A Decade of Tribal Environmental Health Research:

Results and Impacts from EPA's Extramural Grants and Fellowship Programs

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Disclaimer

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Terms Used in This Document

There are many different terms that indigenous peoples of the United States use to identify themselves. For the purposes of this document, the National Center for Environmental Research has chosen to use the term "American Indian and Alaska Native" (abbreviated AI/AN) and the term "citizen" to denote an Alaska Native village or tribal member. EPA recognizes that some Native communities may prefer to refer to themselves using different terminology. Terms such as "Native American," "American Indian," "Alaska Natives," "Alaska Native people," "tribes," "tribal members" or similar may be found in grantees' project descriptions, reports and publications, as well as on the program's website and in Requests For Applications.

A "lifestyle" is the typical way of life of an individual, group or culture. The term "lifeways" generally is understood to mean the specific customs and practices of a culture; in this report "lifeways" refers to the traditional lifestyles of AI/AN people prior to First Contact.

Finally, "environmental justice communities" is a standard term used by EPA to refer to communities with environmental justice concerns. These communities are commonly identified as those in which residents: predominantly are minorities or low-income; have been excluded from the environmental policy-setting or decision-making process; are subject to disproportionate impact from one or more environmental hazards; and experience disparate implementation of environmental regulations, requirements, practices and activities in their communities.

List of Acronyms

AI/AN	American Indian and Alaska Native
EPA	U.S. Environmental Protection Agency
NCER	National Center for Environmental Research
ORD	Office of Research and Development
P3	People, Prosperity and the Planet Student Design Competition for Sustainability
RFA	Request for Applications
STAR	Science To Achieve Results

Table of Contents

Executive Summary 1

Introduction/Background 5

Results of the Tribal Research Funded by EPA 11

- Cultural Practices, Language and Traditional Ecological Knowledge 12
- Subsistence Foods and Water Resources 14
- Community-Based Participatory Research and Community Outreach and Education 20
- Risk Assessment and Sensitive Populations 24
- Impacts on Regulations and Management Plans 26

Future Directions for Tribal Research 29

Conclusion 31

References 34

Appendix A: Summary of Tribal Environmental Health Research Program STAR Grants by RFA 36

Appendix B: Outputs From Tribal Environmental Health Research Program STAR Grants 38

Appendix C: Tribal Environmental Health Research Program Presentations 46

Appendix D: Overview of Tribal Environmental Health Research Program Grantee Webinars 47

Appendix E: Summary Tables of EPA Tribal Research Projects Discussed Within the Report 51

Appendix F: Practical Applications of EPA Tribal Research 53

Appendix G: Additional Resources 54

Executive Summary

American Indian and Alaska Native (AI/AN) communities have been inextricably linked to their environments for millennia. Because of their reliance on natural resources to maintain traditional diets, lifeways, customs and languages, there is a unique need for tribal-focused research to identify impacts of pollution, dietary exposure, cumulative risk and climate change as well as to inform decisions to reduce health risks in these areas.

Recognizing this need, the National Center for Environmental Research (NCER), within the U.S. Environmental Protection Agency's (EPA) Office of Research and Development, was tasked to establish the Agency's Tribal Environmental Health Research Program in 2000 through the Science To Achieve Results (STAR) grants program. Since its inception, the program has funded 10 STAR grants for tribal environmental health research, many of which are carried out on tribal lands by researchers from tribal colleges and universities and tribal health organizations. EPA also supports tribal environmental research via its STAR and Greater Research Opportunities fellowship programs; People, Prosperity and the Planet Student Design Competition for Sustainability (P3); and Small Business Innovation Research program. In addition, NCER, as the program lead, collaborates with EPA-sponsored partnership groups (e.g., National Tribal Operations Committee, National EPA-Tribal Science Council) to ensure that its extramural research program is responsive to tribal needs and research priorities. These grants, programs and partnerships support tribally led research projects that encompass traditional and nontraditional scientific approaches to collect baseline data linking culture and exposure.

To highlight the research conducted within the Tribal Environmental Health Research Program, NCER sponsored a series of webinars in 2009 and 2012. NCER leadership realized that it was critical to develop a synthesis document to communicate the outputs and outcomes of the program and expand awareness in this essential research area. This document describes outcomes of past EPA tribal environmental research and discusses future directions and initiatives.

The first step in identifying the tribal research outcomes was to develop a list of relevant tribal grants, fellowships, P3 grants and Small Business Innovation Research projects. This list was compiled through a targeted search of the NCER Research Project Database. The investigators for these studies were contacted to obtain annual and final reports for their grants/projects as well as information on the outputs and subsequent outcomes of their research. The information collected was analyzed to identify common themes throughout the various projects. Five themes emerged:

- Cultural practices, language and traditional ecological knowledge.
- Subsistence foods and water resources.
- Community-based participatory research and community outreach and education.
- Risk assessment and sensitive populations.
- Impacts on regulations and management plans.

These themes serve as the basis for the format of this synthesis report.

What Are the Outcomes of the Tribal Environmental Health Research Program?

After more than a decade of funding research addressing the unique needs of AI/AN communities, EPA's Tribal Environmental Health Research Program and other Agency tribal research has yielded data, tools, products, methods and knowledge. These help to:

- better define and reduce the health risks of tribal populations,
- protect natural resources essential to cultural and spiritual practices, and
- encourage the ecological knowledge and tribal practices of protecting and preserving the earth for future generations.

Some of these outcomes are described briefly in the following paragraphs.

Cultural Practices, Language and Traditional Ecological Knowledge

Each AI/AN community has its own unique set of cultural practices, language and traditional ecological knowledge. EPA has funded several STAR grants that strive to support tribal citizens in continuing their cultural practices with reduced health risks. These projects also help to strengthen native language skills and increase culturally relevant communication of traditional ecological knowledge. Highlights of this research include:

- Alaska Native communities use STAR research to inform their wellness planning surrounding consumption of subsistence and medicinal berries, which are being threatened by pollution and climate change.
- A library of resources in the Mohawk language has been created for the Haudenosaunee Confederacy to enhance education about toxic substances and empower the community to protect the health of its citizens while practicing traditional subsistence lifeways.
- A booklet on Cherokee wild plant knowledge was created to increase tribal ecological plant knowledge and revitalize the culture; the booklet has been translated into the Cherokee language and serves as a textbook for Cherokee Nation Immersion School students.

Subsistence Foods and Water Resources

AI/AN communities place an emphasis on following traditional diets, many of which include an abundance of fish and seafood. In addition, water is sacred and plays an important role in tribal cultural and spiritual practices. Several STAR grants focused on reducing health effects associated with consumption of contaminated traditional subsistence foods. These research projects have resulted in the following outcomes:

- Fish advisory maps for inland lakes in the Great Lakes region have been created to allow tribal citizens to pursue their traditional subsistence fishing practices while reducing their risk of mercury exposure.
- Personal participation geographic information system maps have been developed for tribes residing near the Klamath River Basin (California) that provide information about historic and contemporary contaminant information, raising awareness of potential exposures.
- The Swinomish Indian Tribal Community issued voluntary consumption limits for shellfish to reduce its citizens' exposures to toxic chemicals.
- The Makah Nation used STAR data to support its claim that its citizens had significantly higher contaminant exposures from locally caught fish than had been previously determined via contaminant-exposure models.
- Researchers are developing an inexpensive, easy-to-use technology from an indigenous material to remove contaminants from groundwater used by residents of the Pine Ridge Indian Reservation in South Dakota.

Community-Based Participatory Research and Community Outreach and Education

Indigenous populations have experienced historical trauma as a result of past unethical research imposed on them. Utilizing community-based participatory approaches in tribal research is crucial to ensure that researchers partner with AI/AN people in planning and implementing needed research. Community-based participatory research, education and outreach continue as longstanding, important components of STAR grants and fellowships funded under the Tribal Environmental Health Research Program. Most of the grants use community outreach and tribal consultations to obtain input that guides the research projects. Tribal citizens learn about the results of the grants through community presentations, training and workshops, books, DVDs, maps, radio interviews and other means. Some outcomes of this research are:

- Researchers actively engaged the Yurok Tribal Council and community in their data-gathering process,

which allowed the scientists to identify community perceptions about the quality and abundance of the tribe's important resources and their relationship to community health.

- Crow Nation tribal elders described previous water quality conditions of the Little Big Horn River, providing the researchers with valuable information that drove their research project, which was focused on developing risk assessment methodology for multimedia exposure to contaminants in water and wastewater.

- Presentations made to the Anishinaabe tribal citizens, including children, increased awareness about fish advisory maps that could be used to reduce their exposure to mercury from consuming subsistence fish.

- Researchers used teacher training and in-class workshops to teach environmental risk and cultural practices to teachers and students at a tribal school. These workshops were completed entirely in the Mohawk language using oral tradition and hands-on participatory response techniques to share meaning.

- STAR research resulted in a traditional food book, coloring book and documentary that promote safe Swinomish fish and shellfish consumption.

Risk Assessment and Sensitive Populations

Tribal citizens experience unique risks because of their traditional lifestyles and use of natural resources. As a result, risk assessments and exposure scenarios must be tailored to the distinct needs of each AI/AN community. Several notable outcomes of the research efforts that have focused on risk assessment and tribal populations include:

- A *Traditional Tribal Subsistence Exposure Scenario and Risk Assessment Guidance Manual* was published to help each tribe to identify its specific exposure risks.

- Researchers developed specific fish consumption guidelines for high-risk and sensitive populations in Great Lakes tribal communities to decrease mercury exposure in these populations.

- A Swinomish Traditional Cultural Lifeways Exposure Scenario was developed to decrease toxic chemical exposure in tribal citizens who pursue traditional lifeways. Subsequent research has identified a set of environmental public health indicators for additional tribes in the Pacific Northwest.

Impacts on Regulations and Management Plans

State and tribal officials have incorporated results from STAR grants and fellowships to refine their regulations and management plans. For example:

- The states of Washington and Oregon are using STAR data to reexamine and revise their state water quality standards. These revisions offer greater protection of tribal populations whose cultural practices and traditional lifeways could result in greater exposures to contaminants in water resources.

- To protect its citizens from exposure to toxic chemicals, the Makah Nation implemented more protective water quality standards than those issued by the state of Washington as a result of data produced by a STAR fellowship.

- The Cherokee Nation used the results of another STAR fellowship to design its Tribal Integrated Resource Management Plan, which provides guidance for Cherokee land and resource planning and management.

- Other STAR research has resulted in the development of tribal aquatic water quality monitoring plans for a number of tribes. These stricter standards and plans protect the resources that are important to the tribes' cultural and spiritual practices.

Where Will the Tribal Environmental Health Research Program Go From Here?

Future STAR tribal research will explore new strategies, methods and tools to assess environmental health exposure among tribal populations. The program also will identify other research opportunities for advancing health protection while maintaining traditional tribal lifeways. The program recently released its latest Request for Applications (RFA), "Science for Sustainable and Healthy Tribes," in February 2013 (U.S. EPA, 2013a). EPA solicited tribal input regarding current tribal environmental challenges to help determine the RFA's focus. This input initially was gathered from tribal citizens and EPA staff at the National EPA-Tribal Science Council-sponsored 2010 National Tribal Science Forum; members of the National EPA-Tribal Science Council continue to provide input. Also, STAR Graduate Fellowship solicitations now include a topic focused specifically on Native populations. The goal of this category is to protect the environment and these communities, with specific focus on related environmental health, sustainability and pollution prevention/remediation strategies and issues.

As it has done for more than a decade, EPA's Tribal Environmental Health Research Program will continue to engage and collaborate with AI/AN communities and partners to support them in maintaining their long-standing, intricate relationships with the natural environment even in the face of the myriad stressors threatening their health, wellness and lifeways. ●

Introduction/Background

Many traditional American Indian and Alaska Native (AI/AN) populations maintain intricate and ecologically interdependent relationships with the natural environment, as they have for millennia. To restore and protect the health and knowledge base of their communities, tribal nations encourage traditional diets, religious practices, customs and language use. This emphasis on traditional, healthy lifeways for AI/AN communities requires that the unique health and environmental impacts of pollution, dietary exposure, cumulative risk and climate change be identified to reduce tribal health risks (U.S. EPA, 2012e).

The relationships between tribal citizens and their environments are being affected adversely by a variety of stressors. Industrial chemical pollution, climate change, the availability of processed foods, and social and political isolation threaten the health, wellness and lifeways of AI/AN communities. Contaminated sites, pesticide drift, bioaccumulation and rights of access issues have an effect on exposures from subsistence lifestyles and diets (U.S. EPA, 2012e).

The U.S. Environmental Protection Agency (EPA) and its tribal partners recognized that AI/AN populations have distinct research needs as a result of their unique relationship with the natural environment. To address these needs, the Agency directed the Office of Research and Development's (ORD) National Center for Environmental Research (NCER) to establish its Tribal Environmental Health Research Program. In 2010, the EPA Administrator made strengthening tribal partnerships one of the Agency's seven priorities, demonstrating EPA's commitment to support and, when possible, bolster tribal capacity (U.S. EPA, 2010a). To underscore this commitment, the *FY 2011–2015 EPA Strategic Plan* includes strengthening of tribal partnerships as a cross-cutting fundamental strategy for EPA (U.S. EPA, 2010b).

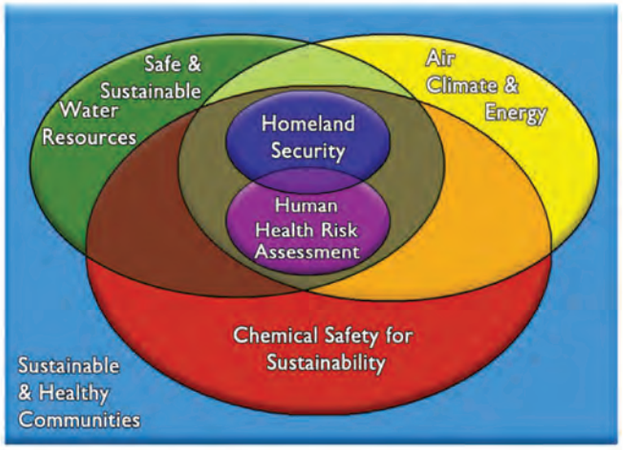
To meet the specific needs of the tribes, EPA supports research that focuses on assessment and reduction of risk in susceptible populations. Tribal populations may be at increased risk for environmentally induced diseases as a result of unique lifestyle practices, community activities, occupations and customs, and/or environmental releases that significantly affect tribal lands. EPA's Tribal Environmental Health Research Program has supported studies to better understand the health effects of environmental contaminants on tribal populations. Through the Agency's Science To Achieve Results (STAR) grants program, NCER has expanded its Tribal Environmental Health Research Program from a single grant in 2000 focused on environmental justice in tribal communities to include nine additional STAR grants that explore tribal environmental risks, particularly cumulative chemical exposure and how global climate change may affect AI/AN populations (U.S. EPA, 2012e). These grants were funded under three Requests for Applications (RFAs) for a total of approximately $6 million (U.S. EPA, 2012c). A summary of the goals and objectives of the research projects organized by RFA is included in Appendix A, and a list of outputs of these grants, including publications and presentations, is provided in Appendix B. Past STAR tribal environmental health research has focused on identifying and quantifying cumulative risk, determining the impacts of climate change on tribal populations, and identifying dietary exposure risks of traditional subsistence diets (U.S. EPA, 2012c, 2012e).

Relationships between tribal citizens and their environments are being affected negatively by a variety of stressors.

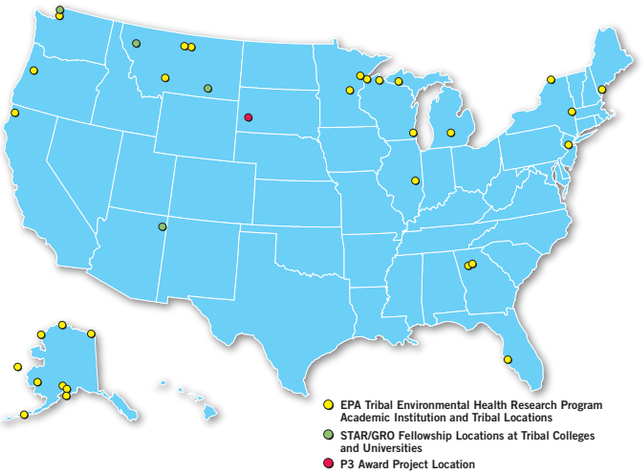
EPA also funds fellowships for undergraduate (Greater Research Opportunities Undergraduate Fellowships) and graduate (STAR Fellowships) students investigating tribal environmental health. In addition, several P3 grants, which provide funding to undergraduate and graduate students to design solutions for a sustainable future, have been focused on tribal projects. The majority of the STAR grant and fellowship research funded by the Tribal Environmental Health Research Program is being or has been carried out at tribal colleges and universities. These schools include Fort Belknap College, Haskell Indian Nations University, Salish Kootenai College, Northwest Indian College, Diné College and Little Big Horn College. Other opportunities for early-career development for tribal citizens include postgraduate fellowships coordinated by NCER (e.g., American Association for the Advancement of Science Science and Engineering Fellows Program, Association of Schools of Public Health Fellows Program, EPA Marshall Scholarship Program). More information about these fellowships may be found via the links in Appendix G.

The Tribal Environmental Health Research Program broadly aligns with EPA's Air, Climate and Energy Research Program by addressing climate change as well as indoor air related research, while specifically addressing impacts on AI/AN communities (U.S. EPA, 2012a). This research synergizes with one of the National EPA-Tribal Science Council's National Tribal Science Priorities announced in 2011, which is devoted to climate change. Also, NCER developed a category beginning in 2011 for its STAR Graduate Fellowship solicitations that is focused on "tribes and American Indian/Alaska Native/Pacific Islander communities" (U.S. EPA, 2012b, 2012g, 2012h). The focus is on investigations that protect the environment and these communities, with specific emphasis on related environmental health, sustainability and pollution prevention/remediation strategies and issues. For example, projects within this category could assess the impacts of environmental challenges on these populations or explore how traditional lifeways may be connected to unique risk and exposure pathways. Other projects could explore sustainability through tribes' traditional or local ecological knowledge or expand the understanding of cumulative risk in Native communities (U.S. EPA, 2012b, 2012g, 2012h).

The STAR tribal program also supports EPA's Sustainable and Healthy Communities Research Program. The STAR tribal program supports EPA's mission under the Sustainable and Healthy Communities Research Program. The newly released Tribal Environmental Health Research Program solicitation, "Science for Sustainable and Healthy Tribes," specifically supports this theme by focusing on improving understanding of tribal exposures and health impacts. The Sustainable and Healthy Communities Research Program research action plans and projects are available at http:// www.epa.gov/ord/research-programs.htm. The relationships among EPA's six integrated research programs are highlighted in the accompanying figure.



EPA's Six Integrated Research Programs. *EPA's six research programs emphasize coordination and integration. The Sustainable and Healthy Communities program integrates research across the environmental spectrum. Air, climate, water and chemical research all inform the Agency's risk assessment and homeland security research efforts.*



Locations of EPA Tribal-Related Research Highlighted in This Document. *Although the NCER grants and fellowships program is a national program, only a relatively small number of projects have been funded as a result of the competitive process driven by identified research gaps. There may be additional tribal project locations that are not identified in this report because they were recently awarded and have not generated outcomes or are funded by other EPA programs or federal agencies.*

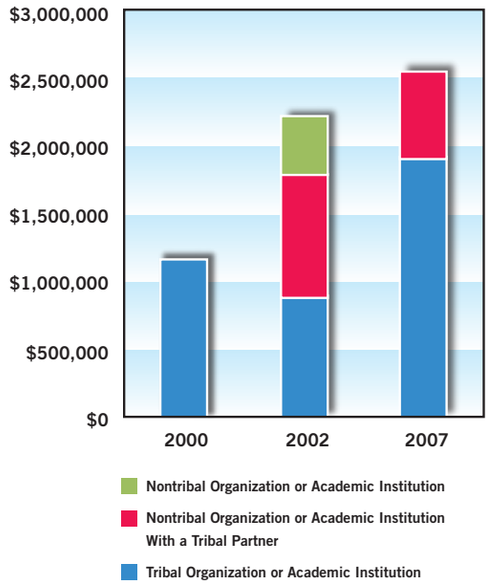
Recognizing the importance of this research program and the need to communicate its results, NCER staff members made several presentations to EPA and external partners/stakeholders (Breville, 2011; McOliver, 2013b). More information about these presentations can be found in Appendix C. NCER also has established a website devoted to tribal environmental health issues (http://www.epa.gov/ncer/tribalresearch) to disseminate the results of the tribal research and communicate with AI/AN stakeholders. The Tribal Environmental Health Research Program conducted a webinar series in 2009 in partnership with the National EPA-Tribal Science Council and a second series in 2012. The presentations can be found at http://www.epa.gov/ncer/tribalresearch/recipients.html and http://www.epa.gov/ncer/tribalresearch/multimedia/index.html.

The webinars were designed to translate and disseminate recent findings of STAR-funded research addressing the

environmental health and exposure concerns of AI/AN subsistence populations. The series highlighted research goals and preliminary findings of projects focused on cumulative risk and climate change. The webinars featured tribal communities and their research partners who are conducting research on dietary exposure, cumulative risk, climate change health effects and risk reduction. This research aimed to quantify and reduce environmental risks and encourage or restore traditional, healthy lifeways for AI/AN communities (U.S. EPA, 2012e). More information about these webinars is available in Appendix D.

Based on the attendance at and response to webinars sponsored by EPA to communicate the outcomes and accomplishments of STAR research across the Agency's programs, this form of dissemination is highly important and useful. AI/AN people can attend webinars to obtain information relevant to their communities on a variety of critical topics across broad program areas (e.g., water, air, sustainable communities). Information about webinars and other events can be found at http://epa.gov/ncer/events/.

To ensure that the Agency's grants are responsive to tribal needs, NCER communicates with Agency-sponsored partnership groups, such as EPA's National Tribal Operations Committee[1] and National EPA-Tribal Science Council. The National EPA-Tribal Science Council helps to integrate Agency and tribal interests, specifically with respect to environmental science issues (U.S. EPA, 2012d). NCER has worked with the National Tribal Operations Committee and National EPA-Tribal Science Council to identify tribal research priorities. For example, a session at the National EPA-Tribal Science Council-sponsored 2010 National Tribal Science Forum encouraged the tribes to provide direct input in developing the Tribal Environmental Health Research Program's most recent RFA (Breville, 2011), "Science for Sustainable and Healthy Tribes," which was released in February 2013 (U.S. EPA, 2013a). Following the strategy session, several members of the National EPA-Tribal Science Council continued to provide



Tribal Environmental Health Research Program Funding by Institution. *The amount of STAR funding granted by the Program to tribal and nontribal institutions is presented by RFA. The majority of funding is provided to tribal organizations or institutions with tribal partners.*

substantive input on updated drafts of the RFA, serving as writing team members and reviewers (McOliver, 2013a). EPA sponsored a series of informational webinars in March, May and June of 2013 to disseminate information about the RFA. The purpose of the webinars was to describe the major research elements of the RFA; review any administrative, electronic filing, eligibility and peer review concerns; and share answers to frequently asked questions about the RFA and application process (U.S. EPA, 2013a, 2013b).

Because research projects funded by the Tribal Environmental Health Research Program resulted in important and beneficial outcomes, EPA leadership recognized the need to publicize them to benefit as many AI/AN communities as possible. This synthesis report, which highlights the outputs and outcomes of this research, is one of the results. This document focuses on tribal-related research funded by EPA, including STAR grants and fellowships. It does not describe any of the tribal research sponsored by other EPA offices, such as the Tribal ecoAmbassadors Program[2], or programs such as the Indian General Assistance Program[3]. The synthesis report describes outcomes for past NCER tribal environmental research and discusses future directions and initiatives while recognizing that each AI/AN community is unique and not all research issues nor results apply to all communities. The goal is that the lessons learned through the research will result in practical applications that can be used broadly by AI/AN and other communities as well as the general public. This research has been conducted to address complex problems within NCER's scope, and is just part of the wide variety of AI/AN research that supports the protection of human and environmental health being undertaken throughout EPA and other federal agencies. It also is important to note that the research may be more qualitative than quantitative in nature, focusing on public health protection and community-level risks rather than individual risk.

To develop this document, all former STAR grantees who had received funding under the Tribal Environmental Health Research Program were contacted to determine the outcomes and impacts of the research, including those that occurred after the funding period ended.

[1] The National Tribal Operations Committee comprises 19 tribal leaders (the National Tribal Caucus) and EPA's senior leadership, including the Administrator, Deputy Administrator, and Assistant and Regional Administrators (U.S. EPA, 2012f).
[2] Through the Tribal ecoAmbassadors Program, EPA conducts research in partnership with tribal colleges and universities to solve the environmental problems most important to their tribal communities.
[3] The General Assistance Program assists tribes in building capacity to plan and establish environmental protection programs and develop and implement solid and hazardous waste programs in accordance with their individual needs.

The researchers were asked whether their research had been utilized by the Agency; tribal, local, state or federal agencies; and/or other interest groups or stakeholders. Examples of such utilization may include educating tribal populations, developing regulations or management plans, taking actions to mitigate climate change and so forth.

Next, all NCER grantees, fellows and contractors were identified—including those from its STAR, P3 and Small Business Innovation Research programs—who had conducted tribal-related research outside of the Tribal Environmental Health Research Program. This was accomplished through relevant keyword searches of the NCER Research Project Database (U.S. EPA, 2012c) as well as input from NCER staff. These researchers were contacted and asked the same questions to determine whether other EPA-funded research had resulted in outcomes that benefitted tribal communities; before the report was finalized, the Tribal Environmental Health Research Program grantees were contacted again to ensure that the most up-to-date information about outcomes was included in the report. In addition, a bibliometric search was performed to assess how often the publications from tribal-related research funded by EPA were cited by other researchers.

NCER staff members also contacted the project officers for the STAR grants and asked them to identify any additional tribal-related research that may not have been captured in the database search and investigator contacts. Finally, after all of the information was collected, it was analyzed, organized by common themes within research projects, and developed into the synthesis report. The research projects identified in the search and their results/impacts are described by theme in the next section and summarized in Appendix E. Several of the research projects encompassed multiple themes and, therefore, may be described in more than one section. Practical applications of EPA's tribal research can be found in Appendix F, and Appendix G contains a list of additional online resources. ●

Summary of NCER-Funded Tribal Grants and Fellowships Discussed in This Report

Project Title (Grant/Fellowship Number)	Institution(s)	Location(s)	Total Amount of Funding	Identified Theme(s)[1]	Research Area(s)[2]
Tribal Environmental Health Research Program STAR Grants					
* An Epidemiologic Study of Time Trends and Health Effects of Persistent Organic Pollutants, Mercury and Micronutrients (R833705)	Alaska Native Tribal Health Consortium	Yukon-Kuskokwim River Delta, Alaska	$948,121	• Risk Assessment and Sensitive Populations	• Tribal cumulative exposures • Impacts of climate change on cultural and physical health
* Community-Based Risk Assessment of Exposure to Contaminants via Water Sources on the Crow Reservation in Montana (R833706)	Montana State University and University of New England	Crow Reservation (Crow Agency, Montana) and Big Horn County, Montana	$329,532	• Subsistence Foods and Water Resources • Community-Based Participatory Research and Community Outreach and Education	• Tribal cumulative exposures • Subsistence-based risk reduction
Impacts of Climate Change on Health Benefits of a Tribal Alaskan Resource: Integrating Traditional Ecological Knowledge with Risk Assessment Through Local Monitoring (R833707)	University of Illinois at Urbana-Champaign	Akutan, Point Hope and Seldovia, Alaska	$300,000	• Cultural Practices, Language and Traditional Ecological Knowledge • Subsistence Foods and Water Resources • Community-Based Participatory Research and Community Outreach and Education	• Impacts of climate change on cultural and physical health • Subsistence-based risk reduction
* Understanding the Cumulative Effects of Environmental and Psycho-Social Stressors that Threaten the Pohlik-lah and Ner-er-ner Lifeway: The Yurok Tribe's Approach (R833708)	Yurok Tribe Environmental Program	Klamath River Basin, California	$974,389	• Subsistence Foods and Water Resources • Community-Based Participatory Research and Community Outreach and Education	• Tribal cumulative exposures • Subsistence-based risk reduction
Environmental Contaminants in Foodstuffs of Siberian Yupiks from St. Lawrence Island, Alaska (R831043)	Alaska Community Action on Toxics	St. Lawrence Island, Gambell and Savoonga, Alaska	$449,510	• Subsistence Foods and Water Resources • Community-Based Participatory Research and Community Outreach and Education	• Tribal cumulative exposures • Subsistence-based risk reduction
Iakotisa'tstentsera:wis Ne Ohontsia: Reducing Risk by Restoring Relationships (R831044)	Akwesasne Task Force on the Environment and Haudenosaunee Environmental Task Force	Akwesasne Freedom School (Hogansburg, New York)	$450,000	• Cultural Practices, Language and Traditional Ecological Knowledge • Community-Based Participatory Research and Community Outreach and Education	• Language preservation and education • Subsistence-based risk reduction

* These grants still are active at the time of publication.
[1] These themes were identified after analyzing all of the information provided by the grantees and fellows; this synthesis report is organized by these themes.
[2] These research areas are based on the RFA needs that the projects addressed as well as relevant keywords assigned to the projects.

Project Title (Grant/Fellowship Number)	Institution(s)	Location(s)	Total Amount of Funding	Identified Theme(s)[1]	Research Area(s)[2]
Risks to Northern Alaskan Iñupiat: Assessing Potential Effects of Oil Contamination on Subsistence Lifestyles, Health and Nutrition (R831045)	Mote Marine Laboratory	Kaktovik, Barrow and Wainwright, Alaska	$437,399	• Community-Based Participatory Research and Community Outreach and Education	• Subsistence-based exposure quantification • Subsistence-based risk reduction
Lifestyle and Cultural Practices of Tribal Populations and Risks From Toxic Substances in the Environment (R831046)	Oregon State University	National Scope	$449,970	• Community-Based Participatory Research and Community Outreach and Education • Risk Assessment and Sensitive Populations	• Risk assessment and exposure scenarios • Culturally sensitive education and guidance
Reducing Risks of the Anishinaabe From Methyl Mercury (R831047)	Great Lakes Indian Fish and Wildlife Commission	Michigan, Minnesota and Wisconsin	$445,830	• Cultural Practices, Language and Traditional Ecological Knowledge • Subsistence Food and Water Resources • Community-Based Participatory Research and Community Outreach and Education • Risk Assessment and Sensitive Populations	• Subsistence-based exposure quantification • Subsistence-based risk reduction
Bioaccumulative Toxics in Native American Shellfish (R829476)	Swinomish Tribal Community	Padilla, Fidalgo and Skagit Bays (state of Washington)	$1,170,389	• Subsistence Foods and Water Resources • Community-Based Participatory Research and Community Outreach and Education • Risk Assessment and Sensitive Populations • Impacts on Regulations and Management Plans	• Researcher/tribal community partnership • Community-based, culturally sensitive education
NCER Grants and Fellowships Awarded Outside of the Tribal Environmental Health Research Program					
Tribal Environmental Public Health Indicators (R834791)	Swinomish Tribal Community	Puget Sound, Washington	$235,517	• Risk Assessment and Sensitive Populations	• Tribal-specific health indicators • Tribal community health
Midwest Hazardous Substance Research Center (R828770)	Kansas State University (in partnership with Haskell Indian Nations University)	Tribal communities throughout the Midwest	$501,000	• Community-Based Participatory Research and Community Outreach and Education	• Hazardous exposure reduction • Community-based, culturally sensitive education
Space-Time Aquatic Resources Modeling and Analysis Program (R829095)	Colorado State University	National via available Internet resources	$2,998,331	• Community-Based Participatory Research and Community Outreach and Education • Impacts on Regulations and Management Plans	• Learning materials development • Tribal aquatic water quality monitoring plan development
Rocky Mountain Training and Technical Assistance to Brownfields Communities Program (TR831579) (STAR Training Grant)	Colorado State University and Montana Tech of the University of Montana (in partnership with Aaniih Nakoda College [formerly Fort Belknap College])	Montana, North Dakota, Colorado and Missouri	$180,000	• Community-Based Participatory Research and Community Outreach and Education	• Hazardous exposure reduction • Community-based, culturally sensitive education
Linking Traditional Knowledge and Environmental Policy in the Cherokee Nation of Oklahoma (F5C30541) (STAR Graduate Fellowship)	University of California, Berkeley	Cherokee Nation of Oklahoma (Tahlequah, Oklahoma)	$106,722	• Cultural Practices, Language and Traditional Ecological Knowledge • Impacts on Regulations and Management Plans	• Cultural revitalization and resource sustainability • Community-based, culturally sensitive education
Dine Bikeyah: Environment, Cultural Identity and Gender in Navajo Country (U915164) (STAR Graduate Fellowship)	University of Wisconsin–Madison	Kayenta, Arizona, and Kirtland, New Mexico	$102,000	• Community-Based Participatory Research and Community Outreach and Education	• Tribal cultural and environmental historical perspectives
Makah Traditional Environmental Knowledge and Gray Whale Conservation (U914970) (STAR Graduate Fellowship)	University of Washington	Neah Bay (state of Washington)	$102,000	• Subsistence Foods and Water Resources • Impacts on Regulations and Management Plans	• Tribal cumulative exposures • Subsistence-based risk reduction
Use of Bone Char for the Removal of Arsenic and Uranium from Groundwater at the Pine Ridge Reservation (SU834713 and SU835069) (P3 Grant)	University of Illinois at Urbana-Champaign (in partnership with Oglala Lakota College)	Pine Ridge Indian Reservation (Pine Ridge, South Dakota)	Phase 1: $10,000 Phase 2: $75,000	• Subsistence Foods and Water Resources • Community-Based Participatory Research and Community Outreach and Education	• Subsistence-based risk reduction • Inexpensive technology development

* These grants still are active at the time of publication.

[1] These themes were identified after analyzing all of the information provided by the grantees and fellows; this synthesis report is organized by these themes.

[2] These research areas are based on the RFA needs that the projects addressed as well as relevant keywords assigned to the projects.

Results of the Tribal Research Funded by EPA

The tribal environmental research funded by EPA for more than a decade has resulted in myriad outcomes and outputs, including but not limited to:

- methods to reduce environmental and social impacts on tribes,
- standards and regulations that offer greater protection to tribal communities,
- advisories that reduce exposure associated with traditional subsistence lifeways,
- tribal education and outreach, and
- peer-reviewed publications.

This section provides greater detail about the five overarching themes that have emerged from the tribal research conducted under the program:

- *Cultural practices, language and traditional ecological knowledge* are of great significance to tribes, and many of the tribal grants funded by EPA reflect their importance.
- AI/AN populations still rely heavily on traditional *subsistence foods and water resources,* considering water a sacred resource to be revered and protected.
- Because the tribes are involved with the *community-based participatory research and community outreach and education* that EPA researchers conduct, they are invested in the research and outcomes and benefit from them.
- Many EPA tribal researchers focus on *risk assessment and sensitive populations.*
- A number of tribal research projects have had beneficial *impacts on regulations and management plans.*

It is important that AI/AN communities, the larger public, researchers, health departments, practitioners, state and local regulators, and other stakeholders understand how tribal research conducted within the STAR Tribal Environmental Health Research Program and other EPA initiatives can provide them with practical applications and approaches that may be replicated in their own communities as they confront real-world environmental health issues. These practical applications and methods are highlighted in call-out boxes within each theme below, and more detailed information is provided in Appendix F.

STAR-funded research is addressing environmental concerns of American Indian and Alaska Native communities so that their members can continue their cultural practices with reduced health risks.

Cultural Practices, Language and Traditional Ecological Knowledge

Each AI/AN community has its own unique set of cultural practices, language and traditional ecological knowledge. STAR-funded research strives to support citizens of these communities as they continue their cultural practices with reduced health risks. For example, as a result of the grant, "Reducing Risks of the Anishinaabe From Methyl Mercury," there is greater awareness of fish advisory maps that help to protect the health of tribal citizens residing in Michigan, Minnesota and Wisconsin. These maps allow them to continue their traditional consumption of subsistence fish by harvesting in less-contaminated waters (DeWeese et al., 2007; Kmiecik and Foran, 2007; Madsen et al., 2007). Additional details about this project are described under the theme of "Subsistence Foods and Water Resources."

Anishinaabe Fishermen Harvesting Walleye Using Spears. *Fish advisory maps developed with STAR funding allow the fishermen to practice traditional lifeways with reduced risk of mercury exposure.*

STAR-funded research also helps to strengthen native language skills and increase culturally relevant communication of traditional ecological knowledge. For example, the researchers of a STAR grant, "*Iakotisa'tstentsera:wis Ne Ohontsia*: Reducing Risk by Restoring Relationships," focused on teaching environmental risk of cultural practices to teachers and students at the Akwesasne Freedom School in upstate New York. During the 3-year project, more than 100 tribal citizens learned about toxic substances while also learning the Mohawk language and skills associated with traditional cultural practices. Workshops were completed entirely in the Mohawk language using oral tradition and hands-on participatory response techniques to share meaning. A library of resources has been created, including posters, books, pictures and charts written in the Mohawk language, which will be shared with other immersion schools and educational programs throughout the Haudenosaunee Confederacy. Through this effort, the community understands risk issues and can take action to protect tribal citizens' health while engaging in traditional subsistence practices (Arquette et al., 2008).

Traditional ecological knowledge of Alaska Native people has long considered wild indigenous berries a health-promoting, life-sustaining resource. The results of a STAR grant, "Impacts of Climate Change on Health Benefits of a Tribal Alaskan Resource: Integrating Traditional Ecological Knowledge with Risk Assessment Through Local Monitoring," confirmed this traditional ecological knowledge, which held that the berries have

Alaska Natives Picking Wild Indigenous Berries.

medicinal properties. The research was carried out with the communities of Akutan, Point Hope and Seldovia, Alaska. The wild berries also were confirmed to play a key role in community wellness beyond nutrition because of the social and outdoor activities associated with harvesting. These benefits, however, are potentially threatened by uncertain impacts from contamination, climate change, and sociocultural and behavioral changes that shift focus away from locally available foods. Research findings are informing community wellness planning by the Alaska Native Tribal Health Consortium and have served as important learning opportunities for community members, particularly youth. The researchers concluded that a strong sense of community and solidarity clearly centered on the annual wild berry yields in Alaska Native communities. Scouting, family-centered wildcrafting and harvests, and preparations are highly anticipated events. Community members' perspectives about the impacts of climate change on this tradition varied, and often risks were categorized along with other perceived threats (e.g., pollution) to the subsistence berries. Several public interviews resulted from this work, including those on National Public Radio and in *The Ecologist* (Lila et al., 2012).

Practical Application

- ***Create culturally relevant educational and training materials to help community members understand risks and actions that will promote healthier lives while practicing their traditions.***

A STAR graduate fellowship, "Linking Traditional Knowledge and Environmental Policy in the Cherokee Nation of Oklahoma," summarized information on culturally significant plant communities of the Cherokee Nation in northeastern Oklahoma. This information is being used to target the plant communities for conservation while simultaneously encouraging the sustainable, cultural use of the resources by tribal citizens. Related work on the revitalization of Cherokee ethnobotanical knowledge has been performed. As a result of interviews with tribal elders conducted under the grant, an advisory group to the Natural Resources Department of the Cherokee Nation of Oklahoma has been created. The group, composed of Cherokee elders who are knowledgeable on the subject of Cherokee ethnobotany, will focus on the issue of Cherokee plant knowledge. The group also works with Natural Resources Department staff on Tribal Integrated Resource Management Plan implementation, as well as on larger goals of cultural and environmental protection. One significant product from this collaboration is a booklet on Cherokee wild plant knowledge, *Wild Plants of the Cherokee Nation*, which is intended to serve as an instrument to increase awareness about this subject among tribal citizens and promote cultural revitalization. The entire booklet has been translated into the Cherokee language and is being used as a textbook in the Cherokee Nation Immersion School (Carroll, 2011). ●

Subsistence Foods and Water Resources

Tribes emphasize consumption of traditional diets, many of which include an abundance of fish and seafood. In addition to food supply, water plays an important role in tribal cultural and spiritual practices. Several STAR grants have focused on identifying the environmental and health risks and approaches for reducing health effects associated with consumption of traditional subsistence foods.

The Siberian Yupik people, who live on Saint Lawrence Island, Alaska, in the northern Bering Sea region, follow a traditional lifestyle that relies on a diet of seal, whale, walrus, sea bird eggs, fish, reindeer, berries and local plants. These traditionally harvested foods play a vital role in their health and prosperity, and the ability to maintain this diet and continue to engage in communal harvesting is critical to their physical, cultural, social and economic well-being. The research team for the STAR grant, "Environmental Contaminants in Foodstuffs of Siberian Yupiks from St. Lawrence Island, Alaska," examined these Yupik traditional foods for polychlorinated biphenyls, chlorinated pesticides and heavy metals. The team worked with Yupik hunters and heads of households to collect tissue samples from freshly killed animals and those that had undergone preparation for consumption. The researchers found that rendered oils (e.g., mungtak and blubber) are major dietary sources of polychlorinated biphenyls, because these oils are vital components of the traditional diet and consumed on a regular basis by the St. Lawrence Island Yupik people. Organ meats of certain animals, such as reindeer and walrus, contain levels of mercury that exceed health-based standards, although these organ meats are consumed less frequently. The researchers concluded that proactive policies are essential to the protection of the health of present and future generations of the St. Lawrence Island Yupik. The leaders of the communities emphasized the need to continue collaborative community-based research. The St. Lawrence Island communities will examine methods to reduce exposures while continuing to rely on their traditional subsistence diet (Miller et al., 2010).

Anishinaabe Fisherman Harvesting Walleye Using Nets. *Fish advisory maps help to protect the health of Anishinaabe people who consume mercury-contaminated walleye.*

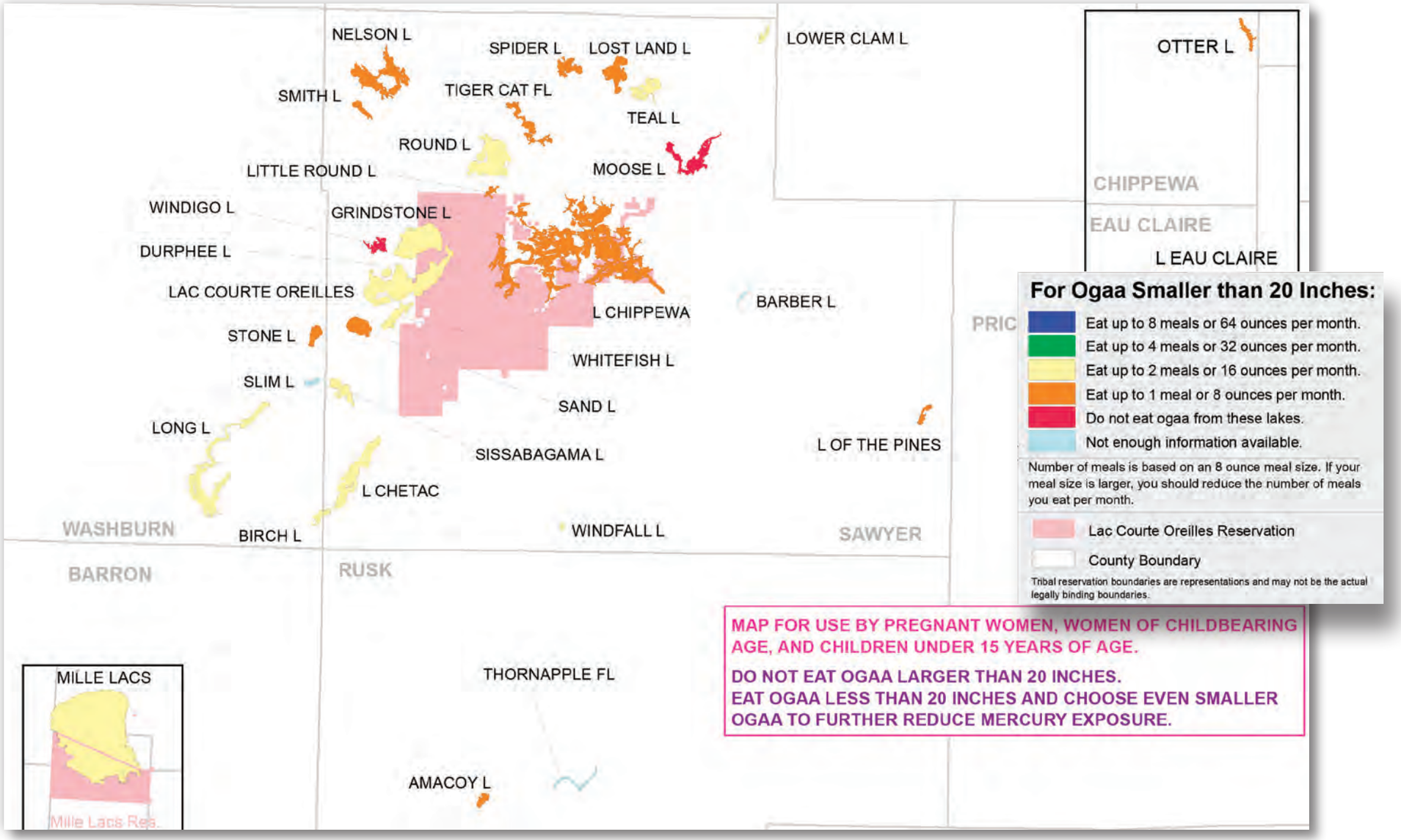
Great Lakes Anishinaabe tribal citizens rely on traditional lifeways, which include the harvesting and consumption of indigenous freshwater fish; this cultural tradition places the tribe at a greater risk for exposure to elevated concentrations of methyl mercury. As a result of the STAR-

The mouth of the Klamath River; the river is an important subsistence resource for the Yurok Tribe.

funded grant, "Reducing Risks of the Anishinaabe From Methyl Mercury," there is greater awareness of the fish advisory maps (see example maps on pages 16 and 17) produced by the Great Lakes Indian Fish and Wildlife Commission. This increased awareness helps to protect the health of Anishinaabe tribal citizens who consume mercury-contaminated walleye. Tribal citizens use the fish advisory maps to reduce their risk of methyl mercury exposure through lake-specific meal consumption advice and information that helps them select lakes for harvest where walleye contain lower mercury concentrations. The data collected under the grant were sufficient to provide consumption advice for 293 of the 449 lakes assessed in the study. Most of these carried a recommendation of no more than four meals per month for the general population, and no more than one meal per month for the sensitive population. A significant increase in preference for smaller walleye occurred among tribal harvesters in Wisconsin, Michigan and Minnesota but not among women of childbearing age. The Great Lakes Indian Fish and Wildlife map-based advisory program did not adversely affect tribal harvest of walleye, which increased from 63,000 to 88,000 less-contaminated fish in the three states following the intervention (DeWeese et al, 2007; Kmiecik and Foran, 2007; Madsen et al., 2007).

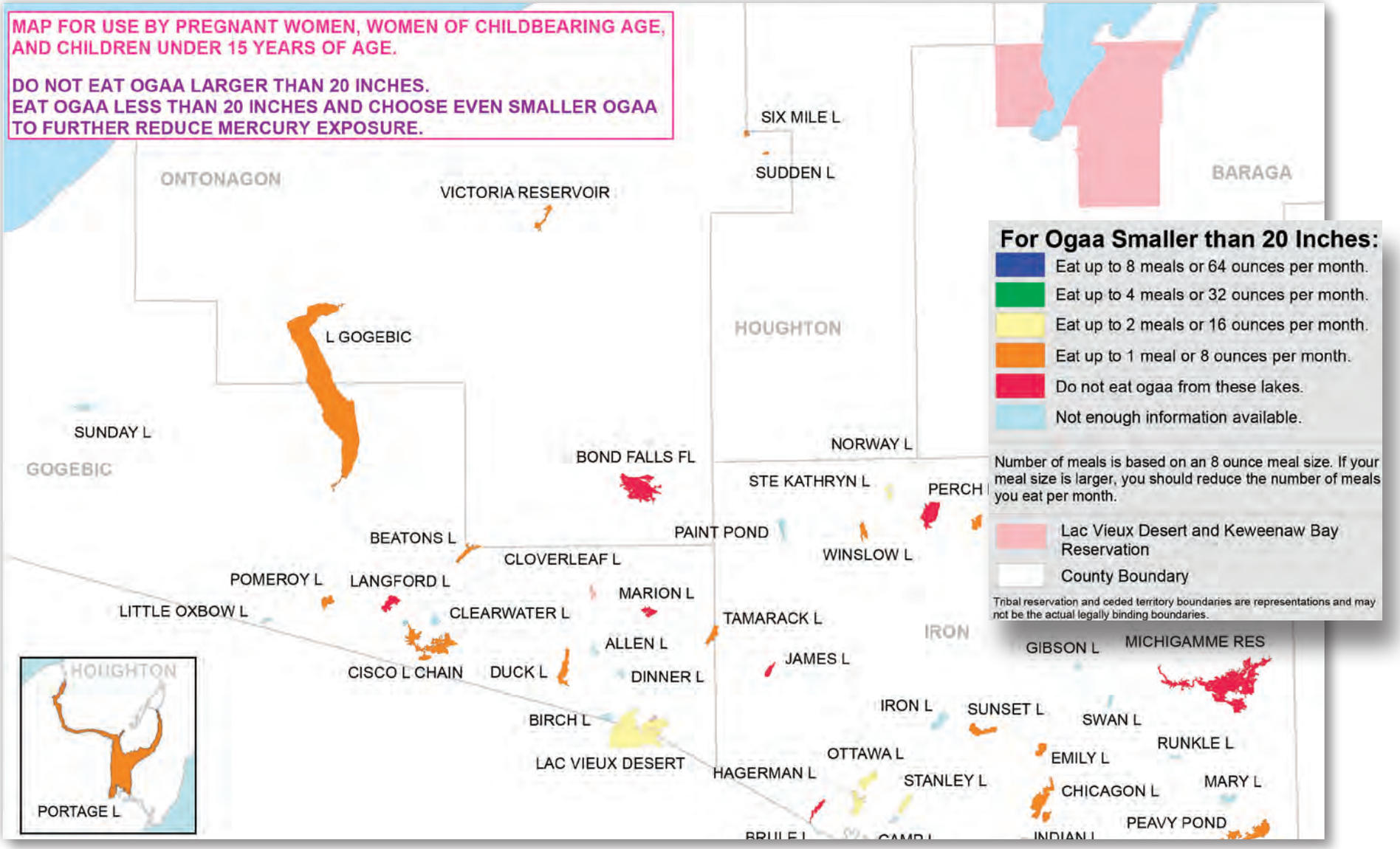
Coastal and river resources are primary and secondary food sources for a majority of Yurok tribal citizens, particularly those residing near or within Yurok ancestral territory in northern California. The researchers involved in the grant, "Understanding the Cumulative Effects of Environmental and Psycho-Social Stressors that Threaten the *Pohlik-lah* and *Ner-er-ner Lifeway*: The Yurok Tribe's Approach," combined ethnography and qualitative data on subsistence resources and practices from previous and current tribal studies with quantitative data on chemical exposures and epidemiological analyses of health data. The goal was to determine how these factors interact to affect the health of various vulnerable populations within the tribe. Using personal (or public) participation geographic information system methods to better incorporate the tribe's local geographic awareness, the researchers were able to develop a series of 12 maps with the Yurok Tribe that provide historic and contemporary contaminant information on the Klamath River Basin in California (Sloan et al., 2011). Although the full impact of the research has not been realized because the project

This map is to help you find safe Ogaa (Walleye) in lakes harvested by Lac Courte Oreilles



This is an example of a fish consumption advisory map developed by the Great Lakes Indian Fish and Wildlife Commission for tribal fishermen in Michigan, Minnesota and Wisconsin.

This map is to help you find safe Ogaa (Walleye) in select Walleye lakes in the Michigan 1842 Ceded Territory



This is another example of a fish consumption advisory map developed by the Great Lakes Indian Fish and Wildlife Commission for tribal fishermen in Michigan, Minnesota and Wisconsin.

is ongoing, these maps will allow the tribal citizens to avoid contaminated areas during harvesting. Another product of the grant was the development of a geographic information system eco-toxicological tool that models and calculates residual contaminants, which allows the tribe to model the amount of contaminants in a specific area. Contaminant queries may be made from disparate data sources and formats, ultimately generating a statistical report on these data. This is useful as pesticide and contaminant data reporting standards and formats change over time and vary among states (Sloan, 2013).

An April 19, 2007, article in the *Seattle Times* reported that Swinomish tribal leaders were advising citizens to restrict their consumption of clams and crabs gathered in and around their reservation after a 4-year study funded by EPA's STAR program, "Bioaccumulative Toxics in Native American Shellfish," found that they contain toxic chemicals. This caused some concern for many tribal citizens, who consume approximately 20 times more shellfish than average Americans. Researchers analyzed Dungeness crabs and two species of clams, including little neck clams, harvested in several sites near the reservation and found traces of toxic chemicals, including polychlorinated biphenyls; various industrial chemicals, including arsenic; and oil and gas derivatives. The tribe issued voluntary limits of up to three meals per week of shellfish from the sampled beaches in the Padilla, Fidalgo and Skagit Bays in the state of Washington. The limits varied depending on the consumer's age. The limits are considered temporary until the tribe can institute a long-term solution. The study found that many tribal citizens already had been decreasing their consumption of shellfish, some because of concern about pollution. One outcome of the study was for the tribe to create its own definition of health to use in the cost-benefit analysis of gauging risk. The social, cultural and spiritual benefits of gathering and eating shellfish could, in some instances, outweigh the risks of contamination (Mapes, 2007).

Stock photograph of little neck clams.

The STAR grant, "Impacts of Climate Change on Health Benefits of a Tribal Alaskan Resource: Integrating Traditional Ecological Knowledge with Risk Assessment Through Local Monitoring," focused on subsistence berries consumed by residents of Alaska Native villages (Akutan, Point Hope and Seldovia, Alaska). The results indicate that the berries studied contain A-type proanthocyanidins, a relatively rare configuration. For commercially available berries, the configuration is found only in cranberries and blueberries. The significance of this unique component in the berries is that the A-type proanthocyanidin has anti-adhesin properties, effectively disabling the bacteria that cause urinary tract infections and dental decay.

The cloudberry (Rubus chamaemorus) *is an important component of Alaska Native subsistence diets.*

Therefore, these berries provide an alternative natural therapy for these microbial diseases (Lila et al., 2012). The proanthocyanidin content in the berries also was found to be highly effective at lowering lipid deposition into adipose tissue, which has implications for prevention of metabolic syndrome. The unique complement of anthocyanins (pigments) in the berries proved to be particularly effective in reducing blood glucose levels *in vivo* in a diabetic mouse model; the consumption of the berries may prove to be an important deterrent to the development of type II diabetes mellitus in adults. The discovery of these properties and the unique components that contribute to them supports the local traditional, medicinal use of the berries (Lila et al., 2012).

The quantitative chemical, mineral and microbial water quality data from the STAR grant, "Community-Based Risk Assessment of Exposure to Contaminants via Water Sources on the Crow Reservation in Montana," revealed

Practical Applications

- ***Utilize community-based research to inform and develop wellness plans that allow communities to consume their traditional foods with less health risks.***
- ***Use data on contaminant levels to help community members protect their health while eating their traditional diets.***

that 55 percent of the wells tested exceed EPA primary standards or health advisories (Ford, 2013). These data were provided recently to the Crow Tribe's Office of Water Resources, which is using the data as a baseline in planning a rural water distribution network for the Crow Reservation and Big Horn County in Montana (Eggers, 2013). The project coordinator and leader continue to meet with tribal elders on the Crow Reservation to discuss the microbial contamination of a spring and a creek on the reservation. The elders supported the submittal of an additional grant proposal to the EPA Environmental Justice Small Grants Program to begin addressing the contamination, and this new grant has been awarded (Eggers, 2013). The researchers also continue to provide data and support to the Apsaalooke Water and Wastewater Authority, which has begun its next phase of water and wastewater infrastructure improvement for the town of Crow Agency, Montana (Eggers, 2013).

The results of a STAR fellowship, "Makah Traditional Environmental Knowledge and Gray Whale Conservation," collected data from Neah Bay in the state of Washington, near the main settlement of the Makah Nation, which indicated that tribal consumption of locally caught fish was significantly higher than the levels used in contaminant exposure models. As the previous water quality standards had been based on these models, they were not as protective as possible. The tribe had been contending that this was true for years, and the STAR data provided the Makah Nation with the evidence that it needed to effectively argue its case and revise the standards to be more protective. These data also were utilized by the tribe to support its request to the International Whaling Commission for an annual subsistence quota of five (nonendangered) gray whales. The tribe also used the data extensively in the revised draft Environmental Impact Statement by the National Marine Fisheries Service on the Makah whaling quota (Sepez, 2011).

Many residents of the Pine Ridge Indian Reservation in southwest South Dakota, home to the Oglala Sioux Tribe (also known as the Oglala Lakota Nation), rely on private wells as their drinking water source. A number of studies revealed that significant levels of arsenic and uranium contaminate the reservation's groundwater (Werth et al., 2010). A P3 grant, "Use of Bone Char for the Removal of Arsenic and Uranium from Groundwater at the Pine Ridge Reservation," focuses on the development of inexpensive, easy-to-use technology based on bone char, an indigenous material, to remove arsenic and uranium from the groundwater used by the residents of the reservation. The researchers tested reservation wells and developed a map that highlights the location of contaminated sources. The team is working with citizens of the reservation and local leaders of the Oglala Lakota College to determine whether the use of bone char filter for water purification is appropriate for the reservation; feedback based on the presentation of a working prototype has been positive (Becraft and Werth, 2012). ●

The P3 team that traveled to the Pine River Reservation to obtain water samples for the EPA-funded project.

A local Pine River Reservation resident works on a pump to provide a house with well water.

Community-Based Participatory Research and Community Outreach and Education

Utilizing community-based participatory research in Tribal Environmental Health Research Program is crucial to ensure that researchers partner with AI/AN people in planning and implementing needed research. As such, community-based participatory research, education and outreach have been and continue to be important components of STAR grants and fellowships funded under the Tribal Environmental Health Research Program. In community-based participatory research, the community is actively involved in every phase of the research project being conducted. The researchers must understand the particular culture of the people with whom they are partnering in research and recognize the sovereignty of their government. For example, the researchers of the EPA grant, "Understanding the Cumulative Effects of Environmental and Psycho-Social Stressors that Threaten the *Pohlik-lah* and *Ner-er-ner Lifeway*: The Yurok Tribe's Approach," developed their research questions by consulting the Yurok Tribal Council and community, which is located in northern California. Phase 2 of their research actively engaged the community in the data-gathering process (Sloan, 2010), presenting about the project at the annual Yurok Tribe Klamath Salmon Festival and annual tribal membership meeting during each year of the project period (Sloan, 2013). Tribal community input via scoping sessions, oral interviews and questionnaires allowed the researchers to identify key resource species. The researchers also ascertained community perceptions about resource quality and abundance, resource conditions across time, and the relationship between resources and community health (Sloan and Fluharty, 2010). The grant allowed the researchers to perform sustained environmental research that addresses community concerns, enabling them to collect valuable data and provide answers about the health of the community's environment and culturally significant and key subsistence species. The community has been grateful for this information, as these long-standing concerns had not been adequately researched or addressed previously (Sloan, 2013). The quantitative data collected and analyzed during the project resulted in the development of a Yurok Community Health Profile, which the researchers shared with the tribe via the Yurok Tribal Environmental Program website. A final version will be printed and distributed with other project materials to the tribe (Sloan et al., 2013).

Because community and traditional communal activities and lifeways are important to the Siberian Yupiks, the research team for one STAR grant, "Environmental Contaminants in Foodstuffs of Siberian Yupiks from St. Lawrence Island, Alaska," conducted a series of meetings with the tribal leadership of the Alaska Native villages of Gambell and Savoonga and with the people in the villages

Crow people "going after water" in the Little Big Horn River, Montana, in the late 1800s. (Photo courtesy Little Big Horn College Archives; original at the Smithsonian Institution)

Practical Applications

- ***Work in strong partnership with communities so that they not only endorse research projects, but are full participants in design/development, translation, and ultimately application of the research findings to improve their health and protect their local environments.***
- ***Communicate and disseminate research to community members and other stakeholders respectfully, creatively and effectively while explaining how they can use the results to protect their health.***

of St. Lawrence Island. At these meetings, the researchers and the communities discussed the implications of the project results, with the awareness that traditional foods are vital to the well-being and culture of the Yupik people. The research team discussed the results in the context of the recognized nutritional and cultural benefits of the traditional diet. The leadership of the St. Lawrence Island communities emphasized the need to continue collaborative community-based research and find methods to reduce exposures while continuing reliance on the traditional diet (Miller et al., 2010).

Elders are respected and revered among AI/AN populations. They carry much of the cultural and traditional ecological knowledge of their tribes and villages and pass their wisdom and knowledge on to the younger generations. Understanding the importance of elders, the researchers involved in the project, "Community-Based Risk Assessment of Exposure to Contaminants via Water Sources on the Crow Reservation in Montana," reached out to Crow tribal elders, who described how the water quality in the Little Big Horn River had deteriorated during the past 50 years. The elders reminded the younger tribal citizens, as well as the researchers, that they do not appreciate water as a precious resource as previous generations did because they no longer must haul it themselves. From the tribal elders, younger generations and academic partners learned about the high respect that the Crow people always have had for water and the importance of protecting this natural resource (Cummins et al., 2010). The tribal elders also helped to guide the research project via their involvement in the Crow Environmental Health Steering Committee (Ford, 2010). To ensure that community outreach and education were successful, the researchers provided Crow Reservation residents comprehensive reports about their water quality, potential health issues and suggested treatments. The researchers provided in-home followup, often in the Crow language, to increase residents' understanding of the research results (Ford, 2010).

The researchers involved with the grant, "Reducing Risks of the Anishinaabe From Methyl Mercury," used community outreach and education to increase awareness of Great Lakes Indian Fish and Wildlife-produced fish advisory maps among the tribal community. Through the grant, researchers explained how to use the maps to tribal leaders, health care providers, fish harvesters, mothers with young children, women of childbearing age, children and elders in Michigan, Minnesota and Wisconsin. These maps help to protect the health of tribal citizens by supporting them in their efforts to reduce consumption of mercury-contaminated walleye. Large fish advisory maps were posted at locations in which spearing and netting permits were issued; maps were distributed to on-reservation health service providers and posted at public locations on the reservation (e.g., tribal administration buildings, grocery stores, libraries, health clinics, natural resources departments, elder centers and community centers). Researchers presented about the maps at various meetings and to children at Boys' and Girls' Club gatherings. The children were provided with maps to take home and encouraged to share them with their families. Postintervention surveys showed that the percentage of survey participants who indicated awareness of the advisory maps significantly increased among fish harvesters in Wisconsin, Michigan and Minnesota and among women of childbearing age in Wisconsin (DeWeese et al., 2007; Kmiecik and Foran, 2007; Madsen et al., 2007). The researchers have continued to update, publish online and distribute the maps and have created additional outreach materials targeted toward the two groups for which the outreach/intervention had been less effective (women of child-bearing age and fish harvesters in Michigan and Minnesota), as identified by the research (Moses, 2013).

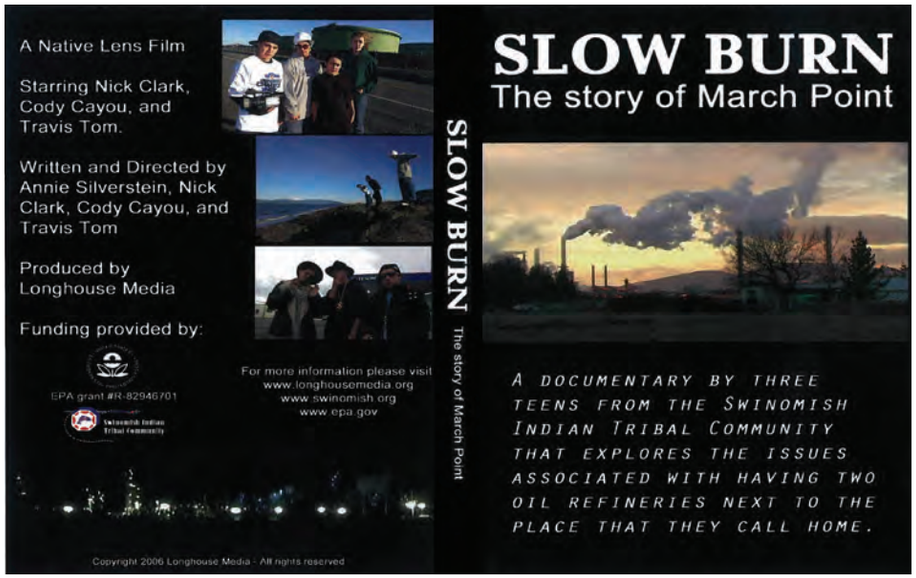
Present-day Crow Nation members and their academic partners obtaining water samples from the Little Big Horn River, Montana.

The approach used for another STAR grant ("*Iakotisa'tstentsera:wis Ne Ohontsia*: Reducing Risk by Restoring Relationships") was to work with teachers at the Akwesasne Freedom School in upstate New York and environmental staff in the Haudenosaunee Confederacy to develop intervention materials and education programs. The project worked to transfer expertise about environmental risk and cultural practices to teachers and students at the Akwesasne Freedom School. This was accomplished through teacher training and in-class workshops in which students were engaged in subsistence practices. During each of the 3 years of the project, 20 professional development days per year were offered to more than 25 teachers, staff members, assistant teachers and environmental research scientists. As a result, more than 100 youth, teachers, teacher assistants and environmental

scientists learned about toxic substances while also learning the Mohawk language and skills associated with traditional cultural practices (Arquette et al., 2008). Workshops were conducted entirely in the Mohawk language using oral tradition and hands-on participatory response techniques to share meaning. A library of resources has been created, including posters, books, pictures and charts written in the Mohawk language, which will be shared with other immersion schools and educational programs throughout the Haudenosaunee Confederacy. Through this effort, community members understand risk issues and can take action to protect their health while engaging in traditional subsistence practices (Arquette et al., 2008).

It is important to foster a positive working relationship—based on trust, credibility and appropriate communication—among researchers and community members. One of the goals of another tribal STAR grant ("Risks to Northern Alaskan Iñupiat: Assessing Potential Effects of Oil Contamination on Subsistence Lifestyles, Health and Nutrition") was to strengthen relationships with Native leaders and communities. The principal investigators worked to develop community ties in various ways, including attending public functions. These efforts have led to recognition of the researchers in the community. The principal investigators made numerous public presentations, met with school children, provided radio interviews and met in small groups with community leaders to present the results of the study. Presentations of the data typically were preceded by discussions with research staff to ensure that scientific information was provided in a culturally relevant and sensitive manner (Wetzel et al., 2008). The researchers presented at a number of town council meetings in Kaktovik, Barrow and Wainwright, Alaska, as well as other towns, to inform the Iñupiat people about the study and the outcomes (Wetzel, 2010).

Community education and outreach have continued beyond the end of the grant, "Impacts of Climate Change on Health Benefits of a Tribal Alaskan Resource: Integrating Traditional Ecological Knowledge With Risk Assessment Through Local Monitoring." The research continues to generate requests from AI/AN groups, with the researchers presenting follow-up workshops on the research in North Dakota and Alaska. Additionally, the project partners in North Dakota and Alaska traveled to North Carolina, where the lead researcher had relocated, to learn how the results of their field biodiscovery of tribal resources would translate to the next level of laboratory investigation and validation. The researchers' training techniques are being used in high school and community college classes at AI/AN institutions in Alaska and North Dakota (Lila, 2013a, 2013b).

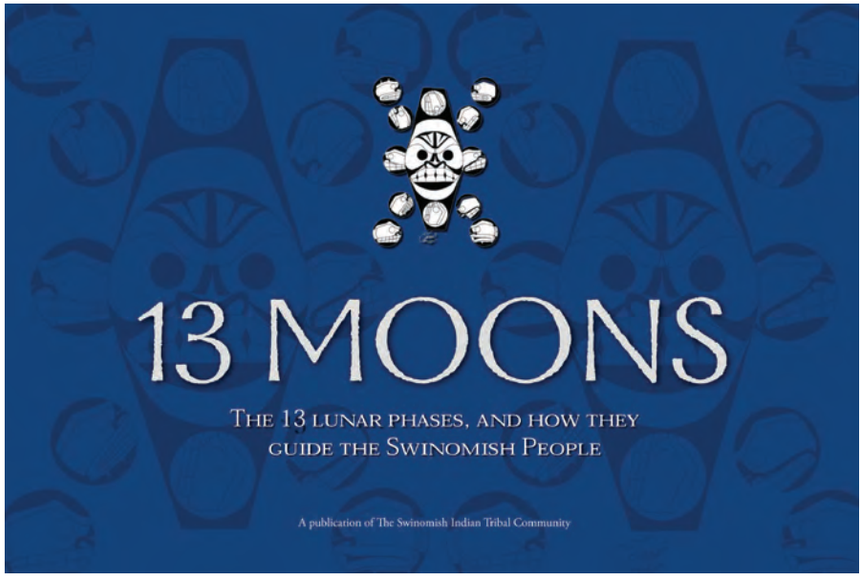


The Swinomish Indian Tribal Community was able to develop this DVD documentary with a STAR grant.

The researchers of the grant, "Lifestyle and Cultural Practices of Tribal Populations and Risks From Toxic Substances in the Environment," sponsored a tribal research symposium in April 2010 that focused on issues addressed in the grant. Participants discussed important matters and perspectives to consider when performing research with tribal communities, including tribal legal issues, research ethics, indigenous and Western science concepts, and integration of sociocultural health indicators in tribal risk research. The symposium featured speakers from several tribes as well as a tribal legal scholar; university researchers, members of the public, public agency staff and others interested in tribal issues attended (Harding, 2013).

The researchers of a Tribal Environmental Health Research Program STAR grant, "Bioaccumulative Toxics in Native American Shellfish," used the research conducted in the state of Washington to publish several outreach and educational pieces about safe Swinomish fish and shellfish consumption, including the Swinomish *13 Moons* traditional food book, Swinomish *13 Moons Coloring Book,* the *Slow Burn* documentary and several posters. Numerous oral presentations were given at independent and EPA-sponsored conferences and symposia to communicate the results of this grant (Donatuto, 2010).

As is the case for STAR grants funded through EPA's Tribal Environmental Health Research Program, education and outreach also are important for other tribally relevant STAR grants and fellowships. A STAR fellowship, "*Dine Bikeyah*: Environment, Cultural Identity and Gender in Navajo Country," resulted in the book, *Dreaming of Sheep in Navajo Country.* The publication has been used in workshops with high school teachers on the reservation, and the author participated in workshops in Navajo communities in Kayenta, Arizona, and Kirtland, New Mexico. These workshops focused on the environmental health of grasslands, grazing issues and oral histories about a



One output of a STAR grant was the 13 Moons[1] *book about how the 13 annual lunar phases guide the Swinomish people in using their natural resources.*

conservation program in the 1930s known colloquially as "livestock reduction" (Weisiger, 2011). The award-winning book provides an important historical perspective about Navajo pastoralism, allowing tribal citizens and other readers to understand the environmental history of the reservation and policies that led to current conditions.

The researchers of a STAR training grant, "Rocky Mountain Training and Technical Assistance to Brownfields Communities Program," found that outreach is more effective when it is partnered with education. The researchers provided one-on-one training and outreach to neighborhoods, tribes and tribal communities in Montana, North Dakota, Colorado and Missouri. The training was developed based on tribal needs and focused on topics that the tribes identified as useful, such as education about hazardous materials and how to write Environmental Impact Statements. Approximately 25 culturally sensitive courses were developed with Fort Belknap College (now known as Aaniiih Nakoda College) faculty members and consultants. The courses addressed specific Brownfields issues and innovative environmental technologies that could be used to remediate these sites. They were offered as full-credit courses for community members; continuing-education credits also could be earned for professional development (Burgher, 2011).

Education and outreach were particularly important for two tribal-relevant projects conducted by the STAR-funded Midwest Hazardous Substance Research Center. The center's Technical Outreach Services for Communities and Technical Outreach Services for Native American Communities programs used university educational and technical resources to help community groups throughout the Midwest understand the technical issues and impacts of hazardous waste sites. The two outreach programs empowered the communities to participate substantively in the decision-making process regarding their hazardous substance problems, including environmental assessment and clean-up needs. The projects provided a link between the community and the university, serving the needs of environmental justice communities. These outreach programs provided technical assistance, such as reviewing and explaining technical reports and offering information and training, to AI/AN communities (Banks et al., 2007).

The Technical Outreach Services for Native American Communities program was national in scope and coordinated primarily through the Haskell Environmental Research Studies Center at Haskell Indian Nations University. Services included first contact, needs assessment, initial support and long-term technical support arrangements by regional Technical Outreach Services for Communities programs and other resources as necessary (Banks et al., 2007). The researchers conducted a number of outreach activities over many years. The most significant outcome of this work is the increased level and capacity for community involvement at Superfund and other environmental issue sites. Training materials and various models for successful community involvement that address tribal risk (subsistence and cultural lifestyle exposures), technical clean-up issues, and environmental justice dynamics at clean-up sites were developed (Leven, 2011). The Center provided support to 24 AI/AN communities in 13 states (Center for Hazardous Substance Research, 2009).

Another STAR-funded center with tribal education and outreach as one of its goals, "Space-Time Aquatic Resources Modeling and Analysis Program," developed and tested learning materials related to environmental sampling that were made available on the Internet. A variety of people, including those associated with tribes, indicated an interest in using these materials. Direct contact, education, outreach and support were offered to the tribes as a result of this project (Urquhart, 2011).

In addition to focusing on the development of water-purification technology, a P3 grant, "Use of Bone Char for the Removal of Arsenic and Uranium from Groundwater at the Pine Ridge Reservation," also aims to educate the residents of the Pine Ridge Indian Reservation in southwest South Dakota about the importance of water quality. The researchers are developing a 2- to 4-minute video about the project to be used in conjunction with a water quality educational outreach effort for children. The researchers also are creating an educational handout that includes water quality education materials for the residents of the reservation (Becraft and Werth, 2012). ●

[1] This book is in its second printing. EPA does not endorse or promote any product, but if you would like more information, please contact Todd Mitchell, Swinomish Water Resources Coordinator, at tmitchell@swinomish.nsn.us, 11430 Moorage Way, La Conner, WA 98257.

Risk Assessment and Sensitive Populations

Some tribal citizens have unique risks as a result of their traditional lifestyles and extensive reliance on natural resources. As a result, risk assessments and exposure scenarios must be tailored to the tribes' distinct needs. The *Traditional Tribal Subsistence Exposure Scenario and Risk Assessment Guidance Manual*, based on the major ecological zones across the mainland United States, was published as a result of a Tribal Environmental Health Research Program STAR grant, "Lifestyles and Cultural Practices of Tribal Populations and Risks From Toxic Substances in the Environment." The researchers' goal was to develop regional traditional tribal subsistence multipathway exposure scenarios based on eco-cultural zone delineations and descriptions, major exposure factors, regional food patterns and unique exposure pathways. The manual can be used by the tribes to modify, refine and adapt the regional scenarios for their site-specific and/or individual tribal situations. It is particularly useful to assist the tribes in compliance with the Comprehensive Environmental Response, Compensation and Liability Act, which includes a risk-based process. To comply, the tribes have been requesting risk tools that reflect their activity patterns and potential exposures. If a tribal scenario is not available early in the compliance process, the results may not be protective of tribal uses. This research resulted in model regional tribal exposure scenarios that are formatted for standard Comprehensive Environmental Response, Compensation and Liability Act risk assessments, which can be progressively modified as site-specific information becomes available (Harper et al., 2007). The researchers have received many requests for the *Traditional Tribal Subsistence Exposure Scenario and Risk Assessment Guidance Manual* from EPA staff, consultants in the private sector, academics, graduate students and others working on tribal issues (Harding, 2013).

Under the grant, "Reducing Risks of the Anishinaabe From Methyl Mercury," researchers explained to those considered to have increased risk from exposure to mercury—mothers with young children, women of childbearing age, children and elders—who consume mercury-contaminated walleye in Michigan, Minnesota and Wisconsin how to use Great Lakes Indian Fish and Wildlife fish advisory maps to reduce their risk. The data collected under the grant were used to recommend that no more than one walleye meal per month from the affected lakes be consumed by these people. To reduce risk in children, the researchers presented fish advisory information at Boys' and Girls' Club gatherings. The children were provided with maps to take home and encouraged to share them with their families (DeWeese et al, 2007; Kmiecik and Foran, 2007; Madsen et al., 2007). For more information about how data

Practical Applications

- ***Use methods that better assess the exposure risk of sensitive populations to help these individuals avoid or reduce exposures and protect their health.***
- ***Develop environmental public health indicators that reflect the community's heath views and priorities to assess and improve the health status of its members.***

Jim Gibson, Swinomish shellfish biologist, provides an offering and asks for abundant harvests and protection from harm during the upcoming fishing seasons in a ceremony called the Blessing of the Fleet. Also known as the First Salmon Ceremony, the ceremony is enacted by many Pacific Northwest tribes.

generated through this grant were used to develop the cumulative risk scenarios and fish advisory maps, please see the section entitled, *Subsistence Foods and Water Resources*.

Risk assessment was an important component of another Tribal Environmental Health Research Program STAR grant, "Bioaccumulative Toxics in Native American Shellfish." The researchers partnered with Oregon State University to develop a Swinomish Traditional Cultural Lifeways Exposure Scenario and perform passive air monitoring of polycyclic aromatic hydrocarbons, one of the suite of chemicals identified as potentially hazardous in the STAR research. A partnership with Seattle University was used to explore the issues of treaty rights and fish consumption (Donatuto, 2010). For more information about how data from this grant were used to develop the exposure scenario, please see the section entitled, *Subsistence Foods and Water Resources*. Although the grant has been completed, the researchers have continued the work initiated in the original STAR grant by partnering with the Puget Sound Partnership and representatives from the Lower Elwha Tribe, the Suquamish Tribe and the Port Gamble S'Klallam Tribe to develop tribal-specific health indicators for the Salish Sea. This research is being carried out under a new STAR grant, "Tribal Environmental Public Health Indicators." During the first year of the project, the researchers were able to establish a set of environmental public health indicators for Coast Salish communities near Puget Sound, Washington, that reflect how the communities view and prioritize health. These "Indigenous Health Indicators" include six key health indicators, each with three components:

- Resources security (abundance, access and sharing).
- Community connection (cooperation, participation/ roles and familiarity.
- Ceremonial use (gatherings/ceremonies, giving thanks and feeding the Spirit).
- Education (elders, youth and the Teachings).
- Self determination (healing, economic development and restoration).
- Well-being (connection to nature, confidence and resilience).

The next step is to test the indicator set with tribal citizens by employing it to assess the health status of the tribal communities (Donatuto, 2012).

The researchers of the grant, "An Epidemiologic Study of Time Trends and Health Effects of Persistent Organic Pollutants, Mercury and Micronutrients," investigated risks to Alaska Native Yupik newborn infants and their mothers, who live in the Yukon-Kuskokwim River Delta of southwestern Alaska and consume the traditional marine subsistence diet. Data regarding blood levels of mercury, lead, cadmium, arsenic and omega-3 fatty acids in these populations have been collected and are being analyzed. These data will allow any potential associations between maternal exposure and potential adverse pregnancy outcomes (e.g., gestational diabetes mellitus, hypertension, preterm delivery, birth defects, growth abnormalities) to be examined as well as any associations between micronutrients and positive pregnancy and infant health outcomes. The researchers also collected salmon tissue for parallel analysis. The results will be used to inform the Alaska Native residents of the Yukon-Kuskokwim River Delta about trends in human tissue levels and any evidence of negative and positive health outcomes. The salmon data, combined with sea mammal data from other studies, will enable subsistence hunters and consumers to have confidence in the low contaminant levels in the salmon and consume those sea mammal species that have been found to have the lowest levels of contaminants. Village-specific harvest adaptation plans will be developed to ensure the lowest exposure for pregnant women and children while still preserving the enormous cultural and public health value of the traditional diet (Berner, 2013).

Impacts on Regulations and Management Plans

Several STAR grants and fellowships have influenced state regulations and tribal management plans. Based on the results of a STAR grant, "Bioaccumulative Toxics in Native American Shellfish," and other studies that have found high levels of toxins in fish and shellfish in and around tribal gathering places, the Washington Department of Ecology began re-examining the state's water quality standards in the fall of 2010 (Brooks, 2010). Oregon's Department of Environmental Quality has been working closely with state, federal and tribal governments and industries to set a stricter water quality standard, one that would allow people to safely eat not just one serving of fish or shellfish per month but one serving per day (State of Oregon, 2007). EPA has encouraged individual states to set standards based on data that show how much fish people typically consume from state waters. In the absence of those data, the federal standard of about one 7-ounce serving of fish per month applies, and this has been the state of Washington's standard for more than 2 decades (State of Washington, 2009, 2010). In the state review of the fish consumption rate, the Swinomish are advocating for historical consumption rates, which are perhaps as high as 1 pound of fish per person per day (Brooks, 2010). At the time of publication of this report, the state of Washington had not revised its limits; more information can be found at the Washington Department of Ecology website.

The quantitative data produced by a STAR fellowship, "Makah Traditional Environmental Knowledge and Gray Whale Conservation," were used by a tribal biologist to support the implementation of stricter water quality standards on the Makah Nation reservation than those issued by the state of Washington. The data indicated that tribal consumption of locally caught fish was significantly higher than the levels used to develop the previous standards (Sepez, 2011).

The results of a STAR fellowship, "Linking Traditional Knowledge and Environmental Policy in the Cherokee Nation of Oklahoma," continue to be used internally by the Cherokee Nation in northeastern Oklahoma to design its Tribal Integrated Resource Management Plan. The plan serves as formal guidance for all of the Cherokee Nation's land and resource planning and management issues. The grant resulted in the formation of a group, composed of Cherokee elders who are knowledgeable on the subject of Cherokee ethnobotany, to advise the Cherokee Nation Natural Resources Department. The elders work with departmental staff on Tribal Integrated Resource Management Plan implementation, as well as on larger goals of cultural and environmental protection (Carroll, 2011).

Practical Applications

- ***Use research to help establish environmental quality standards that take into account community practices and unique exposures of special populations to protect their health.***
- ***Help communities develop conservation plans that allow them to manage and monitor their resources so that community members can continue to safely use them.***

The "Space-Time Aquatic Resources Modeling and Analysis Program," a STAR-funded center, worked with 10 tribes in four states to assist with the development of tribal aquatic water quality monitoring plans that take into account definitive tribal needs for monitoring cultural uses of tribal water. The tribes involved in the research actively pursued the protection of culturally sensitive water uses, such as hand-dredging of clay for pottery making and wetland plant harvesting for construction of sweat lodges and cradle boards (Johnson, 2003). ●

Future Directions for Tribal Research

Future tribal research supported by EPA will explore new strategies, methods and tools to assess environmental health exposure among AI/AN populations as well as identify other research opportunities for advancing health protection while maintaining traditional tribal lifeways. Ongoing research needs for many tribal communities include protection of drinking water from enteric pathogens such as *Escherichia coli*, protection and survival of native plants, better understanding of health issues surrounding climate change, the impacts of widespread pesticide use and endocrine disrupting chemicals, indoor air quality, and the extent and impacts of consumption of contaminated meat from animals that tribal communities raise or harvest (e.g., bison, deer, elk). Past and current STAR research has attempted to address components of many of these issues (e.g., climate change impacts, endocrine disrupting chemicals, indoor air quality, cumulative risk related to subsistence foods), although not always in tribal settings.

An emerging topic of concern for many tribes is hydraulic fracturing (fracking). In addition to sharing in the immense benefits of fracking, tribal, Alaska Native and other communities in the United States are in need of research and guidance related to potential adverse ecological and human health impacts of this activity. For example, what are the considerations regarding the quality and availability of fresh water resources used for pumping? What are the potential health impacts of and exposure scenarios related to the chemical mixtures used in the extraction processes? What are waste disposal concerns and approaches that safeguard the ecosystem and human health? In addition, there are considerations involving air quality, groundwater contamination, and destabilization of rock formations and topography from drilling.

An ongoing issue is related to the ability of tribal community members and staff to gain technical expertise and capacity for applying for grants and responding to solicitations. Please see Appendix G for information about training and workshops that are available from EPA's Office of Grants and Debarment and the contact information for the current Regional Tribal Program Managers in Regions 9 and 10, where the majority of tribes reside.

Finally, there is an opportunity to establish regional tribal research partnerships that would serve as a resource for National EPA-Tribal Science Council Tribal Representatives in linking regional priorities to tribal research needs. This effort would develop a systematic method to connect ORD scientists (e.g., Regional Science Liaisons and scientists in the regional research facilities) with tribal scientists to collaborate on shared goals, communicate current research efforts and pursue common scientific goals for communities. It also is expected that the National EPA-Tribal Science Council's semiannual meetings will continue to provide an opportunity for research and science communication across tribes and regions, including participation by STAR grantees.

EPA's Air, Climate and Energy Research Program released its 2012 RFA, "Measurements and Modeling for Quantifying Air Quality and Climatic Impacts of Residential Biomass or Coal Combustion for Cooking, Heating, and Lighting." This solicitation included a component that focused on the "developing world and Indian tribes and Alaska Native groups." The goal is to quantify the extent that interventions for cleaner cooking, heating or lighting can impact air quality and climate, which in turn affect human health and welfare (U.S. EPA, 2012a).

The Tribal Environmental Health Research Program released its latest RFA, "Science for Sustainable and Healthy Tribes," in February 2013 (U.S. EPA, 2013a). In preparation for this RFA and to help identify tribal research priorities, the program hosted an RFA Strategy Session at the National EPA-Tribal Science Council-sponsored 2010 National Tribal Science Forum in Traverse City, Michigan. EPA and Tribal Representatives discussed current tribal environmental challenges as a basis for determining the focus of the RFA. Many topics of interest were identified during the session. Climate change was acknowledged as an overarching issue; of specific concern was tribal adaptability to climate change. Water concerns included drinking water quality and quantity as well as the presence of wastewater and heavy metals in rivers. Indoor air quality was another tribal concern, specifically exposure to mold, radon and formaldehyde. Mercury contamination in fish is considered a global issue, with dietary change and adaptation being a specific concern among AI/AN people. Stewardship of tribal lands and tribal control of research performed on these lands also emerged as important topics. Another key issue discussed was environmental enforcement and protection against unlawful agricultural practices on reservations (Breville, 2011).

Building on its 2006 priorities, the National EPA-Tribal Science Council initiated a tribally driven process to identify priority science issues of national significance in Indian country. The process commenced with the publication of a document that outlined the background of the National Tribal Science Priorities (U.S. EPA, 2011a). The document was sent to all federally recognized tribes and other tribal organizations and included criteria to allow them to identify their science priorities for Agency consideration as national priorities. An initial set of environmental concerns for AI/AN populations to consider included:

- Climate change impacts on tribal health, well being, and safety as well as on local food sources (with emphasis on adaptation/mitigation strategies).
- Off-reservation sources adversely affecting ambient air quality conditions in tribal communities and comprehensive monitoring for environmental triggers of respiratory distress.
- Impacts of indoor air quality associated with building ventilation (i.e., to assess and mitigate for mold, radon and asbestos) and other sources of pollution (e.g., wood stoves, tobacco consumption, open dump burning) (U.S. EPA, 2011a).

As a result of the process, the National EPA-Tribal Science Council highlighted climate change and the integration of traditional ecological knowledge in environmental science, policy and decision making as two primary research concerns for Agency action (U.S. EPA, 2011b, 2011c). At the July 2011 National Tribal Operations Committee meeting, the National Tribal Caucus and EPA Administrator Lisa Jackson endorsed these priorities as issues that align with their respective efforts to protect human health and the environment in Indian country (U.S. EPA, 2012i).

Building on the priority-setting efforts of the National EPA-Tribal Science Council, this solicitation invites applications for research on climate change and indoor air quality that integrates traditional ecological knowledge for informed science, policy and decision making (U.S. EPA, 2013a). Since the RFA strategy session at the 2010 National Tribal Science Forum, several EPA members of the National EPA-Tribal Science Council have continued to provide substantive input on updated drafts of the RFA, serving as writing team members and reviewers (McOliver, 2013a). The RFA was developed with input from four EPA program offices (Office of Science Policy, Office of Children's Health Protection, American Indian Environmental Office and the Indoor Environments Division within the Office of Radiation and Indoor Air); three regional offices (Regions 5, 7 and 10); and three ORD laboratories and centers (National Risk Management Research Laboratory, National Exposure Research Laboratory and National Center for Environmental Assessment) (Breville, 2011; McOliver, 2013b). ●

Conclusion

The synthesis of more than a decade of research conducted under EPA's Tribal Environmental Health Research Program has resulted in the identification of practical applications that apply to each of the themes. In terms of *cultural practices, language and traditional ecological knowledge*, it is important to understand and integrate the cultural aspects of the community into research and develop culturally relevant educational materials, such as a booklet on wild plant knowledge in the Cherokee language, to explain risks and how to mitigate them to more effectively reduce exposures of sensitive populations as they engage in traditional practices.

One practical application regarding *subsistence foods and water resources* is that it is necessary to utilize community-based research to develop wellness plans, such as those being developed by the Alaska Native Tribal Health Consortium around sustenance berry use, that preserve traditional diets while managing risk and protecting public health. Another is that using quantitative data on contaminant levels, such as those used by the St. Lawrence Island Yupik people to assess the contaminants in rendered oils and organ meat that are part of their traditional diet, can help communities avoid or reduce the risks associated with traditional diets.

Community-based participatory research and community outreach and education are very important when partnering with AI/AN communities. It is essential to develop strong partnerships with the community and enlist community representatives to guide the research design and implementation, as was done for the research project on the Crow Reservation that was guided by the Crow Environmental Health Steering Committee. This approach ensures that the research is informed by the local culture and relevant to the communities' needs and, ultimately, that the results will be more readily accepted and used to protect community health and natural resources. It also is important to communicate research results to community members in a culturally sensitive manner, as was done, for example, during the town council meetings of the Northern Alaskan Iñupiat, and provide personal followup in the native language, such as the in-home followup in the Crow language provided to Crow residents, to increase the community members' understanding of the results and how to use them to reduce their exposures to environmental contaminants.

In terms of *risk assessment and sensitive populations*, incorporating risk assessment methodologies to create exposure scenarios that can be applied at the national, regional and local levels, such as those detailed in the *Traditional Tribal Subsistence Exposure Scenario and Risk Assessment Guidance Manual*, ultimately help sensitive populations to reduce exposures and protect community and environmental health. Also, stakeholders must use the knowledge obtained from environmental public health indicators that are reflective of communities' health views and priorities, such as the Tribal Environmental Public Health Indicators that were developed for Salish Sea tribes, to assess and improve the health status of these communities and their members.

Finally, grants funded under EPA's Tribal Environmental Health Research Program have had positive *impacts on regulations and management plans*. One practical application of the research is to develop and use quantitative data to establish environmental quality standards that more accurately reflect the unique exposures of special populations, such as the stricter water quality standards established by the Makah Nation based on STAR grant data, to ultimately reduce their risks and protect their health and culturally important resources. Research also can be used to assist communities in developing resource management and monitoring plans, such as the tribal aquatic water quality monitoring plans developed by several tribes to monitor cultural uses of tribal water, that protect environmental resources and community health.

As they have done for more than a decade, EPA's Tribal Environmental Health Research Program and the Agency research programs that it helps to support will continue to engage and collaborate with AI/AN communities and partners. These programs will continue to provide opportunities for tribal and Alaska Native citizens, scientists and engineers and other partners to participate in collaborative partnerships that further their communities' capacity for identifying environmental health concerns and research strategies, developing sustainable and culturally relevant solutions, and supporting decision making, with the goal of protecting the health and the environment of AI/AN communities.

These EPA programs play an important role in addressing the myriad stressors threatening the health, wellness and lifeways of AI/AN populations that are striving to maintain their long-standing, intricate relationships with the natural environment. The research funded under the STAR Tribal Environmental Health Research Program has supported the critical research priorities of importance to tribal communities. NCER anticipates that future collaborations with the National EPA-Tribal Science Council and other tribal science partners will ensure that the EPA STAR grants program continues to fund critical, leading-edge research that results in improved human heath for tribal communities and protection of the tribal natural resources. ●

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Appendix A: Summary of Tribal Environmental Health Research Program STAR Grants by RFA

Appendix B: Outputs From Tribal Environmental Health Research Program STAR Grants

Appendix C: Tribal Environmental Health Research Program Presentations

Appendix D: Overview of Tribal Environmental Health Research Program Grantee Webinars

Appendix E: Summary Tables of EPA Tribal Research Projects Discussed Within the Report

Appendix F: Practical Applications of EPA Tribal Research

Appendix G: Additional Resources

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Appendix A: Summary of Tribal Environmental Health Research Program STAR Grants by RFA

Issues in Tribal Environmental Research and Health Promotion: Novel Approaches for Assessing and Managing Cumulative Risks and Impacts of Global Climate Change (2007 RFA)

The U.S. Environmental Protection Agency (EPA) recognized the need to increase capacity within the tribes to assess differential subsistence-based exposures related to cumulative chemical exposures and global climate changes. As a result, this solicitation was designed to stimulate community-based participatory research to generate data that identified subsistence resources, sensitive populations within tribal communities, complex chemical exposures from multiple sources and routes, and links between environmental stressors and health outcomes. The Agency was interested in research proposals that developed culturally relevant strategies for exposure mitigation and/or health promotion. Four grants were awarded under this RFA (U.S. EPA. 2012e). The remaining research projects are scheduled to conclude in 2014.

R833705: An Epidemiologic Study of Time Trends and Health Effects of Persistent Organic Pollutants, Mercury and Micronutrients

This project is being carried out in Yupik Alaska Native residents living in the Yukon-Kuskokwim River Delta of southwestern Alaska. Salmon are the largest component of the subsistence diet for Alaska Native people in the delta, with seals being second in importance in coastal communities. Prior work has shown that pregnant Yupik women have levels of persistent organic pollutants similar to other Arctic women, with higher toxaphene, brominated flame retardants and mercury levels than most other Arctic pregnant women.

The objectives of the research project were to: (1) determine time trends in tissue levels of persistent organic pollutants, mercury and omega-3 fatty acids in a cohort of 200 pregnant Yupik women and infants (because climate change has increased atmospheric and ocean transport of persistent organic pollutants and mercury to Alaska and the Bering Sea, resulting in persistent organic pollutants and mercury uptake by salmon, marine mammals and humans) and (2) determine, using health record review, physical exam and statistical analysis, any association between maternal levels of persistent organic pollutants and mercury and risk for adverse health outcomes in mothers, infants and prior cohort children between 4 and 7 years of age (because Alaska Native infants have a higher risk of a serious infection in the first year of life and a higher risk for congenital heart disease). The proposal is examining the relative risk of these outcomes if they are prenatally exposed to persistent organic pollutants in the highest tercile of the cohort. Alaska Native 4- to 7-year-old children in the highest tercile of prenatal mercury exposure are being compared to determine whether they have significantly higher blood pressure than those in the lowest tercile. Alaska Native women with blood levels of persistent organic pollutants in the highest tercile are being compared with those having POP levels in the lowest tercile to determine they have a greater risk of diabetes.

R833706: Community-Based Risk Assessment of Exposure to Contaminants via Water Sources on the Crow Reservation in Montana

This project is a community-based participatory research project that involves the University of New England, Montana State University, Little Big Horn College and the Crow Tribe in developing risk assessment methodology for multimedia exposure to contaminants in water and wastewater. The objectives of the research were to: (1) establish a sampling and analysis program to assess contaminant loadings to water and aquatic/wetland subsistence foods, (2) evaluate lifestyle and cultural practices that contribute to exposure risk from water sources, (3) supplement the current Tribal LifeLine™ software to include water contamination and exposure factors specific to reservation settings, and (4) design and support culturally appropriate risk communication and risk management measures that minimize impact on subsistence and other traditional practices, which may be transferable to other tribes. This research will test the following hypotheses:

- Contamination is not adequately monitored, and water resources on the reservation are more contaminated than similar rural, non-AI/AN communities.
- Subsistence lifestyles and cultural practices of Crow Reservation communities place them at increased risk of exposure to environmental contaminants.
- The Tribal LifeLine™ software will more accurately assess risks if it includes exposure to water contaminants.
- A community-based participatory research approach to understanding exposure pathways will contribute to developing culturally appropriate mitigation strategies
- Including the local tribal college in risk assessment and management will substantially strengthen and sustain community-based participatory research methodology on reservations.

R833707: Impacts of Climate Change on Health Benefits of a Tribal Alaskan Resource: Integrating Traditional Ecological Knowledge With Risk Assessment Through Local Monitoring

Within Alaska Native communities, traditional ecological knowledge has long held that wild indigenous berries are a health-promoting, life-sustaining resource. Modern science recently has elucidated specific health-protective, adaptogenic properties of the natural components within berry fruits. This project integrates biological scientific data relevant to wild berry bioactive properties with community perceptions of risk under the threat of global climate change and encroachment on the habitat of the berry resources. The research hypothesis is that there are predictable links between climatic stress factors and shifts in climatic regimes, berry fruit composition and the preventative/therapeutic value of berries to combat diabetes and other complications of metabolic syndrome. It also is expected that tribal community approaches to mitigating health risks through dietary berries will be conditioned by community-held risk perceptions, local tribal knowledge and uncertainties regarding global climate change impacts on these valued resources.

The objectives of the research project were to: (1) provide a baseline assessment of the bioactivity (health risk mitigation properties) of berry resources as influenced by climatic stress factors relevant to global climate change via cross-comparison of two Alaska tribal communities characterized by inherently different climatic regimes and (2) assess local traditional knowledge and risk perceptions regarding community health, berries and climate change and integrate these aspects with biophysical findings for informed local health-related decision-making.

R833708: Understanding the Cumulative Effects of Environmental and Psycho-Social Stressors that Threaten the *Pohlik-lah* and *Ner-er-ner* Lifeway: The Yurok Tribe's Approach

Coastal and river resources are primary and secondary food sources for a majority of Yurok tribal members, particularly those residing near or within Yurok ancestral territory. The researchers combined ethnography and qualitative data on subsistence resources and practices from previous and current tribal studies with quantitative data on chemical exposures and epidemiological analyses of health data to determine how these factors interact to affect the health of various vulnerable populations within the Yurok Tribe.

The specific objectives of this research project were to: (1) identify the chemical stressors and contaminants known to be used or to occur historically and contemporarily throughout the Klamath River Basin and watershed, (2) identify the common mechanism groups, pathways and contaminants known to be used or to occur throughout the Klamath Basin that are associated with adverse health outcomes, (3) collect primary data on the current conditions of Klamath River water and select key subsistence species by testing for selected contaminants and chemical stressors as identified in the first two objectives, (4) identify relationships between resource health and tribal member health, and (5) develop geographic information system tools, educational materials, measures and policies designed to reduce, minimize or prevent risks of exposures by subsistence practitioners to improve and protect Klamath River tribal members' and resource health. During the course of the project, the researchers identified three additional research questions: What contaminants currently are detectable in the river and key aquatic subsistence resources? Is there a relationship between environmental health as reflected by resource health and community health? How can this study and the data produced from this study be used to identify and reduce risk and improve tribal member and resource health?

Lifestyle and Cultural Practices of Tribal Populations and Risks From Toxic Substances in the Environment (2002 RFA)

This RFA focused on the need to develop methods to assess subsistence-based exposure and increase capacity within the tribes to assess environmental health threats from subsistence life styles. It was designed to promote research that would help understand the risks derived from the combined or "cumulative" exposure experience associated with concurrent dietary, cultural and related practices. The solicitation invited applications in two areas: (1) exposure and effects assessment methods that can be broadly applied across geographic regions and tribal populations and (2) risk management strategies and options that would lead to reduction in risk from exposure. Five grants were awarded under this RFA (U.S. EPA, 2012e).

R831043: Environmental Contaminants in Foodstuffs of Siberian Yupiks from St. Lawrence Island, Alaska

The researchers previously showed that the Siberian Yupik people of St. Lawrence Island, Alaska, have relatively high serum levels of polychlorinated biphenyls and pesticides. This project examined traditional foods of the Yupik people for polychlorinated biphenyls, three pesticides and several metals to determine those that are the most significant sources of exposure and how preparation for consumption influences the level of contaminants.

R831044: Iakotisa'tstentsera:wis Ne Ohontsia: Reducing Risk by Restoring Relationships

This project aimed to develop and implement a research program to examine the impacts that toxic substances have had on the traditional cultural practices of Haudenosaunee Nations. This project provided training to teachers, youth and Haudenosaunee Environmental Task Force staff who are dealing with a variety of toxic substances impacting their health, lands and future. Community-based participatory research methodologies were used to develop culturally appropriate intervention materials and design educational strategies based on oral tradition. The objectives of the research project were to: (1) empower and strengthen the capacity of Haudenosaunee scientists, environmental staff and educators; (2) build on existing partnerships to share expertise and experiences; and (3) provide hands-on training about the relationship between toxic substances and traditional cultural practices. Secondary objectives were to identify culturally appropriate strategies that effectively communicate environmental health issues to Haudenosaunee, including youth, and identify strategies that effectively evaluate the success of the project.

R831045: Risks to Northern Alaskan Iñupiat: Assessing Potential Effects of Oil Contamination on Subsistence Lifestyles, Health and Nutrition

Scientists have focused on the potential effects of toxic substances on Native American populations with subsistence lifestyles in the Arctic and found that risks from toxicant exposures range from direct health hazards to changes in lifestyle that may impair nutrition and health. Also, petroleum hydrocarbons may enter the Arctic environment in a variety of ways and can enter humans through species that form a major part of the Iñupiat diet. In Barrow, Alaska, 75 percent of Iñupiat households consume bowhead whale (*Balaena mysticetus*), and nearly 50 percent consume bearded seals (*Erignathus barbatus*). Marine mammals are exposed to petroleum directly or through their diet and may metabolically transform petroleum-related compounds. Based on indications from toxicological properties, polycyclic aromatic hydrocarbons in the human diet should be investigated. At the time of the grant application, limited information was available on the extent to which species eaten by the Iñupiat were exposed to and contaminated by petroleum. Contamination could cause Iñupiat households to avoid eating traditional foods, and handling and preparation of foods affect levels of ingested polycyclic aromatic hydrocarbons.

The focus of this project was to evaluate the potential exposure to the native Eskimos from petroleum exploration and drilling on their subsistence harvested foods. The specific objectives of the research were to: (1) characterize levels of polycyclic aromatic hydrocarbons in a range of tissues from bowhead whales and bearded seals, (2) characterize PAH levels in meat and other food items following their handling and preparation for consumption, (3) document traditional biomarkers that hunters and field scientists could use to accept or reject tissues for consumption following harvest, (4) assess chemical or histological assays that could serve as low cost biomarkers of exposure, (5) use published information and the results of this study to develop a risk assessment model incorporating health risks associated with ingestion of petroleum-related compounds and cultural and nutritional risks related to avoidance of certain foods, and (6) develop outreach and public awareness programs to inform residents in northern Alaska of issues, potential consequences and options.

R831046: Lifestyles and Cultural Practices of Tribal Populations and Risks From Toxic Substances in the Environment

The overall goals of the project were to prepare a set of regional traditional tribal subsistence exposure scenarios based on the major ecological zones across the lower 48 states. The specific objectives were to: (1) establish an advisory board of tribal and university community members to provide expertise in tribal cultural lifestyles, nutrition, ecology and activity patterns; actively guide the project; validate scenarios for cultural and numerical accuracy; and ensure that they meet tribal needs; (2) develop regional traditional tribal subsistence multipathway exposure scenarios based on ecocultural zone delineations, major exposure factors, regional food patterns and unique exposure pathways; and (3) develop a draft Tribal Exposure Scenario Guidance Manual for use by tribes to modify, refine and adapt these regional scenarios for their site-specific and/or individual tribal situations.

R831047: Reducing Risks of the *Anishinaabe* From Methyl Mercury

The purpose of this study was to develop, implement, evaluate and document a comprehensive, systematic and culturally sensitive intervention program to the reduce risks associated with subsistence-based consumption of methyl mercury-contaminated fish. This research project was built on EPA and National Academy of Sciences evaluations of the toxicology of methyl mercury.

This study attempted to revise the Great Lakes Indian Fish and Wildlife Commission's geographic information system-based fish advisory methodology to comply with EPA risk-based fish consumption guidance while not significantly compromising *Anishinaabe* culture. Secondly, the study aimed to develop connections to social-tribal networks and systematically train health care providers, tribal fish harvesters, elders and youth in the use of the geographic information system-based fish advisory. Third, the research project aimed to implement the geographic information system-based intervention program through established networks to reach mothers with young children, women of childbearing age, pregnant mothers, breastfeeding mothers and children under the age of 15. Finally, the study evaluated and documented the efficacy of the geographic information system-based intervention program by measuring the change in knowledge and behaviors of targeted populations as well as the educators of those populations before and after implementation.

Environmental Justice: Partnerships for Communication (2000 RFA)

The goal of this RFA was to promote research aimed at achieving environmental justice by identifying and addressing disproportionately high and adverse effects of environmental agents on human health in low-income and minority populations. The Agency desired to promote research activities such as the development of methods for risk communication in low-income and underserved communities unfavorably impacted by environmental hazards; development of community-based, culturally sensitive educational programs to reduce adverse health effects from environmental toxicants in low-income and underserved communities; promotion of public awareness through community-based training to increase environmental health literacy; and raising the awareness of health care providers about disorders resulting from exposure to environmental hazards. One grant was awarded under this RFA (U.S. EPA, 2012e).

R829476: Bioaccumulative Toxics in Native American Shellfish

The two-part central hypothesis of this research project stated that the Swinomish people are exposed to low-level, chronic, bioaccumulative toxics when participating in subsistence consumption of shellfish in traditional harvesting areas and that this exposure contributes to the high incidences of health-related problems on the reservation. The two primary objectives of the project were to: (1) determine the type and concentrations of bioaccumulative toxics present in shellfish and (2) determine what, if any, connections exist between shellfish toxics and the health of the Swinomish people. The secondary objective was to communicate effective and culturally appropriate information regarding identified health risks to the Swinomish community and nearby tribes who also participate in subsistence shellfish harvesting to develop and implement mitigation measures to reduce health risks from shellfish consumption.

This project was intended to complement other ongoing, funded projects, such as the paralytic shellfish poison monitoring program, fresh and marine water quality monitoring programs, ambient air quality program, the EPA nonpoint source pollution Clean Water Act Section 319 program, and the Swinomish indoor air quality/medical clinic health monitoring program.

Appendix B: Outputs From Tribal Environmental Health Research Program STAR Grants

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Camper AK, Doyle J, Bear Don't Walk U, Lefthand M, Shield M, Cummins C, Good Luck B, Hamner S, Broadaway S, and Eggers, M. 2010. Community-Based Risk Assessment on the Crow Reservation. Presented at the Center for Native Health Partnerships Webinar, Bozeman, Montana, 20 December.

Cummins C, Bends A, Young S, and Eggers M. 2010. Crow Water Quality Project: Using community based participatory research to address local environmental and health concerns. Panel presentation at the Earth Rights: Learning the Language of Indigenous Environmentalism Conference, Bozeman, Montana, 1–2 April.

Cummins C, Doyle J, Kindness L, Young SL, Ford TE, and Eggers MJ. 2010. Community-Based Risk Assessment of Exposure to Contaminants via Water Sources on the Crow Reservation in Montana. Panel presentation at the 2010 National Tribal Science Forum, Traverse City, Michigan, 10 June.

Cummins C and Eggers M. 2009. Developing Community Based-Participatory Research With Little Big Horn College, the Crow Reservation Community and Montana State University. Presented at the Western Region COBRE-INBRE Scientific Conference, Big Sky, Montana, 16–18 September.

Cummins C, Ford T, Doyle J, Kindness L, Bear Don't Walk U, and Eggers M. 2009. Community-Based Risk Assessment of Exposure to Contaminants via Water Sources on the Crow Reservation in Montana. Presented at the Promoting Environmental Health in Native American Communities Webinar Series, 18 November.

Croom DB and Lila MA. 2013. Bioexploration Beyond The Field – To the Laboratory, Curriculum, Clinical, and Commercial. Presented at the U.S. Department of Agriculture (USDA) Higher Education Challenge (HEC) Workshop/United Tribes Technical College Summer Camp, Bismarck, North Dakota, July.

Croom DB and Lila MA. 2013. Goals and Outcomes for Student Bioexploration Experiences. Presented at the USDA HEC Finale Workshop, Kannapolis, North Carolina, July.

Croom DB and Lila MA. 2013. TEK + STNs + STEM: Measuring Levels of Engagement. Presented at the USDA HEC Finale Workshop Curriculum Roundtable, Kannapolis, North Carolina, July.

Croom DB and Lila MA. 2013. The Science Behind Traditional Knowledge: An In-Field Plants Bioassay Method Boosts STEM Engagement of American Indian and Alaska Native High School Students. Presented at the 59th Annual North American Colleges and Teachers of Agriculture Conference, Blacksburg, Virginia, 26 June.

Dietrich E, Rao V, Allen C, Doyle JT, Old Coyote TJ, Eggers MJ, and Camper AK. 2013. Service Learning to Address Drinking Water Quality through Community-Based Participatory Research on the Crow Reservation. Presented at the Montana INBRE Network Research and Training Symposium, Bozeman, Montana, 17–19, April.

Donatuto J. 2006. The Importance of Fish Consumption Surveys for Native Americans. Seminar presented at the University of British Columbia, Vancouver, British Columbia, Canada.

Donatuto J. 2006. Swinomish Tribe's Bioaccumulative Toxics and Native American Shellfish Project. Presented to the Skagit Marine Resources Committee, Mt. Vernon, Washington.

Donatuto J. 2006. Swinomish Tribe's Bioaccumulative Toxics and Native American Shellfish Project. Presented at the People for Puget Sound's Toxics Forum, Seattle, Washington.

Donatuto J. 2006. Articulating Sociocultural Health Effects From Contaminated Subsistence Foods. Presented at the 141st American Public Health Association Annual Meeting and Exposition, Boston, Massachusetts, 4–8 November.

Donatuto J. 2006. Fish Consumption and Policy in the Tribal Context. Presented at the 66th Annual Meeting of the Society for Applied Anthropology, Vancouver, British Columbia, Canada, 28 March–2 April.

Donatuto J. 2006. Results and Discussion of the Swinomish Tribe's Toxics in Shellfish Project. Presented at the U.S. Environmental Port Agency Tribal Leaders Summit, Confederated Tribes of the Umatilla Indian Reservation, Pendleton, Oregon.

Donatuto J. 2006. Results and Discussion of the Swinomish Tribe's Toxics in Shellfish Project. Presented at the National Forum on Tribal Environmental Science, Quinault Indian Nation, Ocean Shores, Washington, 24–28 September.

Donatuto J. 2005. Rounding the Home Stretch: Learning Experiences from the Bioaccumulative Toxics in Native American Shellfish Project. Presented at the Puget Sound Georgia Basin Research Conference, Seattle, Washington, 29–31 March.

Donatuto J. 2005. Bioaccumulative Toxics in Native American Shellfish. Presented at the Region 10 U.S. Environmental Protection Agency Tribal Leaders Summit, Sitka, Alaska.

Donatuto J. 2004. Bioaccumulative Toxics in Native American Shellfish. Presented at the U.S Environmental Protection Agency Region 10 Tribal Conference: Collaborating for Success, Bow, Washington, 19 May.

Donatuto J. 2004. Update on the Bioaccumulative Toxics in Native American Shellfish Project. Poster presented at the National Institute for Environmental Health Sciences Annual Grantees Conference, Albuquerque, New Mexico, 13–15 June.

Donatuto J. 2004. Swinomish Toxics Trends in Sediment Monitoring Project Report. Presented to the Swinomish Indian Tribal Community, La Conner, Washington.

Donatuto J. 2004. Bioaccumulative Toxics in Native American Shellfish. Presented at the National Tribal Environmental Council Meeting, Marysville, Washington.

Donatuto J. 2004. Developing a Human Health and Cultural Risk Assessment: Toxics in Shellfish on the Swinomish Reservation. Presented at the 64th Annual Meeting of the Society for Applied Anthropology, Dallas, Texas, 31 March–4 April.

Donatuto J. 2004. Subsistence Lifeways: Native American Fish Consumption Rates and Risk. Presented at the Fourth Society of Toxicology and Environmental Chemistry World Congress and 25th Annual Meeting, Portland, Oregon, 14–18 November.

Donatuto J. 2003. Project Design and Implementation: Bioaccumulative Toxics in Native American Shellfish. Presented at the Georgia Basin/ Puget Sound Research Conference, Vancouver, British Columbia, Canada, 31 March–3 April.

Donatuto J. 2003. Project Design and Implementation: Bioaccumulative Toxics in Native American Shellfish. Presented to the Northwest Indian Fisheries Commission, La Conner, Washington.

Donatuto J. 2003. Project Design and Implementation: Bioaccumulative Toxics in Native American Shellfish. Presented at the People for Puget Sound Meeting, Bellingham, Washington.

Donatuto J and Basabe T. 2003. Project Design and Implementation: Bioaccumulative Toxics in Native American Shellfish. Presented at the U.S. Environmental Protection Agency Science To Achieve Results Human Health Symposium, Washington, DC, 9–10 April.

Donatuto J and Campbell L. 2003. Project Design and Implementation: Bioaccumulative Toxics in Native American Shellfish. Presented at the U.S. Environmental Protection Agency Science Forum, Washington, DC, 5–7 May.

Donatuto J and Harper B. 2008. Defining and Evaluating Risks from Contaminated Food in a Native American Fishing Community (Swinomish). Presented at the International Society of Exposure Analysis Annual Meeting, Pasadena, California, 15 October.

Donatuto J and O'Hara C. 2002. Project Design and Implementation: Bioaccumulative Toxics in Native American Shellfish. Presented at the U.S. Environmental Protection Agency Region 10 Tribal Conference, Lincoln City, Oregon.

Donatuto J and Smith K. 2005. Bioaccumulative Toxics in Native American Shellfish. Poster presented at the National Institute for Environmental Health Sciences Annual Grantees Conference , Talkeetna, Alaska, 19–22 September.

Doyle JT, Kindness L, Bear Don't Walk UJ, Realbird J, Eggers MJ, Bends AL, Crow Environmental Health Steering Committee, and Camper AK. 2012. For As Long As the Grass Shall Grow and the Rivers Shall Flow: Clean Water, a Sovereign Responsibility. Plenary presentation at the National Congress of American Indians Tribal Leader and Scholar Forum, Lincoln, Nebraska, 17–20 June.

Doyle JT, Kindness L, Bear Don't Walk U, Realbird J, Eggers MJ, Crow Environmental Health Steering Committee, Ford TE, and Camper AK. 2013. Addressing Disparities in Safe Drinking Water Access on the Crow Reservation, Montana. Presented at the Environmental Health Disparities and Environmental Justice Meeting, Raleigh, North Carolina, 29–31 July.

Doyle JT, Kindness L, Bear Don't Walk U, Realbird J, Eggers MJ, Crow Environmental Health Steering Committee, Ford TE, and Camper AK. 2012. Reducing Tribal Health Disparities Through Solving Water Infrastructure Challenges. Presented at the National Institutes of Health's National Institute of General Medical Sciences Fourth Biennial National IDeA Symposium of Biomedical Research Excellence (NISBRE), Washington, DC, 25–27 June.

Doyle JT, Kindness L, Bear Don't Walk U, Realbird J, Eggers MJ, Old Coyote TJ, Crow Environmental Health Steering Committee, Ford TE, and Camper AK. 2012. Addressing Disparities in Safe Drinking Water Access on the Crow Reservation, Montana. Presented at the National Institutes of Health Summit on the Science of Eliminating Health Disparities, National Harbor, Maryland, 17–19 December.

Doyle JT, Kindness L, Bends AL, Eggers MJ, Old Coyote TJ, Crow Environmental Health Steering Committee, and Camper AK. 2012. For As Long As the Grass Shall Grow and the Rivers Shall Flow: Clean Water, a Sovereign Responsibility. Panel presentation at the National Congress of American Indians Tribal Leader and Scholar Forum, Lincoln, Nebraska, 17–20 June.

Doyle JT and Young SL. 2013. Understanding and Addressing Disparities in Safe Drinking Water Access on the Crow Reservation. Presented at the Third Biennial Western Regional IDeA Scientific Conference, Honolulu, Hawaii, 6–8 October.

Eggers MJ and Bull Chief E. 2012. Health Risks of Lead Exposure from Elk and Deer Meat Consumption. Presented at the Native American Fish & Wildlife Society 23rd Annual Great Plains Regional Conference, Bozeman, Montana, 27–29 March.

Eggers MJ, Cummins C, Crow Environmental Health Steering Committee, Sigler A, Hamner S, Richards CL, Big Man N, Ford TE, and Camper AK. 2010. Community-Based Risk Assessment on the Crow Reservation. Poster presented at the Third Biennial National IDeA Symposium of Biomedical Research Excellence, Bethesda, Maryland, 16–18 June.

Eggers M, Cummins C, Richards C, the Crow Environmental Health Steering Committee, Hamner S, Broadaway S, Young SL, Ford, T, and Camper A. 2009. Community-Based Risk Assessment on the Crow Reservation. Poster presented at the Western Region COBRE-INBRE Scientific Conference, Big Sky, Montana, 16–18 September.

Eggers MJ, Doyle JT, Lefthand ML, Kindness L, Young SL, Good Luck BT, McCormick AKHG, Dietrich E, Felicia DL, Ford TE, Roberts D, and Camper AK. 2013. Community-Based Risk Assessment of Exposure to Waterborne Contaminants, Crow Reservation, Montana. Presented at the Environmental Health Disparities and Environmental Justice Meeting, Raleigh, North Carolina, 29–31 July.

Eggers MJ, Doyle JT, Old Coyote TJ, Camper AK, Crow Environmental Health Steering Committee, Ford TE. 2012. Addressing Health Disparities and Learning Science Through Community-Based Participatory Research, Crow Reservation, Montana. Invited panel presentation at the National Institutes of Health Summit on the Science of Eliminating Health Disparities, National Harbor, Maryland, 17–19 December.

Eggers MJ, Moore-Nall AL, Doyle JT, Crow Environmental Health Steering Committee, Lageson DR, Roberts D, and Camper AK. 2013. Crow Water Quality Project: A Community Based Participatory Approach Finds Elevated Uranium in Wells on the Crow Indian Reservation, Big Horn County, Montana. Presented at the Fifth Annual International Conference on Medical Geology, Arlington, Virginia, 25–29 August.

Eggers MJ, Old Coyote TJ, Doyle JT, Kindness L, Lefthand MJ, Bear Don't Walk UJ, Young SL, Bends AL, Good Luck B, Stewart R, Leider A, White Clay S, Dietrich E, Ford TE, and Camper AK. 2012. Using Community Based Risk Assessment to Address Health Risks from Waterborne Contaminants on the Crow Reservation. Presented at the National Institutes of Health Summit on the Science of Eliminating Health Disparities, National Harbor, Maryland, 17–19 December.

Eggers MJ, Old Coyote TJ, Dietrich E, Doyle JT, Lefthand MJ, Kindness L, Bear Don't Walk UJ, Young, SL, Bends AL, Good Luck B, Stewart R, Hamner S, Broadaway SC, Ford TE, and Camper AK. 2012. Using Community-Based Risk Assessment to Reduce Tribal Health Risks from Water Contamination. Poster presented at the National Institutes of Health's National Institute of General Medical Sciences Fourth Biennial National IDeA Symposium of Biomedical Research Excellence (NISBRE), Washington, DC, 25–27 June.

Eggers M, Old Coyote T, Ford T, Camper A, and Crow Environmental Health Steering Committee. 2011. Community-Based Risk Assessment of Exposure to Contaminants via Water Sources on the Crow Reservation in Montana. Presented to the Harvard University Group, Pine Creek, Montana, 6 June.

Etnier M and Sepez J. 2003. Ecological, Political, and Cultural Explanations for Changing Patterns of Sea Mammal Exploitation Among the Makah. Presented at the Alaska Anthropological Association Annual Meeting, Fairbanks, Alaska, March.

Fields N, Wetzel D, Reynolds J, Miller P, Waghiyi V, Kmiecik N, Donatuto J, Harper B, Harris S, Waterhous T, and Harding A. 2006. Advancing Exposure and Intervention Research to Protect Native American Tribal Populations. Poster presented at the International Conference on Environment, Epidemiology, and Exposure, Paris, France, 2–6 September.

Fitch JH. 2009. Sustainability: An Emerging Substrate for Creativity, Interdisciplinarity, Integrative Learning, and Survival. Presented at the 31st Conference of the Association for Integrated Studies, University of Alabama, Tuscaloosa, Alabama, 8 October.

Flint CG. 2010. Perceptions of Ecosystem Services and Threats to Well-Being From an Alaska Native Community. Presented at the ACES (A Community on Ecosystem Services) Meeting, Gila River Indian Community, Phoenix, AZ, 6–9 December.

Flint C and Lila MA. 2009. Alaskan Subsistence Resources and Communities at Risk: Integrating Traditional Ecological Knowledge, Risk Perception Assessment, and Plant Science in Participatory Research. Presented at the Rural Sociological Society Annual Meeting, Madison, Wisconsin, 30 July–2 August.

Flint CG and Lila MA. 2010. Traditional Knowledge and Perceptions of Ecosystem and Community Well-Being in Three Alaska Native Communities. Presented at the International Symposium for Society and Resource Management, Corpus Christi, TX, 6–10 June.

Foran J. 2004. Great Lakes Indian Fish and Wildlife Fish Advisory Program and STAR Grant Plans. Presented at the Fifth Annual Environmental and Occupational Health Conference, Minneapolis, Minnesota, 11–13 July.

Foran J. 2004. Great Lakes Indian Fish and Wildlife Fish Advisory Program and STAR Grant Plans. Presented at the Great Lakes Research Consortium State-National Consumption Advisory Workshop.

Ford TE, Eggers MJ, Cummins C, Doyle J, Kindness L, and Young SL. 2010. Translating Community-Based Participatory Research: Lessons Learned. Panel presentation at the 2010 National Tribal Science Forum, Traverse City, Michigan, 6–10 June.

Ford TE, Eggers MJ, Old Coyote TJ, Good Luck B, Felicia DL, Doyle JT, Kindness L, Leider A, Moore-Nall A, Dietrich E, and Camper AK. 2012. Comprehensive Community-Based Risk Assessment of Exposure to Water-Borne Contaminants on the Crow Reservation. Presented at the EPA Tribal Environmental Health Research Program Webinar, 17 October.

Hamner S, Broadaway S, Big Man N, Old Elk J, Doyle J, Kindness L, Pyle B, Eggers M, Camper AK, and Ford T. 2012. Detection of Multiple Enterohemorrhagic *Escherichia coli* Serotypes in the Little Bighorn River, Montana, USA. Presented at the Society for General Microbiology Spring Conference 2012, Dublin, Ireland, 26–29 March.

Harding A and Harper B. 2011. Addressing Tribal Exposures to Polycyclic Aromatic Hydrocarbons (PAHs) and Building Tribal Capacity Through a Tribal-University Partnership. Presented at the National Institute of Environmental Health Sciences and U.S. Environmental Protection Agency Superfund Research Program Risk e-Learning Series Webinar, 23 May.

Harding A, Harper B, Harris S, Stone D, Anderson K, Simonich S, Uesugi S, Forsberg N, Motorykin O, Cardenas A, and Waters K. 2012. Working With a Native American Community to Characterize (and Define) Their "Risk": Risk as a Value-Based Decision Based on Important Cultural Practices. Presented at the 140th American Public Health Association Annual Meeting and Exposition, San Francisco, California, 30 October.

Harding AK, Harper BL, and Harris S. 2008. Estimating Environmental Exposures for Tribes Engaged in Traditional Subsistence Lifestyles. Poster presented at the 136th American Public Health Association Annual Meeting and Exposition, San Diego, California, 25–29 October.

Harper B. 2010. Research Ethics and Informed Tribal Consent. Presented at the Symposium on Conducting Research in Tribal Communities, Oregon State University, Corvallis, Oregon, 7 April.

Harper B. 2009. Exposure Scenarios—Fish Consumption Rates Within the larger Tribal Exposure Context. Presented at the Tribal Rights and Fish Consumption Workshop: Issues and Opportunities for the Pacific Northwest, University of Washington, Seattle, Washington, 12 August.

Harper B. 2008. Bridging Western and Traditional Science in Assessing Exposure in Subsistence Populations. Presented at the 18th Annual International Society of Exposure Analysis Annual Meeting, Pasadena, California, 15 October.

Harper B. 2008. Constructing Traditional Tribal Subsistence Exposure Scenarios. Presented at the 18th Annual International Society of Exposure Analysis Annual Meeting, Pasadena, California, 15 October.

Harper B and Harding A. 2008. Tribal Exposure Analysis and Scenario Development. Presented at the EPA National Risk Assessors Training, Seattle, Washington, 8 October.

Harper B, Harding A, and Harris S. 2007. A Multidisciplinary Approach to Developing Tribal Exposure Scenarios. Presented at the International Society for Exposure Analysis Annual Meeting, Durham, North Carolina, 18 October.

Harper B, Harding A, Waterhous T, Harris S, and Fleming H. 2006. Estimating Environmental Exposures for Tribes Practicing Traditional Subsistence Lifestyles: Part 1: Cross-Cultural Methods and Part 2: Research Results for Specific Exposure Pathways. Poster presented at the National Forum on Tribal Environmental Science, Quinault Indian Nation, Ocean Shores, Washington, 24–28 September.

Harper BL, Harding AK, Waterhous TS, Harris SG, Wilcox AR, McCulley EA, and Fleming HS. 2005. Regional Tribal Exposure Scenarios Based on Major Ecological Zones and Traditional Subsistence Lifestyles. Poster presented at the Oregon Public Health Association Annual Meeting and Conference, Corvallis, Oregon, 6 October.

Harper BL, Harding AK, Waterhous TS, Harris SG, Wilcox AR, McCulley EA, and Fleming HS. 2005. Regional Tribal Exposure Scenarios Based on Major Ecological Zones and Traditional Subsistence Lifestyles. Poster and presentation at the Annual Grantee Meeting Sponsored by the National Institute of Environmental Health Sciences, U.S. Environmental Protection Agency, and National Institute of Occupational Safety and Health, Talkeetna, Alaska, 19–22 September.

Harper B, Harding A, Waterhous T, Wilcox A, and Harris S. 2009. Eco-Social Cultural Mapping: Tribal Lifestyles and Environmental Risks—Regional Tribal Exposure Scenarios Based on Ecological Zones and Traditional Lifeways. Presented at the Promoting Environmental Health in Native American Communities Webinar Series, 30 June.

Harper B and Harris S. 2009. Climate, Drought, Adaptation. Invited presentation at the Workshop on Climate, Drought, and Early Warning on Western Native Lands, Jackson Lake Lodge, Grand Teton National Park, Wyoming, 9–11 June.

Harper B and Harris S. 2007. Risk Assessment at the USDOE Hanford Nuclear Site With an Ecologically Based Tribal Human Health Subsistence Exposure Scenario. Presented at the Society for Environmental Toxicology and Chemistry Annual Meeting, Milwaukee, Wisconsin, 15 November.

Harper B and Harris S. 2005. Tribal Perspectives on Exposure Assessment Presentation and Panel Discussion on Updating EPA's Guidance on Exposure Assessment. Presented at the International Society for Exposure Assessment Annual Meeting, Tucson, Arizona, 2 November.

Harris S, Harper B, Donatuto J, and Harding A. 2006. Impacts to Tribal Health and Culture of Mercury and Other Contaminants in Columbia Basin Fish. Presentation at the Conference on Mercury as a Global Pollutant: Toward Integration of Science, Policy, and Socioeconomics, Madison, Wisconsin, 6–11 August.

Harris SG, Harper BL, and Harding AK. 2004. Risks From Tribal Subsistence Lifeways in the Columbia Basin. Presentation at the Fourth Society for Environmental Toxicology and Chemistry World Congress, Portland, Oregon, 14–18 November.

Kellogg J, Flint C, Ferguson G, Raskin I, and Lila MA. 2010. Phytochemical Composition and Bioactivity of Wild Alaskan Berries. Presented at the 2010 Joint Annual Meeting of the American Society of Pharmacognosy and the Phytochemical Society of North America, St. Petersburg Beach, Florida, 10–14 July.

Kellogg J, Flint C, Ferguson G, Raskin I, and Lila MA. 2010. Partnering With Alaska Native Communities to Link Science and Traditional Ecological Knowledge of Wild Berry Resources. Presented at the 2010 National Tribal Science Forum, Traverse City, Michigan, 6–10 June.

Kellogg J, Yousef GG, Grace MH, Flint C, Raskin I, and Lila. 2009. Partnering With Alaskan Communities to Examine Health Benefits of Traditional Wild Berries. Presented at Experimental Biology 2009, New Orleans, Louisiana, 18–22 April.

Kellogg J, Yousef GG, Grace MH, Flint C, Raskin I, and Lila MA. 2009. Partnering With Alaskan Communities to Examine Health Benefits of Traditional Wild Berries. Presented at the National Science Teachers Association National Conference on Science Education, New Orleans, Louisiana, 19–22 March.

Kellogg J, Wang J, Ribnicky D, Kuhn P, Raskin I, and Lila MA. 2010. Phytochemical Composition and Bioactivity of Wild Alaskan Berries. Presented at the 33rd Meeting of the American Society of Primatologists, Louisville, Kentucky, 16–19 June.

King J. 2007. *Iakotisa'tstentsera:wis Ne Ohontsia*: Reducing Risk by Restoring Relationships. Workshop presentation at the Haudenosaunee Environmental Youth Conference.

Kmiecik N. 2008. Intervention research and Probabilities of Risk in Walleye-Harvesting Ojibwe Communities. Presented at the International Society of Environmental Epidemiology and International Society of Exposure Analysis Joint Annual Meeting, Pasadena, California, 12–16 October.

Kmiecik N. 2008. Reducing Health Risks to the *Anishinaabe* From Methyl Mercury. Presented at the Joint Conference of the National Tribal Forum and National Tribal Air Association, Las Vegas, Nevada, 3–5 June.

Kmiecik N. 2008. Reducing Health Risks to the *Anishinaabe* From Methyl Mercury. Final report presented to the Voigt Intertribal Task Force, Mole Lake, Wisconsin.

Kmiecik N. 2008. Reducing Health Risks to the *Anishinaabe* From Methyl Mercury. Final report presented to Great Lakes Indian Fish and Wildlife Commission Board of Commissioners, Mole Lake, Wisconsin.

Kmiecik N. 2007. Reducing Health Risks to the *Anishinaabe* From Methyl Mercury. Presented at the Society for Risk Analysis Annual Meeting, San Antonio, Texas, 9–12 December.

Kmiecik N. 2007. Reducing Health Risks to the *Anishinaabe* From Methyl Mercury. Presented at the 135th American Public Health Association Annual Meeting and Exposition, Washington, DC, 3–7 November.

Kmiecik N. 2007. Reducing Health Risks to the *Anishinaabe* From Methyl Mercury. Poster presented at the National Forum on Contaminants in Fish, Portland, Maine, 23–26 July.

Kmiecik N. 2007. Reducing Health Risks to the *Anishinaabe* From Methyl Mercury. Presented at the Native American Fish and Wildlife Society Annual Meeting, Reno, Nevada, 20–24 May.

Kmiecik N. 2007. Reducing Health Risks to the *Anishinaabe* From Methyl Mercury. Presented at the Native American Fish and Wildlife Society, Great Lakes Region, Lac du Flambeau, Wisconsin.

Kmiecik N. 2007. Reducing Health Risks to the *Anishinaabe* From Methyl Mercury. Presented at the Multi-State Workgroup Annual Meeting, Madison, Wisconsin.

Kmiecik N. 2006. Reducing Health Risks to the *Anishinaabe* From Methyl Mercury. Presented at the Boys and Girls Club Meeting of the Bad River Tribe, Odanah, Wisconsin, 23 October.

Kmiecik N. 2006. Reducing Health Risks to the *Anishinaabe* From Methyl Mercury. Presented at the National Forum on Tribal Environmental Science, Quinault Indian Nation, Ocean Shores, Washington, 27 September.

Kmiecik N. 2006. STAR Grant Project Progress to Date. Poster presented at the National Forum on Tribal Environmental Science, Quinault Indian Nation, Ocean Shores, Washington, 27 September.

Kmiecik N. 2006. Reducing Health Risks to the *Anishinaabe* From Methyl Mercury. Poster presented at the National Forum on Tribal Environmental Science, Quinault Indian Nation, Ocean Shores, Washington, 25 September.

Kmiecik N. 2006. Mercury as a Global Pollutant. Poster presented at the National Forum on Tribal Environmental Science, Quinault Indian Nation, Ocean Shores, Washington, 25 September.

Kmiecik N. 2006. Fish Consumption Rates of Select *Anishinaabe* Tribal Members. Presented at the Eighth International Conference on Mercury as a Global Pollutant, Madison, Wisconsin, 8 August.

Kmiecik N. 2006. Mercury as a Global Pollutant. Presented at the Eighth International Conference on Mercury as a Global Pollutant, Madison, Wisconsin, 8 August.

Kmiecik N. 2006. Reducing Health Risks to the *Anishinaabe* From Methyl Mercury. Presented at the Boys and Girls Club Meeting of the Lac Courte Oreilles Tribe, Hayward, Wisconsin, 20 July.

Kmiecik N. 2006. Reducing Health Risks to the *Anishinaabe* From Methyl Mercury. Presented at the Bad River Community Meeting, Odanah, Wisconsin, 5 June.

Kmiecik N. 2006. Mercury, Chippewa Flowage Mercury Concentrations, and Great Lakes Indian Fish and Wildlife Fish Advisory Program. Presented at Lac Courte Oreilles Ojibwe Community College, Hayward, Wisconsin, 24 April.

Kmiecik N. 2006. Reducing Health Risks to the *Anishinaabe* From Methyl Mercury. Presented at the Bad River Spearer's Meeting, Odanah, Wisconsin, 22 March.

Kmiecik N. 2006. Fish Consumption Rates of Select *Anishinaabe* Tribal Members. Presented at the 14th Annual Midwest Chapter Meeting of Society of Environmental Toxicology and Chemistry, St. Cloud, Minnesota, 21 March.

Kmiecik N. 2006. Reducing Health Risks to the *Anishinaabe* From Methyl Mercury. Presented at the 14th Annual Midwest Chapter Meeting of the Society of Environmental Toxicology and Chemistry, St. Cloud, Minnesota, 21 March.

Kmiecik N. 2006. Reducing Health Risks to the *Anishinaabe* From Methyl Mercury. Presented at the Great Lakes Native American Elders Meeting, Oneida, Wisconsin, 3 February.

Kmiecik N. 2006. Reducing Health Risks to the *Anishinaabe* From Methyl Mercury. Presented at the Foster Grandparents/Senior Companions Meetings, Mole Lake Foster Reservation, Mole Lake, Wisconsin, 24 January.

Kmiecik N. 2006. Reducing Health Risks to the *Anishinaabe* From Methyl Mercury. Presented at the Foster Grandparents/Senior Companions Meeting, St. Croix Reservation, Webster, Wisconsin, 24 January.

Kmiecik N. 2006. Reducing Health Risks to the *Anishinaabe* From Methyl Mercury. Presented at the Foster Grandparents/Senior Companions Meeting, Lac Courte Oreilles Reservation, Hayward, Wisconsin, 18 January.

Kmiecik N. 2006. Reducing Health Risks to the *Anishinaabe* From Methyl Mercury. Presented at the Foster Grandparents/Senior Companions Meeting, Red Cliff Reservation, Red Cliff, Wisconsin, 17 January.

Kmiecik N. 2006. Reducing Health Risks to the *Anishinaabe* From Methyl Mercury. Presented at the Foster Grandparents/Senior Companions Meeting, Bad River Reservation, Odanah, Wisconsin, 17 January.

Kmiecik N. 2006. Updated Geographic Information System Maps, Including Walleye Advice and the STAR Grant. Presented at the Bad River Community Meeting, Odanah, Wisconsin.

Kmiecik N. 2006. Updated Geographic Information System Maps, Including Walleye Advice and the STAR Grant. Presented at the Great Lakes Native American Elders Meeting, Oneida, Wisconsin.

Kmiecik N. 2005. STAR Grant Project Progress. Presented at the Environmental Justice/Community-Based Participatory Research and Tribal Research Programs Annual Grantee Meeting, Talkeetna, Alaska, 19–22 September.

Kmiecik N. 2005. Updated Geographic Information System Maps, Including Walleye Advice and the STAR Grant. Presented at the U.S. Environmental Protection Agency Fish Forum, Baltimore, Maryland, 18–21 September.

Kmiecik N. 2005. Updated Geographic Information System Maps, Including Walleye Advice and the STAR Grant. Presented at the American Fisheries Society 135th Annual Meeting, Anchorage, Alaska, 10–15 September.

Kmiecik N. 2005. Updated Geographic Information System Maps, Including Walleye Advice and the STAR Grant. Presented at the Great Lakes Indian Fish and Wildlife All Staff Meeting, Odanah, Wisconsin.

Kmiecik N. 2005. Updated Geographic Information System Maps, Including Walleye Advice and the STAR Grant. Presented at the Great Lakes Indian Fish and Wildlife Board of Commissioners Meeting, Lac du Flambeau, Wisconsin.

Kmiecik N. 2005. Updated Geographic Information System Maps, Including Walleye Advice and the STAR Grant. Presented at the Bad River Spearer's Meeting, Odanah, Wisconsin.

Kmiecik N. 2005. Updated Geographic Information System Maps, Including Walleye Advice and the STAR Grant. Presented at the Mole Lake Spearer's Meeting, Mole Lake, Wisconsin.

Kmiecik N. 2005. Updated Geographic Information System Maps, Including Walleye Advice and the STAR Grant. Presented at the Voigt Intertribal Task Force Meeting, Lac du Flambeau, Wisconsin.

Kmiecik N. 2005. Updated Geographic Information System Maps, Including Walleye Advice and the STAR Grant. Presented at the Honor Our Children and Maternal Child Health Staff Meeting, Lac du Flambeau, Wisconsin.

Kmiecik N. 2005. Updated Geographic Information System Maps, Including Walleye Advice and the STAR Grant. Presented at the Consolidated Childhood Programs Staff Meeting, Hayward, Wisconsin.

Kmiecik N. 2005. Updated Geographic Information System Maps, Including Walleye Advice and the STAR Grant. Presented at the Midwest Environmental Advocates Forum, Lac du Flambeau, Wisconsin.

Kmiecik N. 2004. Great Lakes Indian Fish and Wildlife Fish Advisory Program and STAR Grant Plans. Presented at the Wisconsin Environmental Health Conference, Wisconsin, October.

Kmiecik N. 2004. Great Lakes Indian Fish and Wildlife Fish Advisory Program and STAR Grant Plans. Presented at the Great Lakes Consortium State-National Fish Consumption Advisory Workshop.

Lefthand MJ, Eggers MJ, Old Coyote TJ, Doyle JT, Kindness L, Bear Don't Walk UJ, Young SL, Bends AL, Good Luck B, Stewart R, Leider A, White Clay S, Dietrich E, Ford TE, and Camper AK. 2012. Holistic Community Based Risk Assessment of Exposure to Contaminants via Water Sources. Presented at the 140th American Public Health Association Annual Meeting and Exposition, San Francisco, California, 27–31 October.

Lila MA. 2013. Stressed for Success: Why Plants from Arctic Extremes are *Extremely* Health-Protective. Presented at the Alaska Plants as Food and Medicine Symposium, Girdwood, Alaska, May.

Lila MA. 2013. The Science and the Traditional Knowledge Behind Halth-Protective Plant Foods. Presented at the Washington State University Molecular Plant Sciences Seminar, Pullman, Washington, April.

Lila MA. 2013. Culturally Acceptable Strategies for Boosting Protein and Phytoactive Delivery in Rural Villages. Seminar presented at the University of Alaska Fairbanks, Fairbanks, Alaska, March.

Lila MA. 2013. Stressed for Success: Berry Wild Origins' Impact on Health-Relevant Properties. Seminar presented at the University of Alaska Fairbanks, Fairbanks, Alaska, March.

Lila MA. 2012. Stressed for Success: How the Berry's Wild Origins Result in Multifaceted Health Protections. Presented at the 10th International Symposium on Vaccinium and Other Superfruits, in conjunction with ISHS-IFU, MECC Maastricht, The Netherlands, 17–22 June.

Lila MA. 2012. Capitalizing on the Health Benefits of Berryfruits: Science Versus the Marketplace. Presented at BiotechFruit 2012, Nelson, South Island, New Zealand, 20 March.

Lila MA. 2012. Berry Health Benefits. Presented at the Swedish University of Agricultural Sciences (SLU) Symposium—Bioactive Components in Plant Foods, Uppsala, Sweden, 15–16 March.

Lila MA. 2011. Stressed for Success: Berry Crops, Environmental Stress, and Human Health Benefits. Keynote presentation at the North American Raspberry and Blackberry Association Conference, Savannah, Georgia, 5–7 January.

Lila MA. 2011. Berryfruits and Human Health: The Chemistry Behind the Bioactivity. Presented at the American Chemical Society (North Carolina Section) North Carolina Research Campus Meeting, Kannapolis, North Carolina.

Lila MA. 2011. Environmental Stress, Wild Berry Fruits, and Human Health Benefits. Presented at the University of Alaska Fairbanks Department of Neurosciences Summer Seminar Series, Fairbanks, Alaska.

Lila MA. 2009. Alaska Tribal Berry Resources and Human Health Under the Cloud of Climate Change. Presented at the Promoting Environmental Health in Native American Communities Webinar Series, 14 October.

Lila MA. 2009. Berry Resources and Human Health….Under the Cloud of Climate Change. Presented at the International Berry Health Benefits Symposium, Monterey, California, 22–23 June.

Lila MA and Ferguson G. 2011. The Store Outside Your Door: Research Supporting Berries as a Valuable Traditional Food Resource in Diabetes Prevention. Presented at the Annual Alaska Native Diabetes Conference, Anchorage, Alaska, 30 November–December 2.

Lila MA, Kellogg J, Flint C, and Raskin I. 2010. Arctic Berries: Stressed for Success. Presented at the Seventh Natural Health Product Research Conference: The Next Wave, Halifax, Nova Scotia, Canada, 24 May.

McCormick AKHG, Pease B, Lefthand MJ, Eggers MJ, McCleary T, Felicia D, and Camper AK. 2012. Water, A Resource for Health: Understanding Impacts of Water Contamination in a Native American Community. Roundtable presentation at the 140th American Public Health Association Annual Meeting and Exposition, San Francisco, California, 27–31 October.

Miller PK, Carpenter DO, Eckstein L, Wellfinger-Smith G, and Waghiyi V. 2010. Contaminants in the Traditional Foods of the Yupik People of St. Lawrence Island, Alaska—Exposure Pathways, Collaborative Interventions, and Prevention. Presented at the Strengthening Environmental Justice Research and Decision Making: A Symposium on the Science of Disproportionate Environmental Health Impacts, Washington DC, 17–19 March.

Miller PK, Carpenter DO, Eckstein L, Wellfinger-Smith G, and Waghiyi V. 2009. Environmental Contaminants in Foodstuffs of Siberian Yu'piks from St. Lawrence Island, Alaska. Presented at the 15th Annual Alaska Tribal Conference for Environmental Management, Anchorage, Alaska, 16–20 November.

Miller PK, Carpenter DO, Eckstein L, Wellfinger-Smith G, and Waghiyi V. 2009. Environmental Contaminants in Foodstuffs of Siberian Yu'piks from St. Lawrence Island, Alaska. Presented at the University of Alaska Community-Based Research Institute, Nome, Alaska, July.

Miller PK, Carpenter DO, Eckstein L, Wellfinger-Smith G, and Waghiyi V. 2009. Environmental Contaminants in Foodstuffs of Siberian Yu'piks from St. Lawrence Island, Alaska. Presented at the Arctic Monitoring and Assessment Programme and Northern Contaminants Programme Human Health and Arctic Environmental Contaminants Conference, Iqaluit, Nunavut, Canada, 10–12 June.

Miller PK, Carpenter DO, Eckstein L, Wellfinger-Smith G, and Waghiyi V. 2009. Environmental Contaminants in Foodstuffs of Siberian Yu'piks from St. Lawrence Island, Alaska. Presented at the Fourth Meeting of the Conference of the Parties of the Stockholm Convention on Persistent Organic Pollutants, Geneva, Switzerland, 4–8 May.

Miller PK, Carpenter DO, Eckstein L, Wellfinger-Smith G, and Waghiyi V. 2009. Environmental Contaminants in Foodstuffs of Siberian Yu'piks from St. Lawrence Island, Alaska. Presented at the American Association for the Advancement of Science Meeting, Chicago, Illinois, 12–16 February.

Miller PK, Carpenter DO, Eckstein L, Wellfinger-Smith G, and Waghiyi V. 2009. Environmental Contaminants in Foodstuffs of Siberian Yu'piks from St. Lawrence Island, Alaska. Presented at the Alaska Forum on the Environment, Anchorage, Alaska, 2–6 February.

Miller PK, Carpenter DO, Eckstein L, Wellfinger-Smith G, and Waghiyi V. 2009. Environmental Contaminants in Foodstuffs of Siberian Yu'piks from St. Lawrence Island, Alaska. Presented at the Kawerak Regional Health Conference, Nome, Alaska, February.

Miller PK, Carpenter DO, Eckstein L, Wellfinger-Smith G, and Waghiyi V. 2008. Environmental Contaminants in Foodstuffs of Siberian Yu'piks from St. Lawrence Island, Alaska. Presented at the 2008 Joint Annual Conference of the International Society for Environmental Epidemiology and the International Society of Exposure Analysis, Pasadena, California, 12–16 October.

Miller PK, Carpenter DO, Eckstein L, Wellfinger-Smith G, and Waghiyi V. 2006. Environmental Contaminants in Foodstuffs of Siberian Yu'piks from St. Lawrence Island, Alaska. Presented at the National Tribal Forum on Environmental Science, Quinault Indian Nation, Ocean Shores, Washington, 24–28 September.

Moore-Nall A and Eggers MJ. 2012. Elevated Uranium and Lead in Wells on the Crow Reservation, Big Horn County—A Potential Problem. Presented at the 2012 Geological Society of America Annual Meeting and Exposition, Charlotte, North Carolina, 4–7 November.

Moore-Nall A and Eggers MJ. 2012. Elevated Uranium and Lead in Wells on the Crow Reservation, Big Horn County—A Potential Problem. Presented at the 2012 Annual Meeting of the Montana Section of the American Water Resources Association, Butte, Montana, 11–12 October.

Moore-Nall A, Eggers MJ, Camper AK, and Lageson D. 2013. Elevated Uranium and Lead in Wells on the Crow Reservation, Big Horn County—A Potential Problem. Presented at the Earth Science Colloquium, Bozeman, Montana, 12–13 April.

Ramirez N and Steinberg SJ. 2010. Modeling Ecotoxicological Stressors Using Geographic Information Systems. Presented at Humboldt State University, Arcata, California.

Ranco D and Borsuk M. 2011. The Clean Air Mercury Rule and Indian Tribes: Consultation, Subsistence, and Cost-Benefit Analysis. Presented at the College of the Holy Cross, Worcester, Massachusetts, 1 March.

Ranco D and Borsuk M. 2010. The Clean Air Mercury Rule and Indian Tribes: Sovereignty, Subsistence, and Participation. Presented at Bates College, Lewiston, Maine, 17 November.

Reynolds III JE and O'Hara TM. 2004. Goals and Objectives of the Risks to Northern Alaskan Iñupiat: Assessing Potential Effects of Oil Contamination on Subsistence Lifestyles, Health, and Nutrition Project. Presented to the City of Wainwright, Alaska, July.

Reynolds III JE and Wetzel DL. 2005. Bowhead Whales, Bearded Seals, and Alaska Native Health. Invited presentation to the Alaska Forum on the Environment, Anchorage, Alaska, 7–11 February.

Reynolds III JE and Wetzel DL. 2005. Bowhead Whales, Bearded Seals, and Alaska Native Health. Invited presentation to the Barrow Arctic Science Consortium's Outreach Series, Iñupiat Heritage Center, Barrow, Alaska, February.

Reynolds III JE, Wetzel DL, Hanns C, Mercurio P, and O'Hara TM. 2005. Analyses of Polycyclic Aromatic Hydrocarbons in Sediments, Fish and Marine Mammals From the North Slope of Alaska. Presented at the International Symposium on Oil and Gas Activities in the Arctic, St. Petersburg, Russia, 13–15 September.

Richards C, Eggers M, Pyle B, Camper A, and Ford T. 2009. Detection of Opportunistic Pathogens in Drinking Water and Associated Biofilms in Rural Montana. Poster presented at the Eurobiofilms Conference, Rome, Italy, 2–5 September.

Sepez J. 2003. Anthropological and Historical Contexts of Makah Whaling. Invited lecture presented at the GreenLAW Environmental Law Lecture Series, University of Washington Law School, Seattle, Washington.

Sepez, J. 2002. Makah Whaling and Sealing Into the Twenty-First Century. Invited lecture presented at the University of Washington Sociocultural Anthropology Colloquium Series: Indigenous Rights, Indigenous Resources, Indigenous Futures, Seattle, Washington, 18 November.

Sepez J. 2002. If Middens Could Talk: Comparing Ancient, Historic, and Contemporary Makah Foraging Patterns. Presented at the Ninth International Conference on Hunting and Gathering Societies, Edinburgh, Scotland, 12 September.

Sepez J. 2000. The Right to Culture in International Wildlife Management. Presented at the Society For Applied Anthropology Conference, San Francisco, California, 25 March.

Sloan K. 2012. Preliminary Findings of Pacific Lamprey Tissue Testing. Presented at the South Coast Lamprey Summit, North Bend, Oregon, 22–24 May.

Sloan K and Fluharty S. 2012. Cumulative Risk and Yurok Tribal Lifeway. Presented at the U.S. EPA STAR Tribal Environmental Health Research Program Webinar, November 7.

Sloan K and Fluharty S. 2011. Yurok Tribe Environmental Justice and Climate Change Prioritization Project. Presented at the 19th Annual Region 9 Tribal EPA Conference, Pala, California, 20 October.

Sloan K and Fluharty S. 2010. Understanding the Cumulative Effects of Environmental and Psycho-Social Stressors That Threaten the *Pohlik-lah* and *Ner-er-ner* Lifeway: The Yurok Tribe's Approach. Presented at the 2010 National Tribal Science Forum, Traverse City, Michigan, 7 June.

Uesugi S, Harding A, Harper B, Harris S, Schure M, Kile M, and Goins T. 2012. Environment and Health Connections: Perspectives From Community Members of the Confederated Tribes of the Umatilla Indian Reservation. Poster presented at the 25th Annual Meeting of the Superfund Research Program, Raleigh, North Carolina, 21–24 October.

Uesugi S, Harding A, Harris S, Harper B, Simonich S, Anderson K, Stone D, Jia Y, Hirsch N, Cardenas A, and Sudakin D. 2011. Walking in Two Worlds: Tribal-University Partnerships, Capacity Building, Technology Transfer, and Developing Cultural Sensitivity in Toxicology and Environmental Health Research. Presented at Pacific Northwest Association of Toxicologists Annual Regional Chapter Meeting: The Art and Science of Research Translation in Toxicology, North Bonneville, Washington, 7 October.

Wetzel DL and Reynolds III JE. 2007. Bowhead Whales and Bearded Seals of Alaska's North Slope: Contaminant Analysis and Nutritional Assessment. Presented to the citizens of Barrow, Alaska, at the Iñupiat Heritage Museum, Barrows, Alaska, October.

Wetzel DL and Reynolds III JE. 2007. Bowhead Whales and Bearded Seals of Alaska's North Slope: Contaminant Analysis and Nutritional Assessment. Presented to the Tribal Council leaders in the Native Village of Wainwright, Alaska, October.

Wetzel DL, Reynolds III JE, Hanns C, and Mercurio P. 2006. Analysis of Polycyclic Aromatic Hydrocarbons in Marine Mammals From the North Slope of Alaska. Presented at the National Forum on Tribal Environmental Science, Quinault Indian Nation, Ocean Shores, Washington, 24–28 September.

Young SL (moderator), Lefthand MJ, Good Luck BT, Kindness L, Stewart R, Doyle JT, McCormick AKHG. 2013. Finding Answers in Contrary Lessons. Presented at the National EPA-Tribal Science Council Traditional Ecological Knowledge Pre-Workshop Webinar Series Traditional Ecological Knowledge Webinar #2, 28 May.

Appendix C: Tribal Environmental Health Research Program Presentations

Staff members from EPA's Tribal Environmental Health Research Program have given a number of presentations about the research conducted within the program at national and international meetings. A representative list of these presentations is provided below.

Breville M. 2011. NCER Tribal Programs: An Overview. Presented to the EPA Office of International and Tribal Affairs, Washington, DC, 3 August.

Breville M. 2011. NCER Tribal Programs: An Overview. Presentation provided to the National EPA-Tribal Science Council, June.

Breville M. 2010. NCER Tribal Environmental Health Overview. Presented at the 20th Annual International Society of Exposure Science Conference (joint with International Society for Environmental Epidemiology), Seoul, Korea, 30 August.

Breville M. 2010. Tribal Environmental Health Research Program Grants. Presented at the Tribal Environmental Health RFA Strategy Session, 2010 National Tribal Science Forum, Traverse City, Michigan, 9 June.

Breville M. 2010. NCER Tribal Environmental Health Overview. Presented at the 2010 National Tribal Science Forum, Traverse City, Michigan, 7 June.

Breville M. 2009. Educational Opportunities at EPA's National Center for Environmental Research. Presented at the Fifth Biennial National Association of Fellowships Advisors Conference, Seattle, Washington, 16 July.

McOliver C, O'Fallon L, and Finn S. 2013. Role of Federal Funding of Environmental Research in Building Capacity in Indigenous Communities. Poster presented during the Creating Healthy Native Communities—Infrastructure, Capacity, and Equality in Indigenous Public Health Endeavors Poster Session at the American Public Health Association 141st Annual Meeting and Exposition, Boston, Massachusetts, 3 November.

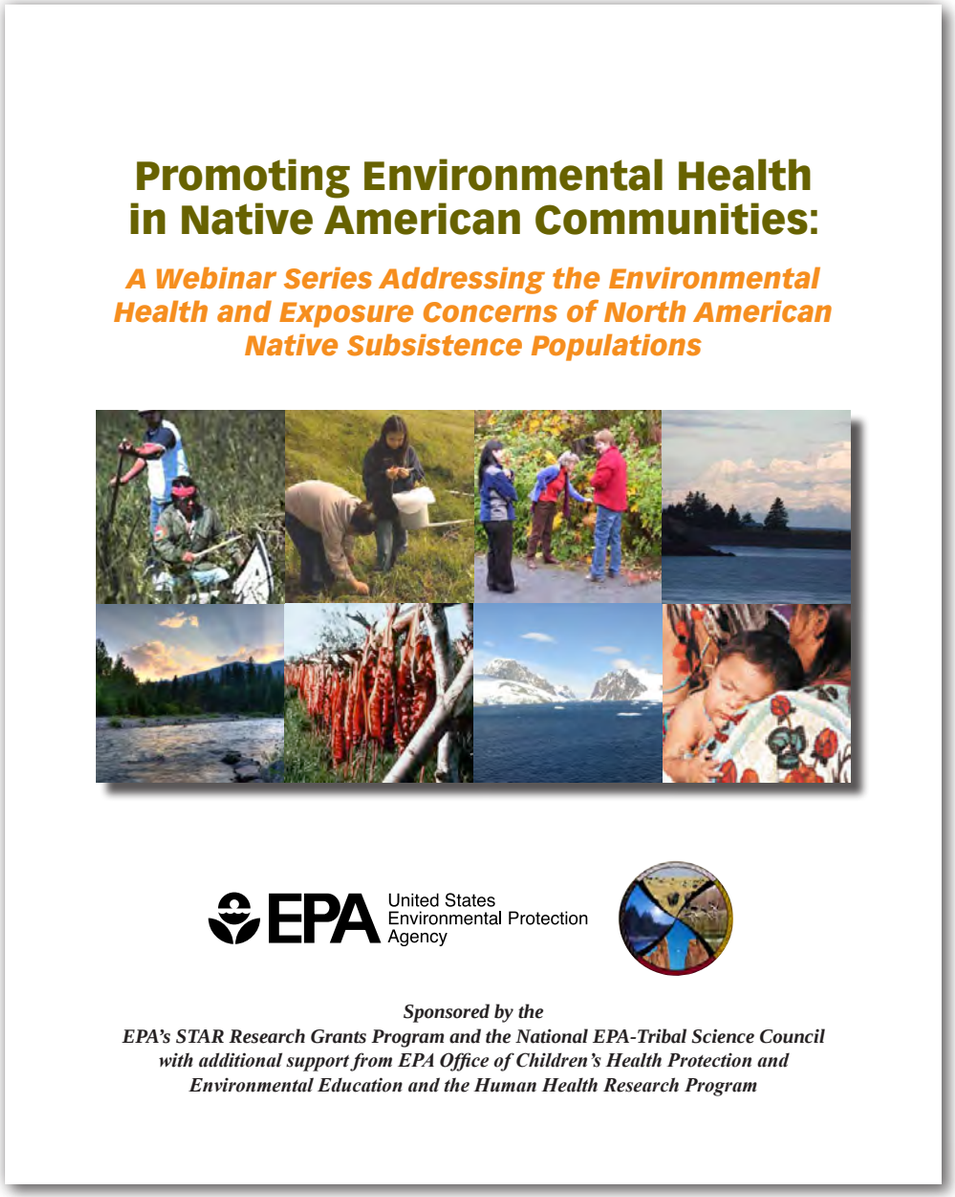
McOliver C. 2012. Tribal Science: NCER STAR Program. Presented to EPA's NCER, Washington, DC, 1 November.

McOliver C. 2012. Tribal Science: NCER STAR Program. Presented at the EPA Office of International and Tribal Affairs American Indian Environmental Office Tribal ecoAmbassadors Meeting, Washington, DC, October.

McOliver C. 2012. Tribal Science: NCER STAR Program. Presented to the EPA Office of International and Tribal Affairs, Washington, DC, Washington, DC, 5 September.

Appendix D: Overview of Tribal Environmental Health Research Program Grantee Webinars

In 2009, the Tribal Environmental Health Research Program, in coordination with the National EPA-Tribal Science Council, sponsored a series of webinars highlighting Science To Achieve Results (STAR) research focused on tribal environmental health and exposure concerns. Another series was held during the fall of 2012. This appendix provides an overview of the 2009 webinars and information about the 2012 webinars.



EPA United States Environmental Protection Agency

Executive Summary

The Environmental Protection Agency's (EPA) STAR Research Grants Program, in partnership with the National EPA-Tribal Science Council, conducted a webinar series designed to translate and disseminate recent findings of previous and current STAR-funded research addressing the environmental health and exposure concerns of North American Native subsistence populations. Additional support for the project was provided by the EPA Office of Children's Health Protection and Environmental Education and the Human Health Research Program.

The series highlighted research goals and preliminary findings of newly awarded projects focused on cumulative risk and climate change. These projects may particularly appeal to those interested in novel risk assessment methods or the potential direct and indirect impacts of global warming on the health outcomes to Alaska Natives. The results discussed in these webinars may be of particular interest to Agency risk assessors, Tribal environmental managers, and Tribal health care practitioners.

The series consisted of four webinars conducted from June 30, 2009 to December 10, 2009:

"Eco-social Cultural Mapping: Tribal Lifestyles and Environmental Risks," June 30, 2009.

"Alaska Tribal Berry Resources and Human Health Under the Cloud of Climate Change," October 14, 2009.

"Community-Based Risk Assessment of Exposure to Contaminants via Water Sources on the Crow Reservation in Montana," November 18, 2009.

"Climate Change and Contaminants in Subsistence Foods: A Tribal Program to Monitor the Health of Alaska Yupik Women and Children," December 10, 2009.

Overview of the Research

Many traditional North American Native Tribal Populations maintain intricate and ecologically interdependent relationships with the natural environment. Though many of these relationships developed over centuries, with knowledge and skills accumulated and passed across scores of generations, the rapid emergence of industrial chemical pollution; the availability of refined, processed foods; and social and political isolation have severely threatened the health, wellness, and way of life of individuals and entire Tribal communities in the United States.

Recently, there has been increased emphasis on encouraging traditional diets, religious practices, and customs to restore and protect the health and knowledge base of Tribal communities, while concomitantly addressing issues of environmental pollution, social justice, and sovereignty. This seminar series featured Tribal communities and their research partners conducting dietary exposure, cumulative risk, climate change health effects, and risk reduction research that aimed to quantify and reduce environmental risks and to encourage or restore traditional, healthy ways of life for American Native communities.

Specific objectives of the Webinar Series included:

1. Understanding and reviewing research findings.
2. Exploring new strategies, methods, and tools for assessing environmental health exposure among Tribal populations.
3. Identifying research opportunities for advancing health protection and maintaining traditional Tribal ways of life.

The following pages provide one-page summaries of each webinar. To read a complete summary or to view the webinars, visit http://www.epa.gov/osp/tribes/events.htm.

EPA United States Environmental Protection Agency

Webinar Series

Promoting Environmental Health in Native American Communities

Eco-social Cultural Mapping: Tribal Lifestyles and Environmental Risks — Regional Tribal Exposure Scenarios Based on Ecological Zones and Traditional Lifeways

Barbara Harper,[1, 2] Anna Harding,[1] Therese Waterhous,[1] Anthony Wilcox,[1] and Stuart Harris[2]

June 30, 2009

This project systematically described how Tribal people interact with the environment and how they might be exposed to environmental contaminants. The initial driver was the lack of exposure scenarios and exposure factors for use in Superfund risk assessments where Tribes and Tribal resources are affected.

Tribal communities engage in active, outdoor lifestyles in all climates, with greater environmental contact rates in comparison to members of the suburban community. Diets of each Tribe are based on the natural resources present and the unique cultural uses. Consequently, most Tribal exposure factors are higher than EPA default rates.

Exposures occur through food and medicine intake as well as through cultural, ceremonial, and occupational practices of Tribal members. Data were taken in consideration of the whole-life scenario—that is, data from full-time residents, not those with recreational status—and analyses were conducted assuming nutritionally complete diets for accurate statistical plotting.

Researchers operated under the basic concepts of ecology, cultural quality of life, a broader definition of health, contemporary suppression of resource use, and reconstruction of traditional lifeways. Researchers considered the biodiversity, landscapes, critical habitat, and human use of the local environment to determine food chain concentrations and socio-cultural exposures for evaluating eco-risk to the population.

The researchers recognized that contemporary suppression of resource use would have to be considered when collecting data. Local fish advisories, contaminated sites, and rights of access issues could restrict use and consumption and associated exposures, so real-time subsistence lifestyles and diets were measured for risk assessment. The outcomes would help target restoration efforts of the natural resources.

To reconstruct traditional lifeways and natural resources, researchers conducted culturally competent interviews and reviewed anthropological literature that included traditional ecological knowledge, physiology, culture, ecology, ethno-botany, language and oral tradition, and exposure science. Major food groups were used to categorize caloric intake, and consumption and exposure rates were estimated based on cultural activities. This holistic overview approach to data collection was used, versus simple food consumption surveys to attain precise and accurate study results, and these multiple lines of evidence were peer-reviewed for a more robust and confident conclusion.

This research was conducted solely for the benefit of the Tribe, so it was critical to ensure their willing participation. An advisory board consisting of Tribal and technical members

ensured that the communities were involved, informed (informed consent) and in control of the data (intellectual property). True informed consent was obtained after members were apprised of how the data would be used and potential misuse of the data was explained fully.

[1] Oregon State University
[2] Confederated Tribes of the Umatilla Indian Reservation

To read a complete summary or to view and/or listen to the webinar, visit http://www.epa.gov/osp/tribes/events.htm.

EPA United States Environmental Protection Agency

Webinar Series

Promoting Environmental Health in Native American Communities

Alaska Tribal Berry Resources and Human Health Under the Cloud of Climate Change

Mary Ann Lila, Ph.D.,[1] Courtney G. Flint, Ph.D.,[2] Gary Ferguson, N.D.[3]

October 14, 2009

This project investigated the potential health and medical benefits of wild berries to Alaska Natives in three coastal communities. Wild Alaska Berries (salmonberries, bog blueberries, blue huckleberries, and blackberries/crowberries/mossberries) are a rich part of many Alaska Native people's Tribal resources, and they produce beneficial biological compounds in response to the stresses they undergo during growth in the harsh climate. The research team worked with students and community members to look at the role berries play in the lives, lifestyle, and culture of Native Americans in each community.

The participating communities—Seldova, Akutan, and Point Hope—are located along three distinctive coastal areas of Alaska. Each one has a complement of berries keyed to the

health and economic benefits of the community. Berries are important for food, physical activity, sharing with family and friends, and keeping traditions alive. They are eaten in a variety of ways and stored for winter. Berries generally are considered healthy, but specific benefits are not very well known in the communities. Berries produced under stress offer enhanced health benefits to humans.

The project was conducted within a Community Based Participatory Research (CBPR) framework. CBPR involves collaboration that equitably includes community members, organizational representatives, and researchers in the project. The research team combined biological and social sciences, community participation, and integrated inquiry.

Field screening of the berries was conducted under the Screens-to-Nature (STN) program to measure health benefits and help students and elders learn first-hand how the chemistry of wild berries makes them healthy for humans. The STN technology tested for amylases and amylase inhibitors; proteases and protease inhibitors; and antioxidants. Scientific analyses of the berries indicated that the amylase-inhibiting activity of berries slows down the process of turning starch into sugar (i.e., it has an important impact on diabetes); berries contain varying levels of antioxidants; and protease inhibitors in berries may help fight HIV/AIDS, parasitic diseases, and metabolic disorders.

Alaska Natives were engaged to assess their overall opinions and perspectives on their communities, including the risks and challenges they face from climate change, environmental contamination, threats to subsistence resources, as well as their concerns about their health and the vitality of their local

economies. Each community has concerns about diabetes, cancer, and unhealthy diets.

In all three communities, Tribal health issues were linked to the loss of a traditional way of life and a decreased emphasis on subsistence resources and foods. Many factors prevent the subsistence lifestyle. The influence of Western culture on Alaska Native youth and the high cost of fuel are also altering the cultural landscape.

[1] North Carolina State University
[2] University of Illinois
[3] Alaska Native Tribal Health Consortium

To read a complete summary or to view and/or listen to the webinar, visit http://www.epa.gov/osp/tribes/events.htm.

EPA United States Environmental Protection Agency

Webinar Series

Promoting Environmental Health in Native American Communities

Community Based Risk Assessment of Exposure to Contaminants via Water Sources on the Crow Reservation in Montana

Crescentia Cummins,[1,2] Timothy Ford, Ph.D.,[3] John Doyle,[2,4,5] Larry Kindness,[1,2,4] Urban Bear Don't Walk,[2,4,6] Mari Eggers[1,7]

November 18, 2009

This research project developed a risk assessment program focusing on the contamination of water sources on the Crow Reservation in Montana. Water, wastewater, and aquatic subsistence foods were collected and analyzed, and contamination from toxic substances in drinking water and surface water sources were evaluated. These data are being combined with an investigation into contemporary and traditional uses of water in the Crow community.

LifeLine Tribal risk assessment modeling software will be used to assess the overall risks to the community from contaminated water sources. Potential outcomes from this research include a better understanding of the environmental risks of water sources associated with a subsistence-based lifestyle of Tribal populations. Also, through community-based participation, this research may help improve Tribal capacity to manage and protect environment and health through health education and other risk communication measures.

The Crow Indian Reservation, located in south-central Montana, encompasses 2.8 million acres and has a population of about 8,000 people. Although much of the Reservation is rangeland, it does include a significant amount of agricultural land.

Water has always been a treasured resource in the Crow community, and traditions and history surrounding water are still honored and practiced today. Rivers and springs continue to be used in many ceremonial practices and recreational purposes, including in the Native American Church, the Sun Dance, and Sweat Lodge ceremonies. However, water quality on the Reservation has deteriorated over the past 50 years, and, today, degradation of water quality is the community's top environmental health concern.

This research project employed a Community-Based Participatory Research (CBPR) model, which is defined as "[a] collaborative approach to research that equitably involves, for example, community members, organizational representatives, and researchers in all aspects of the research process."

The data from this project has helped the Apsaalooke Water and Wastewater Authority move into the next phase of its work, replacing wastewater lagoons and repairing water lines. The Authority is in the process of raising funds for Phase 3, which will include funds for drilling new drinking water wells and expansion of Little Big Horn College's health education facility.

[1] Little Big Horn College
[2] Crow Tribal member
[3] University of New England
[4] Apsaalooke Water and Wastewater Authority; Crow Environmental Health Steering Committee
[5] Big Horn County Commissioner; Big Horn County Health Board
[6] Legal counsel for the Crow Indian Nation
[7] Montana State University

To read a complete summary or to view and/or listen to the webinar, visit http://www.epa.gov/osp/tribes/events.htm.

EPA United States Environmental Protection Agency

Webinar Series

Promoting Environmental Health in Native American Communities

Climate Change and Contaminants in Subsistence Foods: A Tribal Program to Monitor the Health of Alaska Yupik Women and Children

James E. Berner, M.D.[1]

December 10, 2009

Dr. James E. Berner directs the Alaska Native Traditional Food Safety Monitoring Program, which assesses contaminant and micronutrient levels in pregnant Alaska Native women and evaluates health effects in mothers and newborn infants. In this webinar, Dr. Berner describes the climate changes taking place in Alaska and the contaminants these changes are bringing to Alaska. He discusses the impacts climate change and contaminants are having on the health of pregnant Alaska Yupik women and on subsistence food safety.

Health impact mechanisms on the Native Alaska people because of climate change and contaminants in the Arctic include:

- The effect of contaminant transport on subsistence foods.
- The spread of zoonotic disease (diseases animals can give to people).
- Damage to permafrost-dependent infrastructure.
- Unintentional injury.
- Extreme weather events.

Subsistence food safety is essential to the Alaska Native population in the following ways:

- Rural Alaska Natives are the most subsistence dependent population in the United States.
- Accumulation of organic contaminants in the food web biomagnifies and bioaccumulates, and the developing fetus and pregnant women are most sensitive to the toxicologic effects of contaminants and heavy metals.
- Traditional food has public health and culture benefits.
- Transport of contaminants by ocean, river, and atmospheric mechanisms may be increased by a warming climate.

Food safety issues surrounding contaminants include persistent organic pollutants and heavy metals that are present and threaten food safety, including mercury, lead, arsenic, and cadmium.

This research attempted to discover the human toxicological effects of climate change and contaminants in the Arctic on subsistence food safety, including negative effects on Native people in terms of growth, neurologic development; endocrine disruption; immunologic effects; and adult chronic disease, which might turn out to be the most common effect of all.

In a comparison of women in the Yukon-Kuskokwim Delta to other populations along the Arctic coast, the blood levels of persistent organic compounds in circumpolar pregnant women were less than or about average for the group. However, the

Yupik population had substantially higher omega-3 fatty acid levels than any other pregnant Inupiat women on Alaska's Arctic Ocean coast, and future studies will consider the risk and balance of these levels of fatty acids in the diet of pregnant women.

[1] Division of Community Health Services, Alaska Native Tribal Health Consortium, Anchorage, AK

To read a complete summary or to view the webinar, visit http://www.epa.gov/osp/tribes/events.htm.

Dr. Jim Berner

2007 Tribal Environmental Health Star Grantee

A Conversation on Climate Change, POPs, Subsistence Food and Alaskan Communities

Bio: Dr. James E. Berner has practiced medicine in the Alaska Native health system since 1974, and is certified in Internal Medicine and Pediatrics. He is the Senior Director for Science in the Division of Community Health, of the Alaska Native Tribal Health Consortium.

Research: Dr. Berner's current grant (R833705) focuses on the Yupik Alaskan Native (AN) residents in the Yukon-Kuskokwim River Delta (YKD) of Southwestern Alaska. Salmon and seals are the largest component of the subsistence diet for AN in the YKD and climate change has increased the concentration of POPs in these animals. Pregnant Yupik women have POPs levels similar to other Arctic women, with higher toxaphene, brominated flame retardants (PBDEs) and Hg levels than most other Arctic pregnant women. The goal of Dr. Berner's grant is to evaluate whether climate change is affecting the health of the Yupik AN people through its impact on their subsistence lifestyle.

Appendix E: Summary Tables of EPA Tribal Research Projects Discussed Within the Report

STAR Grants Discussed in this Report and Funded Under the EPA Tribal Environmental Health Research Program (TEHRP)

Project Title (Grant Number)	RFA Needs Addressed by Grant	Principal Investigator(s)/ Fellow(s)	Institution(s)	Project Period
Issues in Tribal Environmental Research and Health Promotion: Novel Approaches for Assessing and Managing Cumulative Risks and Impacts of Global Climate Change (2007 RFA)				
An Epidemiologic Study of Time Trends and Health Effects of Persistent Organic Pollutants, Mercury and Micronutrients (R833705)	• Addressed ***tribal cumulative exposures*** to multiple environmental stressor in rural Yupik Alaska Native people. • Evaluated the affect of ***global climate change*** on contaminants in the Bering Sea to address ***impacts on the cultural and physical health*** on Yupik Alaska Native people.	James Berner	Alaska Native Tribal Health Consortium	June 1, 2009 through May 31, 2013 (Extended to May 21, 2014)
Community-Based Risk Assessment of Exposure to Contaminants via Water Sources on the Crow Reservation in Montana (R833706)	• Provided a comprehensive assessment of ***tribal cumulative exposures*** of the Crow residents from their water sources. • Developed culturally appropriate risk communication specific to the Crow Nation ***to reduce subsistence-based risk***.	Timothy Ford	Montana State University and University of New England	June 1, 2009, through May 31, 2012 (Extended to May 31, 2013)
Impacts of Climate Change on Health Benefits of a Tribal Alaskan Resource: Integrating Traditional Ecological Knowledge with Risk Assessment Through Local Monitoring (R833707)	• Provided a baseline assessment of sustenance berry bioactivity as influenced by ***global climate change and its impact on the cultural and physical health*** of three Alaska communities. • Integrated this information with biophysical findings for informed local health-related decision-making ***to reduce subsistence-based risk***.	Mary Ann Lila	University of Illinois at Urbana-Champaign	January 1, 2008, through December 31, 2011
Understanding the Cumulative Effects of Environmental and Psycho-Social Stressors that Threaten the Pohlik-lah and Ner-er-ner Lifeway: The Yurok Tribe's Approach (R833708)	• Collected and evaluated health data on the Yurok Tribe with a focus on health problems associated with ***tribal cumulative exposures*** to target contaminants. • Determined with the tribe how the findings could ***reduce subsistence-based risk*** and preserve Yurok subsistence resources.	Kathleen Sloan	Yurok Tribe Environmental Program	July 1, 2008, through December 31, 2012
Lifestyle and Cultural Practices of Tribal Populations and Risks From Toxic Substances in the Environment (2002 RFA)				
Environmental Contaminants in Foodstuffs of Siberian Yupiks from St. Lawrence Island, Alaska (R831043)	• Examined Yupik traditional foods and ***subsistence activities*** to determine food safety and ***ascertain the cumulative exposure profile*** of the tribe. • Discussed the project implications with the Yupik in a ***culturally sensitive*** manner in an effort ***to reduce subsistence-based risk without compromising lifestyles to a significant extent*** because traditional foods are vital to Yupik well-being and culture.	Pamela K. Miller	Alaska Community Action on Toxics	December 1, 2003, through November 30, 2006
Iakotisa'tstentsera:wis Ne Ohontsia: Reducing Risk by Restoring Relationships (R831044)	• Developed ***educational and intervention materials*** for the Mohawk community that promote traditional cultural and subsistence practices ***to reduce subsistence-based risk without compromising lifestyles to a significant extent*** while restoring healthy relationships with the natural world. • Identified ***culturally sensitive strategies*** to decrease the health risk associated with exposure to persistent toxic substances and ***reduce subsistence-based risk***.	Mary Arquette	Akwesasne Task Force on the Environment/ Haudenosaunee Environmental Task Force	April 1, 2004, through March 31, 2007
Risks to Northern Alaskan Iñupiat: Assessing Potential Effects of Oil Contamination on Subsistence Lifestyles, Health and Nutrition (R831045)	• Analyzed Iñupiat subsistence marine mammals ***to quantify subsistence-based exposures that occur primarily through food, cultural/ceremonial and occupational practices***. • Presented study information and outcomes to the Iñupiat in a ***culturally sensitive*** manner in an effort ***to reduce risk in subsistence groups without compromising lifestyles to a significant extent***.	Dana L. Wetzel	Mote Marine Laboratory	August 1, 2003, through July 1, 2006
Lifestyle and Cultural Practices of Tribal Populations and Risks From Toxic Substances in the Environment (R831046)	• Prepared a set of regional traditional tribal subsistence exposure scenarios ***to reduce risk in subsistence groups without compromising lifestyles to a significant extent***. • Developed a ***culturally sensitive*** publication, the ***Tribal Exposure Scenario Guidance Manual***.	Barbara Harper	Oregon State University	August 1, 2003 through July 31, 2006

Summary of Grants Discussed in This Report and Funded Under the EPA Tribal Environmental Health Research Program (TEHRP) *continued*

Project Title (Grant Number)	RFA Needs Addressed by Grant	Principal Investigator(s)/ Fellow(s)	Institution(s)	Project Period
Reducing Risks of the Anishinaabe From Methyl Mercury (R831047)	• Analyzed Anishinaabe walleye consumption data and collected walleye mercury data ***to quantify subsistence-based exposures and predict the cumulative exposure profile*** of the Anishinaabe. • Developed a ***culturally sensitive*** intervention program, including fish advisory maps, ***to reduce subsistence-based risks*** from consumption of methylmercury-contaminated walleye ***without compromising lifestyles to a significant extent***.	Jeffrey Foran	Great Lakes Indian Fish and Wildlife Commission	July 1, 2003, through June 30, 2006 (Extended to October 31, 2007)
Environmental Justice: Partnerships for Communication (2000 RFA)				
Bioaccumulative Toxics in Native American Shellfish (R829476)	• ***Established effective input from an underserved community affected by an environmental toxicant***, the Swinomish Indian Tribal Community, by administering a community survey and conducting individual interviews of tribal citizens. • ***Developed community-based, culturally sensitive educational*** materials, including a Swinomish traditional food book, coloring book, documentary and posters, to mitigate adverse health effects from environmental toxicants in the Swinomish community.	Jamie Donatuto	Swinomish Tribal Community	March 15, 2002, through March 14, 2006 (Extended to August 28, 2006)

Summary of Non-TEHRP EPA-Funded Tribal Projects Discussed in This Report

Project Title (Grant Number)	Funding Program	Request for Application	Principal Investigator(s)/ Fellow(s)	Institution(s)	Project Period
Tribal Environmental Public Health Indicators (R834791)	NCER STAR Grant	Exploring Linkages Between Health Outcomes and Environmental Hazards, Exposures, and Interventions for Public Health Tracking and Risk Management (2009 NCER RFA)	Jamie Donatuto	Swinomish Tribal Community	July 1, 2011, through June 30, 2013
Midwest Hazardous Substance Research Center (R828770)	STAR-Funded Center	Hazardous Substance Research Centers—HSRC (2001 NCER RFA)	M. Katherine Banks	Kansas State University (in partnership with Haskell Indian Nations University)	October 1, 2001, through September 30, 2006
Space-Time Aquatic Resources Modeling and Analysis Program (R829095)	STAR-Funded Center	Research Program on Statistical Survey Design and Analysis for Aquatic Resources (2001 NCER RFA)	N. Scott Urquhart	Colorado State University	October 1, 2001, through September 30, 2006
Rocky Mountain Training and Technical Assistance to Brownfields Communities Program (TR831579)	STAR Training Grant	HSRC—TTAB Brownfields (2003 NCER RFA)	Charles D. Shackelford and Karl Burgher	Colorado State University and Montana Tech of the University of Montana (in partnership with Aaniih Nakoda College [formerly Fort Belknap College])	April 1, 2004, through March 30, 2007 (Extended to March 30, 2008)
Linking Traditional Knowledge and Environmental Policy in the Cherokee Nation of Oklahoma (F5C30541)	STAR Graduate Fellowship	STAR Graduate Fellowships (2005)	Clinton R. Carroll	University of California, Berkeley	September 1, 2005, through August 31, 2007
Dine Bikeyah: Environment, Cultural Identity and Gender in Navajo Country (U915164)	STAR Graduate Fellowship	STAR Graduate Fellowships (1997)	Marsha L. Weisiger	University of Wisconsin–Madison	September 1, 1997, through December 31, 2000
Makah Traditional Environmental Knowledge and Gray Whale Conservation (U914970)	STAR Graduate Fellowship	STAR Graduate Fellowships (1996)	Jennifer Sepez	University of Washington	January 1, 1996, through August 16, 1999
Use of Bone Char for the Removal of Arsenic and Uranium from Groundwater at the Pine Ridge Reservation (SU834713 and SU835069)	P3	Phase I (SU834713): P3 Awards: A National Student Design Competition for Sustainability Focusing on People, Prosperity and the Planet (2010) Phase II: (SU835069): P3 Awards: A National Student Design Competition for Sustainability Focusing on People, Prosperity and the Planet - Phase 2 (2011)	Charles J. Werth (Faculty Advisor), Jacob Becraft et al. (Student Team)	University of Illinois at Urbana-Champaign (in partnership with Oglala Lakota College)	Phase I (SU834713): August 15, 2010, through August 14, 2011 Phase II: (SU835069): August 15, 2011, through August 14, 2013

Appendix F: Practical Applications of EPA Tribal Research

It is important that AI/AN communities, the larger public, researchers, health departments, practitioners, state and local regulators, and other stakeholders understand how tribal research conducted within the STAR Tribal Environmental Health Research Program and other EPA initiatives can provide them with practical applications and tools, methods and approaches that may be replicated in their own communities as they confront real-world environmental health issues.

Theme: Cultural Practices, Language and Traditional Ecological Knowledge

- Understand and integrate the cultural aspects of the community into research and develop culturally relevant educational materials, such as a booklet on wild plant knowledge in the Cherokee language, to explain risks and how to mitigate them to more effectively reduce exposures of sensitive populations as they engage in traditional practices.

Theme: Subsistence Foods and Water Resources

- Utilize community-based research to develop wellness plans, such as those being developed by the Alaska Native Tribal Health Consortium around sustenance berry use, that preserve traditional diets while managing risk and protecting public health.

- Use quantitative data on contaminant levels, such as those used by the St. Lawrence Island Yupik people to assess the contaminants in rendered oils and organ meat that are part of their traditional diet, to help communities avoid or reduce the risks associated with traditional diets.

Theme: Community-Based Participatory Research and Community Outreach and Education

- Develop strong partnerships with the community and enlist community representatives to guide the research design and implementation, as was done for the research project on the Crow Reservation that was guided by the Crow Environmental Health Steering Committee. This approach ensures that the research is informed by the local culture and relevant to the communities' needs, and ultimately, the results will be more readily accepted and used to protect community health and natural resources.

- Communicate research results to community members in a culturally sensitive manner, as was done, for example, during the town council meetings of the Northern Alaskan Iñupiat, and provide personal followup in the native language, such as the in-home followup in the Crow language provided to Crow residents, to increase the community members' understanding of the results and how to use them to reduce their exposures to environmental contaminants.

Theme: Risk Assessment and Sensitive Populations

- Incorporate risk assessment methodologies to create exposure scenarios that can be applied at the national, regional and local levels, such as those detailed in the Traditional Tribal Subsistence Exposure Scenario and Risk Assessment Guidance Manual, ultimately helping sensitive populations to reduce exposures and protect community and environmental health.

- Use the knowledge obtained from environmental public health indicators that are reflective of communities' health views and priorities, such as the Tribal Environmental Public Health Indicators that were developed for Salish Sea tribes, to assess and improve the health status of these communities and their members.

Theme: Impacts on Regulations and Management Plans

- Develop and use quantitative data to establish environmental quality standards that more accurately reflect the unique exposures of special populations, such as the stricter water quality standards established by the Makah Nation based on STAR grant data, to ultimately reduce their risks and protect their health and culturally important resources.

- Assist communities in developing resource management and monitoring plans, such as the tribal aquatic water quality monitoring plans developed by several tribes to monitor cultural uses of tribal water, that protect environmental resources and community health.

Appendix G: Additional Resources

NCER Program Websites

NCER Home Page: http://www.epa.gov/ncer

Events and Webinars: http://epa.gov/ncer/events

Fellowships Programs: http://www.epa.gov/ncer/fellow

People, Prosperity and the Planet Student Design Competition for Sustainability: http://www.epa.gov/P3

Requests for Applications/Funding Announcements: http://www.epa.gov/ncer/rfa

Small Business Innovation Research: http://www.epa.gov/ncer/sbir

Tribal Environmental Health Research Program: http://www.epa.gov/ncer/tribalresearch

EPA Tribal Websites

American Indian Environmental Office: http://www.epa.gov/aieo/index.htm

American Indian Environmental Office Tribal Portal: http://www.epa.gov/indian/

Indoor Air Quality Tribal Partners Program: http://www.epa.gov/iaqtribal/index.html

Region 1 Tribal Program in New England Portal: http://www.epa.gov/region1/govt/tribes/index.html

Region 2 Indian Nations: http://www.epa.gov/region02/nations/index.html

Region 4 Indian Program: http://www.epa.gov/region4/indian/index.htm

Region 5 Indian Environmental Office: http://epa.gov/region5/tribes/

Region 6 Tribal Affairs: http://www.epa.gov/earth1r6/6dra/oejta/tribalaffairs/index.html

Region 7 Tribal Program: http://www.epa.gov/region07/tribal/index.htm

Region 8 Tribal Assistance Program: http://www.epa.gov/region8/tribes/

Region 9 Tribal Program: http://www.epa.gov/region09/tribal/

Region 10 Tribal Programs: http://yosemite.epa.gov/r10/tribal.NSF

Science in Indian Country: http://www.epa.gov/osp/tribes/who.htm

Grantee Websites

EPA is not affiliated with the content of these websites.

Regional Tribal Exposure Scenarios Based on Major Ecological Zones and Traditional Subsistence Lifestyles Grant: http://health.oregonstate.edu/research/featured-projects/tribal-grant

Space-Time Aquatic Resources Modeling and Analysis Program: http://www.stat.colostate.edu/~nsu/starmap/program.html

Swinomish Indian Tribal Community Bioaccumulate Toxics in Native American Shellfish: http://www.swinomish-nsn.gov/Resources/Environment/Shellfish/Bioaccumulate-Toxics-In-Native-American-Shellfish.aspx

Technical Outreach Services for Native American Communities: http://www.engg.ksu.edu/chsr/outreach/tosnac/

Yurok Tribal Environmental Program: http://www.yuroktribe.org/departments/ytep/ytep.htm

Federal Tribal Websites

EPA is not affiliated with the content of these websites.

Agency for Toxic Substances & Disease Registry: http://www.atsdr.cdc.gov/tribal/

Indian Health Service: http://www.ihs.gov

U.S. Department of Agriculture: http://www.usda.gov/wps/portal/usda/usdahome?navid=OTR

U.S. Department of the Interior Bureau of Reclamation: http://www.usbr.gov/native/

U.S. Fish & Wildlife Service: http://www.fws.gov/nativeamerican/

U.S. Forest Service: http://www.fs.fed.us/spf/tribalrelations/index.shtml

U.S. Geological Survey: http://www.usgs.gov/indian/

Grants Training: EPA-Supported Programs and Contacts

http://www.petetribal.org/

http://www.epa.gov/ogd/training/recip_train.htm

http://www.epa.gov/tp/contactinfo/regcontacts.htm

Region 9 Current Contact: Laura Ebbert (ebbert.laura@epa.gov)

Region 10 Current Contact: Sally Thomas (thomas.sally@epa.gov)
gov/tribal/

Grants Training: Non-EPA Programs

EPA is not affiliated with the content of this website.

The Administration for Native Americans has been hosting grant writing training across the country, including Alaska and Hawaii, on an annual basis for more than 15 years. There is no fee for tribes to attend; however, they must cover transportation-related expenses. The schedule can be found at:

http://www.acf.hhs.gov/programs/ana/assistance/applicant-training-technical-assistance

These website links were current at the time of publication, but they are subject to change.

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