultural values exist. For example, in 1994 the Yakama Indian Nation instituted a project with the Department of Energy-Hanford site in Washington to incorporate and integrate the use of tribal and cultural knowledge and values into the decision-making process for Department of Energy activities affecting the Yakama Indian Nation. This project, known as the Holistic Engineering Project, blends the institutional perspective with the technological and cultural/tribal points of view.⁴¹ Similarly, the Confederated Tribes of the Colville Reservation in Washington have developed a decision-making process known as the Holistic Resource Management Model.⁴²

ECOLOGICAL RELEVANCE

Generally, three principal criteria are utilized when selecting assessment endpoints (what to protect): (1) their ecological relevance, (2) their susceptibility to the known or potential stressors, and (3) whether they represent management goals. In other words, ecological relevance and susceptibility are essential for selecting assessment endpoints that are scientifically valid. Importantly from an indigenous perspective, what is missing from an ecological relevance discussion is the recognition and inclusion of cultural values and the operational approach of tribal traditions. In short, the standard ecological-relevance approach is too limited, and without the proper assessment endpoints the risk to a given ecosystem may be seriously misrepresented, which could lead to major adverse impacts or misguided management. Any discussion with regard to ecological relevance endpoints that assist in sustaining a natural structure or reflect the structure of the community ecosystem or landscape must consider that tribal people possess ancestral territories or ancient boundaries which go far beyond their present-day reservation political boundaries or ecosystem. Ancient tribal boundaries or ancestral territories are relevant to the ecological risk assessment because they recognize the time-tested relationship between the natural resources and the regional subsistence culture, that is, all endemic species and their associated habitats corresponding to the indigenous way of life under investigation.

The historically interactive and adaptive nature of Native biodiversity prior to the introduction of modern technology and economic exploitation is self-evident. However, the tribal spatially mediated and time-tested culture cannot be properly understood within the political boundaries of the present homeland in accordance with traditional wisdom and scientific knowledge. Therefore, in order to accomplish a meaningful ecological risk assessment, the federal reviewing agency must consider the correct proper spatial domain (regional subsistence culture) of the affected tribe with the potential impacts to be defined by the ancient and aboriginal boundaries of the tribes. Indeed, tribal cultural resources, which include foods and medicines of the tribes, demonstrate that a fragmented network of habitats and endemic species cannot continue to exist without the preservation of the associated patterns of interdependence and diversity well documented in the oral traditions of tribal people.⁴³

Additionally, most endpoint discussions fail to recognize that risk can occur when tribal communities have lost their traditional land base because of a hazardous materials accident, or when new technologies are sited in culturally sensitive areas such as tribal lands or aboriginal territories. The consequences can be devastating. The loss of treaty homelands or the use of traditional sacred lands can lead to the risk of irreversible cultural extinction for some communities. As explained, the tribal land base is the linchpin to tribal sovereignty because it serves as the center for economic stability, cultural vitality, and tribal sovereignty. If tribal lands or places are contaminated or damaged, habitation may be restricted or eliminated which will result in the Indian tribe losing its political powers to control and regulate the activities occurring on its homelands. Moreover, the tribe will be unable to adequately preserve and protect its membership's general health, welfare, and safety. Loss of tribal culture and identity may occur because tribal identity depends heavily upon the sociocultural ties that link individuals, families, and groups to specific tribal territories and lands.⁴⁴

PRIORITIZATION OF SPECIES

Tribal traditions recognize that all species are connected and impact each other over a complex natural web of life. Consequently, all species are treated with equity and cultural recognition, and therefore we cannot prioritize one species over another by the standard biodiversity conservation, for instance, measuring the genetic distance between the classified species within a region. Generally, tribal values support the idea of multi-species risk analysis within the context of a traditional information system, which respects the functional relationship between species, and between species and the hierarchical organization of species. The tribal value for the sustenance of all life in the ecological web must share the risk of extinction on each and every species interactively. The procedure for evaluation of such interrelated risks consequently would reflect the Native cultural value system and assume adaptive and online characteristics.

Ecological risk assessments often employ systematic biology and genetic distance measures to determine the priority of species for conservation. For example, risk assessors identify or analyze the potential "cascade of adverse effects" and "series

of effects among a diversity of organisms" which implies the hierarchical structure of species and processes of interrelationships.⁴⁵ While tribal cultural values are not in direct conflict with the scientific research of conservation priority and the mathematics of biodiversity, tribal people express the deep and singular concern of the presumed human superior ability and intelligence to decide which species and process are ultimately most relevant to the protection and preservation of life, ecological health, and lasting welfare for all. Given the very limited and short existence of scientific knowledge in the life history of all species, and that scientific fallibility is the premise for technological progress, the tribal cultural value system challenges the assumed superiority of the human race in its search for a balanced solution to preserve the natural resources, in this case using ecological risk assessment as the main consideration.⁴⁶

To avoid the possible escalation of conflict between the different value systems within the ecological risk assessment processes and risk management decision-making, tribal governments, tribal elders, and other indigenous people should promote a moderate and equitable approach by first establishing and institutionalizing the formal dialogue and engagement process between Native peoples who possess distinct cultural value systems. Accordingly, the conservation genetics or prioritization of species question will be addressed in the manner cognizant of the relative importance of each and every species rather than the less than perfect and self-destructive power of the human species.

CONCLUSION

Since first entering into treaties with the United States, Native nations have waged a two-hundred-year struggle to maintain an autonomy against an encroaching majority society. Now at the threshold of the twenty-first century, the future of tribal existence for many indigenous communities is imperiled. The tribal way of life that remains intrinsically connected to the natural environment and dependent on the continued integrity of the land and resources faces an ecological crisis of unprecedented magnitude. Due to the unique nature of tribal land tenure and tribal culture, tribes cannot simply relocate to new areas when their lands become contaminated, their water polluted, or their wildlife resources decimated as a result of eco-

logical abuse by the non-Indian sector. The mobility and transience that provide short-term solutions to members of the majority society do not provide options to tribes when their way of life is threatened or destroyed.

This article has suggested a fundamental means by which the federal government can begin to meet its federal trust responsibility of protection—the institutionalization of risk assessment and risk management that incorporate time-honored traditional indigenous knowledge of the environment. Federal agencies have a unique opportunity to design ecological risk assessment approaches that can fully value tribal homelands and resources, and support the existence of tribal lifestyles in this country. The development of such approaches and management should serve as a focal point of future dealings between tribal communities and the federal government, and will be a fundamental challenge for federal agencies to overcome the years of reliance solely on science and technology to inform their decision-making. This challenge, however great, is implicit in the promise of Native separatism that underlies the vast cessions of land made just over two centuries ago.

Even beyond this challenge, the introduction of tribally held cultural values to the majority society, which seems at a loss to secure a sustainable future for its own coming generations, will confer immeasurable benefits to non-Indian society. And, finally, the recognition and acceptance of such tribal wisdom and knowledge is only the beginning. There must be a continuing federal dialogue with tribes, resolution of existing issues, resources provided to tribal communities, and meaningful consultation with tribes in order to fully preserve the creation for all.

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Indians); Ted Howard (Shoshone-Paiute); Toney Begay (All Indian Pueblo Council); and Claude Broncho (Shoshone-Bannock Tribes).

NOTES

1. For a comprehensive discussion of these attributes of tribal sovereignty, see Mary Christina Woods, "Indian Land and the Promise of Native Sovereignty: The Trust Doctrine Revisited," *Utah Law Review* (1994): 1,471.

2. Charles F. Wilkinson, *American Indians, Time, and the Law* 14 (New Haven: Yale University Press, 1987), discusses land base as the linchpin to other attributes of tribal sovereignty.

3. For purposes of this article, the term *indigenous peoples* refers to people descending from the original inhabitants of the Western Hemisphere who have maintained distinct languages, culture, or religion from time immemorial. Most consider themselves to be custodians, not owners, of the land and other cultural and natural resources. See Russell L. Barsh, "Indigenous Peoples, an Emerging Object of International Law," *American Journal of International Law* 80 (1986): 369, 373-75.

4. Risk assessment is defined as "the systematic, scientific characterization of potential adverse effects of human and ecological exposures to hazardous agents or activities. Risk assessment is performed by considering the types of hazards, the extent of exposure to hazards, and information about the relationship between exposures and responses, including variation in susceptibility. Adverse effects or responses could result from exposures to chemicals, microorganisms, radiation, or natural events." The Presidential/Congressional Commission on Risk Assessment and Risk Management, "Risk Assessment and Risk Management in Regulatory Decisionmaking," *Final Report*, Vol. 2 (1997), 2.

5. Risk management is defined as "the process of identifying, evaluating, selecting, and implementing actions to reduce risk to human health and to ecosystems. The goal of risk management is scientifically sound, cost effective, integrated actions that reduce or prevent risks while taking into account social, cultural, ethical, political, and legal considerations." The Presidential/Congressional Commission on Risk Assessment and Risk Management, "Risk Assessment and Risk Management in Regulatory Decisionmaking," *Final Report*, Vol. 2 (1997), 2.

6. The number of federally recognized Indian tribes as of June 1997 was provided by the Office of the Assistant Secretary for Indian Affairs, Department of Interior, Washington, D.C.

7. David H. Getches, et al., *Cases and Materials on Federal Indian Law*, 3d. ed. (1993): 20.

8. Valerie Talisman, "Environment Key to Native Survival," *Ethnic Newswatch* (May 31, 1993): 14.

9. Getches, et al., *supra* note 5, p. 20.

10. *Ibid.*, 8, 13, 15.
11. *Ibid.*, 8-9.
12. Wilkinson, *supra* note 2, p. 18.
13. Act of February 8, 1887, ch. 119, 24 Stat. 388, codified as amended at 25 U.S.C. Sections 331-34, 341-42, 354, 381 (1988).
14. Act of June 18, 1934, ch. 576, Section 1, 48 Stat. 984, codified at 25 U.S.C. Section 461 (1988). Of the 1.38 million acres of tribal lands in 1887, only 48 million acres remained in 1934. Felix S. Cohen, *Handbook of Federal Indian Law* (Charlottesville, VA: The Michie Company, 1982), 138.
15. See Rennard Strickland, "Genocide-at-Law: An Historic and Contemporary View of the Native American Experience," *Kansas Law Review* 34 (1986): 713.
16. Getches, et al., *supra* note 5, p. 20.
17. Getches, et al., *supra* note 5, p. 22.
18. Ward Churchill and Winona LaDuke, "Native North American: The Political Economy of Radioactive Colonism," in *The State of North America: Genocide, Colonization and Resistance*, ed. M. Annette Jaimes (South End Press, Boston, MA, 1992), 241.
19. Pamela A. D'Angelo, "Waste Management Industry Turns to Indian Reservations as States Close Landfills," *Environmental Report* (BNA) No. 35, at 1607 (Dec. 28, 1990): 21; Valerie Talisman, "Stuck Holding the Nation's Nuclear Waste," *Race, Poverty & Environment* (Fall 1992): 6; "Nuclear Waste: On the Reservation," *Economist* (Oct. 3, 1992): 30.
20. See, e.g., *United States v. Washington*, 384 F. Supp. 312 (W.D. Wash. 1974), *affd.* 520 F.2d 676 (9th Circuit, 1975), *cert. denied*, 423 U.S. 1086 (1976); *Sohappy v. Smith*, 302 F. Supp. 899 (D. Or. 1969), *affd.*, 529 F.2d 570 (9th Cir. 1976).
21. See, e.g., *United States v. Michigan*, 471 F. Supp. 192 (W.D. Mich. 1979), *affd.*, in part and *rev'd* in part, 653 F.2d 277 (6th Cir.), *cert. denied*, 454 U.S. 1124 (1981).
22. See, e.g., *Lac Courte Oreilles Band v. Voight*, 700 F.2d 341 (7th Cir.), *cert. denied*, 464 U.S. 805 (1983), *on remand*, 775 F. Supp. 321 (W.D. Wis. 1991).
23. Idaho, Montana, Michigan, Minnesota, Oregon, Washington, and Wisconsin.
24. These federal agencies include the U.S. Forest Service, the National Park Service, and the Bureau of Land Management.
25. The agencies responsible for management of these resources include the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, the U.S. Army Corps of Engineers, and the Bureau of Reclamation.
26. From 1955 to 1959, federal workers at Hanford dumped more than 30 million curies of radioactivity directly into the Columbia River. Paul Koberstein, "Hanford's Tank 103-C Potential Chemical Nightmare," *Oregonian*, July 23, 1992, A1, A8.
27. *Ibid.* From 1943 to 1966, the Department of Energy dumped an additional 444 billion gallons of radioactive waste into open trenches and 178 underground storage tanks, many of which are leaking. See also, Churchill and LaDuke, *supra*, note 18.

28. See John Daniel, "Dance of Deniel," *Sierra* (Mar.-Apr. 1993): 64, 66-67.
29. See *United States v. Mazurie*, 419 U.S. 544 (1975), upholding congressional delegation of federal authority to tribes, and *Montana v. United States*, 450 U.S. 544 (1981), sustaining tribes' broad inherent authority to control reservation lands.
30. *Montana v. United States*, 450 U.S. 544 (1981); See *Nance v. EPA*, 645 F.2d 701 (9th Cir.), cert. denied, 454 U.S. 1081 (1981).
31. See the Safe Drinking Water Act, 42 U.S.C. Sections 300f-300j-12 (1988); Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. Sections 9601-9675 (1988); the Clean Water Act, 33 U.S.C. Sections 1251-1387 (1988); and the Clean Air Act, 42 U.S.C. Sections 7400-7642 (1988).
32. See *Washington Department of Ecology v. E.P.A.*, 752 F.2d 1465 (9th Cir. 1985) upholding EPA's refusal to accept state's application to regulate on-reservation activities involving hazardous waste.
33. William J. Clinton, "Memorandum for the Heads of Executive Departments and Agencies, Government-to-Government Relations with Native American Governments," *Federal Register* 22,951, May 4, 1994, 59.
34. See, e.g., Wolfley, J., et al., "A Process for Developing and Implementing the Methodology for Collecting Data to be Used in and for Tribal Decision-Making," Shoshone-Bannock Tribal Risk Assessment Forum, Pocatello, Idaho (June 1996).
35. See E. Tso, et al., "Risk Assessment In Indian Country: Guiding Principles and Environmental Ethics of Indigenous People," Shoshone-Bannock Tribal Risk Assessment Forum, Pocatello, Idaho (June 1996).
36. The term *stressor* is defined as "any physical, chemical or biological entity that can induce an adverse response," in "Framework for Ecological Risk Assessment," United States Environmental Protection Agency, Risk Assessment Forum, Washington, D.C. (Feb. 1992), 38.
37. "Ecological component" is "any part of an ecological system, including individuals, populations, communities, and the ecosystem itself," *ibid.*, 37.
38. The "exposure characterization phase" or "characterization of exposure" is a "portion of the analysis phase of ecological risk assessment that evaluates the interaction of the stressor with one or more ecological compounds. Exposure can be expressed as co-occurrence, or contact depending on the stressor and ecological component involved"; *ibid.*, 37.
39. R. Jim, G. Nguyen, and B. Barry, "Introducing Native Landscape Ecology to Hanford Cleanup," *Proceedings of the Vienna International Conference on Radioactive Waste Management and Environment Remediation*, eds. S.C. Slate and S.V. Johnson, ASME (Sept. 1995).
40. See G. Nguyen, "A Cultural Value System Based on Native Landscape Ecology," Nez Perce Tribal Risk Assessment Forum, Clarkston, Idaho (October 1996).
41. See R. Jim, and B. Barry, "The Yakama Indian Nation Holistic Engineering Project: A Novel Integrated Risk Management System Approach to the Cleanup of the Hanford Site" (Papers presented at Department of Energy meetings, 1994); P. Kurstedt, et al., "The Environmental Trilogy Project:

Balancing Technical, Institutional, and Cultural Perspectives to Environmental Management," (Papers presented at Department of Energy meetings, 1992).

42. Confederated Tribes of the Colville Reservation Holistic Resource Management, "Planning Today for Future Generations" (Nez Perce Tribal Risk Assessment Forum, Claukston, Idaho (October 1996).

43. See D.L. Hawksworth, *Biodiversity: Measurement and Estimation, The Royal Society* (London: Chapman & Hall, 1995).

44. See, S. Curtis, "Cultural Relativism and Risk Assessment Strategies for Federal Projects," *Human Organization* 1 (Spring 1992): 51.

45. "Cascading adverse effects" means that the interrelationship among entities and processes in ecosystems results in the potential for cascading adverse effects: As one population, species, process, or other entity in the ecosystem is altered, other entities are affected as well, often adversely. For example, application of an herbicide on a wet meadow results in direct toxicity to plants. Death of the wetland plants leads to secondary effects such as loss of feeding habitats for ducks, breeding habitat for black birds, alteration of wetland hydrology that changes the spawning for fish, and so forth.

46. See S. Blackmore, "Knowing the Earth's Biodiversity: Challenges for the Infrastructure of Systemic Biology," *Science* 274 (1996): 63-64; R.H. Crozier and R.M. Kusminski, "Genetics Distances and the Setting of Conservation Priorities," *Conservation Genetics*, eds. V. Loeschcke, et al. (Birkhauser Verlag, Basel, Switzerland, 1994), 227-237.