

A Method for Tribal Environmental Justice Analysis

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ABSTRACT

The goal of environmental justice (EJ) is for all peoples to achieve the same degree of protection from environmental health hazards. Although each tribe is an independent sovereign nation and a single federal approach may not suit all tribes, this article presents an improved method for evaluating and quantifying potentially disproportionate impacts in tribal communities under the National Environmental Policy Act (NEPA). A critical first step in evaluating disproportionate impacts in tribal communities might be to determine the condition of natural resources used by, important to, or appertaining to tribes. The eco-cultural system or ethno-habitat relevant to the tribe and its resource interests can be described in narrative and quantitative terms. The features, attributes, goods, and services provided by the baseline conditions of the ethno-habitat and its resources can be described. Examples of quantifiable measures to evaluate interruptions in service flow and risks to traditional lifeways over multiple generations are suggested. A subsistence exposure scenario and risk assessment based on traditional lifeways can be included in this step, since risks to tribal members are likely to be higher than to non-native persons due to differences in the frequency and intensity of environmental contact. To evaluate cumulative impacts, existing co-risk factors that make the community more vulnerable can also be considered.

INTRODUCTION

THE GOAL OF ENVIRONMENTAL JUSTICE (EJ) is to lower disproportionately high risks and consequences so that “no group of people, including racial, ethnic, or socioeconomic groups, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies.¹ When significant federal actions are proposed, an analysis of impacts to different racial, ethnic, or socioeconomic groups is required under the National Environmental Policy Act (NEPA), typically as an EJ chapter in an environmental impact statement (EIS).

The underlying concept in this article is that for many tribal communities the human systems are interconnected with natural systems within a single eco-cultural system or ethno-habitat. This requires a holistic approach to the environmental justice and cumulative impact analysis when EISs are written. Tribal narratives can identify the eco-cultural attributes of the natural systems and resources as a way to identify key resources, identify the goods and services flowing between natural and human systems, and suggest ways to measure impacts. Further, when the federal action might impact tribal communities or natural resources important to the community, the EJ analysis needs to consider the impact of the proposed action on federal fiduciary trust obligations and natural resource trusteeship.

The authors of this article fully recognize that each tribe is an independent sovereign, with differences in beliefs, cultures, religions, traditional practices, and ecologies. We respect these differences and realize that a single approach may not suit all tribes. We also recognize that there is often a potential for negative unintended consequences of participating in a decision process with inadequate technical and strategic resources, and of revealing sensitive information. Nevertheless, we are trying to

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¹U.S. EPA (1998). “Final Guidance For Incorporating Environmental Justice Concerns in EPA’s NEPA Compliance Analyses” (April 1998). <http://www.epa.gov/compliance/resources/policies/ej/ej_guidance_nepa_epa0498.pdf>.

present a framework that is compatible with commonalities expressed by many tribes, and presents a more relevant starting place for discussions between individual tribes and federal agencies. In each case, we believe that the basic NEPA framework does not need to be changed, but that most methods need at least some modification to capture tribal impacts and issues. Based on our own (Confederated Tribes of the Umatilla Indian Reservation, CTUIR) experience with the NEPA process, we have found that the following steps form a useful framework to explain a tribal perspective to federal agencies:

1. Prepare a tribal narrative describing the overall ethno-habitat or eco-cultural system(s), with a holistic worldview and general spatial boundaries as appropriate. The EJ goal of 'meaningful involvement' suggests that the tribe(s) should prepare this narrative.
2. Compare the spatial distribution of natural or cultural resources appertaining to tribes with the spatial distribution of potential impacts. Overlaps may indicate a need to discuss affected resources with tribes.
3. Prepare tribal narratives for individual resources and cultural keystone species, with recommendations for impact evaluation.
4. Prepare tribal narratives for human health, socio-cultural, subsistent economic, and homeland security impacts.
5. Conduct a cumulative analysis across all impacts and determine whether individual or cumulative impacts are unevenly distributed among affected populations.

In a NEPA analysis, the impacts of proposed federal actions on individual resources and a variety of health, economic, and other endpoints are generally evaluated in a fragmented manner, even in the cumulative assessment section. However, traditional lifeways and ecosystems form interconnected eco-cultural systems that require more integrated approaches. For example, an intact eco-cultural system includes hunting and fishing, food gathering, governance, commerce, art, education, health care, and social support systems, in continuous interlocking eco-cultural cycles.² Ecosystem services flow back and forth among the components. Unfortunately, less attention is paid in typical NEPA analyses to the ecosystem functions and services provided by an intact and functioning habitat³ even though they are essential to traditional health and well-being.

²Harris, S. (1998). "Cultural Legacies: Challenge to the Risk Community," (Plenary Address, Society for Risk Analysis Annual Meeting, Phoenix, AZ, December, 1998); Harris, S. and Harper, B. (2000). "Using Eco-Cultural Dependency Webs in Risk Assessment and Characterization." *Environmental Science and Pollution Research* 7(Special 2): 91–100. Cajete, G. (1999). *A People's Ecology*. Santa Fe, NM: Clear Light Publishing.

³Costanza, R. and Folke, C. (1997). *Valuing ecosystem services with efficiency, fairness and sustainability as goals*. Washington, D.C.: Island Press. Daly, H. (1996). *Beyond Growth: The Economics of Sustainable Development*. Boston: Beacon Press.

AFFECTED RESOURCES

Because traditional native life is intertwined with the natural resources, we have found it helpful to begin the affected resource section with a tribal narrative that gives a local tribal perspective and describes the oral history and environmental knowledge of the area and some of the key ecological and cultural keystone resources.⁴ For example, the Hanford Reach of the Columbia River has been important to the CTUIR since "time immemorial," as the salmon people return each spring to feed their human brothers and sisters as they promised the Creator they would do. In addition to being explicitly reserved as a treaty right, the annual gatherings along the shoreline during the spring Chinook salmon runs is associated with teaching fishing skills and right behavior (salmon keeps his promise), language and place names, socializing, nutrition, thanksgiving ceremonies, trade and commerce, annual planning conclaves, and governance or power brokering. This system is formally illustrated in the Natural Law (Tamanwit) of the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) and includes teachings related to First Foods, medicine, dress, people, land/earth, water, light, speech, air, dwellings, and energy flows and the life force in a single body of knowledge. Without this explanation, the breadth and magnitude of adverse impacts caused by restricting access or harming the salmon spawning areas would be significantly underestimated.

The human ethno-history in indigenous areas is generally divided into cultural periods that parallel the historical climatic periods and represent accumulated cultural adaptations to changing environmental conditions. This traditional environmental knowledge (TEK) provides facts about the region's flora, fauna, and geology that complement other bodies of knowledge and assists the evaluation of environmental and eco-cultural impacts. The large literature base about TEK also contains information about environmental processes and cycles, natural resource usage, and interactions between people and the environment.⁵

⁴Harper, B., Harding, A., Waterhous, T., and Harris, S. (2007). *Regional Tribal Exposure Scenarios Based on Major Ecological Zones and Traditional Subsistence Lifestyles*. <<http://www.hhs.oregonstate.edu/ph/tribal-grant-main-page>>.

⁵Cameron, I. (2008). "Late Holocene environmental change on the Interior Plateau of Western Canada as seen through the archaeological and oral historical records." World Archaeological Congress 6, Dublin, Ireland. Cajete, G. (2004) Philosophy of Native Science. In: A Waters (ed.) *American Indian Thought*. Malden, MA: Blackwell Publishing, 45–57. Nadasdy, P. (1999). "The politics of TEK: power and the integration of knowledge." *Arctic Anthropology* 35 (1–2): 1–18. Agrawal, A. (1995). "Dismantling the divide between indigenous and scientific knowledge." *Development and Change* 26(3):413–439. Berkes, F. (2008). *Sacred Ecology: Traditional Ecological Knowledge and Resource Management (2nd Edition)*. Philadelphia: Taylor and Francis. Sillitoe, P. (2007). "Local science vs Global Development: Approaches to Indigenous Knowledge in International Development." Oxford, UK: Berghahn Books. Tsosie, R. (2007). "Cultural Challenges to Biotechnology: Native American Genetic Resources and the Concept of Cultural Harm." *Journal of Law, Medicine & Ethics* 35: 396. Turner, N., Gregory, R., Brooks, C., Failing, L., and T. Satterfield, T. (2008). "From invisibility to transparency: identifying the implications." *Ecology and Society* 13(2): 7. <<http://www.ecologyandsociety.org/vol13/iss2/>>.

Official tribal policy may also codify certain resource values based on the ancient teachings. For example, CTUIR policy states that the responsibility taught as tribal law is to

“protect, preserve, and enhance this earth including the air, water, and ground, and all that grows and lives here. In order to fulfill this responsibility, the native sovereign nations need cold, clean, uncontaminated water; clean, clear uncontaminated air; uncontaminated soil; clean, vibrant, and uncontaminated biological resources; clean, uncontaminated, and wholesome foods; and clean, uncontaminated, and healthful medicines.”

We believe that describing the eco-cultural attributes of each affected resource also enhances the tribal narratives, along with recommendations about how to evaluate impacts and services provided by the resources.⁶ For example, a tribal narrative about physiographic resources could include descriptions of cultural and sacred attributes associated with vantage points overlooking songscapes and storyscapes,⁷ and tangible features of the physical landscape that are cultural mnemonics tied to specific events, stories, culture, instructions in ethical behavior, and religious practices. Tribal narratives for biological resources would describe the roles of individual cultural keystone species and recommend measures of impacts to the services that those resources provide.⁸ An individual species may be important for several reasons or have several eco-cultural attributes (e.g., as a food, medicine, a name, and a story). An animal or place may be important for several reasons (e.g., as a cultural keystone species to a tribe and thus irreplaceable, and as wildlife viewing interest to the non-tribal population and thus replaceable); the tribe would be more affected than the non-tribal population in this situation. A tribal narrative about water might explain that, as with all resources, there is both a practical and a spiritual aspect to water.⁹ The quality of purity is very important for

ceremonial use of water. From a ceremonial perspective, the most important drop of contamination is not the drop that causes a body of water to exceed a numerical standard, but the drop that changes the quality of the water from pure to impure. The same principle is true for the important but fragile qualities of “dark” and “quiet.” One small light can destroy the darkness; one small drop can render water impure; one small road can fragment a habitat. These qualities of the whole are important measurement endpoints.

IMPACT ANALYSIS

EJ analysis is typically a comparison of the degree of impacts among different human communities, such as health impacts, socio-cultural impacts, and so on. If reduced to simply a dollar valuation, tribal impacts are inevitably undervalued. Therefore, part of the EJ analysis must find another way to bring tribal interests into parity. One way to do this is by examining impacts to tribal goods and services identified in the tribal narratives. Another is to recognize the proportion of the tribal population that is adversely affected both directly and indirectly rather than absolute numbers. Table 1 lists some of the affected resources, the services they provide, and metrics that might be appropriate for tribal use. There are many ways that impacts and service loss might be quantified:

- Risk-acre-years (using tribal exposure scenarios)
- Spatial service-acre-years, gallon-years or acre-feet, viewshed degrees, etc.
- Landscape ecology, large-scale metrics, indices for fragmentation and diversity related to human utility, performing a cultural habitat equivalency analysis, performing an equity analysis to regain parity in the decision process
- Constructed scales (numbers of lost visits to Traditional Cultural Properties, other community surveys, etc.)
- Public health metrics such as tribal QALY-DALY-QOL¹⁰
- Identification of natural law components, cultural keystone species
- Dependency webs to identify users, uses, linkages, and secondary impacts.

Health impacts

When environmental media or tribal foods and medicines are impacted by contamination or degradation, health impacts may be unevenly distributed among populations proportional to their degrees of environmental contact. This is well-recognized with respect to fish contamination because different ethnic groups might eat quite different amounts and species of fish from the same waterway. If a full risk assessment is performed, a tribal traditional or subsistence exposure would be needed. Tribal exposure scenarios are similar in format to

⁶Harper, B. and Harris, S. (2000). “Measuring Risks to Community Health and Quality of Life.” Paper #6034 presented at 9th ASTM Symposium of Environmental Toxicology and Risk Assessment, and published in *Environmental Toxicology and Risk Assessment* (F Price, K Brisk and N Lane, eds.) 195–211.

⁷Stoffle, R., Halmo, D., and Austin, D. (1998). “Cultural Landscapes and Traditional Cultural Properties: a Southern Paiute View of the Grand Canyon and Colorado River.” *American Indian Quarterly* 21: 229–250. Walker, D. (1991). “Protection of American Indian Sacred Geography.” In: Vecsey, C., (ed.), *Handbook of American Indian Religious Freedom*. New York, NY: Crossroad Publishing: 100–115. Greaves, T. (1996). “Tribal Rights.” In: Brush S. and Stabinsky, D. (eds.), *Valuing Local Knowledge*. Washington, D.C.: Island Press: 25–40.

⁸Garibaldi, A. and Turner, N. (2004). “Cultural keystone species: implications for ecological conservation and restoration.” *Ecology and Society* 9: 1. Posted at <<http://www.ecologyandsociety.org/vol9/iss3/art1/>>.

⁹Altman, N. (2002). *Sacred Water: the Spiritual Source of Life*. Mahwah, NJ: Hidden Spring Publishers. Burmila S., Daniel S., and Hetherington, J. (1999). “Human values and perceptions of water in arid landscapes.” *Landscape and Urban Planning* 44: 99–109. Marks, W. (2001). *The Holy Order of Water*. Herndon, VA: Steiner Books Inc., 2001.

¹⁰Quality-adjusted life years; disability-adjusted life years; quality of life.

TABLE 1. IMPACT ANALYSIS FOR TRIBAL SERVICE FLOWS

<i>Affected Resource</i>	<i>Attributes, Goods and Services provided under baseline conditions</i>	<i>Measurement Endpoints (parameters, direction of impact—improvement or decrement)</i>
Ethnohabitat	Intact webs of resources, goods, and service flows that support the exercise of rights and traditional lifeways, heritage, and culture. Illustrated by Tamanwit (natural law)—components of traditional lifeways and linkages or relationships	<ul style="list-style-type: none"> - Loss or preservation of future land use options - Loss or enhancement of conservation potential - Lost bequest, visits, ceremonies - Degree of impact (or enhancement) of traditional lifeways by cultural quality-adjusted life years (QALY) and risk - Net loss or recovery of individual traditional activities (hunting, gathering, fishing) - Acreage with direct or indirect impacts (cultural acre-years or similar metric) - Degree of impact to the Tamanwit web integrity
Landscape(s) and viewshed	Intact 'scapes for places, names, songs, calendars, linguistic landmarks, cultural mnemonics Sacred geography Wilderness, solitude, quiet, dark	<ul style="list-style-type: none"> - Impact on physiographic profile; Loss or recovery of native 'scapes - Degrees of vision with undisturbed viewshed and without lights - Significance of direction or features of interruption (line of sight) - Detectable noise - Quality of religious or recreational experience
Soil, minerals, gravel, fill, sediments	Unique tribal uses (pigments, clays, etc.), pottery Conventional exposure pathway Ecological functions	<ul style="list-style-type: none"> - Degree of tribal access to special materials - Contamination, if present (degree of risk by inclusion in a tribal exposure scenario with standards-based and risk-based thresholds)
Water	Habitat for sacred plants, fish, and wildlife; subsistence use; ceremonial drinking; sweat lodge; conventional exposure pathway	<ul style="list-style-type: none"> - Soil profile, soil micro-biota, area, volume - Gal-yrs exceeding a tribal risk-based standard, cumulative risk level, or detection limit - Any institutional control needed to protect human (including tribal) health
Biologic resources (terrestrial, wetlands, critical habitats, food webs, T&E and other rare species, ecological keystone species)	Support for subsistence fishing, hunting, and gathering; ceremonial and spiritual uses, many related services	<ul style="list-style-type: none"> - Risk > 1E-6 for any individual resources and for all resources together - Individual resource advisories - Ecosystem metrics such as biodiversity and risks to sensitive species - Ecological risk thresholds; human risk thresholds - Indirect effects resulting in lost resources, missing resources; presence of invasive species - Number of reasons an individual resource is important
Cultural keystone species	Specific resources identified in subsistence scenario and other important uses; First Foods associated with the site	<ul style="list-style-type: none"> - Risks to the species; interruptions of specific services to people such as nutritional or medicinal services - Socio-cultural impacts of missing First Foods
Human health	Goal is both lack of excessive exposure to contaminants and active multi-dimensional health promotion within traditional lifeways	<ul style="list-style-type: none"> - Individual and community doses and risks using tribal scenarios - Advisories or institutional controls - Multigenerational exposures and risk - Consideration of broader health context, vulnerabilities, clusters of stressors

(continued)

TABLE 1. Continued

<i>Affected Resource</i>	<i>Attributes, Goods and Services provided under baseline conditions</i>	<i>Measurement Endpoints (parameters, direction of impact—improvement or decrement)</i>
Social, education, linguistic, other impacts	General support for heritage and culture	Lost educational opportunity, lost skills, lost language words for places and place-based stories, lost access to heritage fishing sites, lost numbers of ceremonies, other endpoints
Economic impacts	Support of subsistence economy in additional to conventional economic functions.	Recognition of subsistence economic measures, respect for subsistence needs, use of tribally-relevant metrics.
Cultural resources	Likely or known impacts to sites, traditional cultural property (TCP), archaeological or historic zones, districts; respect for sacred sites.	- Amount of negative activity in TCP, etc. - Degree of impact (can be a survey with a constructed scale)
Homeland security	See text—support for heritage and culture	Scales or survey for degrees of direct or indirect impacts
Cumulative	Cumulative support of, or impacts to heritage and well-being (security, materials, health, social setting) and freedom of choice and action	- Impacts to health, ecology, cultural, socio-economic, other analyses - Space-time mapping of impacts - Lifecycle impacts and costs - Sitewide totals of hazardous materials, footprints; impact on the ability to reach a fully restored endstate

existing residential or recreational scenarios, but reflect natural resource usage and are inclusive of tribal cultural and lifestyle activities.¹¹

Socio-cultural impacts

Tribal socio-cultural activities are likewise often tied to the land and may be disproportionately affected by federal actions that affect natural resources. Examples of ways to measure impacts to various socio-cultural services include:¹²

- Impact on societal structure and cohesion (e.g., hours per year unavailable for social interaction through loss, restricted access, or reduced value of the resource or area)

- Educational opportunity (e.g., lost study areas associated with traditional stories, place names, family history, traditional practices)
- Integrity of cultural resources (e.g., number of sites with any degree of disturbance or contamination, weighted by type and years of history associated with the site)
- Access to traditional lands: degree of restricted access (e.g., full restriction to any area or resource evidenced by institutional controls or barriers or reduced visits), fraction of ceremonial resources available relative to original quantity and quality
- Cultural landscape quality: proxy scale with elicited judgment based on original condition; total remaining landscape size without encroachments
- Degree of compliance with treaty rights (e.g., proxy scale based on access, safety, natural and cultural resource integrity and quality, hassle-free exercise of rights)
- Degree of compliance with trusteeship obligations with evaluation of tribal services
- Preservation of future land use and remedial options (e.g., acres of permanent losses including groundwater plumes, number of uses no longer viable, ir-retrievable waste forms)
- Degree of sustainability of the resource, its degree of permanent administrative protection, and associated exercise of treaty rights of access and use

Economic impacts

Evaluating economic impacts to indigenous communities may also need modification from conventional methods. Evaluating economic impacts to tribes thus involves much more than simply counting jobs created

¹¹Harper, B. and Harris, S. (1997). "A Native American Exposure Scenario." *Risk Analysis* 17: 789–795. Harper, B. and Harris, S. (2004). "Exposure Scenario for CTUIR Traditional Subsistence Lifeways." <<http://www.hhs.oregonstate.edu/ph/tribal-grant/index.html>>. Harper, B. and Ranco, D. (2009). "Wabanaki Traditional Cultural Lifeways Exposure Scenario." <<http://www.epa.gov/boston/govt/tribes/pdfs/DITCA.pdf>>. Harper, B., Flett, B., Harris, S., Abeyta, C. and Kirschner, F. (2002). "The Spokane Tribe's Multipathway Subsistence Exposure Scenario and Screening Level RME." *Risk Analysis* 22(3): 513–526.

¹²Harris, S. (2000). "Risk analysis: changes needed from a Native American perspective." *Human and Ecological Risk Assessment* 6: 529–535. Harris, S. and Harper, B. (1999). Environmental Justice in Indian Country: Using Equity Assessments to Evaluate Impacts to Trust Resources, Watersheds, and Eco-Cultural Landscapes) Proceedings of "Environmental Justice: Strengthening the Bridge Between Tribal Governments and Indigenous Communities, Economic Development, and Sustainable Communities. Posted at <<http://www.iiirm.org/publications/EnvJust/papero-1.pdf>>.

by the project in the local community. Eco-cultural systems are also economic systems. Indigenous eco-economies provide the same services as any economic system, including employment (i.e., careers in hunting, fishing, gathering, etc.), shelter (house sites, construction materials), education (intergenerational transfer of knowledge), commerce (barter items, stability of extended trade networks, discharge of obligations), hospitality and elder-care, energy (fuel), administration and coordination (chiefs and councils); governance (citizenship activities, conclaves), adjudication, transportation (land and water travel, waystops, navigational guides), the arts, and economic support for specialized community-wide roles such as religious leaders and teachers. In the general population these service flows are quantified in the symbolic form of dollars or other agreed-on exchange systems. Likewise, indigenous subsistence economies use exchange systems composed of networks of materials with labor-based value and interlinked networks of reciprocity, obligation, and trust that determine how materials, services, and information flow within the community and between the environment and the community.

Homeland security

In these days of increased security concerns, a NEPA analysis might benefit from an evaluation of impacts to national or regional security. A secure homeland means the same for tribal sovereign nations as it does for any other level of government. Impacts to homeland security of native sovereign nations may be a relevant part of EJ analysis if the proposed federal action could affect the attributes listed below:

- Land base—a secure land base with jurisdiction and ownership, free from encroachment or legal threat to sovereignty or self-government or jurisdiction
 - Governance—stable, balanced government with self-determination
 - Resource security—natural, cultural, legal, technical, organizational, and human resources adequate to define and meet threats
 - Capital resources—infrastructure, cyber, and domestic resources employed to protect tribal values and resources with strength and understanding in a traditional manner
 - Security and freedom—confidence in natural resource adequacy and quality, confidence in a leadership that looks out for the members and the resources, confidence in adequate economic well-being; confidence that the culture, language, values, and people will survive; freedom from legal battles brought by the federal and other governments
 - Culture and heritage—appreciation of individuals, creativity, support of the needy, devotion to the people, justice, fairness, respect, and the shared history and blood ties to the land and to each other, according to the teachings of the elders
 - Religion—freedom to choose and practice any religion
- Economy—adequate food, clothing, shelter for individual and tribal needs, both in dollars and barter, but also including the beauty and riches of the landscape, heritage, and knowledge

CUMULATIVE IMPACTS AND CUMULATIVE RISK

The cumulative impacts section of an EIS may or may not be integrated. Cumulative impacts to everything that is “at risk” from the proposed federal action should provide enough information to answer the questions that people ask about impacts to their community, health, resource base, and way of life.¹³ The U.S. Environmental Protection Agency (EPA) developed a Comparative Risk method almost two decades ago that added a community welfare or quality of life component to the risk assessment paradigm.¹⁴ Since then, measures for community quality of life (QOL) and community impact assessment have progressed¹⁵ and could be used for tribal cumulative impact evaluations as well.¹⁶ Because the types of impacts are so disparate, normalizing across different types of impacts can be done by aligning the maximum and minimum of each impact scale and distributing the degrees of impact along narrative tick-marks of catastrophic > significant > moderate > perturbation > de minimis by experts within each discipline (risk assessors, economists, elders, etc.).

¹³NRC (1994). *Building Consensus: Risk Assessment and Management in the Department of Energy's Environmental Remediation Program*. National Research Council. Washington, D.C.: National Academy Press. NRC (1996). *Understanding Risk: Informing Decisions in a Democratic Society*. National Research Council. Washington, D.C.: National Academy Press. Presidential Commission (1997). *Presidential/Congressional Commission of Risk Assessment and Risk Management: Framework for Environmental Health Risk Management, Final Report, Volume 1* (1529 14th Street, NW, Suite 420, Washington, D.C.). Posted at <<http://www.riskworld.com>>. Millenium Ecosystem Assessment <<http://www.maweb.org/en/index.aspx>>.

¹⁴U.S. EPA (1993). “A Guidebook to Comparing Risks and Setting Environmental Priorities.” EPA-230-B-93-003. Available from the National Service Center for Environmental Publications (NSCEP) at <<http://nepis.epa.gov/>>. Last, J. (1998). *Public Health and Human Ecology, 2nd ed.* Stamford, CT: Appleton & Lange.

¹⁵Lindholm, L. Rosen, M., and Emmelin, M. (1998). “How many lives is equity worth? A proposal for equity adjusted years of life saved.” *Journal of Epidemiology and Community Health* 52: 808–811.

¹⁶Harper and Harris 1995, op. cit. Harper, B. and Harris, S. (2001). “An Integrated Framework for Characterizing Cumulative Risks To Tribal Health And Well-Being And Subsistence Lifeways.” IIRRM, Denver, CO, <<http://www.iiirm.org>>, and Report to EPA/OSWER. Donatuto, J. (2008). “When Seafood Feeds the Spirit yet Poisons the Body: Developing Health Indicators for Risk Assessment in a Native American Fishing Community.” (PhD Diss. University of British Columbia). Nancy Turner, Robin Gregory, Cheryl Brooks, Lee Failing, and Terre Satterfield. 2008. From invisibility to transparency: identifying the implications. *Ecology and Society* 13(2008): 7–19. <<http://www.ecologyandsociety.org/vol13/iss2/art7/>>.

DISCOVERING DISPARITIES

The EJ analysis itself is intended to compare the magnitude of individual and cumulative impacts across populations. Some of the aspects that are relevant to many tribal situations include (but are not limited to):

1. Disparities in the amount and significance of natural resource impacts
2. Disparities in contamination-based human health risk based on exposure scenarios relevant to tribal natural resource use
3. Disparities in socio-cultural impacts (interruptions of socio-cultural services), economic impacts, and other impact categories
4. Disparities in cumulative risks (risk to health, culture, economy, homeland security, etc) magnified by clusters of vulnerabilities and co-risk factors
5. Overall equity; cost-risk-benefit distribution; proportion of EJ population affected

CONCLUSION: RESTORING EQUITY

A methodology for measuring disproportionate impacts is presented in this article. The approach presented in this article is consistent with the policies and teachings of our own tribe, and is offered in the hope that it is amenable to a more generally appropriate and inclusive federal approach to EJ when tribes or their resources are affected. As always, no federal guidance can substitute for government-to-government consultation.¹⁷ We have been careful not to imply that every tribe would choose the same metrics, or that there is a single threshold of magnitude of impact that is acceptable to any tribe. However, simply sharing a qualitative perspective may not be enough to enable a federal agency to evaluate impacts in a way that disproportionalities can be revealed, or to know when disparities have been reduced to an equitable amount. Finally, we urge federal agencies to avoid labeling tribal concerns simply as “uncertainties” because this disrespects the heritage and the value of indigenous science, and implies that this is just a perception or a personal opinion or is otherwise not deserving of equal weight in a decision process.

Principles of informed consent and full disclosure should also be followed, since there is generally a potential for unintended consequences such as imposition of greater restrictions on vulnerable populations if their risks are disproportionately higher.¹⁸ For example, if a tribe

would suffer a greater impact to their health, rights, resources, and heritage from a proposed federal action, it would be the tribe that must curtail its uses of the affected resources more than less-affected communities. Although the goal of EJ is to reduce these higher impacts, it does not happen in practice; rather a heavier burden falls on the more-affected group to make the most accommodation.

One laudable example of using tribal narratives in an EIS is presented by the U.S. Department of Energy (DOE).¹⁹ This draft EIS compares some nuclear waste disposal options at several U.S. DOE sites with affected Indian tribes. The tribes at each site developed narratives, and summaries are included in the main text for each site, and the entire tribal narratives are included in an Appendix. Tribal recommendations on methods and metrics are then completely ignored, even in the EJ sections, but U.S. DOE is to be commended for recognizing that tribal issues require acknowledgment and evaluation, and for taking a first step by including tribal narratives throughout the document.

Although tribes can provide data about tribal impacts, implementing environmental justice executive orders (#12898, #13175), developing appropriate guidance, and requiring true equity can only be done by the federal government. Thus the greatest challenge is to the federal government to reduce (or at least mitigate) the inequity by making more ethical and protective decisions.²⁰ To this end, we encourage the U.S. EPA and other federal agencies to examine their policies and guidance to identify areas that could support improved analysis and equity.

AUTHOR DISCLOSURE STATEMENT

The authors declare that they have no conflicts of interest or financial ties to disclose.

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¹⁷<http://www.ncai.org/fileadmin/governance/Parker_Consultation_Policies_2009.10.15.pdf>; <<http://www.epa.gov/fedreg/eo/eo13175.htm>>; <<http://www.ncai.org/Consultations-with-Tribal-Gove.449.0.html>> on Executive Order 13175.

¹⁸O'Neill, C. A. (2003). “Risk avoidance, cultural discrimination, and environmental justice for indigenous peoples.” *Ecology Law Quarterly* 30(1): 1–58.

¹⁹U.S. DOE (2011). Draft EIS for the Disposal of Greater-Than-Class-C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste. DOE/EIS-0375-D; posted at <<http://www.gtcceis.anl.gov/documents/index.cfm>>.

²⁰Wing, S. (2005). “Environmental Justice, Science, and Public Health.” <[http://www.researchethics.org/uploads/pdf/SteveEJEHP\(1\).pdf](http://www.researchethics.org/uploads/pdf/SteveEJEHP(1).pdf)>. Donatuto J. and Harper, B. (2008). “Issues in Evaluating Fish Consumption Rates for Native American Tribes.” *Risk Analysis* 26: 1497–1506.

