

Integrating Community Knowledge into Environmental and Natural Resource Decision-Making: Notes from Alaska and Around the World

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Abstract

Community knowledge (including traditional, local, and indigenous knowledge) has a role to play in government agency decisions regarding the environment and natural resources. This article considers the benefits of using community knowledge, as well as obstacles to collecting this knowledge and integrating it with Western science. The article further discusses how federal agencies in Alaska use community knowledge and laws that potentially affect this use (including the Data Quality Act). Finally, the article provides recommendations for agencies to consider in collecting and using community knowledge.

Table of Contents

I. Introduction.....	82
II. Terminology.....	84
III. Benefits of Using Community Knowledge in Decision-Making	87
A. Filling in the Gaps of Western Science	87
B. Unique Communities, Environments, and Forms of Information.....	89
C. Increasing Community Trust and Compliance.....	90
IV. Obstacles to Collecting and Using Community Knowledge	91
A. Conflicts between Natural Resource Management Based on Western Science and Based on Community Knowledge and Traditions	91
B. Spiritual Aspects of Knowledge.....	93
C. Identifying Proper Sources of Community Knowledge ...	95

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D.	Limited Scope of Knowledge.....	96
E.	Loss of Knowledge.....	96
F.	Reluctance to Share Knowledge.....	98
V.	Laws Affecting the Use of Community Knowledge	100
A.	Data Quality Act.....	101
B.	ANILCA.....	103
C.	Executive Order on Environmental Justice	104
D.	Executive and Secretarial Orders on Tribal Consultation.....	105
VI.	Federal Agency Collection and Use of Community Knowledge in Alaska.....	107
A.	MMS/BOEMRE.....	108
B.	EPA	108
C.	NOAA/NMFS	109
D.	FWS.....	110
E.	BLM	111
F.	North Slope Borough.....	112
VII.	Recommendations for Obtaining and Using Community Knowledge	113
A.	Knowledge Collection.....	113
B.	Data Quality Control	116
C.	Processing and Using Data.....	118
D.	The Need for Mutual Benefit and/or Compensation	119
E.	Integrating Community Knowledge and Western Science.....	121
F.	Knowledge and Spirituality beyond the Realms of Western Science	122
VIII.	Summary and Conclusion.....	124
	Appendix, International Agreements, and Declarations	126

I. Introduction

Since the late twentieth century, the terms “traditional (environmental) knowledge,” “local knowledge,” and “indigenous knowledge” have been used to describe sources of knowledge outside of Western science.¹ In this article, I introduce the term “community knowledge” and discuss its role in

1. See Stacie McIntosh, *Incorporating Traditional Knowledge in the Bureau of Land Management's Planning Process in the National Petroleum Reserve-Alaska*, 27 PRACTICING ANTHROPOLOGY 38, 41 (Winter 2005) (discussing the fact that, since the mid-1990s, traditional knowledge has gained popularity and widespread recognition in the academic realm).

government agency decisions regarding the environment and natural resources. The article is based on a literature review of scientific, legal, and anthropological journals and reports from across the globe,² as well as interviews I conducted in Alaska with subsistence hunters, anthropologists, and government agency representatives.³ The article considers the benefits of using community knowledge as a basis for agency decision-making, as well as the obstacles.⁴ It discusses laws relevant to community knowledge and explains how federal agencies in Alaska have been collecting and using this knowledge.⁵ Finally, it provides recommendations for agencies and researchers to consider in integrating community knowledge into natural resources and environmental decision-making.⁶

2. I conducted word searches for the English terms “traditional knowledge” and “local knowledge,” the Spanish term “conocimiento tradicional,” the French term “connaissance traditionnelle,” and the Russian term “традиционные знания” on Westlaw, Questia (Online Library of Books and Journals), and the Internet.

3. I am grateful to the following people who allowed me to discuss community knowledge with them: Taylor Brelsford, Anthropologist, URS Corporation; Dee Williams, Ph.D., Anthropologist and Chief of Environmental Studies, Alaska OCS Region, Bureau of Ocean Energy Management (BOEMRE); Taqulik Hepa, Director, North Slope Borough Department of Wildlife Management; Brad Smith, Biologist and Anchorage Field Office Supervisor, National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA); Tami Fordham, Tribal Coordinator, Environmental Protection Agency (EPA) Region 10; Stacie McIntosh, Branch Chief of Resources, Northern Field Office in Fairbanks, Alaska, Bureau of Land Management (BLM); Hanh Shaw, National Environmental Protection Act Coordinator, EPA Region 10; Patty McGrath, Mining Specialist, EPA Region 10 Tribal Waters Program; Ted Rockwell, Senior Advisor for Oil and Gas, EPA Region 10; John Chase, Community Planner, Northwest Arctic Borough; Delbert Rexford, Land Manager, Ukpeagvik Iñupiat Corporation; Johnny Aiken, Whaling Co-Captain and Executive Director of the Alaska Eskimo Whaling Commission; Jewel Bennett, Branch Chief for Conservation Planning, Alaska Division, U.S. Fish and Wildlife Service (FWS); Nora Jane Burns, Village of Kaktovik Liaison and Planning Commission Representative for the North Slope Borough, Kaktovik City Council Member; Craig George, Ph.D., Senior Biologist, North Slope Borough Department of Wildlife; Doug Vincent-Lang, Special Assistant to the Commissioner of the Alaska Department of Fish and Game (ADF&G); Kristi Frankson, Subsistence User and Village of Point Hope Liaison to the North Slope Borough; Lloyd Vincent, Iñupiat Artist, Point Hope; Jack Schaefer, Lands Manager, Tikigaq Corporation; Catherine Villa, Tribal Coordinator, EPA. I acknowledge that the views of these individuals do not necessarily represent the views of the entities for which they work.

4. *See infra* Parts II and III.

5. *See infra* Parts IV and V.

6. *See infra* Part VI.

II. Terminology

There are many names for the kinds of environmental knowledge that do not fit into the framework of Western science.⁷ Each has its own nuances. “Traditional knowledge” implies that the knowledge is stuck in time, passed down from generation to generation. While this is often the case, environmental knowledge is ever-evolving and can develop in a single generation.⁸ “Local knowledge” suggests that the knowledge is limited to fixed geographic boundaries. But in this modern world with high-speed Internet and people on the move, knowledge is seldom confined to a particular place.⁹ “Indigenous knowledge” implies that the knowledge is

7. The term “Western science” as used here is equivalent to the definition of science developed by Britain’s Science Council: “Science is the pursuit of knowledge and understanding of the natural and social world following a systematic methodology based on evidence.” *What is Science?*, THE SCIENCE COUNCIL, <http://www.sciencecouncil.org/content/what-science> (last visited Oct. 4, 2011) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment). This methodology includes objective observation, evidence, experiment, and/or observation as benchmarks for testing hypotheses, induction, repetition, critical analysis, and verification and testing. *Id.* The characteristics of Western science from a legal point of view are similar to the standard for admitting evidence set forth in *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579, 579 (1993). According to the Court,

The evidence must be reliable, that is, the underlying methodology and procedure from which evidence is derived (not the conclusion drawn) must be based on scientific knowledge. . . . In deciding if the testimony is scientifically valid, the court looks to many factors, including whether the theory or technique can and has been tested, whether it has been subjected to peer review, the known or potential rate of error, and whether it has been generally accepted. *Id.*

Although my article distinguishes between community knowledge and Western science, there is not always a clear line between the two. See Aranya Siriphon, *Local Knowledge, Dynamism and the Politics of Struggle: A Case Study of the Hmong in Northern Thailand*, 37 J. SOUTHEAST ASIAN STUD. 65, 66 (2006) (questioning “the myth of ‘bipolar’ local/modern knowledge (indigenous/scientific knowledge)”); see also Interview with Craig George, Ph.D., Senior Biologist, North Slope Borough Department of Wildlife, in Barrow, Alaska (Apr. 7, 2011) [hereinafter George Interview] (stating that he sees little difference between traditional knowledge and Western science on the North Slope of Alaska and noting that there are experts and those who lack knowledge; but experts identify the source of their knowledge and admit when they lack knowledge) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment). My article nevertheless treats community knowledge as a distinct body of knowledge, in an effort to demystify this kind of knowledge and encourage its use.

8. See Jennifer Isé & Susan Abbott-Jamieson, *Students Gather Local Fisheries Knowledge as Part of a NOAA Fisheries Education and Outreach Program*, 27 PRACTICING ANTHROPOLOGY 29, 32 (Winter 2005) (describing knowledge of fishermen who began their fishing careers prior to World War II and who are still living and the need to preserve this knowledge).

9. For contrasting definitions of local ecological knowledge and traditional ecological knowledge, see SUSAN CHARNLEY, A. PAIGE FISCHER & ERIC T. JONES, U.S. DEP’T

isolated within a particular ethnic group, yet it can be acquired by non-indigenous residents who have settled within an indigenous community.¹⁰

I use the term “community environmental knowledge” or “community knowledge” to describe all kinds of environmental knowledge that arise from communities, outside the context of Western science. The

OF AGRIC., PNW-GTR-751, TRADITIONAL AND LOCAL ECOLOGICAL KNOWLEDGE ABOUT FOREST BIODIVERSITY IN THE PACIFIC NORTHWEST 2 (2008), available at http://www.fs.fed.us/pnw/pubs/pnw_gtr751.pdf. The authors state that

[N]ew knowledge is created all the time. This more recent LEK [local ecological knowledge] is defined here as knowledge, practices, and beliefs regarding ecological relationships that are gained through extensive personal observation of and interaction with local ecosystems, and shared among local resource users. Local ecological knowledge may eventually become TEK [traditional ecological knowledge]. *Id.*

For another example, see McIntosh, *supra* note 1, at 40. According to McIntosh,

Traditional knowledge, as I understand it, is shared and agreed upon direct experience that is passed on from one generation to the next, so that it becomes integrated not only at the community level, but at the cultural level. In contrast, local knowledge represents shared recent experiences; those hypotheses that still need testing and positive correlation before they can truly become “traditional.” *Id.*

10. Although a great deal of literature is devoted to knowledge held by indigenous residents, there are many examples of non-indigenous individuals and communities with extensive environmental knowledge. See, e.g., Т. Р. Михайлова [T.R. Mikhailova], *Традиционные Экологические Знания Их Роль в Сохранении Биологического Разнообразия Охраняемых Природных Территориях* [Traditional Ecological Knowledge and its Role in Biodiversity Conservation in Nature Reserves], in *Традиционные Знания Коренных Народов Алтае-Саянв Области Природопользования* [TRADITIONAL KNOWLEDGE OF THE INDIGENOUS PEOPLE OF ALTAE-SAYAN REGARDING NATURAL RESOURCE USE] 56, 59 (2009) [hereinafter ALTAE-SAYAN TRADITIONAL KNOWLEDGE], available at <http://ethnography.omskreg.ru/res/page000000001203/Files/2.pdf> (stating that a study of traditional ecological knowledge held by residents in the Elizovsky, Bystrinsky, and Milkovsky regions of Russia suggests that this knowledge is held not only by indigenous residents, but also by long-time non-indigenous residents); see also CHARNLEY ET AL., *supra* note 9, at 36 (discussing that the ecological knowledge of farmers and indigenous people in the Pacific Northwest is valuable, “but so too is that of other forest practitioners, who should not be overlooked”); Jason Corburn, *Bringing Local Knowledge into Environmental Decision Making: Improving Urban Planning for Communities at Risk*, 22 J. PLAN. EDUC. & RES. 420, 423–30 (2003), available at http://remap.ucla.edu/jburke/misc/Corburn_2003.pdf (considering the local knowledge of immigrant residents in a Brooklyn neighborhood regarding the environmental health hazards they face). In Arctic Alaska, where the population is predominately Inupiat Eskimo, there are also examples of “outsiders” who have integrated into the community and acquired knowledge regarding local subsistence practices. See, e.g., CHARLES D. BROWER, *FIFTY YEARS BELOW ZERO* (1985) (describing the memoirs of a Yankee whaler living in Arctic Alaska); see also Interview with Kristi Frankson, Subsistence User and Point Hope Village Liaison for the North Slope Borough, in Point Hope, Alaska (Feb. 2, 2011) [hereinafter Frankson Interview] (explaining her experience as a non-native who moved to the village of Point Hope in 1978 after marrying a local resident and became deeply involved in the subsistence culture) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment).

“community” can be largely defined by ethnicity or geography, but it need not be. Community knowledge is based on the observations and personal experiences of community members over long periods of time.¹¹ It is transmitted informally, often orally,¹² and usually cannot be attributed to a defined source.¹³ It usually comes from trial and error rather than the scientific method,¹⁴ although there are examples of community members acquiring knowledge through controlled experiments.¹⁵ It has historically been separate from the knowledge held and disseminated by government agencies,¹⁶ although there have been recent efforts by government agencies to collect and use this knowledge.¹⁷

11. In the case of many Alaska Natives, knowledge has been transmitted orally for generations over hundreds or thousands of years. See J.C. George et al., *An Analysis of Ancient Bowhead Whale Mangtak from Gambell Alaska: What can it tell us?*, Scientific Committee Report, International Whaling Commission Meeting, International Convention for the Regulation of Whaling, 2008, at 1, 4, available at http://iwcoffice.org/_documents/sci_com/SC60docs/SC-60-E2.pdf (stating that recovery of thousand-year-old bowhead whale skin and blubber from Saint Lawrence Island kept in old ice cellar validated community knowledge that Saint Lawrence residents had hunted whales for hundreds of years); see also Telephone Interview with John Chase, Community Planner, Northwest Arctic Borough (Feb. 8, 2011) [hereinafter Chase Interview] (stating that indigenous knowledge has only been written recently but is based on oral history that has been passed down for generations) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment).

12. See Alan B. Dixon, *Wetland Sustainability and the Evolution of Indigenous Knowledge in Ethiopia*, 171 THE GEOGRAPHICAL J. 306, 308 (2005) (declaring that oral communication is often important to transmitting community knowledge and stating that the “exchange of information through informal communication networks plays an important role in facilitating innovation and adaption”); see also Lawrence D. Kaplan, *Iñupiat and the Schools: A Handbook for Teachers* (1984), available at http://www.alaskool.org/language/inupiaqhb/Inupiaq_Handbook.htm#contents (stating that writing of the Iñupiat language of Arctic Alaska did not begin until the missionaries arrived and translated religious materials into the Native languages and that Iñupiat writing was not standardized until the 1940s).

13. See *Mikhailova*, *supra* note 10, at 56 (noting that each region of the world has a different view on traditional knowledge).

14. See *What is Science?*, *supra* note 7 (defining the scientific method as including objective observation, evidence, experiment, and/or observation to test hypotheses, induction, repetition, critical analysis, and verification and testing).

15. See Dixon, *supra* note 12, at 317 (describing Ethiopian farmers that deliberately experiment with new ideas and practices, such as the spacing of coffee seedlings, herbicides, and fertilizer treatments); see also Karen Brewster & Craig George, *Iñupiat Knowledge of Selected Subsistence Fish Near Barrow, Alaska* 63–64 (2008) (unpublished study) (describing experiments conducted by Arnold Brower, an Iñupiat Eskimo born in 1922, to determine whether particular water bodies would support fish) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment).

16. See Dixon, *supra* note 12, at 315 (describing the disconnect between the knowledge of Ethiopian farmers and that of government extension agents); see also Janet C. Sturgeon, *Pathways of “Indigenous Knowledge” in Yunnan, China*, 32 ALTERNATIVES: GLOBAL, LOC., POL. 129, 132–33 (2007), available at

III. Benefits of Using Community Knowledge in Decision-Making

A. Filling in the Gaps of Western Science

Particularly in remote places like Arctic Alaska, the environmental data compiled by Western scientists are limited.¹⁸ Community knowledge gathered over generations may be far more extensive,¹⁹ particularly on topics such as climate change that require long periods of observation.²⁰

http://findarticles.com/p/articles/mi_hb3225/is_1_32/ai_n29338601/ (describing the disconnect between rural Chinese farmers and the government).

17. See *infra* Part V (stating that federal agencies have recently realized the importance of community knowledge).

18. See Elizabeth Barrett Ristroph, *Alaska Tribes' Melting Subsistence Rights*, 1 ARIZ. J. OF ENVTL. POL'Y 47, 57–58 (2010) (describing the lack of baseline data in Arctic Alaska); see also CHARNLEY ET AL., *supra* note 9, at 27 (referring to the limited amount of western scientific research on the use of non-timber forest products in the Pacific Northwest); Heather Lazrus & Jennifer Sepez, *The NOAA Fisheries Alaska Native Traditional Environmental Knowledge Database*, 27 PRACTICING ANTHROPOLOGY 33, 35 (Winter 2005) (expressing that in some Alaskan locations, the temporal depth of NOAA's scientific measurements and records "may be almost ineffectually shallow"); Stephen R. Braund, *Traditional Knowledge*, Environmental Protection Agency, Literature Review of North Slope Marine Traditional Knowledge 1, 1 (2010) (unpublished study) (explaining that traditional knowledge often has answers to questions that otherwise will be left open and therefore unacted-upon while expensive long-term studies are commissioned and take place) (on file with author); Telephone Interview with Jewel Bennett, Branch Chief for Conservation Planning, Alaska Division, Federal Wildlife Service (Apr. 7, 2011) [hereinafter Bennett Interview] (explaining that community knowledge can be a reality check or ground truth where there are information gaps in published science and surveys) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment).

19. See Lorena Ibarguen Tinley & Gonzalo Chapela Mendoza, *Conocimiento Tradicional Forestal en México [Traditional Knowledge of Forests in Mexico]*, in BIODIVERSIDAD Y CONOCIMIENTO TRADICIONAL EN LA SOCIEDAD RURAL [BIODIVERSITY AND TRADITIONAL KNOWLEDGE IN RURAL SOCIETY] 300, 308 (Luciano Concheiro Borquez & Francisco Lopez Barcnas, eds., 2007) [hereinafter BIODIVERSITY AND TRADITIONAL KNOWLEDGE], available at <http://www.cedrssa.gob.mx/?doc=1336> (averring that there are vast numbers of species in Mexican forests for which there is no "scientific" knowledge and explaining that community knowledge can explain the reproductive cycles, morphology, location, population densities, and potential for domestication of these species); see also И.И. Назаров [I.I. Nazarov], *Об Издании Информационно-Методического Справочника по Традиционным Знаниям Коренных Народов Алтае-Саянского Региона в Области Природопользования [On Publishing an Informational-Methodological Reference Book on Traditional Knowledge of the Indigenous People of Altae-Sayan Regarding Natural Resource Use]*, in ALTAE-SAYAN TRADITIONAL KNOWLEDGE, *supra* note 10, at 60, 63 (2009) (describing the significant lack of information in the scientific literature regarding natural resource use in the Altae-Sayan region of Russia); Chase Interview, *supra* note 11 (discussing that Western science is knowledge acquired in professional lifetime, whereas indigenous knowledge comes from thousands of years of knowledge).

20. See Bennett Interview, *supra* note 18 (explaining that community knowledge will be helpful as wildlife management agencies study how climate change impacts species distributions such that communities may identify new occurrences of species in certain

Occasional extreme events are likely to become community knowledge, whereas Western science may miss an event altogether because of a short sampling duration.²¹ Consideration of community knowledge can save Western scientists effort in their research.²²

There are a number of examples in which Western scientists who doubted or disregarded community knowledge have been proven wrong. A well-known example from Arctic Alaska concerns the estimated population of the Western Arctic stock of bowhead whales.²³ At that time, Western scientists believed that bowhead whales tended to avoid passing under the ice, preferring to pass through the narrow open water channels (called "leads").²⁴ A census conducted by the National Marine Fisheries Service (NMFS) in 1978 and 1979 relied primarily on sightings of passing whales by observers standing on shorefast ice near the open ocean.²⁵ The NMFS census estimated the whale population to be between 1,783 and 2,865.²⁶ As a result of this low estimate, the Alaska Eskimo whale subsistence quota was set at zero for 1978.²⁷

Eskimo hunters believed that the estimate was far below the real number of whales, as many whales were passing unobserved beneath the ice or far offshore.²⁸ The hunters successfully negotiated with NMFS to take over the census, and later, to have it turned over to Alaska's North

areas); *see also* Telephone Interview with Taylor Brelsford, Anthropologist, URS Corporation (Feb. 23, 2011) [hereinafter Brelsford Interview] (stating that people who are familiar with annual fluctuations may be better able to detect large changes, such as climate change) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment).

21. *See* Henrik Moller et al., *Combining Science and Traditional Ecological Knowledge: Monitoring Populations for Co-Management*, 9 *ECOLOGY & SOC'Y*, no. 3, Dec. 2004, at 1, 11, *available at* <http://www.ecologyandsociety.org/vol9/iss3/art2/> (stating that traditional ecological knowledge is more likely to take note of extreme and rare events but Western science methods of research would likely miss the event because of a short sampling duration).

22. *See* Chase Interview, *supra* note 11 (suggesting that if a university biologist wants to study ringed seals near a village in Northwest Alaska, the scientist may not find the seals if he does not first consult with the village residents).

23. *See generally* Thomas F. Albert, *The Influence of Harry Brower, Sr., an Iñupiaq Eskimo Hunter, on the Bowhead Whale Research Program Conducted at the UIC-NARL Facility by the North Slope Borough*, in *FIFTY MORE YEARS BELOW ZERO* 265, 266 (David Norton ed., 2001).

24. *See id.* ("[B]owhead whales (like most people) were 'afraid' of ice and therefore when migrating north in the spring tended to restrict themselves to the rather narrow open water channels (called 'leads') in the ice and thereby avoid the 'dangerous' ice.')

25. *See id.* (discussing the results of the 1978–79 NMFS census effort).

26. *Id.*

27. *See id.* (asserting that because of the increase subsistence hunting impacts and the low whale population estimate, the 1978 whale subsistence quote was set at zero).

28. *See id.* at 268 (stating that hunters were aware of whales swimming through areas of heavy ice, breaking small holes in the ice to breathe).

Slope Borough.²⁹ Borough biologists formed personal relationships with some of the hunters, which helped facilitate trust and goodwill between the two groups.³⁰ The biologists relied on these hunters' knowledge to implement a revised methodology for the estimates.³¹ Biologists used aerial surveys as well as passive acoustics that could locate vocalizing whales.³² The revised census methodology eventually resulted in an estimate of about 8,200 whales, and the Eskimo whaling quota was raised.³³

B. Unique Communities, Environments, and Forms of Information

Community knowledge is a valuable source of information regarding communities whose diets or lifestyles differ from those of other populations.³⁴ This is particularly true for Iñupiat Eskimos, who still rely on marine mammals and other subsistence foods for a large percentage of their diet.³⁵ Community knowledge can also inform decisions regarding regions with distinct environmental features (such as national parks).³⁶

29. *See id.* at 269 (documenting negotiations that took place between the AEW and NMFS to assume the task of taking the census of spring migrating bowheads). While the Borough is a municipality incorporated by Iñupiat Eskimos, its Wildlife Management Department includes many Western scientists. *Id.*

30. *See id.* (explaining that when the Borough assumed responsibility for taking the spring-migrating bowhead whale census, Eskimo hunters provided advice on best practices for conducting field work).

31. *See id.* at 270 (stating that the census program was modified based upon suggestions from hunters and other scientists).

32. *See id.* at 271 (describing the aerial survey and passive acoustic technique used to conduct the census of the migrating bowheads).

33. *See id.* at 273 (affirming that by incorporating the aerial survey and passive acoustic data, the population was about 8,200 whales).

34. *See* Corburn, *supra* note 10, at 428 (explaining that local knowledge can “help capture the information that is often ruled out by professionals . . .”).

35. *See* Ristoph, *supra* note 18, at 50–51 (discussing subsistence reliance in Arctic Alaska); *see also* Patricia Cirone, *The Integration of Tribal Traditional Lifeways into EPA's Decision Making*, 27 PRACTICING ANTHROPOLOGY 20, 20 (Winter 2005) (stating that tribal people are concerned that the current EPA risk assessment methodology does not afford a complete accounting of tribal culture, values, and lifestyles).

36. *See* Chelsea Lynne Aldrich, *Shoreline Management at Padre Island National Seashore: An Investigation of Angler Relationships to the Beach*, at 95, 102 (Aug. 2009), available at <http://repository.tamu.edu/bitstream/handle/1969.1/ETD-TAMU-2009-08-3250/ALDRICH-THESIS.pdf?sequence=1> (unpublished thesis, Texas A&M University) (describing how the community around the Padre Island National Seashore was concerned that the National Park Service was making regulations for the sake of maintaining consistency in regulations and policies in parks nationwide and that these regulations did not reflect the unique environment and users of the National Seashore) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment).

Community knowledge often takes a holistic view of humans in their environment,³⁷ encompassing aspects outside the models and theories characteristic of Western science.³⁸ This should enrich decision-making, although the inability of these aspects to fit into a scientific mold may become an obstacle.³⁹

C. Increasing Community Trust and Compliance

Some of the conflict between community and scientific knowledge lies in the struggle for power between communities and government agencies.⁴⁰ Communities that have no control over decisions made regarding their environment and resources may naturally distrust those who are making the decisions.⁴¹ In these communities, consultations to obtain community

37. See Seth Appiah-Opoku, *Indigenous Beliefs and Environmental Stewardship: A Rural Ghana Experience*, 24 J. CULTURAL GEOGRAPHY 79, 80 (2007) (discussing that environmental stewardship implies an acceptance of personal responsibility and management of natural resources); see also Serge Larochelle & Fikret Berkes, *Traditional Ecological Knowledge and Practice for Edible Wild Plants: Biodiversity Use by the Raramuri in the Sierra Tarahumara, Mexico*, 10 J. SUSTAINABLE DEV. & WORLD ECOLOGY 361, 366 (2003) (noting that viewing humans as interconnected with nature involves a relationship between humans and nature and a respect for natural resources); Erika M. Zimmerman, Essay, *Valuing Traditional Ecological Knowledge: Incorporating the Experiences of Indigenous People into Global Climate Change Policies*, 13 N.Y.U. ENVTL. L.J. 803, 806 (2005) (describing the holistic nature of indigenous knowledge that includes principles and rules about the interactions of humans with the natural and spiritual worlds).

38. See Namulauulu G. V. Tavana, *Traditional Knowledge is the Key to Sustainable Development in Samoa: Examples of Ecological, Botanical and Taxonomical Knowledge*, Proceedings of the 2001 Samoan Environmental Forum 19, 20 (2002), <http://www.mnre.gov.ws/forum/2001/index.htm> (asserting that many of the core contributions that Samoan culture has to offer to the world are in the form of tacit knowledge, which is deeply integrated with traditional values and difficult to articulate); see also Corburn, *supra* note 10, at 428 (documenting that when community members engage with science, they expand the values knowledge that traditional science often excludes); Bosire Maragia, *The Indigenous Sustainability Paradox and the Quest for Sustainability in Post-Colonial Societies: Is Indigenous Knowledge All that is Needed?*, 18 GEO. INT'L ENVTL. L. REV. 197, 230 (2006) (explaining that in collecting indigenous knowledge for scientific use, the knowledge may be "scientized" such that only its tangible and reproducible aspects remain; this may lead to near obliteration of the "non-useful" aspects, which, paradoxically, are inextricably intertwined with the tangible, useful aspects).

39. See *infra* Part III (stating that agencies are weary of making decisions based upon community knowledge since it may not confine to traditional Western science concepts).

40. See Hemant Ojha et al., *Knowledge Systems and Deliberative Interface in Natural Resource Governance: An Overview*, in KNOWLEDGE SYSTEMS AND NATURAL RESOURCES MANAGEMENT, POLICY AND INSTITUTIONS IN NEPAL 1, 11 (Hemant Ojha et al. eds., 2008) [hereinafter KNOWLEDGE SYSTEMS] (describing the tensions between community and scientific knowledge).

41. For example, Alaska North Slope residents resented FWS's efforts to manage migratory bird hunting following a 2008 shooting of a bird species listed under the Endangered Species Act, as they felt disrespected and disempowered. See Ristroph, *supra*

knowledge can increase trust and willingness to comply with agency decisions.⁴²

IV. Obstacles to Collecting and Using Community Knowledge

A. Conflicts between Natural Resource Management Based on Western Science and Based on Community Knowledge and Traditions

It is no surprise that agencies charged with making decisions based on Western science can be skeptical of community knowledge.⁴³ There have long been conflicts between Western and traditional/indigenous systems for managing natural resources and the environment.⁴⁴

note 18, at 70–71 (explaining the regulations placed upon North Slope hunting by the FWS without addressing other factors that may have caused the decline in species population); *see also* Isé & Abbott-Jamieson, *supra* note 8, at 29 (stating that fishermen have complained that NMFS “does not listen to what they know and observe about the fisheries and local marine environments in which they work or recreate”); Aldrich, *supra* note 36, at 95 (discussing that local resource users felt that regulations were implemented without public input; they expressed anger and a lack of respect for the management and law enforcement agents on the National Seashore).

42. *See* Omer Chouinard, Steve Plante & Gilles Martin, *The Community Engagement Process: A Governance Approach in Adaptation to Coastal Erosion and Flooding in Atlantic Canada*, 31 CAN. J. REG’L SCI. 507, 510 (2008), available at <http://www.cjrs-rcsr.org/archives/31-3/Chouinard-final2.pdf> (expressing that researchers interested in climate-related adaptation measures engaged and interviewed residents from Canadian coastal communities dealing with serious flooding and erosion problems and explaining that the process served to give more credibility to previous research efforts and to strengthen bridges between the community and civil servants); *see also* Ю.В. КОРЧАГИНА [YU. V. KORCHAGINA], ТРАДИЦИОННЫЕ ЗНАНИЯ И ИХ ЗНАЧИМОСТЬ ДЛЯ СОХРАНЕНИЯ БИОРАЗНООБРАЗИЯ КАМЧАТКИ [TRADITIONAL KNOWLEDGE AND ITS SIGNIFICANCE FOR CONSERVING BIODIVERSITY IN КАМЧАТКА] 171 (2008), available at <http://www.fishkamchatka.ru/proon/monograph2008.pdf> (asserting that in Kamchatka, Russia, where there is no natural resource co-management, consultation with local people regarding natural resource decisions has improved trust); Moller et al., *supra* note 21, at 13 (“Involving the harvesters themselves by using their own monitoring methods or inviting their participation and partnership with scientific monitoring is much more likely to lead to the application of the results and altered harvest practice where needed for sustainability.”).

43. *See* Telephone Interview with Dee Williams, Ph.D., Anthropologist and Chief of Environmental Studies, Alaska OCS Region, BOEMRE (Feb. 17, 2011) [hereinafter Williams Interview] (using community knowledge requires agencies to come to terms with a component of social science that they may not have previously taken seriously; agencies may view the promotion of community knowledge as an attempt by some stakeholders to dictate the outcome of resource management decisions).

44. *See, e.g.*, Comité de Coordination des Peuples Autochtones d’Afrique, Atelier Régional d’Afrique Australe IPACC sur la Formalisation des Savoirs Traditionnels de Pistage [IPACC Southern Africa Regional Workshop on the Formalization of Traditional Knowledge of Tracking], Camp Klein Dobe Centre de Réserve de Nlloq’àn!àè Nyae Nyae Tsumkwe Est, Namibie at 36 (Sep. 25–29, 2006), available at http://www.ipacc.org.za/uploads/docs/Tsumkwe_French.pdf [hereinafter IPACC Workshop]

Some of the products of Western colonialism (namely expansive mono-culture production) have proven to be more environmentally damaging than traditional practices that were small in scale and promoted species diversity.⁴⁵ On the other hand, some traditional practices based on community knowledge (such as slash-and-burn agriculture) are impractical under modern-day environmental, political, and economic constraints.⁴⁶ Extreme climate and demographic changes, particularly those that confront the world in the twenty-first century, can reduce the utility of community knowledge⁴⁷ and render certain community practices unsustainable.⁴⁸ At the

(declaring that the exclusion of Aboriginal knowledge in school curriculums is detrimental to the country); *see also* Isé & Abbott-Jamieson, *supra* note 8, at 29 (“Fisheries scientists often dismiss fishermen’s knowledge because they perceive it as anecdotal and it is not collected with quantitative methods and presented in data formats with which they are familiar.”).

45. *See, e.g.*, Tavana, *supra* note 38, at 22 (describing the traditional Samoan agricultural practice of integrating trees with other crops, which results in favorable soil conditions); *see also* Craig Segall, Note, *The Forestry Crisis as a Crisis of the Rule of Law*, 58 STAN. L. REV. 1539, 1550–51 (2006) (describing Indian forestry management under the British empire, in which the Forestry Department sharply restricted customary use while exploiting the forests to produce revenue for the empire; this transformed diverse tropical forests into monocultures of profitable timber species).

46. *See* Yolanda Cristina Massieu & Francisco Chapela Mendoza, *Valorización de la Biodiversidad y el Conocimiento Tradicional [Valuing Biodiversity and Traditional Knowledge]*, in BIODIVERSITY AND TRADITIONAL KNOWLEDGE, *supra* note 19, at 329, 338 (averring that in the case of slash-and-burn agriculture, demographic pressure may mean that abandoned fields do not have sufficient time to rest and regenerate before they must be used again); *see also* Maragia, *supra* note 38, at 232 (stating that indigenous and traditional practices can be difficult in a system of individualized land ownership, where there is no longer opportunity for free movement or expansion). Economic conditions may also hinder the exercise of practices based on community knowledge. *See, e.g.*, CHARNLEY ET AL., *supra* note 9, at 26 (citing the example of family forest owners in the Pacific Northwest, who recognize the importance of biodiversity but face limited markets for small quantities of logs of diverse sizes and species).

47. *See* Ristroph, *supra* note 18, at 64–65 (regarding the impact of climate change on traditional knowledge in Arctic Alaska); *see also* Braund, *supra* note 18, at 1 (“Because of changes to the Arctic marine environment, particularly related to climate change, this review focused on [traditional knowledge] for the last 20 years as older [traditional knowledge] may not apply accurately to today’s marine environment.”).

48. *See* Dixon, *supra* note 12, at 319 (stating that current land shortages in Ethiopia appear to have prevented farmers from applying ancestral knowledge of important techniques such as crop diversification, manuring, and fallowing, which would arguably sustain crop production at much higher yields); *see also* W.H. Thomas, *One Last Chance: Tapping Indigenous Knowledge to Produce Sustainable Conservation Policies*, 35 FUTURES 989, 995 (2003), available at http://www.sprep.org/att/IRC/eCOPIES/Countries/Papua_New_Guinea/42.pdf (“Any policy for the conservation of cultural and biological diversity must deal with the political realities of incorporating mobile autonomous people, into the global economy of a world with an expanding population, facing a shortage of arable land.”); KORCHAGINA, *supra* note 42, at 97 (suggesting that traditional knowledge is not equipped to address circumstances of contemporary development); Abelardo Juep Bakuants, *Rescate del Conocimiento*

same time, climate change may also reduce the utility of some models used by Western scientists to project species populations and environmental conditions.⁴⁹

B. Spiritual Aspects of Knowledge

Even though a community's knowledge may not directly conflict with Western science, it can be difficult to fit the knowledge into the constructs

Tradicional y Biológico para el Manejo de Productos Forestales no Maderables en la Comunidad Indígena Jameykari, Costa Rica [Reclaiming Traditional Biological Knowledge for the Management of Non-Timber Forest Projects in the Indigenous Community of Jameykari, Costa Rica], at 29 (2008) (unpublished thesis, Tropical Agriculture Research and Higher Education Center), available at <http://orton.catie.ac.cr/repdoc/A1961e/A1961e.pdf> (describing the indigenous Jameykari of Costa Rica and their respect for resources, although the traditional use of non-timber products by both indigenous and non-indigenous residents has resulted in some cases of species loss as the demand for resources increases); Jules R. Siedenburg, *Local Knowledge and Natural Resource Management in a Peasant Farming Community Facing Rapid Change: A Critical Examination 7* (University of Oxford QEH Working Paper Series, Working Paper No. 166, 2008), available at <http://www3.qeh.ox.ac.uk/RePEc/qeh/qehwps/qehwps166.pdf> (questioning the ability of farmers to adapt natural resource management practices when once-abundant resources suddenly become scarce; some farmers may have knowledge of what must be done to cultivate or conserve resources, while others may not). *But see* Ricardo Pérez Aviles et al., *El Conocimiento Popular, Campesino e Indígena desde Abajo, El Caso Pueblo* [Folk Knowledge, Rural and Indigenous People from Below, The Case of Pueblo], in BIODIVERSITY AND TRADITIONAL KNOWLEDGE, *supra* note 19, at 425 (stating that knowledge responds to changes in people's relationship to nature and the environmental problems caused by human activity); *see also* Winona LaDuke, *Traditional Ecological Knowledge and Environmental Futures*, 5 COLO. J. INT'L ENVTL. L. & POL'Y 127, 130 (1994) (arguing that large populations are not incompatible with traditional management practices; "previous North American indigenous populations were substantially higher than they are now"); Interview with Taqulik Hepa, Director, North Slope Borough Wildlife Director, in Barrow, Alaska (Apr. 1, 2011) [hereinafter Hepa Interview] (stating that Arctic people are adapting to the changing migration patterns of Arctic animals and knowledge is evolving; Inupiat Eskimos are able to continue to go whaling even if the ice is thinner, although they must adjust to a shorter season and take extra precautions) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment).

49. *See, e.g.,* David A. Keith et al., *Predicting Extinction Risks under Climate Change: Coupling Stochastic Population Models with Dynamic Bioclimatic Habitat Models*, 4 BIOL. LETT. 560, 562–63 (July 29, 2008), available at <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2610061/> (describing shortcomings of current methods for assessing species responses to climate change); *see also* Walter M. Grayman et al., A Review of Quantitative Methods for Evaluating Impacts of Climate Change on Urban Water Infrastructure, Presentation at the First National Expert and Stakeholder Workshop on Water Infrastructure Sustainability and Adaptation to Climate Change (Jan. 6–7, 2008), available at http://www.epa.gov/nrmrl/wswrd/wq/wrap/pdf/workshop/B2_Grayman.pdf (questioning whether certain models are sufficiently sensitive to climate change).

of Western science⁵⁰ and the regulatory system that agencies use.⁵¹ The difficulty may arise from the interconnectedness of a community's knowledge with its traditional values, practices, and stories.⁵² Particularly for indigenous knowledge, there may be no distinction between the tangible and the intangible,⁵³ the religious and the secular,⁵⁴ or the individual and the

50. See CHARNLEY ET AL., *supra* note 9, at 14 (“[A]ccounts [of community knowledge] are rarely framed in a manner that addresses scientific questions relating to forest management.”); see also Taylor Brelsford, “*We have to Learn to Work Together*”: *Current Perspectives on Incorporating Local and Traditional/Indigenous Knowledge into Alaskan Fishery Management*, 70 AM. FISHERIES SOC’Y SYMP. 381, 385 (2009) (suggesting that agencies may be hesitant to fund projects that include the study of spiritual beliefs, as these beliefs appear to have limited applicability to resource management decisions).

51. Federal migratory bird hunting regulations applicable to Alaska are an example. See 50 C.F.R. § 92.31 (2011) (listing Region-specific regulations). These regulations provide for a 30-day hunting closure on the North Slope during the summer, in accordance with traditional practices. *Id.* But the setting of specific dates for the closure has been problematic, since closure traditionally began when birds started to pair up and the rivers melted. See Hepa Interview, *supra* note 48. This may occur earlier or later in a given year, depending on the weather. *Id.* The North Slope Borough Fish and Game Committee proposed regulations under which closure would begin when North Slope hunters observed the birds pairing up, but FWS did not accept the proposal. *Id.*

52. See Víctor Reyes-García, *Conocimiento Ecológico Tradicional para la Conservación: Dinámicas y Conflictos* [Traditional Ecological Knowledge for Conservation: Dynamics and Conflicts], 107 PAPELES 39, 47 (2009), available at http://www.fuhem.es/media/ecosocial/file/Proyecto%20Cultura%20y%20Ambiente/Art%C3%ADculos/conocimiento%20ecologico%20tradicional_V.REYES-GARCIA.pdf (noting that the Apache’s ecological knowledge is transmitted via diverse forms, including myths, prayers, and ceremonies); see also Zimmerman, *supra* note 37, at 825 (suggesting that indigenous people view traditional ecological knowledge as their way of life and that the spiritual and sustainable aspects of this knowledge cannot be separated); Frankson Interview, *supra* note 10 (describing traditional practices associated with preparation for whaling, including prayer and cleaning one’s cellar); Interview with Nora Jane Burns, Village of Kaktovik Liaison and Planning Commission Representative for the North Slope Borough, Kaktovik City Council Member, in Kaktovik, Alaska (Feb. 16, 2011) [hereinafter Burns Interview] (declaring that Iñupiat Eskimo elders tell stories containing traditional knowledge and showing how the knowledge plays out in real life; the culture, stories, and knowledge are all mixed together) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment).

53. See Rebeca Alfonso Romero, *Sobre la Conceptualización “Conocimiento Tradicional,” Fundamentos y Contextos en la Legislación Actual* [On the Conceptualization of “Traditional Knowledge,” Fundamentals and Contexts in Current Legislation], in BIODIVERSITY AND TRADITIONAL KNOWLEDGE, *supra* note 19, at 79, 81 (citing a 2003 workshop on Traditional Knowledge Protection in Columbia).

54. See E. A. Бельгибаев [E. A. Belgibaev], *Образовательный Ресурсв Сфере Сохраня Биоразнообразия Алтае-Саянскогоэкорегиона: Региональный Компонент* [Educational Resources in Biodiversity Conservation in the Altai-Sayan Ecoregion: Regional Component], in ALTAE-SAYAN TRADITIONAL KNOWLEDGE, *supra* note 10, at 14 (asserting that among the Altai-Sayan people of Russia, practical knowledge is closely aligned with religion and myth); see also IPACC Workshop, *supra* note 44, at 30 (stating that, for the San tribe of Southern Africa, there is no line between culture, faith, and knowledge).

world.⁵⁵ Agencies generally cannot process or use spiritual aspects of knowledge in the same manner as other forms of data.⁵⁶

C. Identifying Proper Sources of Community Knowledge

Not everyone in a community necessarily has community knowledge.⁵⁷ Power structures in a community can mean that researchers ignore those who have more in-depth knowledge in favor of those with higher status⁵⁸ (or louder voices). Women have different kinds of knowledge than men, and in some cases they are the principle holders of community knowledge.⁵⁹ Yet women may be reluctant to speak,⁶⁰ and women's participation may not even be sought.⁶¹

55. See KORCHAGINA, *supra* note 42, at 72 (declaring that traditional knowledge is made up of knowledge, ethical norms, and personal memories—it is inseparable from personal recollections).

56. See Bennett Interview, *supra* note 18 (maintaining that there is currently no way for Western science to incorporate the emotions and spiritual aspects associated with traditional practices; this does not make the spirituality or the practices illegitimate—just difficult to capture).

57. See Siedenburt, *supra* note 48, at 2, 10–11 (citing example of farmers in rural Senegal and Tanzania, some of whom removed all trees from their fields, while others retained or cultivated trees); see also Telephone Interview with Brad Smith, Biologist and Anchorage Field Office Supervisor, National Marine Fisheries Service (NMFS) (Mar. 11, 2011) [hereinafter Smith Interview] (suggesting that it is difficult for NMFS to determine what Native comments are correct because of the tendency in Alaska Native culture not to question what different community members say, resulting in differing comments) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment); Telephone Interview with Doug Vincent-Lang, Special Assistant to the ADF&G Commissioner (Mar. 9, 2011) [hereinafter Vincent-Lang Interview] (stating that agencies struggle with knowledge coming from a single person who could be inaccurate; to address this, ADF&G gives more weight to information supplied by village corporations than to that provided by a single person) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment).

58. See Hilary Warburton & Adrienne Martin, Natural Resources Institute, *Local People's Knowledge in Natural Resources Research*, SOCIO-ECONOMIC METHODOLOGIES FOR NATURAL RESOURCES RESEARCH, BEST PRACTICE GUIDELINES 3 (1999), available at <http://www.nri.org/publications/bpg/bpg05.pdf> (citing examples of people with knowledge who have been ignored by researchers because of power structures).

59. See Pérez Aviles, *supra* note 48, at 420 (explaining that women are the main holders and guardians of traditional knowledge).

60. See Warburton & Martin, *supra* note 58, at 7–8 (stating that, in some communities, men answer researchers' question for women, although women might have more knowledge about farming).

61. See Carla Guerrón-Montero, *Marine Protected Areas in Panama: Grassroots Activism and Advocacy*, 64 HUMAN ORGANIZATION 360, 368 (2005) (describing the implementation of a marine protected area in Panama, in which there was little effort to incorporate the participation of women).

D. Limited Scope of Knowledge

Just as Western science has not penetrated all areas of the earth, community knowledge is limited to particular places and environmental circumstances. Community members may not be familiar with areas beyond what they use or with conditions that take place during times in which they are not hunting.⁶² This limits the extent to which the knowledge can be generalized and universally applied.⁶³

E. Loss of Knowledge

Loss of community knowledge is associated with loss of the language associated with the knowledge,⁶⁴ lack of written records,⁶⁵ insistence on formal (Western-style) education,⁶⁶ loss of access to traditional land and

62. See Moller et al., *supra* note 21, at 11 (suggesting that sampling at different places or at non-harvest times of the life cycle may be necessary to investigate harvesting and other population impacts).

63. See CHARNLEY ET AL., *supra* note 9, at 14 (“[Community knowledge] is not easy to generalize at different scales or at widely varying locations. . . . Trying to gain access to it in written form and treating it as a set of technical facts to be applied to forest management problems elsewhere is inappropriate.”); see also Lazrus & Sepez, *supra* note 18, at 35 (declaring that community knowledge in the NOAA Fisheries Alaska Native Traditional Environmental Knowledge Database “can be primarily useful to reflect local environmental and social conditions; however without an explicit link to place, the reflection is blurred”).

64. See, e.g., Alonso Mielgo, *El Conocimiento Tradicional Aplicado al Manejo de las Huertas en Andalucía* [Traditional Knowledge Applied to Garden Management in Andalucía], in INTRODUCCIÓN A LA AGROECOLOGÍA COMO DESARROLLO RURAL SOSTENIBLE [INTRODUCTION TO AGRO-ECOLOGY AS RURAL SUSTAINABLE DEVELOPMENT], at 303 (G. Guzmán, M. González de Molina, & E. Sevilla eds., 2000), available at <http://www.cifaed.es/archivos/publicaciones/23.pdf> (noting that species names are a component of community knowledge as they give insight on how species are classified); see also Tavana, *supra* note 38, at 21 (“Deterioration of language has serious implications for the Samoan culture: when elders die, the language, cultures and knowledge die with them.”); George Interview, *supra* note 7 (stating that the loss of language means loss of this knowledge).

65. See, e.g., Reyes-García, *supra* note 52, at 52 (citing M. Lizarralde, *Biodiversity and Loss of Indigenous Languages and Knowledge in South America*, in ON BIO-CULTURAL DIVERSITY: LINKING LANGUAGE, KNOWLEDGE, AND THE ENVIRONMENT (L. Maffi ed., 2001)) (stating that the loss of traditional values is a leading cause of the loss of traditional ecological knowledge); Juep Bakuants, *supra* note 48, at 2 (asserting that the study of community knowledge and environmental management in Jameykari, Costa Rica, an indigenous community, suggests that community knowledge is disappearing in part because there is no written record).

66. See, e.g., Reyes-García, *supra* note 52, at 53 (citing R. Sternberg et al., *The Relationship between Academic and Practical Intelligence: A Case Study in Kenya*, 29 INTELLIGENCE 410 (Sept.–Oct. 2001)) (attributing the loss of traditional ecological knowledge to the acculturation caused by formal education).

resource use areas,⁶⁷ social change,⁶⁸ and movement toward a market economy (through which Western or store-bought products substitute for traditionally made or harvested products).⁶⁹

The degree to which Alaskan community knowledge is retained varies, depending on the immersion of an individual or family in the traditional culture⁷⁰ and native language.⁷¹ But overall, it appears that a gap is emerging between the knowledge held by older generations and that of younger generations.⁷²

67. See, e.g., CHARNLEY ET AL., *supra* note 9, at 19, 34 (describing loss of knowledge regarding forest resources in the Pacific Northwest, in part due to increased privatization).

68. See, e.g., Juep Bakuants, *supra* note 48, at 2 (stating that community knowledge is disappearing in part because youth are focused on western lifestyles); IPACC Workshop, *supra* note 44, at 10 (affirming that, as youth look towards urban life, there is a loss of traditional knowledge among the San tribe of southern Africa); Frankson Interview, *supra* note 10 (describing the loss of spiritual and social significance associated with the traditional practice of making skin boats for whaling); Interview with Delbert Rexford, Land Manager, Ukpeagvik Iñupiat Corporation, in Barrow, Alaska (Feb. 8, 2011) [hereinafter Rexford Interview] (stating that youth are attuned to technology and not engaging in subsistence activities as much as before).

69. See, e.g., Ibarguen Tinley & Chapela Mendoza, *supra* note 19, at 303 (stating that traditional knowledge and practices in Mexico, aside from having pre-Columbian roots, are influenced by modern technology and respond partially to capitalist market incentives and globalization); Reyes-García, *supra* note 52, at 54 (citing two independent studies that found that the more integrated into a market a society was, the less traditional ecological knowledge it had); Pricette Dovonou-Vinagbè & Omer Chouinard, *Gestion Communautaire des Ressources Naturelles au Bénin (Afrique de l'Ouest): le Cas de la Vallée du Sitatunga [Community Management of Natural Resources in Benin (West Africa): The Case of the Sitatunga Valley]*, 12 ÉTUDES CARIBÉENNES at ¶53 (Apr. 2009), <http://etudescaribeennes.revues.org/3630> (describing challenges to community management in south Benin: as residents transfer from a traditional agrarian economy to an individualistic cash economy, traditions and values formerly allotted to the wetlands have almost disappeared); Juep Bakuants, *supra* note 48, at 15 (declaring that resources traditionally used solely for subsistence purposes are now used at least in part for commercial uses).

70. See Burns Interview, *supra* note 52 (stating that families that are still hunting continue to pass down knowledge about traditional skills (i.e., skinning and sled-making), but other families are not passing down as much information); see also Chase Interview, *supra* note 11 (suggesting that someone growing up in an Eskimo community would probably have more traditional knowledge, depending on how much emphasis the person's family puts on traditional knowledge).

71. See Frankson Interview, *supra* note 10 (stating that because knowledge is tied to language, it is more difficult to understand Iñupiaq concepts spoken in the English language because the Iñupiaq terms are more definitive); see also Rexford Interview, *supra* note 68 (stating that when the younger generation talks about whaling, some of the meaning is lost because they are speaking in English instead of Iñupiaq).

72. See Brelsford Interview, *supra* note 20 (stating that the traditional stewardship values in Alaskan indigenous communities are not embraced by all but have not disappeared and that there are gaps in knowledge between youth and elders).

F. Reluctance to Share Knowledge

A community may be reluctant to share its knowledge with researchers and government agencies. In Alaska, there are various reasons for people's reluctance to share traditional knowledge, one of which is the sense that community knowledge has long been dismissed by Western scientists and agencies.⁷³ This resentment has eased as agencies have shown more interest in community knowledge.⁷⁴

A second reason relates to distrust of outsiders and the government—particularly the federal government⁷⁵ and law enforcement agents.⁷⁶ Some villages have refused to participate in studies because of concerns that law enforcement agents could find out about illegal harvests.⁷⁷ There is also a concern that environmental organizations will use information (particularly about whaling) against local hunters.⁷⁸

A third reason pertains to intellectual property rights,⁷⁹ even when community knowledge is gathered for use in government decision-making

73. *See id.* (stating that there is a sense that community knowledge has long been derided and dismissed in what amounts to an assault on the dignity of community elders); *see also* Frankson Interview, *supra* note 10 (maintaining that if people knew their knowledge was valued, they would be more forthcoming in sharing it).

74. *See* Bennett Interview, *supra* note 18 (stating that on the North Slope, provided there is not a threat of law enforcement, people are willing to share information and are glad that someone is interested in their knowledge); *see also* Brelsford Interview, *supra* note 20 (proposing that in the twenty-first century, people may be more upset about their knowledge being left out of a decision-making process than they would be about having the knowledge out in the public domain).

75. *See* Smith Interview, *supra* note 57 (averring that, in Alaska, because there is a history of animosity toward the federal government, it can be hard to channel public meetings in a productive direction).

76. *See* Brelsford Interview, *supra* note 20; *see also* Rexford Interview, *supra* note 68 (stating that, in general, North Slope residents are reluctant to share information with outsiders and are deterred by the aggressive approach of some law enforcement officers); Email from Catherine Villa, Tribal Coordinator, EPA, to author (Feb. 4, 2011) [hereinafter Villa Email] (stating that people may have a mistrust of the government and want to know why community information is needed and how it will be used) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment).

77. *See* Brelsford Interview, *supra* note 20.

78. *See* Interview with Johnny Aiken, Whaling Co-Captain and Executive Director of the Alaska Eskimo Whaling Commission, in Barrow, Alaska (Feb. 8, 2011) [hereinafter Aiken Interview] (expressing concern that environmentalists could use information regarding the number of whale strikes (whales struck but not landed) to campaign for a reduction in the whaling quota).

79. *See* Brelsford Interview, *supra* note 20 (noting that “intellectual property” concerns exist, although this term is rarely used in the context of Alaskan traditional ecological knowledge). Brelsford has only seen one instance in which long-term royalties were requested for the use of traditional ecological knowledge. *Id.*

rather than for a commercial venture.⁸⁰ A community may be concerned that once knowledge enters the public domain, it can be exploited without any recognition of the community's rights to the knowledge.⁸¹ If a published study reveals the location of community hunting and fishing sites, outside hunters may begin using these sites.⁸²

A fourth reason relates to the lack of compensation and community benefit. There may be little incentive to share knowledge unless it is in the community's interest to do so—for example, if sharing knowledge leads to shared management or at least the protection of community resource use.⁸³ At the individual level, people may be unwilling to take time out of their day to talk with researchers unless they are adequately compensated (even though the knowledge is supposed to be used to make better decisions concerning community resources).⁸⁴

80. An example of a conflict regarding intellectual property rights is a project through which the Minerals Management Service (MMS) funded a village native corporation to collect over 3,000 records containing community knowledge. The corporation ultimately did not share the records with MMS due to disputes over the right to control the information. *See* Williams Interview, *supra* note 43.

81. *See* Pérez Aviles, *supra* note 48, at 424 (indicating that under Mexican law, there are no legal means to protect community knowledge without losing the value of the knowledge as cultural patrimony and community heritage; the knowledge becomes capital rather than a patrimony); *see also* Cirone, *supra* note 35, at 20 (describing the struggle between tribes' privacy rights and laws providing for freedom of information); Interview with Jack Schaefer, Lands Manager, Tikigaq Corporation, in Point Hope, Alaska (Feb. 2, 2011) [hereinafter Schaefer Interview] (referring to occasion in which the federal government got information regarding local people's land occupancy and suggesting that this information was misused in a later federal oil and gas lease sale) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment); Williams Interview, *supra* note 43 (stating that informants may not be willing to provide knowledge without some control over how it is used and that informants may feel exploited).

82. *See* Brelsford Interview, *supra* note 20 (suggesting that if a study provides insight into where animals are likely to be, people may worry that others will encroach on their hunting or fishing sites); *see also* George Interview, *supra* note 7 (stating that a book regarding community knowledge on North Slope fish was not published, as there was a concern that sport hunters could come to the area and use community fishing sites).

83. *See* Emily Walter, R. Michael M'Gonigle & Céleste McKay, *Fishing Around the Law: The Pacific Salmon Management System as a "Structural Infringement" of Aboriginal Rights*, 45 MCGILL L.J. 263, 310 (2000), which states the following:

In community-based systems, local and traditional knowledge is harnessed more effectively to provide a wider range of inputs into stock assessment and other policy functions. Community-based regimes also allow harvesters to turn their energies to improving instead of beating the system, such that compliance is enhanced and problems with poor estimation of effort, which have confounded stock assessors under the present system, are ameliorated.

84. *See* Jon Isaacs, Use of Traditional Knowledge in the Northstar Oil Development EIS, Presentation in North Slope Borough (NSB) Traditional Knowledge Workshop, in Anchorage, Alaska (Sep. 6, 2007) (stating that the U.S. Army Corps of Engineers attempted to incorporate community knowledge from the Barrow, Nuiqsut, and Kaktovik villages in an Environmental Impact Statement (EIS) for the Northstar offshore Arctic development; while

A fifth reason relates to spirituality and religious privacy.⁸⁵ Where community knowledge is inseparable from spirituality, communities may not want their religious practices to be discussed with outsiders.⁸⁶

A final reason relates to the difficulty of inter-cultural communication.⁸⁷ In collecting community knowledge, both the informant and the person collecting information must stretch beyond their normal means of communicating.⁸⁸ This requires patience, practice, and goodwill on the part of all involved.⁸⁹

V. Laws Affecting the Use of Community Knowledge

While Canadian laws⁹⁰ and international agreements⁹¹ call for the use of community knowledge in environmental and natural resource decision-

many residents were pleased with the effort, one village declined to participate without compensation) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment); *see also* Williams Interview, *supra* note 43 (stating that informants may feel exploited even though their knowledge is being gathered in order to make better decisions concerning their land).

85. *See* Brelsford Interview, *supra* note 20 (discussing the sensitive nature of religious privacy and how it is intertwined with traditional knowledge).

86. *See id.*

87. *See* Williams Interview, *supra* note 43 (stating that there are many cultural and communication challenges to collecting traditional knowledge; it can be difficult for a researcher to get a substantive answer to a question rather than a story).

88. *See id.*

89. *See* Brelsford Interview, *supra* note 20 (stating that all methods of collecting data presume goodwill and that if there is a lack of goodwill, no one will participate).

90. Canada has some specific statutory provisions for integrating community knowledge, although they are permissive rather than mandatory. Article 42(j) of the Canada Oceans Act, R.S.C. 1996, c. 31, allows the Minister of Fisheries and Oceans to “conduct studies to obtain traditional ecological knowledge for the purpose of understanding oceans and their living resources and ecosystems.” Canada Oceans Act, R.S.C. 1996, c. 31. Section 16.1 of the Canadian Environmental Assessment Act says that “[c]ommunity knowledge and aboriginal traditional knowledge may be considered in conducting an environmental assessment.” Canadian Environmental Assessment Act, R.S.C. 2003, c. 37. There has been difficulty in enforcing, standardizing, and monitoring the use of community knowledge in environmental assessments, however. *See* Graham R. Statt, *Tapping Into Water Rights: An Exploration of Native Entitlement in the Treaty 8 Area of Northern Alberta*, 18 CAN. J.L. & Soc’y 103, 104 n.3 (2003) (suggesting that there has been difficulty with enforcing, standardizing, and monitoring the full consideration of traditional knowledge and the full and equal consideration of traditional ecological knowledge among federal environmental assessment panels). Some aboriginal people still feel that their participation in environmental assessments is too limited. *See* Pat Larcombe, *Determining Significance of Environmental Effects: An Aboriginal Perspective*, Winds and Voices Environmental Services Inc., Research and Development Monograph Series (2000), available at <http://www.ceaa.gc.ca/default.asp?lang=En&n=072A8227-1&offset=2&toc=show> (recounting Aboriginal people’s suggestion that “[d]etermination of significance should be [expanded] to include effects significant to Aboriginal peoples, and not be limited . . .”). Two Canadian provinces provide for the incorporation of community knowledge into

making, there is no law or agreement requiring its use in the United States.⁹² Still, several United States laws are relevant to agencies' use of community knowledge.⁹³

A. Data Quality Act

The Data Quality Act,⁹⁴ enacted in 2000 as a short rider to a spending bill, may affect how federal agencies can use community knowledge in decision-making. The Act requires the Office of Management and Budget (OMB)⁹⁵ and other federal agencies to establish guidelines "ensuring and maximizing the quality, objectivity, utility, and integrity of information . . . disseminated by [the agency]."⁹⁶ The act further requires agencies to provide a mechanism allowing for complaints to correct information that does not apply with agency guidelines.⁹⁷

The guidelines of the federal agencies that are largely responsible for making decisions regarding natural resources and the environment do not address "community," "traditional," "local," or "indigenous" knowledge.⁹⁸

environmental decision-making. *See* Article 14.5 of The Western Arctic Claim: The Inuvialuit Final Agreement, as amended January 15, 1987, at 53 § 14.(5), *available at* <http://fishfp.sasktelwebhosting.com/publications/IFA.pdf> ("The relevant knowledge and experience of both the Inuvialuit and the scientific communities should be employed in order to achieve conservation."); *see also* Northwest Territories Policy § 51.06, *available at* <http://www.mtnforum.org/sites/default/files/pub/383.pdf> (stating that "r" knowledge and experience of the Inuvialuit and scientific communities should be employed in order to achieve conservation).

91. *See infra* Appendix (listing agreements and declarations calling for the use of community knowledge in environmental decision-making).

92. *See generally infra* Part IV, §§ A–D (discussing current laws affecting community knowledge, but finding no specific law mandating the use of community knowledge).

93. *See infra* Part IV, §§ A–D, and Part V (outlining several U.S. laws pertaining to agencies' use of community knowledge).

94. Data Quality Act, Pub. L. No. 106-554, 114 Stat. 2763, 2763A-153-54 (2000) (codified as a note to 44 U.S.C. § 3516). The act is also referred to as the Information Quality Act. *Id.*

95. OMB guidelines state that, in general, scientific and research information that has "been subjected to formal, independent, external peer review" is regarded as presumptively objective. Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies, 67 Fed. Reg. 8,452, 8,454 (Feb. 22, 2002). The guidelines provide that the presumption of objectivity "is rebuttable based on a persuasive showing by the petitioner in a particular instance." *Id.* at 8,459.

96. Data Quality Act, *supra* note 94, § 515(a).

97. *See id.* § 515(b)(2)(B) (establishing mechanisms by which individuals may correct information that does not apply with guidelines); *see also id.* § 515(b)(2)(C) (requiring agencies to report such complaints and actions to resolve the complaints to the Office of Management and Budget).

98. *See* Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by the Environmental Protection Agency, EPA/260R-02-008 (67 Fed. Reg. 8,452) (Oct. 2002), *available at*

The guidelines refer only to scientific knowledge that is collected according to standard procedures and/or peer reviewed.⁹⁹ For example, the National Oceanic and Atmospheric Administration (NOAA) collects data “according to documented procedures or in a manner that reflects standard practices accepted by the relevant scientific and technical communities.”¹⁰⁰ Deviations from NOAA procedures “occur only if valid scientific reasons exist for such [] deviation[s].”¹⁰¹

The prospect of being challenged for using community knowledge that is insufficiently objective or peer-reviewed may hinder agencies from relying on this source of knowledge.¹⁰² On the other hand, the lack of a peer

http://www.epa.gov/quality/informationguidelines/documents/EPA_InfoQualityGuidelines.pdf (implementing the Data Quality Act within the EPA); *see also* National Oceanic and Atmospheric Administration Information Quality Guidelines (Nov. 6, 2006), *available at* http://www.cio.noaa.gov/Policy_Programs/IQ_Guidelines_110606.html [hereafter NOAA Guidelines] (implementing the Data Quality Act within the NOAA); Bureau of Land Management Information Quality Guidelines, *available at* http://www.blm.gov/pgdata/etc/medialib/blm/national/national_page.Par.7549.File.dat/guidelines.pdf (implementing the Data Quality Act within the Bureau of Land Management); Minerals Management Service Information Quality Guidelines, *available at* <http://www.boemre.gov/qualityinfo/PDF/MMSQualityInfoGuidelines-Final.pdf> (implementing the Data Quality Act within the Minerals Management Service); U.S. Department of Agriculture Guidelines (Feb. 24, 2010), *available at* http://www.ocio.usda.gov/qi_guide/index.html (implementing the Data Quality Act within the Minerals Management Service).

99. *See* Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by the Environmental Protection Agency, *supra* note 98 (requiring that “major scientifically- and technically-based work products . . . related to Agency decision should be peer reviewed”).

100. NOAA Guidelines, *supra* note 98.

101. *Id.*

102. *See* Williams Interview, *supra* note 43 (indicating that the government is constrained by the Data Quality Act to meet objective evidentiary standards, which must be applied to all information used in decision-making; it is sometimes difficult for assertions of traditional knowledge to measure up to this). Complaints and challenges have been filed under the Data Quality Act against agencies on a wide range of decisions regarding natural resource and environmental issues. *See* Data Quality Petitions by Agency, Center for Regulatory Effectiveness, *available at* <http://thecre.com/quality/petitions.html> (listing petitions for information received by the various agencies under the Data Quality Act); *see also* David S. Caudill, *Images of Expertise: Converging Discourses on the Use and Abuse of Science in Massachusetts v. EPA*, 18 VILL. ENVTL. L.J. 185, 200 (2007) (stating that many proposed regulations are challenged with claims that the scientific evidence is flawed or otherwise imperfect). Thus far, however, federal courts do not appear to have used the Data Quality Act as a basis for invalidating agency decisions regarding natural resources or the environment. *See, e.g.,* McKeen v. U.S. Forest Service, 615 F.3d 1244, 1259 (10th Cir. 2010) (claiming that, based on the Data Quality Act, the National Environmental Policy Act, and the Administrative Procedure Act (APA), Forest Service action was found to be not arbitrary and capricious); *see also* San Luis & Delta-Mendota Water Authority v. Salazar, 760 F.Supp.2d 855, 959–64 (E.D. Cal. 2010) (pronouncing that APA barred review of claim that FWS failed to apply Data Quality Act in drafting biological opinion under Endangered Species Act; Data Quality Act did not provide private right of action); Family Farm Alliance

review process for community knowledge may mean that it can be used without any peer review.¹⁰³ Many agencies continue to collect community knowledge and incorporate it into their work and may see the Data Quality Act as not directly applying to this type of knowledge.¹⁰⁴

B. ANILCA

The Alaska National Interest Lands Conservation Act (ANILCA) “enabl[es] rural residents who have personal knowledge of local conditions and requirements to have a meaningful role in the management of fish and wildlife”¹⁰⁵ The Act requires the Secretary of the Interior to undertake subsistence use studies that seek data from local residents.¹⁰⁶

Under the authority of ANILCA,¹⁰⁷ five federal agencies,¹⁰⁸ the Federal Subsistence Board (comprised of the Alaska heads of the five agencies), and ten Regional Advisory Councils manage subsistence on

v. Salazar, 749 F.Supp.2d 1083, 1,091–92 (E.D. Cal. 2010) (asserting that makeup of peer review panel was committed to FWS's discretion, precluding judicial review of challenge to peer review brought under the Data Quality Act; further, the act contained no substantive standards respecting peer review, and OMB guidelines disclaimed that its contents created any enforceable rights).

103. See Smith Interview, *supra* note 57 (stating that traditional knowledge can be used by NMFS without peer review because there is no peer review process for this type of knowledge).

104. See Bennett Interview, *supra* note 18 (affirming that the Data Quality Act has not affected her work with FWS, which is more descriptive and less concerned with the level of precision or repeatability); see also Telephone Interview with Stacie McIntosh, Branch Chief of Resources, BLM (Apr. 18, 2011) [hereinafter McIntosh Interview] (asserting that the Bureau of Land Management is not directly involved in the collection of data (particularly numeric data) and is thus less affected by the Data Quality Act) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment); Telephone Interview with Ted Rockwell, Senior Advisor for Oil and Gas, EPA Region 10 (Mar. 25, 2011) [hereinafter Rockwell Interview] (suggesting that to the extent the Data Quality Act does apply to community knowledge, it can be addressed by having the community review a report before it is finalized) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment).

105. 16 U.S.C. § 3111(5) (2011).

106. See *id.* § 3122 (requiring the Secretary to consult with and make use of the special knowledge of local residents engaged in subsistence use and make the results of this research available).

107. See *Federal Subsistence Management Program, About the Program*, U.S. FISH & WILDLIFE SERVICE (June 2, 2008), <http://alaska.fws.gov/asm/about.cfml> (noting that to help carry out the responsibility for subsistence management under ANILCA, the Secretaries of the Interior and Agriculture established the Federal Subsistence Management Program) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment).

108. These include the USDA Forest Service and four Department of Interior agencies: the Bureau of Indian Affairs, the Fish and Wildlife Service, the National Park Service, and the Bureau of Land Management.

federal lands in Alaska.¹⁰⁹ The Regional Advisory Councils consist of agency representatives as well as residents who are knowledgeable about subsistence and other uses of fish and wildlife resources in their region.¹¹⁰

The Office of Subsistence Management (within the U.S. Fish and Wildlife Service) was created to support the Federal Subsistence Board, the Regional Advisory Councils, and the Fisheries Resource Monitoring Program (“the Program”).¹¹¹ The Program sponsors harvest pattern studies and the collection/analysis of community knowledge,¹¹² which provides context for understanding harvest information and interpreting biological and environmental phenomena.¹¹³

C. Executive Order on Environmental Justice

A 1994 executive order on environmental justice¹¹⁴ seems to encourage the collection of community knowledge, as it requires federal agencies to ensure greater public participation and improve research and data collection on the environment of minority and low-income populations.¹¹⁵

Even before the executive order was issued, the U.S. Environmental Protection Agency (EPA) established the National Environmental Justice Advisory Council to address environmental justice issues.¹¹⁶ The Council’s

109. See Polly Wheeler & Amy Craver, *Office of Subsistence Management and Issues and Challenges of Integrating TEK into Subsistence Fisheries Management*, 27 PRACTICING ANTHROPOLOGY 15, 15 (Winter 2005) (explaining that the state of Alaska is divided into ten geographic regions, each having a Regional Advisory Council).

110. See *id.* (describing the Regional Advisory Councils as being made up of local residents who represent sport, commercial, and subsistence hunting and fishing interests).

111. See *Federal Subsistence Management Program*, Office of Subsistence Management, U.S. FISH & WILDLIFE SERVICE (Dec. 10, 2010), <http://alaska.fws.gov/asm/osm.cfm> (last visited Jan. 4, 2012) (describing the Office of Subsistence Management, a branch of the U.S. Fish and Wildlife Service) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment).

112. See Wheeler & Craver, *supra* note 109, at 15 (explaining the processes used by the Fisheries Resource Monitoring Program to provide information on community harvest estimates at local fisheries).

113. See *id.* at 16 (regarding information gathered from the Fisheries Resource Monitoring Program).

114. Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, Exec. Order No. 12,898, 59 Fed. Reg. 7629 (Feb. 16, 1994).

115. See *id.* at 7,629 (requiring agencies to identify and address health and environmental effects of their activities on minority populations and low-income populations).

116. See EPA, Environmental Justice Fact Sheet, National Environmental Justice Advisory Council (Jan. 2010), *available at* <http://www.epa.gov/compliance/environmentaljustice/resources/publications/factsheets/factsheet-nejac-2009.pdf> (“In 1993, the Agency established the National Environmental Justice

suggestions for public involvement include recognizing community knowledge.¹¹⁷

D. Executive and Secretarial Orders on Tribal Consultation

A 2000 executive order on tribal consultation may similarly encourage the gathering of community knowledge from tribes, although it does not require any action beyond consultation.¹¹⁸ Each agency has its own approach to this consultation,¹¹⁹ and many have developed specific guidelines.¹²⁰

Many agencies or divisions had provisions for consultation even prior to the executive order. EPA's National Environmental Justice Advisory Council developed a guide on consultation with Indian tribal governments,¹²¹ listing the recognition of community knowledge as a guiding principle to provide for public participation.¹²² Agencies within the Department of Interior developed guidelines pursuant to a 1993 Secretarial

Advisory Council (NEJAC) in order to obtain independent advice and recommendations from all stakeholders involved in the environmental justice dialogue.”)

117. *See Environmental Justice Key Terms*, ENVIRONMENTAL PROTECTION AGENCY, REGION 7 (Apr. 15, 2011), <http://www.epa.gov/region07/ej/definitions.htm> (last visited Oct. 4, 2011) (noting the National Environmental Justice Advisory Council's suggestion that recognizing community knowledge will increase meaningful public involvement with environmental justice) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment).

118. *See Consultation and Coordination with Indian Tribal Governments*, Exec. Order No. 13,175, 65 Fed. Reg. 67,249 (Nov. 6, 2000) (providing for consultation and coordination with tribal governments).

119. *See id.* § 5(a), § 7 (requiring each agency to establish an accountable consultation process).

120. *See, e.g., Tribal Consultation Framework: Working Definition of Tribal Consultation*, ENVIRONMENTAL PROTECTION AGENCY REGION 10 (Sept. 6, 2011), <http://yosemite.epa.gov/r10/tribal.NSF/Programs/Consultation> (last visited Jan. 4, 2012) (delineating the guidelines for consulting with tribal governments regarding EPA decisions and actions) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment). EPA Region 10 also has a North Slope Communications Protocol to ensure meaningful communication with communities on the North Slope. *See* EPA, North Slope Communications Protocol, Communication Guidelines to Support Meaningful Involvement of the North Slope Communities in EPA Decision-Making (2009) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment).

121. *See Guide on Consultation and Collaboration with Indian Tribal Governments and the Public Participation of Indigenous Groups and Tribal Citizens*, NATIONAL ENVIRONMENTAL JUSTICE ADVISORY COUNCIL, INDIGENOUS PEOPLES SUBCOMMITTEE (2000), available at <http://www.epa.gov/communityhealth/communityrelations.html> (outlining the National Environmental Justice Advisory Council's suggestions to address concerns relating to the lack of coordination between federal agencies and tribal governments).

122. *See id.* at 48 (suggesting the importance of community knowledge to building successful partnerships).

Order requiring consultation with tribal governments whenever tribal resources could potentially be affected by a proposed agency action.¹²³

A Secretarial Order by the Secretaries of Interior and Commerce¹²⁴ provides for tribal consultation in regards to the Endangered Species Act.¹²⁵

Several sections call for the use of tribal traditional knowledge in federal and tribal land management.¹²⁶ A question-and-answer document by the Fish and Wildlife Service (FWS) explains the role of traditional knowledge under the order:

The use of the best scientific evidence available does not preclude the consideration of other factors that would shed light on the scientific evidence at hand. . . . Traditional knowledge might inform the Services on the times, seasons, conditions, etc., of such behavior pattern which has been observed since time immemorial by an Indian tribe.¹²⁷

Alaska tribes are covered by a separate order,¹²⁸ which provides for participation by Alaska Natives in “research design, data collection and use of traditional knowledge.”¹²⁹

123. See Secretarial Order No. 3175, Departmental Responsibilities for Indian Trust Resources, November 8, 1993 (clarifying the responsibility of the Department of the Interior to ensure that the resources of Indian tribes are identified, conserved, and protected).

124. Secretarial Order No. 3206, American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act (1997), available at http://training.fws.gov/CSP/Resources/HCP/Policies_and_Regulations/ESA_tribe.htm.

125. 16 U.S.C. §§ 1531–44; see also Secretarial Order No. 3206, *supra* note 124, § 4 (“Because of the unique government-to-government relationship between Indian tribes and the United States, the Departments and affected Indian tribes need to establish and maintain effective working relationships and mutual partnerships to promote the conservation of sensitive species . . . and the health of ecosystems upon which they depend.”).

126. See Secretarial Order No. 3206, *supra* note 124, § 4, Appendix § 3(C–D) (requiring the Fish and Wildlife Service to provide notification to affected tribes as soon as the Service is aware that a proposed federal agency action may affect tribal rights or tribal resource trust and seeking to involve tribes in conserving and expanding the tribal resource trust).

127. *Questions & Answers, American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act*, U.S. FISH & WILDLIFE SERVICE Question 27, http://www.fws.gov/nativeamerican/Questions_Answers_3206.htm (last visited Oct. 4, 2011) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment).

128. See Secretarial Order No. 3206, *supra* note 124, § 7 (Alaska) (finding a need to study the implementation of the Act to preserve the ability of Alaska Natives to take species for subsistence purposes; providing for a supplemental order to be issued following further study); see also Secretarial Order No. 3225, Endangered Species Act and Subsistence Uses in Alaska (Supplement to Secretarial Order No. 3206) (2001) (defining the application of Secretarial Order No. 3206 in Alaska, establishing a consultation framework relative to the subsistence exemption in the Endangered Species Act, and reiterating the government-to-government consultation requirements relative to overall implementation of the Act in Alaska).

VI. Federal Agency Collection and Use of Community Knowledge in Alaska

Although most federal agencies have only recently begun to recognize the importance of community knowledge in natural resource and environmental decision-making, there has long been an awareness of its significance in Arctic Alaska.¹³⁰ Early white settlers of the area relied on the knowledge of Iñupiat Eskimos as a matter of basic survival.¹³¹ Iñupiat knowledge of the Arctic environment and its extreme conditions gradually came to be recognized as beneficial to the work of government scientists at the Naval Arctic Research Laboratory in the 1960s.¹³²

The early 1980s bowhead whale censuses were pivotal in the recognition of community knowledge, as Eskimo whalers were able to demonstrate the validity of their knowledge about bowhead whales.¹³³ Research and documentation of Alaskan community knowledge has grown rapidly since then, and government agencies (particularly the former Minerals Management Service (MMS)) and EPA have attempted to integrate this knowledge into their decision-making.¹³⁴

MMS's 1996 Environmental Impact Statement (EIS) regarding a proposed oil and gas lease sale in the Beaufort Sea was one of the first EISs to identify and incorporate community knowledge.¹³⁵ The U.S. Army Corps of Engineers' 1999 EIS for the Northstar field in the Beaufort Sea¹³⁶ was

129. Secretarial Order No. 3225, *supra* note 128, § 3 (outlining the Department of the Interior's plan to include Native Arctic Alaskans in "all aspects of the management of subsistence species that are candidate, proposed or listed species under the ESA . . .").

130. *See infra* Part V, §§ A–F (detailing the long-standing awareness in Alaska of the importance of community knowledge to environmental decision-making).

131. *See* Aiken Interview, *supra* note 78.

132. *See generally* Karen Brewster, *Native Contributions to Arctic Science at Barrow, Alaska*, 50 ARCTIC 277 (Sep. 1997) (relating the experiences of the Iñupiat community in activities at the Naval Arctic Research Laboratory); *see also* Aiken Interview, *supra* note 78.

133. *See* Brelsford Interview, *supra* note 20.

134. *See e.g.*, Williams Interview, *supra* note 43 (referring to studies conducted by MMS/BOEMRE); *see also* Telephone Interview with Tami Fordham, Tribal Coordinator, EPA Region 10 (Mar. 25, 2011) [hereafter Fordham Interview] (referring to studies conducted by EPA) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment); Braund, *supra* note 18, at 1–3 (citing studies of traditional knowledge conducted by federal agencies).

135. *See* Braund, *supra* note 18, at 2 (stating that based on the input of North Slope communities, the Final EIA revised "Information to Lessees" and standard leasing stipulations, added an option to defer leasing in an area important to bowhead whales, and incorporated information dealing with the effect of noise and sources of traditional knowledge (citing *Beaufort Sea Planning Area, Oil and Gas Lease Sale 144: Final Environmental Impact Statement*, MMS 96-0012, U.S. DEP'T OF THE INTERIOR MINERALS MGMT. SERVICE V-2 (1996), *available at* http://www.alaska.boemre.gov/ref/EIS%20EA/Beaufort_FEIS_144/96_0012Vol2.pdf)).

136. *See* Final Environmental Impact Statement: Beaufort Sea Oil and Gas Development, Northstar Project, U.S. ARMY CORPS OF ENGINEERS, U.S. Army Engineer

among the first EISs to use community knowledge as the basis for distinguishing among environmentally preferable alternatives.¹³⁷ Additional use of community knowledge by federal agencies in Alaska is discussed below.¹³⁸

A. MMS/BOEMRE¹³⁹

MMS/BOEMRE has extensively funded projects to collect community knowledge from subsistence hunters in Alaskan communities.¹⁴⁰ It has used this knowledge to identify issues, assess impacts, mitigate development, monitor impacts, and determine whether to defer leasing an area until a later time (but not to determine which areas should be leased).¹⁴¹

B. EPA

EPA Region 10 (which includes Alaska) has facilitated the collection of community knowledge in connection with various water discharge permits,¹⁴² including those for Red Dog Mine,¹⁴³ Cook Inlet General

District, Alaska (1999) [hereinafter 1999 Beaufort Sea Oil and Gas Development/Northstar Project] (applying community knowledge to environmental policy alternatives).

137. See Braund, *supra* note 18, at 1.

138. This information is based largely on interviews; it is not intended to be a comprehensive representation of how federal agencies in Alaska work with community knowledge. See *infra* Part V, §§ A–F.

139. MMS was reorganized in May 2010, and the relevant office for environmental reviews is the Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE).

140. See Williams Interview, *supra* note 43 (regarding examples of projects BOEMRE has funded, including collecting information from Point Lay; an agreement with ADF&G to produce “biographical jukeboxes”; a project demonstrating that local experts contributed to improving understanding arctic cisco; an attempt to develop a community traditional knowledge database; and a study to research bowheads).

141. See Mike Burwell & Dee Williams, Accommodating Traditional Ecological Knowledge (TEK) in MMS EIS Analysis and Decision Making, NSB Traditional Knowledge Workshop, in Anchorage, Alaska (Sep. 6, 2007) (listing the MMS’s uses of community knowledge); see also Williams Interview, *supra* note 43 (indicating that community knowledge does not determine whether or not a lease sale should occur because this is primarily a political decision about national priorities).

142. See Telephone Interview with Hanh Shaw, EPA, NEPA Coordinator, Mining Specialist (Mar. 25, 2011) [hereafter Shaw Interview] (listing studies for which EPA collected community knowledge) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment). Section 402 of the Clean Water Act provides for EPA to issue general permits under the National Pollutant Discharge Elimination System for effluent discharges. See 33 U.S.C. § 1342(a)(1) (“Except as provided in sections 1328 and 1344 of this title, the Administrator may, after opportunity for public hearing, issue a permit for the discharge of any pollutant, or combination of pollutants . . .”).

143. See Authorization to Discharge Under the National Pollutant Discharge Elimination System for Teck Alaska, Inc., Red Dog Mine, Permit No.: AK-003865-2 EPA

Permit,¹⁴⁴ and the forthcoming Beaufort Sea and Chukchi Sea Oil and Gas General Permits.¹⁴⁵ Community knowledge is generally not used to make quantitative decisions, such as effluent limits.¹⁴⁶ It is more often used in a qualitative sense to determine the areas in which certain discharges should not occur or whether a certain type of discharge should not be authorized.¹⁴⁷

C. NOAA/NMFS¹⁴⁸

In Alaska, NOAA/NMFS maintains the Alaska Native Traditional Environmental Knowledge Database, a catalog of quotes and paraphrases from published literature, videos, and pre-existing interviews relevant to the management of natural marine resources.¹⁴⁹ The database was created in response to public comments received on a 2001 Environmental Impact

Region 10 (March 1, 2010), available at <http://www.epa.gov/region10/pdf/permits/npdes/ak/ak0038652-fp-030110.pdf> (noting that traditional knowledge was used in the review conducted pursuant to the National Environmental Policy Act). Through its contractor (Steve Braund), EPA Region 10 collected information from local tribes suggesting that a mining road had caused a change in caribou migration. See Telephone Interview with Patty McGrath, Mining Specialist, EPA Tribal Waters Program (Mar. 25, 2011) [hereinafter McGrath Interview] (on file with the Washington and Lee Journal of Energy, Climate, and the Environment). Western science (based on satellite tracking) did not prove or disprove this information. *Id.* EPA nevertheless relied on the community's information to suggest that mining slurry be conducted through a buried pipeline, as opposed to being trucked on a road. *Id.*

144. See Fact Sheet for Authorization to Discharge Under the National Pollutant Discharge Elimination System for Oil and Gas Exploration, Development and Production Facilities Located in State and Federal Waters in Cook Inlet, Alaska Permit No.: AKG-31-5000 EPA Region 10, at 47–49 (effective Feb. 23, 2006) (interviewing members of local tribes led to uncovering concerns about catastrophic environmental events and discharge of contaminants). For the Cook Inlet General Permit, EPA documented concerns from tribal members regarding the potential for environmental impacts from oil and gas operations, the overall decline in the population of important food species and in the quality of the species harvested, and the effect of tidal currents on discharges. *Id.* EPA agreed that additional information should be gathered regarding the fate of oil and gas discharges and required two new studies on the potential impacts of discharges. *Id.* Also, EPA expanded the area in which discharge was prohibited to 4,000 meters. *Id.*

145. See Braund, *supra* note 18 (reviewing previously conducted studies on traditional knowledge (particularly studies conducted by MMS) to identify data gaps related to traditional knowledge of the Chukchi and Beaufort seas).

146. See Shaw Interview, *supra* note 142.

147. See *id.*

148. The National Marine Fisheries Service (NMFS) is a division of the National Oceanic and Atmospheric Administration (NOAA). See NOAA FISHERIES SERVICE, NATIONAL OCEANIC AND ATMOSPHERIC ADMIN., <http://www.nmfs.noaa.gov> (last visited Oct. 4, 2011) (showing the relationship between the NMFS and the NOAA) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment).

149. See Lazrus & Sepez, *supra* note 18, at 33 (describing the database).

Statement suggesting that traditional ecological knowledge was inadequately considered.¹⁵⁰

Since NOAA/NMFS acknowledged the value of community knowledge in the bowhead whale census, it has enjoyed some credibility in Alaska's Eskimo communities.¹⁵¹ Inupiat Eskimo knowledge plays a role in the Cooperative Agreement NOAA/NMFS has with the Alaska Eskimo Whaling Commission (AEWC), which accords Eskimo whaling captains a role in managing the bowhead whale hunt.¹⁵²

Community knowledge also plays a role in NOAA/NMFS's decisions to issue incidental harassment authorizations (IHAs) for development that may incidentally impact marine mammals.¹⁵³ NOAA/NMFS must consider whether the proposed development will impact the availability of marine mammals for subsistence purposes; and availability is informed by hunters' observations regarding the location and behavior of marine mammals.¹⁵⁴

D. FWS

FWS does not have a specific system for working with community knowledge, although this knowledge has been used to bolster biological assessments and provide context.¹⁵⁵ Community knowledge can help

150. *See id.* at 33–34 (expressing the importance of public comments to the creation of the Database).

151. *See* Aiken Interview, *supra* note 78 (describing the trust between NOAA/NMFS and the native community arising from their cooperation in the 1980s whale censuses and the NOAA Cooperative Agreement with the Alaska Eskimo Whaling Association).

152. *See id.* (referring to the Cooperative Agreement between the National Ocean and Atmospheric Administration and the Alaska Eskimo Whaling Commission, as amended 2008).

153. *See* Smith Interview, *supra* note 57 (explaining that Alaska Natives were able to get regulations permitting Incidental Harassment Authorization (IHA) amended in 1996 so that an authorized activity must provide for “the least practicable adverse impact on . . . the availability of the species for subsistence uses”); *see also* 50 C.F.R. § 216.107 (outlining procedure for issuance of incidental harassment authorizations); Small Takes of Marine Mammals; Harassment Takings Incidental to Specified Activities in Arctic Waters; Regulation Consolidation; Update of Office of Management and Budget (OMB) Approval Numbers, 61 Fed. Reg. 15884-01 (Apr. 10, 1996) (providing for the regulation of incidental harassment authorizations in Arctic waters).

154. *See* Smith Interview, *supra* note 57 (describing the role of community knowledge in determining whether an activity will have an impact on subsistence for purposes of issuing an incidental harassment authorization under 50 C.F.R. 216.107). At the same time, just because one hunter says the whale is spooked does not mean a whole program is going to be shut down; there is a need to quantify observations. *Id.*

155. *See* Bennett Interview, *supra* note 18 (explaining that community knowledge can be included in the background discussion of a biological assessments to give the assessment a more complete context); *see also* Smith Interview, *supra* note 57 (explaining that biological assessments required by Section 7 of ESA are a good opportunity to present and use community knowledge).

determine the direction of a new assessment or where information should be gathered.¹⁵⁶ Community knowledge is also relevant to the work of the Office of Subsistence Management, the branch of FWS that assists with the implementation of ANILCA.¹⁵⁷

E. BLM

The Bureau of Land Management's (BLM) 1998 EIS for the northeast portion of the National Petroleum Reserve—Alaska (NPRA)¹⁵⁸ was perhaps BLM's first attempt to include more than just Western scientific data in the analysis of effects and impacts.¹⁵⁹ It contains quotes from local residents and an appendix written by the North Slope Borough mayor.¹⁶⁰ A later EIS on the northwest portion of NPRA incorporates sections entitled "Community Traditional Knowledge of Effects on Resources and Harvests" based on information BLM received from public meetings on the North Slope.¹⁶¹

BLM continues to collect community knowledge on NPRA through its Subsistence Advisory Panel, which is composed of residents from North Slope villages.¹⁶² The Panel "advises the BLM on how subsistence

156. See Bennett Interview, *supra* note 18.

157. See *supra* Part IV.B.

158. *Northeast National Petroleum Reserve—Alaska Final IAP/EIS 1998 Record of Decision*, U.S. DEP'T OF THE INTERIOR BUREAU OF LAND MGMT. (Sept. 21, 2010), http://www.blm.gov/pgdata/etc/medialib/blm/ak/aktest/planning/nenpra_feis_1998.Par.36593.File.dat/1998_NE-NPR-A_ROD.PDF [hereinafter *Northeast NPRA Final IAP/EIS 1998 Record of Decision*]; see also *Northeast National Petroleum Reserve—Alaska Final IAP/EIS 1998 Record of Decision, Appendix I, "The Iñupiat People's History and Future with Regard to the National Petroleum Reserve—Alaska: A 1997 Perspective from the North Slope Borough"*, U.S. DEP'T OF THE INTERIOR BUREAU OF LAND MGMT. (Sept. 21, 2010), http://www.blm.gov/pgdata/etc/medialib/blm/ak/aktest/planning/nenpra_feis_1998.Par.68767.File.tmp/appendix_i.pdf (providing an overview of North Slope residents' concerns with respect to the National Petroleum Reserve-Alaska).

159. See McIntosh, *supra* note 1, at 39 (discussing BLM's response to public commentary on the need for traditional knowledge).

160. See *Northeast NPRA Final IAP/EIS 1998 Record of Decision*, *supra* note 158 (containing review and analysis on comments received and an appendix authored by Mayor Ben Nageak).

161. See *Environmental Consequences, Final Northwest National Petroleum Reserve—Alaska Integrated Activity Plan/Environmental Impact Statement*, U.S. DEP'T OF THE INTERIOR BUREAU OF LAND MGMT., at IV-234 (Nov. 2003), http://www.blm.gov/pgdata/etc/medialib/blm/ak/aktest/planning/nw_npra.Par.33788.File.dat/voll-10_section4.pdf (including testimony of residents).

162. See McIntosh Interview, *supra* note 104 (describing the composition and role of the NPRA Subsistence Advisory Panel); see also *Northeast National Petroleum Reserve—Alaska Final IAP/EIS 1998 Record of Decision (1998)*, U.S. DEP'T OF THE INTERIOR BUREAU OF LAND MGMT., at II-49 (Sept. 21, 2010), http://www.blm.gov/pgdata/etc/medialib/blm/ak/aktest/planning/nenpra_feis_1998.Par.11931.File.tmp/section2.pdf (establishing the Subsistence Advisory Panel).

resources, uses, and users may be impacted by oil and gas exploration and development in the NPRA.”¹⁶³

F. North Slope Borough

The North Slope Borough is not a federal agency,¹⁶⁴ but it has had a significant role in development planning regarding Arctic natural resources.¹⁶⁵

The Borough has used community knowledge in combination with Western science in land use permitting and rezoning for petroleum development. For example, in 2000, community knowledge indicated that a proposed oil and gas development project¹⁶⁶ would take place near an area that was important for caribou calving.¹⁶⁷ Community knowledge further

163. *Notice of the National Petroleum Reserve—Alaska Research and Monitoring Advisory Team Public Meeting*, 68 Fed. Reg. 4792-01 (Jan. 30, 2003).

164. The Borough, which covers most of Arctic Alaska, is a home rule municipality under the Article X, Section 11 of the Alaska Constitution. The Home Rule Charter of the North Slope Borough, Art. I, § 1.020(c), available at http://dcra.commerce.alaska.gov/DCBD/Municipal_charters/Charters%20-%20Home%20Rule/Borough/North_Slope_Borough.pdf (“The North Slope Borough shall be classified as a home rule borough.”); see also The Constitution of the State of Alaska, Art. 10, § 11 (“A home rule borough or city may exercise all legislative powers not prohibited by law or by charter.”).

165. The North Slope Borough has land use permitting authority over all uses and developments within its boundaries, which (concurrent with state boundaries) extend to three nautical miles offshore. See Alaska Statehood Act, Pub. L. No. 85-508, § 6(m), 72 Stat. 339 (1958) (applying the Submerged Lands Act of 1953, 43 U.S.C. §§1301–15, to the State of Alaska). North Slope Borough Municipal Code (NSBMC) Title 19 regulates land use. See NORTH SLOPE BOR., ALASKA, CODE OF ORDINANCES § 19.10 (1990) (providing land use regulations for development in the Borough). The Borough has served as a cooperating agency on Environmental Impact Statements conducted by federal agencies, including the Bureau of Land Management’s 2008 Northeast National Petroleum Reserve-Alaska Final Supplemental Integrated Activity Plan/Environmental Impact Statement. See *Northeast NPR-A Final Supplemental IAP/EIS*, BUREAU OF LAND MANAGEMENT (Sept. 25, 2008), http://www.blm.gov/ak/st/en/prog/planning/npra_general/ne_npra/northeast_npra_final.html (last visited Oct. 4, 2011) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment); see generally 1999 Beaufort Sea Oil and Gas Development/Northstar Project, *supra* note 136; *Environmental Impact Statement on the Effects of Oil and Gas Activities in the Arctic Ocean*, NOAA FISHERIES OFFICE OF PROTECTED RESOURCES, <http://www.nmfs.noaa.gov/pr/permits/eis/arctic.htm> (last visited Oct. 4, 2011) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment).

166. The Meltwater Prospect (east of the National Petroleum Reserve—Alaska) was approved by the North Slope Borough Assembly through Ordinance No. 1975-6-41, An Ordinance Amending the Official Zoning Map of the North Slope Borough for the Area Generally Known as the Meltwater Prospect to be Rezoned from Conservation District to Resource Development District (adopted Jan. 17, 2001).

167. See Gordon Brower, Integrating Traditional Knowledge in Permit Reviews, NSB Traditional Knowledge Workshop, in Anchorage, Alaska (Sep. 6, 2007) (describing the

indicated that pipelines associated with the project could hinder caribou movement into the area.¹⁶⁸ Borough biologists conducted research using radio collars to determine movement patterns and areas of high caribou concentrations.¹⁶⁹ Based on this information and community knowledge, pipelines were required to be at least seven feet high to facilitate caribou passage.¹⁷⁰

The Borough has also had success in using subsistence representatives with community knowledge to guide new oil and gas development or development in areas where subsistence takes place.¹⁷¹

VII. Recommendations for Obtaining and Using Community Knowledge

Agencies that do not yet have protocols for collecting and using community knowledge should develop them.¹⁷² These protocols could be integrated into the information quality guidelines that agencies are required to issue under the Data Quality Act. Below are some general suggestions.

A. Knowledge Collection

The most practical method for knowledge collection depends on the time and resources an agency has to invest in the collection.¹⁷³ Generally, the more time an agency spends getting to know a community and gaining its trust, the more successful the collection of community knowledge will

concerns of residents of the village of Nuiqsut associated with the proposed Meltwater project).

168. *See id.* (explaining that pipelines in close proximity can lead to a buildup of snow that blocks caribou movement).

169. *See id.* (stating that calving data from 1983 for the Central Arctic Caribou Herd was compared with contemporary radio collar calving data to determine movement patterns and areas of high caribou concentrations).

170. *See id.* (stating that pipelines were constructed to a minimum height of seven feet to facilitate caribou passage). The Borough also required spacing between roads and pipelines to decrease the amount of snow drifting from the road. *Id.* These measures allowed caribou and community members to freely pass under the elevated pipeline. *Id.* It also allowed for easier visual inspection, since the pipelines did not become buried in snow. *Id.*

171. *See id.* (explaining the Borough's use of local residents with community knowledge as subsistence guides). Subsistence representatives share information with operators regarding locations and timing of local subsistence activities, features of the terrain, and methods to decrease tundra damage. *Id.*

172. *See* Williams Interview, *supra* note 43 (expressing that ironically, many agencies are using trial and error (rather than a scientific approach) to figure out how to integrate community knowledge and Western science).

173. *See* Wheeler & Craver, *supra* note 109, at 18 (suggesting that investigators who have relationships with the community in which they work, who actively participate in the community, and who can read and write the language spoken in the community have the most success in obtaining traditional knowledge).

be.¹⁷⁴ Also, collection is more likely to be successful when it involves community members working in partnership with Western social scientists trained in inter-cultural communication.¹⁷⁵

The involvement of community members (or those who have assimilated into and learned from a community) in data collection can help overcome the tendency to distrust “outside” agencies or researchers.¹⁷⁶ Also, community members may be more successful than outsiders at gathering tacit information that would otherwise be lost in the communication gap between the community and those seeking the knowledge.¹⁷⁷

In some cases, community members are uniquely qualified to obtain the desired information.¹⁷⁸ Agencies may consider offering grants to

174. See McIntosh, *supra* note 1, at 41 (explaining that for a study on North Slope fish, BLM researchers spent multiple days meeting with local experts, in an effort to get to know these informants and convey the importance of the project and the researchers’ dedication); Wheeler & Craver, *supra* note 109, at 18 (“[I]nvestigators that generally have the greatest success in bridging the gap between TEK and western science tend to have long-term relationships with the people and community with whom they are working”); Brelsford Interview, *supra* note 20 (stating that longer ethnographic studies conducted by researchers who live in the community have generally yielded better results); see also Chase Interview, *supra* note 11 (suggesting that researchers should consult with a community to obtain knowledge before conducting research there; obtaining knowledge requires gaining the community’s trust, which takes time and rapport).

175. See CHARNLEY ET AL., *supra* note 9, at 33 (stating that collaboration may require the assistance of people trained in ethnographic methods, as well as those schooled in the language of both Western science and the knowledge of the particular community involved, as many scientists and managers lack the formal training to facilitate participatory research and monitoring processes); see also McIntosh, *supra* note 1, at 41 (claiming that the lack of employees trained in social science research needs to be addressed; in the Alaska division of BLM, there are few staff anthropologists compared to the large number of biologists); Brelsford Interview, *supra* note 20 (describing the need for local people to be involved in data collection).

176. See CHARNLEY ET AL., *supra* note 9, at 13 (“Some people are reluctant to share their knowledge, however, because of concern that others will not use it responsibly or in a manner that benefits the knowledge holders.”).

177. See Corburn, *supra* note 10, which states the following:

The information provided by the subsistence anglers—most of whom were immigrants, non-English speakers, and fearful of talking with outsiders—was an example of the kind of tacit information that only local people could accurately gather. When community members surveyed the anglers, with whom they shared a common language, cultural heritage, socioeconomic background, and immigration status, many of the anglers’ fears and disincentives to participate were allayed. *Id.* at 429.

178. See Hepa Interview, *supra* note 48 (describing NOAA’s involvement of North Slope whalers in a project to tag endangered right whales near the Aleutian Islands; North Slope hunters, who currently tag bowhead whales in a non-invasive way, are knowledgeable as to how to approach a whale without spooking it).

community organizations so that they can conduct the research themselves.¹⁷⁹

Specific methods that agencies have used to collect community knowledge in Alaska include semi-directed group interviews¹⁸⁰ (which may use maps to stimulate conversation about environmental observations¹⁸¹), workshops, and ethnographic field surveys conducted by ecologists in cooperation with social scientists.¹⁸²

Another method to generate information involves the use of an integrated scientific panel from a mix of western scientists and community members holding community knowledge. The panel works together to jointly address specific resource management problems by analyzing existing data and developing recommendations for how to manage natural resources.¹⁸³

A relatively low-cost method that does not involve the collection of new information is the review of testimony from previous workshops and

179. See Fordham Interview, *supra* note 134 (stating that tribes have told EPA they would like to collect information themselves, and EPA is considering how this may be done); see also Rexford Interview, *supra* note 68 (explaining that FWS provided a grant to the Native Village of Barrow, but there was friction because FWS was viewed as prioritizing its own needs above those of the Native Village).

180. Interviewers should be cognizant of the cultural preferences of those they interview. People from the Iñupiat Eskimo tradition many prefer to take their time and give a well thought-out answer, which makes unplanned interviews difficult. People may also prefer to talk in groups rather than one-on-one interviews. And women may tend to talk less when in groups with men; they may be more comfortable by themselves. See Frankson Interview, *supra* note 10; see also CHARNLEY ET AL., *supra* note 9, at 14 (noting that community members may prefer to share knowledge through shared experiences or conversation as opposed to written communication).

181. See Wheeler & Craver, *supra* note 109, at 16 (recommending that, because interviews alone cannot capture all aspects of community knowledge, investigators use prompts such as maps and drawings as a means of eliciting information and for providing further explanation).

182. See RITA A. MIRAGLIA, TRADITIONAL ECOLOGICAL KNOWLEDGE HANDBOOK: A TRAINING MANUAL AND REFERENCE GUIDE FOR DESIGNING, CONDUCTING, AND PARTICIPATING IN RESEARCH PROJECTS USING TRADITIONAL ECOLOGICAL KNOWLEDGE (1998) (outlining methods for systematically gathering community knowledge, including interviewing “key respondents” (people especially knowledgeable about a topic); holding meetings in which several knowledge holders discuss a topic in depth; investigating archives, data bases, and other written materials; and making visits to communities and participating in subsistence and other activities); see also Brelsford, *supra* note 50, at 383–88 (chronicling and analyzing the effectiveness of efforts to incorporate traditional knowledge into Alaskan fishery management, including regional workshops and intensive ethnographic fieldwork); Hepa Interview, *supra* note 48 (explaining that workshops about specific topics (such as ice or fish) where agency representatives join with scientists and hunters have been successful).

183. See CHARNLEY ET AL., *supra* note 9, at 18 (citing the example of the Alaska Beluga Whale Committee, which is comprised of Native Alaskans who hunt beluga whales and government agency biologists and managers).

public hearings regarding development projects over many years.¹⁸⁴ While testimony at these hearings is largely focused on community concerns, it is also a source of community knowledge related to development and natural resources.¹⁸⁵ There is a wealth of records from meetings on the North Slope over the past three decades, and many residents feel that this information is ignored.¹⁸⁶ Agencies should review this information before attempting to gather additional knowledge.¹⁸⁷

B. Data Quality Control

Given that not everyone in a community has the kind of knowledge an agency or researcher may be seeking, it is essential that knowledgeable people be identified and consulted.¹⁸⁸ Agencies should engage in systematic (and documented) processes to identify community experts, not unlike qualifying expert witnesses in court.¹⁸⁹ These experts could then be certified

184. See Braund, *supra* note 18, at 2 (drawing information from previous studies of community knowledge, public testimony, subsistence mapping, and harvest data studies for an EPA study of community knowledge pertinent to environmental conditions in the area of the Chukchi and Beaufort Seas).

185. See *id.*

186. See Aiken Interview, *supra* note 78 (stating that public meeting attendees share their knowledge about caribou, whales, and birds, but the knowledge seems to be ignored, as if the government hears only what it wants to hear).

187. See generally Braund, *supra* note 18 (reviewing previously conducted studies on traditional knowledge (particularly studies conducted by the former Mineral Management Service) to identify data gaps related to traditional knowledge of the Chukchi and Beaufort seas). Several databases regarding community knowledge exist in Alaska, including the Alaska Traditional Knowledge and Native Foods Database developed by the Alaska Native Science Commission and the Institute of Social and Economic Research (ISER). See, e.g. ALASKA TRADITIONAL KNOWLEDGE AND NATIVE FOODS DATABASE, <http://www.nativeknowledge.org/login.asp> (last visited Oct. 4, 2011) (providing resources for the community and information on foods and contaminants) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment).

188. See McGrath Interview, *supra* note 143 (stating that the EPA must ensure that it talks to a sufficient number of knowledgeable people in the community; villages and tribal governments can assist in pointing out these knowledgeable people); Chase Interview, *supra* note 11 (noting that, to collect knowledge for a project that maps subsistence use sites, the Northwest Arctic Borough will be going to the seven Borough villages and consulting with tribal and city administrators there to find out who in the area is actually doing subsistence hunting); Williams Interview, *supra* note 43 (explaining that an agency must avoid both of two extremes—the idea that everything everyone in the community says is relevant and valid and the idea that the community has nothing to contribute).

189. See Wheeler & Craver, *supra* note 109, at 16 (“While there is a tendency among some investigators to want to protect the identity of local experts, this can be counterproductive, as fisheries managers (among others) are often interested in what qualifies someone as an expert, and specifically, how or why were they selected to be interviewed.”); Williams Interview, *supra* note 43 (stating that a qualified social scientist must engage in a systematic process to identify experts and must document the process used).

as community knowledge sources for future projects.¹⁹⁰ Community knowledge experts could also serve as “peer reviewers” of information that agencies collect in community workshops and other forums.¹⁹¹ This could help alleviate the sense that agencies are only hearing what they want to hear.¹⁹²

Another mechanism to increase reliability is to compare data collected for a particular project with data collected from previous planning efforts. Statements that are repeated over time are more likely to be reliable.¹⁹³

190. North Slope subsistence stakeholders have expressed concern about ensuring the reliability of the community knowledge that agencies gather. At a 2007 conference, one suggestion was to certify elders as experts to assure quality data is given, as opposed to hearsay. *See* Management Challenges and Benefits Section, NSB Traditional Knowledge Workshop, in Anchorage, Alaska (Sep. 6, 2007) (recording commentary from a participant that it is difficult to know whether the information shared at a public hearing is just hearsay and the suggestion that elders be certified as having knowledge). In southern Africa, national governments and non-profit organizations have developed mechanisms to certify indigenous hunters as having knowledge regarding the large mammals that they track. *See* IPACC Workshop, *supra* note 44, at 5 (describing efforts and challenges associated with certifying hunters from the local San tribe as trackers). In South Africa, the Skills Development Act 97 of 1998 (S. Afr.) provides for a program to certify trackers. *See id.* at 22 (outlining requirements to become a registered tracker). The program has increased the willingness of national park managers to work with indigenous trackers. *See id.* at 10 (providing insight from indigenous trackers trained as trackers and guides and national parks’ increased willingness to work with them). CyberTracker Conservation, a non-profit, has also developed a tracking certification. *See id.* at 24 (asserting that CyberTracker Conservation, launched in 1994, enforces certification standards for tracking).

191. *See* Hepa Interview, *supra* note 48 (suggesting that communities be involved in data gathering (i.e., conducting fieldwork and interviews) as well as in reviewing results and draft reports (a form of peer review)); *see also* Chase Interview, *supra* note 11 (referring to a joint effort between his community and non-profit group to map subsistence use areas to help guide development; suggesting that the maps could be “peer reviewed” by community members).

192. *See* Aiken Interview, *supra* note 78 (recalling public meetings, where most people who comment want to share their knowledge about caribou, whales, and birds, but the traditional knowledge seems to be ignored, as if the government hears only what it wants to hear); *see also* Frankson Interview, *supra* note 10 (declaring that at public meetings, federal agencies usually say that it is important to consider traditional knowledge, but this seems like a charade or a formality; the government does not seem concerned with the spirituality connected to traditional knowledge—it is not ever discussed). EPA Region 10’s contractor enlists community members to assist him in interviews of other community members; he then sends notes from the interviews back to the community for verification and approval before giving them to EPA. *See* Fordham Interview, *supra* note 134. These techniques avoid the potential for sensitive and/or inaccurate information becoming part of the public record. *Id.*

193. *See* McIntosh Interview, *supra* note 104 (describing BLM’s success using testimony from multiple planning efforts and considering what people say over and over again).

C. Processing and Using Data

Once data is collected, it may be presented in agency documents in the form of excerpts from public comments or interview transcripts.¹⁹⁴ While this helps preserve the holistic and unique nature of the information, it does not integrate the observations into the data used to make decisions.¹⁹⁵

Summarizing the information by topic and comparing it with scientific data may be a more useful approach.¹⁹⁶ As is the case with Western science, an individual observation must be considered in the context of other data obtained at different times under different circumstances.¹⁹⁷

Decision-makers should consider compiling information into a database, with key words coded to allow for searches on particular locations, species, or socio-cultural dimensions.¹⁹⁸ The database could indicate whether information has been validated by personal observations and the informant's qualifications for providing the knowledge. A piece of information that appears repeatedly in the database is likely to be more reliable, particularly when the information is based on personal observations by those in regular contact with the environment.¹⁹⁹

Databases may have the effect of fragmenting information or disrupting the format in which it is conveyed,²⁰⁰ although this may be

194. See Wheeler & Craver, *supra* note 109, at 17 (describing one approach used by the Fisheries Subsistence Monitoring Program).

195. See McIntosh, *supra* note 1, at 40 (questioning whether the use of community members' quotes in an EIS really serves to incorporate traditional knowledge in the plan; suggesting that these quotes represent recent observations and hypothesis-generating statements rather than the collective body of traditional knowledge).

196. See Wheeler & Craver, *supra* note 109, at 17 (describing how summarizing by topic and using biological information for comparison purposes has been more useful in fisheries management).

197. See *id.* at 19 (“[R]esearchers that employ a variety of data collection methods . . . generally collect and provide the most useful information for use in management.”).

198. See Brelsford, *supra* note 50, at 386 (outlining several efforts to create databases containing traditional knowledge). North Slope Borough Senior Biologist Craig George keeps a database in which he records environmental observations he collects from North Slope residents, noting the name of the observer, the date, time, species, location, whether the knowledge is a personal observation or something communicated, and any other details. See George Interview, *supra* note 7.

199. See McIntosh, *supra* note 1, at 41 (reviewing a study in which several elder fishermen and women with a detailed knowledge of the area are interviewed extensively about local fish populations).

200. See Lazrus & Sepez, *supra* note 18, at 36 (describing how some community knowledge is relayed in an anecdotal or storytelling format, making it difficult to put in a database); see also McIntosh Interview, *supra* note 104 (claiming that databases may take away from the full picture such that information is misconstrued).

overcome if the database is used as a foundation for conducting additional research or interviews to extend the information in a focused area.²⁰¹

Ideally, the best way to use community knowledge is not to simply paste it into a document or inject it into a database but to allow those with community knowledge to actually participate in natural resources and environmental decision-making.²⁰² Effective co-management regimes allow for the input of community knowledge at every step of the decision-making process.²⁰³

D. The Need for Mutual Benefit and/or Compensation

Communities are more willing to share information when they can see the benefits of doing so.²⁰⁴ Examples of community benefits include opportunities to participate in decision-making,²⁰⁵ employment opportunities,²⁰⁶ and cooperating agency status for environmental impact statements.²⁰⁷ Further, community members need assurance that they will

201. See Brelsford, *supra* note 50, at 385–86 (detailing how the U.S. Army Corps of Engineers compiled a searchable database for a review of the Northstar project based on community knowledge collected from North Slope public meetings over several years and then used the database as a starting point for supplemental interviews with North Slope whaling captains); see also Wheeler & Craver, *supra* note 109, at 17 (stating that databases may be useful as a repository for information and “can provide a wealth of information for additional analysis”).

202. See McIntosh Interview, *supra* note 104 (expressing desire to allow those with actual community knowledge be a part of the decision-making process as regarding natural resources and the environment).

203. See Brelsford Interview, *supra* note 20 (explaining that co-management regimes allow the knowledge-givers to see what happens with their knowledge and to participate in the decision-making and outcome).

204. See IPACC Report to the UN Permanent Forum on Indigenous Issues Concerning African Hunter-Gatherers’ Lands, Territories Natural Resources and Traditional Knowledge of Biodiversity, 3 (Feb. 11, 2008), available at http://www.ipacc.org.za/uploads/docs/HUGAFO_IPACC_UNPermanentForumReport.pdf (discussing Namibia’s allowance of traditional hunting and quota-controlled commercial hunting, through which “poaching is apparently reduced and communities benefit from the [sic] both the revenue from commercial and the experience and nutritional advantages of traditional hunting”); see also Burns Interview, *supra* note 52 (explaining how subsistence hunters will share information with FWS when it is in their interest to do so, in order to protect subsistence hunting).

205. See Brelsford Interview, *supra* note 20 (detailing how institutional arrangements where communities have permanent standing (like AEWC) give communities more reason to contribute knowledge, as they can participate in the decision-making and see what happens with their knowledge).

206. See Rexford Interview, *supra* note 68 (asserting that there has been a relatively good relationship between FWS and the community of Kotzebue (in the Northwest Arctic Borough), where FWS provides opportunities for employment).

207. Different agency regulations provide different eligibility criteria for serving as a cooperating agency. Under the Council on Environmental Quality regulations, a cooperating

not be penalized for sharing information with researchers. To encourage the sharing of accurate information regarding hunting and harvest patterns, research and law enforcement functions should be conducted separately.²⁰⁸

Regardless of whether communities are given a role in managing natural resources or development projects, community members should be compensated for contributing their time and knowledge (as would any expert providing scientific knowledge).²⁰⁹ Payment should be significant enough to demonstrate respect for the knowledge.²¹⁰

Compensation is relatively simple to arrange when private sector entities are funding the knowledge collection.²¹¹ It is more difficult when public agencies with limited funding are conducting research, although some agencies have found ways to compensate people in the form of door prizes for attending public meetings.²¹²

agency is defined as an entity with “jurisdiction by law or special expertise with respect to any environmental impact involved in a proposal (or a reasonable alternative)” 40 C.F.R. § 1508.5 (2011). The term includes state or local agencies and Indian Tribes “when the effects are on a reservation.” *Id.* In contrast, BLM regulations do not contain the requirement that effects be on a tribal reservation. *See* 43 C.F.R. § 1601.0-5(d)(2) (2011) (stating that a federally recognized Indian tribe may be an eligible cooperating agency). EPA likewise does not appear to restrict cooperating agency status to tribes whose reservations are affected. *See EPA Tribal Compliance Assistance Center, Buildings and Vehicles / Regulatory Requirements*, EPA.GOV (Oct. 16, 2008), <http://www.epa.gov/tribalcompliance/buildandveh/bvregsdrill.html> (last visited Oct. 4, 2011) (“Agencies should also invite tribes to comment and be a ‘cooperating agency’ when non-reservation tribal resources are affected.”) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment). Cooperating agency status allows a community to have a greater role (beyond just offering public comments) in an agency’s decision, although this is a time and resource-intensive role. A cooperating agency agreement may provide for funding for the expenses incurred by the local or tribal entity. *See, e.g., Cooperating Agency Agreement between the Federal Aviation Administration and the Hualapai Indian Tribe* (1999), *available at* http://ceq.hss.doe.gov/ntf/compendium/MOU/CA_AG_6_Grand_Canyon_Air_Tours.pdf (describing how the FAA will, if possible, fund activities or analysis requested from cooperating agencies relating to air tour operations in the vicinity of Grand Canyon National Park).

208. *See* Brelsford Interview, *supra* note 20 (stating that while conducting research, he discovered illegal hunting, which he could not report to law enforcement agencies).

209. *See* CHARNLEY ET AL., *supra* note 9, at 33 (describing a research project in which harvesters of non-timber resources in the Pacific Northwest were compensated for participating in research at a rate slightly higher than that which they made from commercial sales of their harvest); *see also* Shaw Interview, *supra* note 142 (describing how EPA contractor Steve Braund offers informants an honorarium for their time); Williams Interview, *supra* note 43 (stating that BOEMRE pays informants for their time, usually with elevated rates for elders and other regional experts).

210. *See* Brelsford Interview, *supra* note 20.

211. *See id.* (stating that compensation is relatively easy when private sector entities are footing the bill for the knowledge collection, but harder when public agencies are involved).

212. *Id.*

Not all communities have concerns about intellectual property rights associated with community knowledge.²¹³ But since the issue can be contentious, an agreement on the ownership of data, payment of project participants, and participant anonymity or credit should be reached prior to conducting research.²¹⁴

E. Integrating Community Knowledge and Western Science

Many sources suggest that community knowledge and scientific knowledge, when combined, can achieve what neither could do on its own.²¹⁵ Combining disparate sets of knowledge is a challenge, but it is one that agencies have always faced (whether the knowledge comes from mechanical engineers and hydrologists or communities).²¹⁶ There is a need for all types of knowledge to be on reasonably equitable footing, even if they are not easily reconcilable.²¹⁷

An agency should not simply disregard community knowledge when it seems to be in conflict with scientific findings.²¹⁸ Rather, the agency should search for the root of a conflict, considering whether it results from different viewpoints or missing information, and gather more information if possible.²¹⁹ Further discussion or scientific research may prove community knowledge correct or at least explain the basis for the knowledge.²²⁰

213. See MIRAGLIA, *supra* note 182, at 11–12 (indicating that different communities may want different agreements regarding ownership of data and acknowledgement of individual respondents).

214. See *id.* at 11 (describing a protocol for using community knowledge in Exxon Valdez oil spill restoration projects which recommends that details of the research (such as ownership of data, participant consent, payment of project participants, and participant anonymity or credit) be negotiated with each community prior to conducting research).

215. See, e.g., Ram Chhetri, *Culturally Embedded Knowledge in Irrigation: People's Ways of Thriving in a Himalayan Village*, in KNOWLEDGE SYSTEMS, *supra* note 40, at 135, 153 (concluding that the case study suggests that local and scientific knowledge combined can do more than either can alone); see also Maragia, *supra* note 38, at 247 (“[I]ndigenous knowledge could contribute to sustainable development if it is both de-essentialized and combined with Western science and technology.”); Moller et al., *supra* note 21, at 8–10 (discussing how to use scientific and traditional knowledge together to better monitor populations).

216. See Rockwell Interview, *supra* note 104.

217. See *id.*

218. See Hepa Interview, *supra* note 48.

219. See Rockwell Interview, *supra* note 104 (suggesting that when community knowledge conflicts with Western science, it must be considered whether the difference results from different viewpoints or missing information).

220. See Hepa Interview, *supra* note 48 (stating that an example is the 2010 scientific research confirming that bowhead whales can smell (something the Inupiat people have been saying for many years)); see also Smith Interview, *supra* note 57 (giving an example where community knowledge initially did not appear to make sense, but later was clear: a hunter explained that because of climate change, when he shoots a seal it sinks five feet into the

In some cases, an agency may not be able to integrate community knowledge and Western science at all because the agency lacks the connecting science or resources.²²¹ The community's concern should still be noted and respected, even if it cannot be resolved.²²²

F. Knowledge and Spirituality beyond the Realms of Western Science

As discussed above, there are many aspects of community knowledge that do not “fit the grid” of Western science-based decision-making. Sometimes, this results from an overemphasis on specific, rigid models that only account for certain types of information.²²³ But even when models are not involved, capturing the holistic and sometimes intangible nature of community knowledge can be challenging.²²⁴

Anthropologists with experience collecting community knowledge suggest that the knowledge should be recorded in its entirety and in its own configuration.²²⁵ The spirituality and traditional stewardship practices²²⁶

water; this was later explained by the increase in freshwater runoff); Matt Walker, *Whale 'Sense of Smell' Revealed*, EARTH NEWS (Jul. 22, 2010), http://news.bbc.co.uk/earth/hi/earth_news/newsid_8844000/8844443.stm (last visited Oct. 4, 2011) (noting that research was motivated by Native whale hunters who claimed that Bowhead whales had a sense of smell) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment).

221. See McGrath Interview, *supra* note 143 (recalling that, in connection with the Red Dog Mine, people in the village of Kivilina asked about impacts on the legendary *immunaruk* (little people); the concern went into the record, but EPA did not know how to resolve it).

222. See *id.* (explaining that community concerns based on their knowledge are always recorded and respected, although they may not be addressed in a manner satisfactory to the community because the agency may not be sure how to address them.).

223. See Krishna Paudel & Hemant Ojha, *Contested Knowledge and Reconciliation in Nepal's Community Forestry: A Case of Forest Inventory Policy*, in KNOWLEDGE SYSTEMS, *supra* note 40, at 40, 55–56 (discussing how adaptive plans for resource management can work well even under uncertain conditions); see also Isé & Abbott-Jamieson, *supra* note 8, at 29 (“Fishermen’s knowledge is . . . highly localized whereas fisheries science models are constructed to characterize regions.”); Vincent-Lang Interview, *supra* note 57 (recounting a meeting on the proposed listing of ringed seals under the Endangered Species Act, in which a subsistence hunter spoke about seeing fat, healthy seals, but the federal agency responsible for the listing did not know how to plug this information into its model and may discard it).

224. See Frankson Interview, *supra* note 10 (discussing Iñupiat Eskimo spiritual knowledge that bowhead whales give themselves only to whaling captains who show them respect); see also Interview with Lloyd Vincent, Iñupiat Artist, in Point Hope, Alaska (Feb. 2, 2011) (giving examples of sometimes unexplainable behavior of the bowhead whales) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment).

225. See Brelsford Interview, *supra* note 20 (discussing the necessity to vary collection methods and to be sure to work with local organizations to ensure completeness of information); see also Williams Interview, *supra* note 43 (suggesting that a systematic process is necessary to collect traditional knowledge; first, experts must be identified, then, the process properly documented).

that are often interlaced with community knowledge should be recorded not only for their cultural value, but also for their pragmatic implications.²²⁷ Communities are more likely to adhere to decisions and laws that affect their environment if these decisions and laws are consistent with community values.²²⁸ This is true not only with indigenous communities, but also in Western culture.²²⁹ Some of the most heralded Western scientists are those who have forged an emotional connection between science, the environment, and the well-being of our society.²³⁰

226. Many communities have clearly articulable conservation values that form the basis for stewardship practices. See Т. Е. Гончарова [T.E. Goncharova], *Традиционные Знания Народов, Проживающих на Территории Республики Коми, в Области Природопользования* [*Traditional Knowledge of People Living in the Komi Republic Regarding Natural Resource Use*], in *ALTAE-SAYAN TRADITIONAL KNOWLEDGE*, *supra* note 10, at 30 (describing stories and legends of Komi hunting, fishing, and gathering containing knowledge relating to the concept of biodiversity conservation); see also Belgibaev, *supra* note 54, at 14 (describing traditional conservation practices of the people in the Altai-Sayan region of Russia, including a prohibition on shooting young female animals and birds, particularly those with offspring, and a prohibition on shooting certain species of birds); Brelsford, *supra* note 50, at 384 (describing a study in which a tribal elder described selective fish harvest practices ensuring that pregnant females were freed from the weir to continue upstream to spawn; study discussing the Tlingit practice of placing fallen logs and sculpting pools to provide a “welcoming” habitat for salmon returning to spawn); LaDuke, *supra* note 48, at 129–30 (describing the game management of Timiskaming tribe of the Great Lakes Region: the tribe kept track of game populations to regulate harvest levels, avoiding depletion of the stock, and the killing of game was regulated by each family); Segall, *supra* note 45, at 1545 (discussing the role of social convention in natural resource management); see also Joseph Elizeri Mbaiwa, *Tourism, Development, Rural Livelihoods, and Conservation in the Okavango Delta, Botswana*, at 140–41 (Aug. 2008) (Ph.D. dissertation, Texas A&M University), available at <http://repository.tamu.edu/bitstream/handle/1969.1/ETD-TAMU-3064/MBAIWA-DISSERTATION.pdf?sequence=1> (citing examples of pre-colonial social conventions in Botswana observed by community members: breeding animals were not hunted, hunting expeditions were controlled by the chief on behalf of his community, hunting targeted old male animals, and, after a hunt, the community shared meat until the meat was finished); Chase Interview, *supra* note 11 (stating that Eskimos have timeframes for hunting and gathering bird eggs; gatherers leave some eggs behind in the nest); Hepa Interview, *supra* note 48 (describing how for thousands of years, Arctic people have had rules for each type of animal hunted, based on the traditional values of respect for nature, sharing, spirituality, and cooperation; these rules ensure good hunting); Rexford Interview, *supra* note 68 (detailing how the Iñupiat do not hunt caribou or seal in their breeding seasons).

227. See Brelsford Interview, *supra* note 20 (noting that there is a pragmatic value in stewardship traditions, even if they are framed in religious terms).

228. See Brelsford, *supra* note 50, at 385 (“[T]he Ahtna and Tlingit studies promote the possibility of new hybrid models for conservation and management, building jointly on these rich and long-standing traditions and values alongside western science and management.”).

229. See Bennett Interview, *supra* note 18 (suggesting that we may have no reason to care about science if there is no emotional connection to link the science to ourselves).

230. See *id.* (describing the work of Rachel Carson, Aldo Leopold, and Carl Sagan—scientists who made science relevant to the public through their moving works of literature).

It is clear that agencies must base their decisions on knowledge that is subject to demonstration or proof, as opposed to unsubstantiated belief or emotion.²³¹ But this does not prevent agencies from treating the spiritual aspects of community knowledge with respect.²³² Respect entails maintaining a record of all the knowledge a community shares and informing the community whether and how this knowledge is incorporated into a decision.²³³

VIII. Summary and Conclusion

Although it is not specifically addressed in U.S. law, there is a role for community knowledge in government agency decisions regarding the environment and natural resources. Not only does this knowledge supplement gaps in Western science, it helps build trust in an agency and may increase compliance with the agency's decisions.

Agencies in Alaska have been working to increase their use of community knowledge. Still, there are challenges to collecting this knowledge and integrating it with Western science. Community knowledge may not neatly fit into the constructs of Western science and the regulatory system that agencies use, particularly when it has a spiritual component. Also, communities may be reluctant to share their knowledge, and there are areas in which knowledge is limited or has been lost.

Agencies should develop protocols for collecting, recording, processing, and applying community knowledge and for addressing conflicts or disconnections between this knowledge and Western science.

231. See *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579, 590 (1993) (“[T]he word ‘knowledge’ connotes more than subjective belief or unsupported speculation.”); *Henry v. Milwaukee Cnty.*, 539 F.3d 573, 588 (7th Cir. 2008) (“A court that permits a state (or for that matter a federal agency) to make decisions influenced by intuitions about what the data ultimately will show must insist that the state (or agency) find out whether those intuitions are sound or simply superstitions.” (citing *Bechtel v. FCC*, 10 F.3d 875 (D.C. Cir.1993))).

232. See Chase Interview, *supra* note 11 (stating that if a researcher or agency would come to the community with more respect, it would make a difference—people would be more willing to help the researcher or agency); see also Rexford Interview, *supra* note 68 (declaring that the Iñupiat have always had a spiritual link to the land and renewable resources; agencies can recognize this by having a respectful attitude and making comments in a culturally sensitive manner). North Slope residents have felt that FWS has not been sufficiently culturally sensitive or respectful of what the community has to say about their hunting practices and the status of threatened migratory bird species. See Hepa Interview, *supra* note 48 (questioning why agencies are listing species based on models rather than what local people say); see also Rexford Interview, *supra* note 68 (noting that FWS did not seem to believe the North Slope community's knowledge about migratory birds).

233. See Management Challenges and Benefits to Using Traditional Knowledge Interactive Discussion, NSB Traditional Knowledge Workshop, in Anchorage, Alaska (Sep. 6, 2007) (discussing the need to provide feedback to communities as to how their knowledge was used).

The best methods for data collection involve anthropologists as well as community experts. When agencies work in a respectful partnership with community members to evaluate community knowledge, integrate it with Western science where possible, and apply it to decisions, the outcomes are better for all involved.

Appendix, International Agreements, and Declarations

Since the 1992 United Nations Summit in Rio de Janeiro, there has been recognition of the value of community knowledge and the need for greater local and indigenous autonomy.²³⁴ The following table contains a non-exclusive list of international agreements and declarations calling for the use of community knowledge (usually referred to as traditional knowledge) in environmental and natural resource decision-making.²³⁵

234. See, e.g., Indira Simbolon, *Law Reforms and Recognition of Indigenous Peoples' Communal Rights in Cambodia*, in LAND AND CULTURAL SURVIVAL, THE COMMUNAL LAND RIGHTS OF INDIGENOUS PEOPLES IN ASIA 63, 66–67 (Jayantha Perera ed., 2009), available at <http://www.adb.org/documents/Books/Land-Cultural-Survival/land-cultural-survival.pdf> (discussing Agenda 21 from the 1992 Rio World Summit and the Declaration on the Rights of Indigenous Peoples adopted by the UN General Assembly in 2007); see also Lee Breckenridge, *Protection of Biological and Cultural Diversity: Emerging Recognition of Local Community Rights in Ecosystems Under International Environmental Law*, 59 TENN. L. REV. 735 (1992) (“The articulation of international environmental requirements is accompanied, strikingly, by a new recognition of local communities’ roles in protecting biological diversity and ecosystem viability.”).

235. In addition to the conventions listed in the Appendix, see World Bank, Operational Directive 4.20, art. 8, 71 (Sept. 1991), available at http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2003/05/01/000160016_20030501182633/additional/862317580_200306204005416.pdf (“[I]dentifying local preferences through direct consultation, incorporation of indigenous knowledge into project approaches, and appropriate early use of experienced specialists are core activities for any project that affects indigenous peoples and their rights to natural and economic resources.”).

Agreement or Declaration and Citation	Excerpt (all emphasis added)	Affects U.S.?
Convention on Biological Diversity, June 4, 1992, 31 I.L.M. 818 art. 8(j).	“Each contracting Party shall, as far as possible and as appropriate . . . respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices.”	U.S. has not signed ²³⁶

236. See *Country Profile - U.S.*, CONVENTION ON BIOLOGICAL DIVERSITY, <http://www.cbd.int/convention/parties/list/> (last visited Oct. 4, 2011) (illustrating the fact that the U.S. did not sign the Convention on Biological Diversity) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment).

<p>Report on the United Nations Conference on Environment and Development, Rio de Janeiro, June 14, 1992 [hereinafter Report], <i>Non-Legally Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of All Types of Forests</i>, ¶ 12(d), U.N. Doc. A/CONF.151/26 (Vol. III), available at http://www.un-documents.net/for-prin.htm.</p>	<p>“<u>Appropriate indigenous capacity and local knowledge regarding the conservation and sustainable development of forests should</u>, through institutional and financial support and in collaboration with the people in the local communities concerned, <u>be recognized, respected, recorded, developed and, as appropriate, introduced in the implementation of programmes.</u> Benefits arising from the utilization of indigenous knowledge should therefore be equitably shared with such people.”</p>	<p>Non-binding</p>
<p>Report, Annex I, <i>Rio Declaration on Environment and Development</i>, U.N. Doc. A/CONF.151/26 (Vol. I), at Principle 22, available at http://www.un.org/documents/ga/conf151/annex1/annex1.htm.</p>	<p>“Indigenous people and their communities and other local communities have a vital role in environmental management and development <u>because of their knowledge and traditional practices.</u> States should recognize and duly support their identity, culture and interests and enable their effective participation in the achievement of sustainable development.”</p>	<p>Non-binding</p>

<p>Agenda 21, art. 14.26, U.N. Doc A/Conf.151/26 (1992), <i>available at</i> http://www.un.org/esa/dsd/agenda21/.</p>	<p>“The objectives of this programme area [Improving farm production and farming systems through diversification of farm and non-farm employment and infrastructure development] are . . . [t]o enhance the self-reliance of farmers in developing and improving rural infrastructure, and to facilitate the transfer of environmentally sound technologies for integrated production and farming systems, <u>including indigenous technologies and the sustainable use of biological and ecological processes</u>, including agroforestry, sustainable wildlife conservation and management, aquaculture, inland fisheries and animal husbandry.”</p>	<p>Non-binding</p>
<p><i>Id.</i>, at art. 26.3</p>	<p>“In full partnership with indigenous people and their communities, Governments and, where appropriate, intergovernmental organizations should aim at fulfilling the following objectives: (a) Establishment of a process to empower indigenous people and their communities through measures that include: . . . iii. <u>Recognition of their values, traditional knowledge and resource management practices</u> with a view to promoting environmentally sound and sustainable development.”</p>	<p>Non-binding</p>

<p>United Nations Convention to Combat Desertification in Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, art. 16 (1992), available at http://www.unccd.int/convention/text/convention.php.</p>	<p>“The Parties agree . . . to integrate and coordinate the collection, analysis and exchange of relevant short term and long term data and information to ensure systematic observation of land degradation in affected areas To this end, they shall, as appropriate: . . . (g) . . . <u>exchange information on local and traditional knowledge</u>, ensuring adequate protection for it and providing appropriate return from the benefits derived from it, on an equitable basis and on mutually agreed terms, to the local populations concerned.”</p>	<p>Non-binding</p>
<p><i>Id.</i> at art. 17</p>	<p>“The Parties undertake . . . to promote technical and scientific cooperation in the fields of combating desertification and mitigating the effects of drought To this end, they shall support research activities that: . . . (c) <u>protect, integrate, enhance and validate traditional and local knowledge</u>, know-how and practices, ensuring, subject to their respective national legislation and/or policies, that the owners of that knowledge will directly benefit on an equitable basis and on mutually agreed terms from any commercial utilization of it or from any technological development derived from that knowledge.”</p>	<p>Non-binding</p>

<p>Program of Action of the World Summit for Social Development. <i>Report of the World Summit for Social Development</i>, ch. 2 ¶ 32, U.N. Doc A/CONF. 166/9 (1995), available at http://www.un.org/documents/ga/conf166/aconf166-9.htm.</p>	<p>“Rural poverty should be addressed by: . . . (g) . . . building on local and traditional practices of sustainable agriculture and <u>taking particular advantage of women's knowledge</u>; (h) Strengthening agricultural training and extension services to promote a <u>more effective use of existing technologies and indigenous knowledge</u> systems and to disseminate new technologies in order to reach both men and women farmers and other agricultural workers, including through the hiring of more women as extension workers.”</p>	<p>Non-binding</p>
<p>United Nations Declaration on the Rights of Indigenous Peoples, Adopted by G.A. Res. 61/295 (Sep. 13, 2007), available at http://www.un.org/esa/socdev/unpfii/en/drip.html.</p>	<p>“Recognizing that <u>respect for indigenous knowledge, cultures and traditional practices</u> contributes to sustainable and equitable development and proper management of the environment.”</p>	<p>Non-binding, endorsed, Dec. 16, 2010²³⁷</p>

237. See *Indigenous Rights Endorsed*, UNREPRESENTED NATIONS AND PEOPLES ORGANIZATION (Dec. 20, 2010), <http://www.unpo.org/article/12071> (“The United States has announced that it endorses the United Nations Declaration on the Rights of Indigenous Peoples.”) (on file with the Washington and Lee Journal of Energy, Climate, and the Environment).

