

The background of the cover is a collage of images. In the top left, a bear is shown eating a large fish. In the center left, there is a portrait of an elderly man. To the right, a red fishing boat is on the water. In the bottom center, three children are smiling. In the bottom left, there are green plants with red berries. The entire collage is overlaid with a green and blue geometric pattern.

# NCER Tribal Environmental Health Research Program

## SYNTHESIS REPORT



U.S. Environmental Protection Agency  
National Center for Environmental Research

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## Disclaimer

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## Executive Summary

Native American tribes and Alaska Native villages have been inextricably tied to their environments for millennia. Tribes recently have emphasized a return to traditional diets, lifeways, customs and language use to protect the health and cultural well-being of their members. This increased emphasis on traditional, healthy ways of life for Native American and Alaska Native communities requires that the health and environmental impacts of pollution, dietary exposure, cumulative risk and climate change be identified to allow lifestyle adjustments and environmental actions to be taken to reduce health risks. Recognizing that these communities have special research needs, the National Center for Environmental Research (NCER), within the U.S. Environmental Protection Agency's (EPA) Office of Research and Development, established its Tribal Environmental Health Research Program in 2000 through the Science To Achieve Results (STAR) grants program. Since its inception, the tribal research 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. NCER also supports tribal environmental research via its STAR and Greater Research Opportunities fellowship programs; P3 (People, Prosperity and the Planet) award program; and Small Business Innovation Research (SBIR) program. In addition, the Center collaborates with EPA tribal organizations (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.

As the early grants of the Tribal Environmental Health Research Program were nearing completion, NCER leadership thought that it would be useful to develop a synthesis document that highlights the outputs and outcomes of this tribal research program. This document not only describes

outcomes of past NCER tribal environmental research, it also 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 awards and SBIR 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, and 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; and impacts on regulations and management plans. These themes form 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 that is addressing the unique needs of Native American and Alaska Native communities, NCER's Tribal Environmental Health Research Program and other tribal research has yielded data, tools, products, methods and knowledge that are better defining and reducing the health risks of tribal populations, protecting natural resources that are essential to their cultural and spiritual practices, and strengthening the ecological knowledge and tribal practices of protecting and preserving the earth for future generations. Some of these outcomes are identified in the following paragraphs.

### Cultural Practices, Language and Traditional Ecological Knowledge

Each tribal nation and Alaska Native village has its own unique set of cultural practices, language and traditional ecological knowledge. NCER has funded several STAR grants that will help tribal members continue their cultural practices with reduced health risks as well as strengthen their native language skills and 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 members 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

Tribes increasingly are encouraging their members to return to 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 traditional subsistence foods, such as fish and shellfish. 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 members to pursue their traditional subsistence fishing practices while reducing their risk of mercury exposure.
- GIS maps have been developed for tribes residing near the Klamath River Basin (California) that provide information about historic and contemporary contaminant information, which allows tribal members to be aware of potential exposures.
- A tribe in the Pacific Northwest issued voluntary consumption limits for shellfish to reduce its members' exposures to toxic chemicals.
- Another Pacific Northwest tribe was able to use STAR data to support its claim that its members

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 poorest reservation in the United States.

### Community-Based Participatory Research (CBPR) and Community Outreach and Education

The tribes have experienced historical trauma as a result of past unethical research imposed on them. Using CBPR in tribal research ensures that the Native American and Alaska Native populations have a voice. CBPR, 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 and guide the research projects. Tribal members learn about the results of the grants through community presentations, training and workshops, books, DVDs, maps, radio interviews and other means.

- Researchers actively engaged the Yurok Tribal Council and community in their data-gathering process, which allowed the scientists to identify key species and perceptions about the tribe's important resources.
- Crow Nation tribal elders described previous water quality conditions about the Little Big Horn River, providing the researchers with valuable information that drove their research project.

- Presentations made to the Anishinaabe tribal members, including children, increased awareness about fish advisory maps that the tribe could use to reduce the members' 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 funded the production of a traditional food book, coloring book and documentary that promote safe Swinomish fish and shellfish consumption.

### Risk Assessment and Sensitive Populations

Tribal members have unique risks as a result of their traditional lifestyles and use of natural resources. As a result, risk assessments and exposure scenarios must be tailored to the tribes' distinct needs. Several notable outcomes of the research efforts that have focused on risk assessment and tribal populations include:

- A much-needed *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 exposure of tribal members 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.
- The Makah Nation implemented higher water quality standards compared to Washington State as a result of 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 work has resulted in the development of tribal aquatic water quality monitoring plans for a number of tribes. These higher standards and plans protect the resources that are important to the tribes' cultural and spiritual practices.

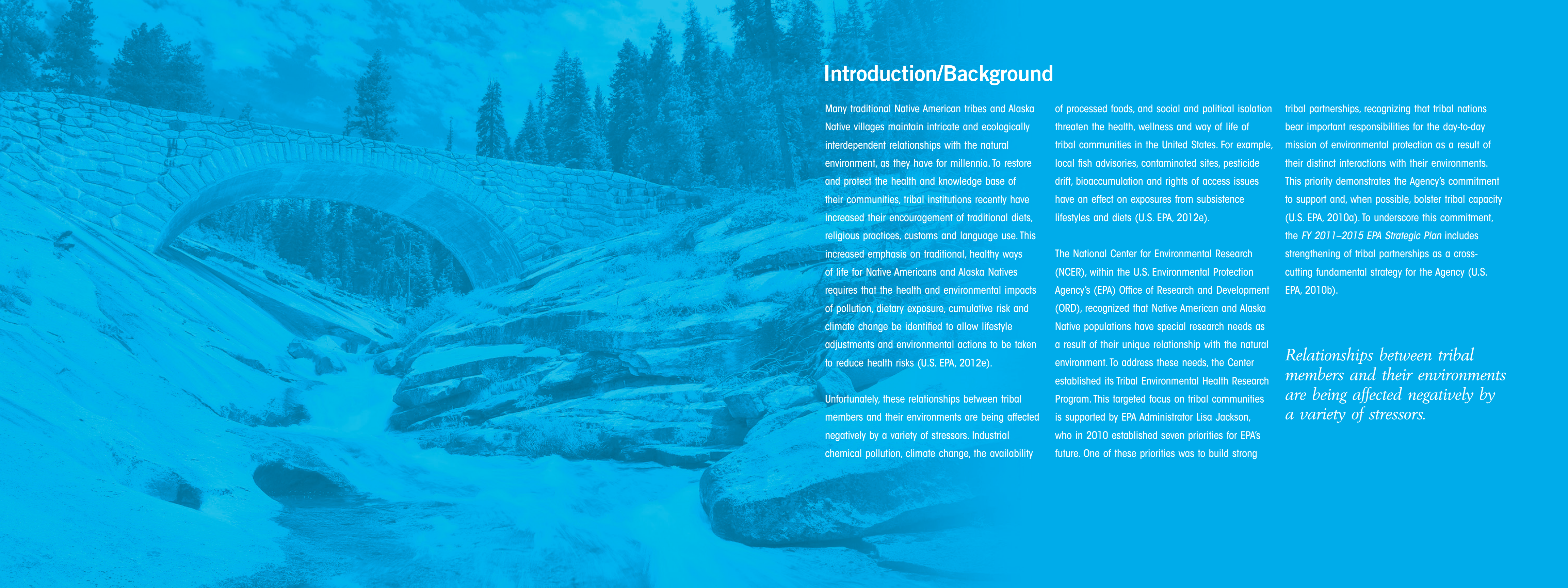
## Where Will the Tribal Environmental Health Research Program Go From Here?

Future STAR Tribal research will explore new strategies, methods and tools to assess environmental health exposure among tribal populations as well as identify other research opportunities for advancing health protection while maintaining traditional tribal ways of life. The program plans to release its upcoming Request for Applications (RFA) in late 2012. EPA solicited tribal input regarding current tribal environmental challenges to determine the RFA's focus. This input was gathered from tribal members and EPA staff at the National EPA-Tribal Science Council's 2010 National Tribal Science Forum. Upcoming webinars will highlight the research conducted within the tribal research program.

The STAR graduate fellowship program now includes a topic focused specifically on tribes and American Indian/Alaska Native/Pacific Islander communities. The STAR graduate fellowship program now includes a topic focused specifically on tribes and American Indian/Alaska Native/Pacific Islander communities. Under this research topic, fellows can assess the impacts of environmental challenges (e.g., climate change, mining activities, land use changes) on these communities, explore how their lifeways may be connected to unique risk and exposure pathways, study sustainability through tribes' traditional ecological knowledge, or expand the understanding of cumulative risk in tribes and related communities.

As it has done for the past decade, NCER's Tribal Environmental Health Research Program will continue to work with Native American tribes and Alaska Native villages to help them maintain their long-standing, intricate relationships with the natural environment even in the face of the myriad stressors threatening their health, wellness and way of life. ●





## Introduction/Background

Many traditional Native American tribes and Alaska Native villages 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 institutions recently have increased their encouragement of traditional diets, religious practices, customs and language use. This increased emphasis on traditional, healthy ways of life for Native Americans and Alaska Natives requires that the health and environmental impacts of pollution, dietary exposure, cumulative risk and climate change be identified to allow lifestyle adjustments and environmental actions to be taken to reduce health risks (U.S. EPA, 2012e).

Unfortunately, these relationships between tribal members and their environments are being affected negatively 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 way of life of tribal communities in the United States. For example, local fish advisories, 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 National Center for Environmental Research (NCER), within the U.S. Environmental Protection Agency's (EPA) Office of Research and Development (ORD), recognized that Native American and Alaska Native populations have special research needs as a result of their unique relationship with the natural environment. To address these needs, the Center established its Tribal Environmental Health Research Program. This targeted focus on tribal communities is supported by EPA Administrator Lisa Jackson, who in 2010 established seven priorities for EPA's future. One of these priorities was to build strong

tribal partnerships, recognizing that tribal nations bear important responsibilities for the day-to-day mission of environmental protection as a result of their distinct interactions with their environments. This priority demonstrates the Agency'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 the Agency (U.S. EPA, 2010b).

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



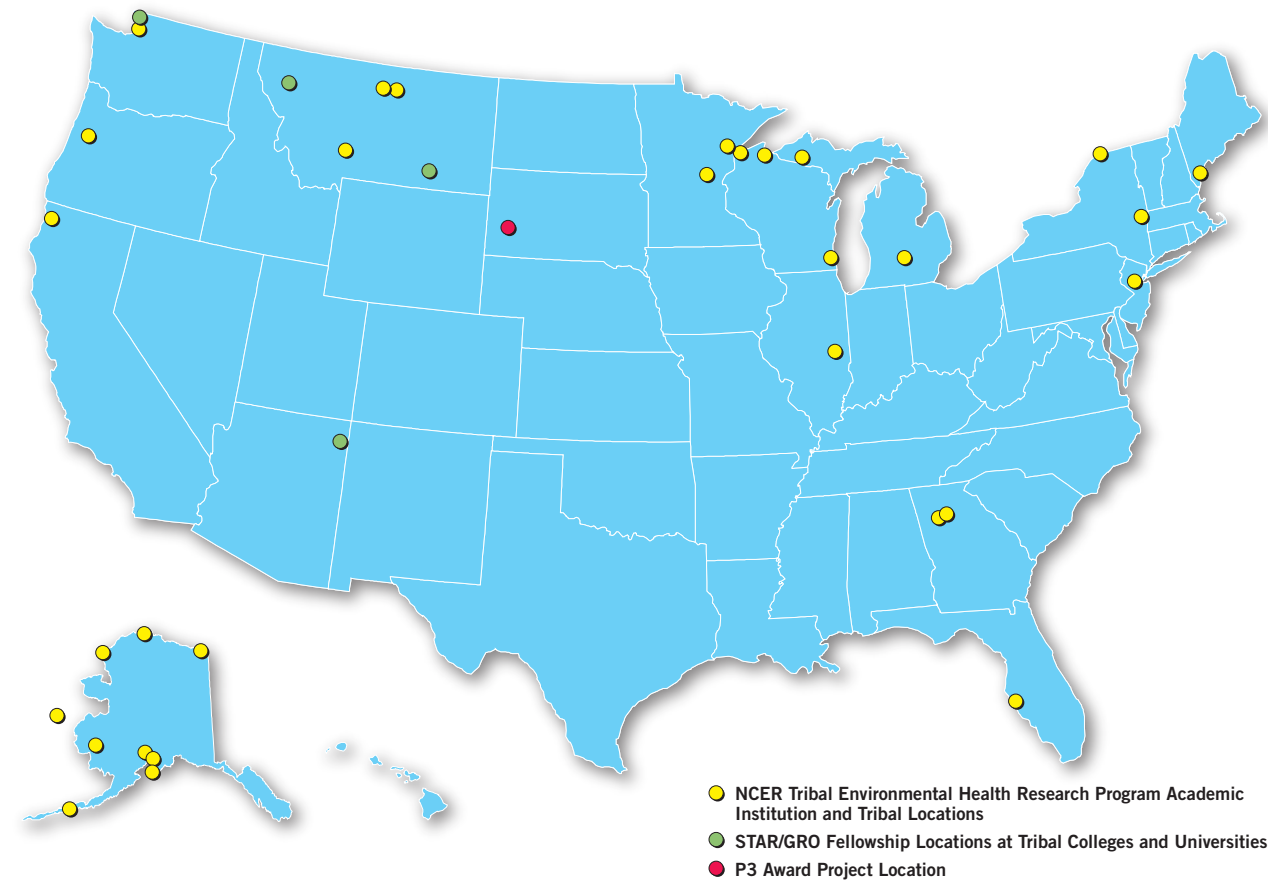
To meet the specific needs of the tribes, NCER supports research that focuses on the assessment and reduction of risk in susceptible populations. Tribal populations may be at an increased risk for environmentally induced diseases as a result of unique lifestyle practices of the tribe, community activities, occupations and customs, and/or environmental releases that significantly affect tribal lands. NCER's Tribal Environmental Health Research Program has supported studies to better understand the health effects of environmental contaminants on tribal populations. Through its Science To Achieve Results (STAR) grants program, NCER has grown 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 tribes (U.S. EPA, 2012e). A summary of the goals and objectives of these projects is included in Appendix A, and a list of outputs of the grants, including publications and presentations, is provided in Appendix B.

For more than a decade, NCER's Tribal Environmental Health Research Program has been funding extramural tribal environmental research at many sites across Indian Country. Since 2000, 10 grants have been funded under three Requests for Applications (RFAs) for a total of nearly \$6 million (U.S. EPA, 2012c). 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). Fellowships for undergraduate (STAR) and graduate (Greater Research Opportunities) students investigating tribal environmental health also have been funded by NCER. In addition, several P3 (People, Prosperity and the Planet) awards, which provide funding to undergraduate and graduate students to design sustainable solutions for the 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. In conjunction with the Tribal Environmental Health Research Program, EPA's Air, Climate and Energy Research Program released an RFA in March 2012, "Measurements and Modeling for Quantifying Air Quality and Climatic Impacts of Residential Biomass or Coal Combustion for Cooking, Heating, and Lighting" (U.S.

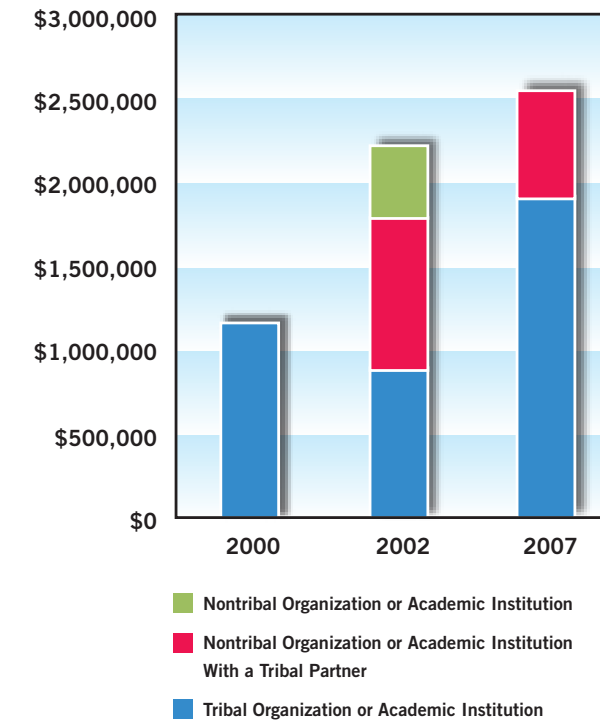
EPA, 2012a). This RFA synergizes with the National EPA-Tribal Science Council's (TSC) National Tribal Science Priority, announced in 2011, devoted to climate change. Also, NCER created a topic devoted to tribes and American Indian/Alaska Native/Pacific Islander communities for its 2011 and 2012 STAR fellowships (U.S. EPA, 2012b, 2012g).

Recognizing the importance of this research program and the need to communicate its important results, NCER staff members have made presentations at a number of meetings (Breville, 2011). More information about these



Locations of NCER tribal-related research highlighted in this document.

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 its tribal stakeholders. The Tribal Environmental Health Research Program also conducted a webinar series in 2009 in partnership with the TSC that was designed to translate and disseminate recent findings of previous and current STAR-funded research addressing the environmental health and exposure concerns of Native American subsistence populations. The series highlighted research goals and preliminary findings of newly awarded projects focused on cumulative risk and climate change. The webinars featured tribal communities and their



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

research partners conducting dietary exposure, cumulative risk, climate change health effects and risk reduction research that aimed to quantify and reduce environmental risks and encourage or restore traditional, healthy ways of life for Native American and Alaska Native communities (U.S. EPA, 2012e). More information about these webinars is available in Appendix D.

To ensure that the grants it funds are responsive to tribal needs, NCER communicates with Agency tribal organizations, such as EPA's National Tribal Operations Committee (NTOC) and TSC<sup>1</sup>. The TSC helps to integrate Agency and tribal interests, specifically with respect to environmental science issues (U.S. EPA, 2012d). NCER has worked with the NTOC and TSC to identify tribal research priorities. For example, a session at the TSC-sponsored 2010 National Tribal Science Forum allowed the tribes to provide direct input in developing the Tribal Environmental Health Research Program's next RFA, which is planned for release in late 2012 (Breville, 2011).

As some of the early grants of the Tribal Environmental Health Research Program were completed, NCER leadership decided that there was a need for a synthesis document to highlight the outputs and outcomes of this research. As such, this document focuses on tribal-related research funded by NCER, including STAR grants and fellowships and P3 awards. It does not describe any of the tribal research sponsored by other EPA offices, such as the Tribal ecoAmbassadors program, through which EPA conducts research in partnership with tribal colleges and universities to solve the environmental problems most important to their tribal communities. The synthesis document describes outcomes for past NCER tribal environmental research and discusses future directions and initiatives.

To develop this document, a contractor employed by NCER contacted all former STAR grantees and fellows who had received funding under the Tribal Environmental Health Research Program to determine the outcomes and impacts resulting from the research, including those that occurred after the funding period. 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 could be for educating tribal populations, developing regulations or management plans, taking actions to mitigate climate change and so forth. Next, the contractor identified all NCER grantees and fellows—including those from its STAR, Small Business Innovation Research (commonly known as SBIR) and P3 programs—who had conducted tribal-related research outside the Tribal Environmental Health Research Program. This was accomplished through relevant keyword searches of the NCER Research Project Database as well as input from NCER staff (U.S. EPA, 2012c). These researchers then were contacted and asked the same questions to determine whether other NCER-funded research had resulted in outcomes that benefitted tribal communities. The contractor also performed a bibliometric search to obtain times-cited data for the publications from tribal-related research projects funded by NCER. In addition, NCER staff members 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 the investigator contacts. Finally, after all of the information was collected, the contractor analyzed it, organized the research projects by common themes and developed the synthesis report using the outline determined in collaboration with NCER staff. The research projects identified in the search and their results/impacts are described by the themes in the next section. ●

<sup>1</sup> The NTOC 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).



A brown bear is shown in a natural setting, standing in shallow water. The bear is holding a large fish, likely a salmon, in its mouth. The water is clear, and the bear's fur is a mix of brown and black. The background shows a rocky shoreline and some greenery.

## Themes of the Tribal Research Funded by NCER

The decade-long tribal environmental research funded by NCER has resulted in a myriad of outcomes and outputs, including peer-reviewed publications, tribal education and outreach, advisories that reduce exposure associated with traditional sustenance lifeways, standards and regulations that offer greater protection to tribal communities, methods to reduce environmental and social impacts on tribes, and many others. Five overarching themes, as emphasized below, 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 NCER reflect their importance. Native

American and Alaska Native populations still rely heavily on their age-old *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 NCER researchers conduct, they are invested in the research and outcomes and benefit greatly from them. Many NCER tribal researchers focus on *risk assessment and sensitive populations*, and a number of tribal research projects have had beneficial *impacts on regulations and management plans*. This section provides greater detail about each of these themes.

*STAR-funded research is helping tribal members continue their cultural practices with reduced health risks.*



## Cultural Practices, Language and Traditional Ecological Knowledge

Each tribal nation and Alaska Native village has its own unique set of cultural practices, language and traditional ecological knowledge. STAR-funded research is helping tribal members continue their cultural practices with reduced health risks. This research also is strengthening their native language skills and bolstering their traditional ecological knowledge. For example, as a result of the grant, "Reducing Risks of the Anishinaabe From Methyl Mercury" (EPA Grant No. R831047 under the 2002 RFA), there is greater awareness of fish advisory maps that help to protect the health of tribal members by limiting the consumption of mercury-contaminated walleye as a part of their traditional, cultural practices (DeWeese et al., 2007; Kmiecik and Foran, 2007; Madsen et al., 2007).



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.

Traditional ecological knowledge of Alaska Natives 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, EPA Grant No. R833707 under the 2007 RFA) scientifically confirmed this traditional ecological knowledge, which held that berries have medicinal properties. The wild berries also were found to play a key role in community wellness beyond nutrition from 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 were 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 to the subsistence berries (e.g., pollution threats). Several public interviews resulted from this work, including those on National Public Radio and in *The Ecologist* (Lila et al., 2012).



Alaska Native villagers gather traditional subsistence berries.

The researchers of another STAR grant (*Iakotisa' tstentsera:wis Ne Ohontsia*: Reducing Risk by Restoring Relationships, EPA Grant No. R831044 under the 2002 RFA) focused on teaching environmental risk of cultural practices to teachers and students at the Akwesasne Freedom School. During the 3-year project, more than 100 tribal members learned about toxic substances while 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 has been empowered to understand risk issues and take action to protect tribal members' health while engaging in traditional subsistence practices (Arquette et al., 2008).

Information on Cherokee Nation culturally significant plant communities generated by a STAR graduate fellowship (Linking Traditional Knowledge and Environmental Policy in the Cherokee Nation of Oklahoma, EPA Grant No. F5C30541) is being used to target the plant communities for conservation while simultaneously encouraging the sustainable use of the resources by tribal citizens for

cultural purposes. 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 Cherokee Nation of Oklahoma Natural Resources Department has been created on the issue of Cherokee plant knowledge. The group is composed of Cherokee elders who are knowledgeable on the subject of Cherokee ethnobotany and work 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 that has come 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. Subsequently, the booklet has been translated completely 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 increasingly are encouraging their members to return to traditional diets, many of which include an abundance of fish and seafood. In addition, 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, such as fish and shellfish. These research projects have resulted in the following outcomes:

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 marine mammals, 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 project team for one STAR grant (Environmental Contaminants in Foodstuffs of Siberian Yupiks from St. Lawrence Island, Alaska, EPA Grant No. R831043 under the 2002 RFA) examined these Yupik traditional foods for polychlorinated biphenyls (PCBs), chlorinated pesticides and heavy metals. The research 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, mungtak and blubber, comprise major dietary sources of PCBs, as they 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 the 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).

Great Lakes Anishinaabe tribal members rely on traditional lifeways, which includes 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 funding from EPA's STAR grants program (Reducing Risks of the Anishinaabe From Methyl Mercury, EPA Grant No. R831047 under the 2002 RFA), there is greater awareness of the fish advisory maps produced by the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) to protect the health of Anishinaabe tribal members who consume mercury-contaminated walleye. Tribal members use the fish advisory maps to reduce their risk to 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



*An Anishinaabe fisherman harvesting walleye using nets. Fish advisory maps help to protect the health of Anishinaabe tribal members who consume mercury-contaminated walleye.*

for smaller walleye occurred among tribal harvesters in Wisconsin, Michigan and Minnesota but not among women of childbearing age. The GLIFWC 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 members, particularly those residing near or within Yurok ancestral territory. The researchers involved in the grant, "Understanding the Cumulative Effects of Environmental



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

and Psycho-Social Stressors that Threaten the *Pohlik-lah* and *Ner-er-ner* Lifeway: The Yurok Tribe's Approach" (EPA Grant No. R833708 under the 2007 RFA), 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 subpopulations within the tribe. Using personal (or public) participation geographic information systems (PPGIS) methods to better incorporate the tribe's local geographic awareness, the researchers were able to



develop a series of 12 maps for the Yurok Tribe that provide historic and contemporary contaminant information on the Klamath River Basin in California (Sloane et al., 2011). Although the full impact of the research has not been realized because the project has not yet been completed, these maps will allow the tribal members to avoid contaminated areas during harvesting.

An April 19, 2007, article in the *Seattle Times* reported that Swinomish tribal leaders were advising members 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, EPA Grant No. R829467 under the 2000 RFA) found that they contain toxic chemicals. This caused some concern for many tribal members, who



*Recurring toxic algae in the Klamath River threatens the traditional subsistence lifeways of the Yurok Tribe.*



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

consume approximately 20 times more shellfish than average Americans. Researchers analyzed Dungeness crabs and two species of clams harvested in several sites near the reservation and found traces of toxic chemicals, including PCBs, 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 Padilla, Fidalgo and Skagit Bays in Washington State. 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 members 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).

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" (EPA Grant No. R833707 under the 2007 RFA), focused on subsistence berries consumed by residents of Alaska Native villages. The results indicate that the berries studied contain A-type proanthocyanidins, a relatively rare configuration; in terms of 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 caries and providing an excellent natural therapy for these microbial diseases. 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 compliment of anthocyanins (pigments) in the berries proved to be particularly efficacious 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 traditional use of the berries in local diets as a source of medicine in addition to sustenance (Lila et al., 2012).

The results of a STAR graduate fellowship (Makah Traditional Environmental Knowledge and Gray Whale Conservation, EPA Grant No. U914970) indicated that tribal consumption of locally caught fish was significantly higher than the levels used in the models for contaminant exposure on which the previous standards had been based. The tribe had been contending that this was true for years, but the STAR data provided them with the evidence that they needed to effectively argue their case. 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 as well as being used extensively in the revised draft Environmental Impact Statement by National Marine Fisheries Service on the Makah whaling quota (Sepez, 2011).

The Pine Ridge Indian Reservation in South Dakota, home to the Oglala Sioux Tribe (also known as the Oglala Lakota Nation), is the poorest reservation in the country, and many residents rely on private wells as their drinking water source. A number of studies reveal that significant levels of arsenic and uranium contaminate the reservation's groundwater (Werth et al., 2010). A P3 award (Use of Bone Char for the Removal of Arsenic and Uranium from

Groundwater at the Pine Ridge Reservation, EPA Grant No. SU834713 [Phase I] and SU835069 [Phase II]) 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 wells on the Pine Ridge Reservation and developed a map that highlights the location of contaminated sources. The team is working with members 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 Ridge Reservation to obtain water samples for the NCER-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

Community-Based Participatory Research (CBPR) and Community Outreach and Education CBPR in tribal research is crucial to ensure that the Native American and Alaska Native populations have a voice in planning and implementing needed research. This is important to tribes as they have experienced trauma resulting from past unethical research imposed on them. As such, CBPR, education and outreach have been and continue to be important components of STAR grants and fellowships funded under the Tribal Environmental Health Research Program. Within CBPR, the community (i.e., the tribe, Alaska Native village) is actively involved in every phase of the research project being conducted. The researchers involved in Tribal Environmental Health Research Program CBPR projects must understand the particular culture and recognize the sovereignty of the indigenous peoples they are researching. For example, the researchers of 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" (EPA Grant No. R833708 under the 2007 RFA), developed their research questions by consulting the Yurok Tribal Council and community. Phase 2 of their research, which included PPGIS, actively engaged the community in the data-gathering process (Sloan, 2010). Community input via scoping sessions, oral interviews and tribal member questionnaires allowed the researchers to identify key species and perceptions regarding resource quality and abundance, resource conditions across time, and the relationship between resource and community health (Sloan and Fluharty, 2010).

Because community and traditional communal activities and lifeways are so important to the Siberian Yupiks,

the project team for one STAR grant (Environmental Contaminants in Foodstuffs of Siberian Yupiks from St. Lawrence Island, Alaska, EPA Grant No. R831043 under the 2002 RFA) conducted a series of meetings with the tribal leadership of the native villages of Gambell and Savoonga (Alaska) and with the communities in the villages of St. Lawrence Island to discuss 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 to find methods to reduce exposures while continuing reliance on the traditional diet (Miller et al., 2010).



*Crow tribal members "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)*

Tribal elders are respected and revered among Native American tribes. They carry much of the cultural and traditional ecological knowledge of their tribes and pass their wisdom and knowledge on to the younger generations. Understanding the importance of tribal elders, the researchers involved in the CBPR project, "Community-Based Risk Assessment of Exposure to Contaminants via Water Sources on the Crow Reservation in Montana" (EPA Grant No. R833706 under the 2007 RFA), reached out to tribal elders, who described how the water quality in the Little Big Horn River had deteriorated during the previous 50 years. The elders reminded the younger tribal members, as well as the researchers, that they do not appreciate water 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 researchers involved with the grant, "Reducing Risks of the Anishinaabe From Methyl Mercury" (EPA Grant No. R831047 under the 2002 RFA), used community outreach and education to increase awareness of GLIFWC-produced fish advisory maps among the tribal community. Through the grant, tribal leaders, health care providers, fish harvesters, mothers with young children, women of childbearing age, children and elders were trained in the use of the maps, which help to protect the health of tribal members who consume 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



*Crow tribal members and their academic partners obtaining water samples from the Little Big Horn River, Montana, today.*

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). Presentations regarding the maps were made 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 as well as among women of childbearing age in Wisconsin (DeWeese et al., 2007; Kmiecik and Foran, 2007; Madsen et al., 2007).



The approach used for another STAR grant (*Iakotisa' tstentsera:wis Ne Ohontsia*: Reducing Risk by Restoring Relationships, EPA Grant No. R831044 under the 2002 RFA) was to work with teachers at the Akwesasne Freedom School 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 through teacher training and in-class workshops with students during which they 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, assistant teachers and environmental research scientists. As a result, more than 100 youth, teachers, teacher assistants and environmental scientists learned about toxic substances while learning

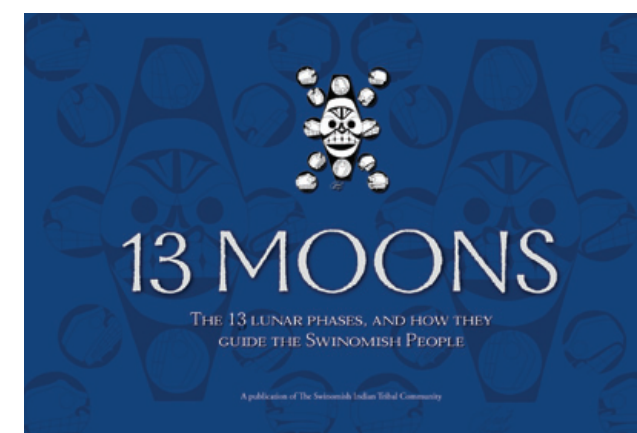
the Mohawk language and skills associated with traditional cultural practices (Arquette et al., 2008). Workshops were completed entirely in the Mohawk language using oral tradition and hands-on participatory response techniques to share meaning. A library of resources have been created, including posters, 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 has been empowered to understand risk issues and take action to protect their health while engaging in traditional subsistence practices (Arquette et al., 2008).

Researchers must develop credibility and trust with community members whose sustenance is threatened by chemical contamination. 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, EPA Grant No. R831045 under the 2002 RFA) was to develop such ties with native leaders and communities. The principal investigators worked to develop ties in various ways, including being visible in the community by attending public functions. The efforts have led to recognition in the community. An important goal of developing such ties is to establish credibility and trust with the communities

for which subsistence resources potentially are threatened by chemical contamination. In that regard, the principle investigators made numerous public presentations, met with school children, provided radio interviews and met in small groups with native 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 of the study and the outcomes (Wetzel, 2010).

The researchers of a Tribal Environmental Health Research Program STAR grant (Bioaccumulative Toxics in Native American Shellfish, EPA Grant No. R829467 under the 2000 RFA) published 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 as well as several posters. Numerous oral presentations were given at independent conferences and EPA-sponsored conferences and symposia to communicate the results of this grant (Donatuto, 2010).

As is the case for STAR grants funded by the Tribal Environmental Health Research Program, education and outreach also is important for other tribally relevant STAR grants and fellowships. A STAR graduate fellowship (*Dine Bikeyah*: Environment, Cultural Identity and Gender in Navajo Country, EPA Grant No. U915164) resulted in a book, *Dreaming of Sheep in Navajo Country*, which has been used in workshops with high school teachers on the reservation. The author participated in workshops in Navajo communities in Kayenta, Arizona, and Kirtland, New



One output of a STAR grant was the *13 Moons* book about how the 13 annual lunar phases guide the Swinomish People in using their natural resources. The book is in its second printing. For more information, please contact Todd Mitchell, Swinomish Water Resources Coordinator, at [tmitchell@swinomish.nsn.us](mailto:tmitchell@swinomish.nsn.us), 11430 Moorage Way, La Conner, WA 98257.

Mexico, which centered on the environmental health of grasslands, grazing issues and oral histories regarding a 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 members and others 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, EPA Grant No. TR831579) found that outreach is much more effective when it is partnered with education. The researchers provided one-on-one training and outreach to neighborhoods, tribes and tribal communities. The training was developed based on tribal needs, such as education about hazardous materials and how to write Environmental Impact Statements, that the

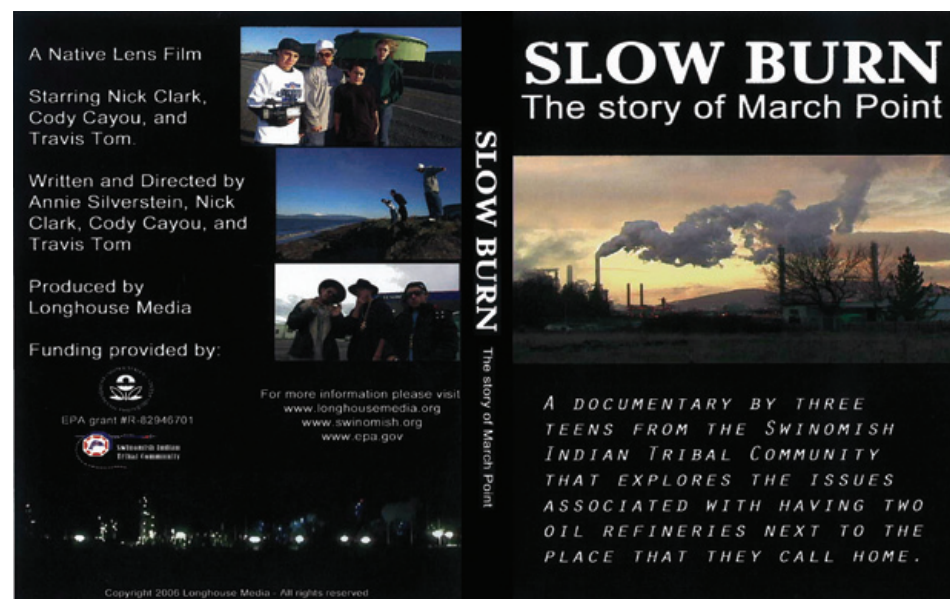
tribes found useful. Approximately 25 culturally sensitive courses were developed with Fort Belknap College faculty members and consultants. The courses addressed specific Brownfields issues and innovative environmental technologies that could be used to remediate these sites. They were offered as full-credit courses for community members; continuing-education credits also could be earned for professional development (Burgher, 2011).

Education and outreach were particularly important for a STAR-funded center (Midwest Hazardous Substance Research Center, funded by EPA Grant No. R828770). Two of the center projects (Technical Outreach Services for Communities [TOSC], EPA Grant No. R828770C001 and Technical Outreach Services for Native American Communities [TOSNAC], EPA Grant No. R828770C002) used university educational and technical resources to help community groups understand the technical issues involving the impacts of hazardous waste sites. TOSC and TOSNAC empowered communities to participate substantively in the decision-making process regarding their hazardous substance problems, including environmental assessment and clean-up needs, by providing a link between the community and the university, serving the needs of environmental justice communities, empowering community groups and their leaders, reviewing and explaining technical reports, and providing information and training. The TOSNAC program provided technical assistance to Native American communities dealing with hazardous substance issues. This program was national in scope and was 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 TOSC programs and other resources as necessary (Banks et al., 2007). The most significant outcome of this work,

based on the number of outreach activities conducted during a period of years to many of the tribes with which the researchers work, is the increased level and capacity for community involvement at Superfund and other types of environmental 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 Native American tribes and Alaska Native villages in 13 states (Center for Hazardous Substance Research, 2009).

Another STAR-funded center with tribal education and outreach as its goal (Space-Time Aquatic Resources Modeling and Analysis Program, commonly known as STARMAP, EPA Grant No. R829095) 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 award (Use of Bone Char for the Removal of Arsenic and Uranium from Groundwater at the Pine Ridge Reservation, EPA Grant No. SU834713 [Phase I] and SU835069 [Phase II]) also aims to educate the residents of the Pine Ridge Reservation 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 project for children as well as creating an educational handout that includes water quality education materials for the residents of the reservation (Becraft and Werth, 2012).●



The *Slow Burn* DVD documentary that resulted from a STAR grant.



## Risk Assessment and Sensitive Populations

Risk Assessment and Sensitive Populations Tribal members 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. A much-needed *Traditional Tribal Subsistence Exposure Scenario and Risk Assessment Guidance Manual* 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, EPA Grant No. R831046 under the 2002 RFA). 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 *Traditional Tribal Subsistence Exposure Scenario and Risk Assessment Guidance 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 (CERCLA), 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 CERCLA process, the results may not be protective of tribal uses. This research resulted in model regional tribal exposure scenarios that are formatted for standard CERCLA risk assessments, which can be

progressively modified as site-specific information becomes available (Harper et al., 2007).

Sensitive populations were considered in the research under the grant, "Reducing Risks of the Anishinaabe From Methyl Mercury" (EPA Grant No. R831047 under the 2002 RFA). Through this grant, those with increased risk from exposure to mercury—mothers with young children, women of childbearing age, children and elders—who consume mercury-contaminated walleye were trained in the use of GLIFWC fish advisory maps to reduce their risk. The data collected under the grant were used to recommend no more than four walleye meals per month from the affected lakes for the general population and no more than one meal per month for the sensitive population. Because the greatest risk from methyl mercury exposure occurs among children who may consume large walleye from lakes that contain heavily contaminated fish, the researchers presented fish advisory information 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 (DeWeese et al, 2007; Kmiecik and Foran, 2007; Madsen et al., 2007).

Risk assessment was an important component of another Tribal Environmental Health Research Program STAR grant (Bioaccumulative Toxics in Native American Shellfish, EPA Grant No. R829467 under the 2000 RFA). 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 is being used to explore the issues of treaty rights and fish consumption (Donatuto, 2010). Although the grant has been completed, the researchers have continued the work initiated in the STAR project 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 (Tribal Environmental Public Health Indicators, EPA Grant No. R834791). 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: (1) resources security (abundance, access and sharing); (2) community connection (cooperation, participation/roles and familiarity); (3) ceremonial use (gatherings/ceremonies, giving thanks and feeding the Spirit); (4) education (elders, youth and the Teachings); (5) self determination (healing, economic development and restoration); and (6) well-being (connection to nature, confidence and resilience). The next step is to test the indicator set with tribal members by employing it to assess the health status of the tribal communities (Donatuto, 2012).●



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.



## Impacts on Regulations and Management Plans

**I**mpacts 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 Toxins in Native American Shellfish, EPA Grant No. R829467 under the 2000 RFA) 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 taking a new look at the state's water quality standards in fall 2010. Using Oregon as a model, the department hopes to develop an amicable process that produces results acceptable to all the key players (Brooks, 2010). Oregon's Department of Water 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 eat from state waters. In the absence of those data, the federal standard applies: 6.5 grams of fish per day per person—or about one 7-ounce serving of fish per month—and this has been the State of Washington's standard for nearly 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).

The quantitative data produced by a STAR graduate fellowship (Makah Traditional Environmental Knowledge and Gray Whale Conservation, EPA Grant No. U914970) were used by a tribal biologist to support the implementation of higher water quality standards on the Makah Nation reservation compared to those of Washington State. The data indicated that tribal consumption of locally caught fish was significantly higher than the levels used in the models for contaminant exposure on which the previous standards had been based. The tribe had been contending that tribal consumption was much higher for years, but the STAR data provided the tribe with the evidence that it needed to effectively argue its case (Sepez, 2011).

The results of a STAR graduate fellowship (Linking Traditional Knowledge and Environmental Policy in the Cherokee Nation of Oklahoma, EPA Grant No. F5C30541) continue to be used internally by the Cherokee Nation

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 an advisory group to the Cherokee Nation Natural Resources Department composed of Cherokee elders who are knowledgeable on the subject of Cherokee ethnobotany and work with Natural Resources Department staff on Tribal Integrated Resource Management Plan implementation, as well as on larger goals of cultural and environmental protection (Carroll, 2011).

A STAR-funded center (Space-Time Aquatic Resources Modeling and Analysis Program, commonly known as STARMAP, EPA Grant No. R829095) worked with 10 tribes in four states to assist with the development of tribal aquatic water quality monitoring plans taking into account definitive tribal needs for monitoring cultural uses of tribal water. The tribes involved in the research actively pursue 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).●



*Regulations and management plans that take tribal consumption levels into account help to protect the subsistence resources that tribal members, like this young boy, consume.*





## Future Directions for Tribal Research

Future tribal research supported by NCER will explore new strategies, methods and tools to assess environmental health exposure among tribal populations as well as identify other research opportunities for advancing health protection while maintaining traditional tribal ways of life. In cooperation with the Tribal Environmental Health Research Program, ORD's Air, Climate and Energy Research Program recently 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 includes a component that focuses on the developing world and Indian tribes and Alaska Native groups. The goal is to quantify the extent to which 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 is planning on releasing its upcoming RFA in late 2012. In preparation for this RFA and to help identify tribal research priorities, the program hosted an RFA Strategy Session at the 2010 National Tribal Science Forum in Traverse City, Michigan, during the week of June 6, 2010. 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 that affect drinking water quality. Indoor air quality was another tribal concern, specifically exposure to mold, radon and formaldehyde in the indoor environment.

Mercury in fish is considered a global issue, with dietary change and adaptation being a specific concern among Native American and Alaska Native communities. Stewardship of tribal lands and allowing the tribes to control the research performed on these lands also emerged as important topics. Another key issue discussed was protection against unlawful agricultural practices and environmental enforcement on reservations (Breville, 2011).

*Stewardship of tribal lands and allowing the tribes to control the research performed on these lands also emerged as important topics.*



The writing team for the Tribal Environmental Health Research Program 2012 RFA included representatives 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 Exposure Assessment) (Breville, 2011).

The STAR graduate fellowship program for the fall of 2011 and 2012 included a topic focused on tribes and American Indian/Alaska Native/Pacific Islander communities. Applications in this topic are for interests

and investigations at the intersections of protecting the environment and American Indian/Alaska Native/Pacific Islander communities and/or tribes and focus on related environmental health, sustainability and pollution prevention/remediation strategies and issues. Projects may include assessing the impacts of environmental challenges on American Indian/Alaska Native/Pacific Islander communities and/or tribes such as climate change, mining activities, water quality, drinking water reliability, invasive species and land-use changes; exploring how American Indian/Alaska Native/Pacific Islander lifeways may be connected to unique risk and exposure pathways; exploring sustainability through tribes' traditional ecological knowledge and/or local ecological knowledge of an area; expanding the understanding of cumulative risk in tribes, American Indians/Alaska Natives/Pacific Islanders

and related communities; analyzing environment-related governance among American Indian/Alaska Native/Pacific Islander communities such as risk management, multisectoral or emerging approaches, ecosystem-based management approaches and so forth; and exploring integrated approaches to providing reliable supplies of safe drinking water to American Indian/Alaska Native/Pacific Islander communities (U.S. EPA, 2012b, 2012g).

As it has done for the past decade, NCER's Tribal Environmental Health Research Program will continue to work with Native American tribes and Alaska Native villages to help them maintain their long-standing, intricate relationships with the natural environment even in the face of the myriad of stressors threatening their health, wellness and way of life.●

## References

**Appendix A: Summary of NCER Tribal Research by RFA**

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

**Appendix C: NCER Tribal Environmental Health Research Program Presentations**

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

**Appendix E: Additional Resources**



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## Appendix A: Summary of Prior NCER Tribal Research 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 Request for Applications [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 (CBPR) to generate data that identified subsistence resources, sensitive subpopulations 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 research projects are scheduled to conclude in 2012.

### R833705: The Alaska Maternal Organics Monitoring Study: An Epidemiologic Study of Cumulative Health Effects of Persistent Organic Pollutants and Mercury in Subsistence-Dependent Rural Alaska Natives

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 Natives 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 (POPs) 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 POPs, 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 POPs and mercury to Alaska and the Bering Sea, resulting in POPs 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 POPs 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 POPs 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 POPs 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 CBPR 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-Native 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 CBPR approach to understanding exposure pathways will contribute to developing culturally appropriate mitigation strategies

### 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 native 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 subpopulations 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 GIS 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 (PCBs) and pesticides. This project examined traditional foods of the Yupik people for PCBs, 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. CBPR 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.

#### R821045: 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 (PAHs) 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 PAHs.

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 PAHs 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 native 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 GIS-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 GIS-based fish advisory. Third, the research project aimed to implement the GIS-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 GIS-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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Arquette M. 2007. Akwesasne Task Force on the Environment Inc. Akwesasne Freedom School: A Place to Maintain and Renew Relationships. Presented at the State University of New York Potsdam Campus Festival and International Conference: Connections and Intersections—Our Changing Landscape, Potsdam, New York, 18–22 April.

Arquette M. 2006. Haudenosaunee Environmental Protection Process (HEPP): Applying Traditional Teachings to Protect the Natural World and Promote a Sustainable Society. Presented at the National Forum on Tribal Environmental Science, Quinault Indian Nation, Ocean Shores, Washington, 24–28 September.

Arquette M. 2005. Connecting social and environmental factors to measure and track environmental health disparities summary report. Presented at the U.S. Environmental Protection Agency Office of Children's Health Protection Meeting, University of Michigan, Ann Arbor, MI, 24–25 May.

Berner JE. 2009. Maternal Organics Monitoring Program and Initial Findings. Presented at the Annual General Meeting of the International Network for Circumpolar Health Research, Copenhagen, Denmark, 18–19 May.

Berner JE. 2009. Maternal Organics Monitoring Program and Initial Findings. Presented at the Northern Contaminants Program and Arctic Monitoring Assessment Program (AMAP) Symposium on Human Health and Arctic Environmental Contaminants, Iqaluit, Nunavut, Canada, 10–12 June.

Berner JE. 2009. Maternal Organics Monitoring Program and Initial Findings. Presented to the Centers for Disease Control and Prevention/National Center for Environmental Health, Atlanta, Georgia, July.

Berner JE. 2009. Climate Change and Contaminants in Subsistence Foods: A Tribal Program To Monitor the Health of Alaskan Yupik Woman and Children. Presented jointly at the Promoting Environmental Health in Native American Communities Webinar Series and the National EPA-Tribal Science Council, 10 December.

Berner JE. 2009. Maternal Organics Monitoring Program and Initial Findings. Presented to the Yukon Kusokwim Human Studies Committee, Bethel, Alaska, December.

Big Man N, Smith Backbone A, Cummins C, Eggers M, and Camper A. 2009. Community-Based Risk Assessment of Exposure to Contaminants Through Water Sources on the Crow Reservation. Poster presented at the Western Region COBRE-INBRE Scientific Conference, Big Sky, Montana, 16–18 September.

Burger J, Gochfeld M, and Harper B. 2008. Identifying High-End and Highly Impacted Fish Consumers: Methods for Assessing Exposure Risk for Populations with High Fish Consumption Rates. Presented at the International Society of Exposure Analysis Annual Meeting, Pasadena California, 13 October.

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 18.

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 American Public Health Association Annual Meeting, Boston, Massachusetts.

Donatuto J. 2006. Fish Consumption and Policy in the Tribal Context. Presented at the Society for Applied Anthropology Annual Meeting, Vancouver, British Columbia, Canada.

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.

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.

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.

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 Society for Applied Anthropology Meeting, Dallas, Texas.

Donatuto J. 2004. Subsistence Lifeways: Native American Fish Consumption Rates and Risk. Presented at the Society of Toxicology and Environmental Chemistry Annual Meeting, Portland, Oregon.

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.

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.

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.

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.

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. 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 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.

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 Meeting, Madison, Wisconsin.

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. GLIFWC 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. GLIFWC 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. Translating Community-Based Participatory Research: Lessons Learned. Panel presentation at the 2010 National Tribal Science Forum, Traverse City, Michigan, 6–10 June.

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, San Diego, California, 25–29 October.



Harper B. 2010. Research Ethics and Informed Tribal Consent. Presented at 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 International Society of Exposure Analysis Annual Meeting, Pasadena, California, 15 October.

Harper B. 2008. Constructing Traditional Tribal Subsistence Exposure Scenarios. Presented at the 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 18.

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 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 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 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, OR, 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, LA, 19–22 March.

Kellogg J, Wang J, Ribnick 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, KY, 16–19 June.

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

Kmieciak 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.

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

Kmieciak N. 2008. Reducing Health Risks to the *Anishinaabe* From Methyl Mercury. Presented at the American Public Health Association Annual Meeting, Washington.

Kmieciak N. 2008. Reducing Health Risks to the *Anishinaabe* From Methyl Mercury. Presented at the Society for Risk Analysis Annual Meeting, San Antonio, Texas.

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

Kmieciak 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.

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

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

Kmieciak 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.

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

Kmieciak 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.

Kmieciak N. 2006. Mercury, Chippewa Flowage Mercury Concentrations, and GLIFWC Fish Advisory Program. Presented at Lac Courte Oreilles Ojibwe Community College, Hayward, Wisconsin, 24 April.

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

Kmieciak 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.

Kmieciak 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.

Kmieciak 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.

Kmieciak 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.

Kmieciak 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.

Kmieciak 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.

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

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

Kmieciak 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.

Kmieciak 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.

Kmieciak 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.

Kmieciak 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.

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

Kmieciak 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.

Kmieciak 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.

Kmieciak 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.

Kmieciak N. 2006. Updated GIS-Maps, Including Walleye Advice and the STAR Grant. Presented at the Bad River Community Meeting, Odanah, Wisconsin.

Kmieciak N. 2006. Updated GIS-Maps, Including Walleye Advice and the STAR Grant. Presented at the Great Lakes Native American Elders Meeting, Oneida, Wisconsin.

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

Kmieciak N. 2005. Updated GIS-Maps, Including Walleye Advice and the STAR Grant. Presented at the GLIFWC All Staff Meeting, Odanah, Wisconsin.

Kmieciak N. 2005. Updated GIS-Maps, Including Walleye Advice and the STAR Grant. Presented at the GLIFWC Board of Commissioners Meeting, Lac du Flambeau, Wisconsin.

Kmieciak N. 2005. Updated GIS-Maps, Including Walleye Advice and the STAR Grant. Presented at the Bad River Spearer's Meeting, Odanah, Wisconsin.

Kmieciak N. 2005. Updated GIS-Maps, Including Walleye Advice and the STAR Grant. Presented at the Mole Lake Spearer's Meeting, Mole Lake, WI, 2005.

Kmieciak N. 2005. Updated GIS-Maps, Including Walleye Advice and the STAR Grant. Presented at the Voigt Intertribal Task Force Meeting, Lac du Flambeau, Wisconsin.

Kmieciak N. 2005. Updated GIS-Maps, Including Walleye Advice and the STAR Grant. Presented at the Honor Our Children and Maternal Child Health Staff Meeting, Lac du Flambeau, Wisconsin.

Kmieciak N. 2005. Updated GIS-Maps, Including Walleye Advice and the STAR Grant. Presented at the American Fisheries Society 135th Annual Meeting, Anchorage, Alaska.

Kmieciak N. 2005. Updated GIS-Maps, Including Walleye Advice and the STAR Grant. Presented at the Consolidated Childhood Programs staff meeting, Hayward, Wisconsin.

Kmieciak N. 2005. Updated GIS-Maps, Including Walleye Advice and the STAR Grant. Presented at the Midwest Environmental Advocates Forum, Lac du Flambeau, Wisconsin.

Kmieciak N. 2005. Updated GIS-Maps, Including Walleye Advice and the STAR Grant. Presented at the U.S. Environmental Protection Agency Fish Forum, Baltimore, Maryland.

Kmieciak N. 2004. GLIFWC Fish Advisory Program and STAR Grant Plans. Presented at the Wisconsin Environmental Health Conference, October.

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

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

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. 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. 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, NC.

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

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. 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. 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. Berry Health Benefits. Presented at the Swedish University of Agricultural Sciences (SLU) Symposium—Bioactive Components in Plant Foods, Uppsala, Sweden.

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 7th Natural Health Product Research Conference: The Next Wave, Halifax, Nova Scotia, 24 May.

Miller PK, Carpenter DO, Eckstein L, Wellfenger-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, March.

Miller PK, Carpenter DO, Eckstein L, Wellfenger-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, June.

Miller PK, Carpenter DO, Eckstein L, Wellfenger-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, Wellfenger-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, February.

Miller PK, Carpenter DO, Eckstein L, Wellfenger-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, February.

Miller PK, Carpenter DO, Eckstein L, Wellfenger-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, September.

Miller PK, Carpenter DO, Eckstein L, Wellfenger-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, Wellfenger-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, November.

Miller PK, Carpenter DO, Eckstein L, Wellfenger-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, May.

Miller PK, Carpenter DO, Eckstein L, Wellfenger-Smith G, and Waghiyi V. 2008. Environmental Contaminants in Foodstuffs of Siberian Yu'piks from St. Lawrence Island, Alaska. Presented at the International Society for Environmental Epidemiology, Pasadena, California, October.

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

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.

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.

Reynolds III JE and O'Hara TM. 2004. Goals and Objectives of the Risks to Northern Alaskan Inupiat: 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, 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, Inupiat 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.

Rickard PM and Hargrave G. 2008. *KANIEN'KEHA:KA*: Living the Language. Video aired on the Aboriginal Peoples Television Network, Fall.

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.

Sepez J. 1997. International Politics of Native Whaling in the United States. Presented at the Society of Ethnobiology Conference, Athens, Georgia, 28 March.

Sepez J and Bowe chop J. 1999. Nature, Culture, and Makah Subsistence. Presented at the American Ethnological Society Conference, Portland, Oregon, March 25, 1999.

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 National Tribal Science Forum, Traverse City, Michigan, 7 June.

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 Inupiat 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.

## Appendix C: NCER Tribal Environmental Health Research Presentations

To be added when received from EPA.



**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 is scheduled for the fall of 2012. This appendix provides an overview of the 2009 webinars and information about the 2012 webinars.*

**Promoting Environmental Health in Native American Communities:**

**A Webinar Series Addressing the Environmental Health and Exposure Concerns of North American Native Subsistence Populations**



*Sponsored by the EPA's STAR Research Grants Program and the National EPA-Tribal Science Council with additional support from EPA Office of Children's Health Protection and Environmental Education and the Human Health Research Program*



**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>.



**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,<sup>1,2</sup> Anna Harding,<sup>1</sup> Therese Waterhous,<sup>1</sup> Anthony Wilcox,<sup>1</sup> and Stuart Harris<sup>2</sup>  
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.

To reconstruct traditional lifeways and natural resources, researchers conducted culturally competent interviews and reviewed anthropological literature that included traditional ecological knowledge, physiology, culture, ecology, ethnobotany, 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

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.



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.

<sup>1</sup> Oregon State University  
<sup>2</sup> 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>.







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.,<sup>1</sup> Courtney G. Flint, Ph.D.,<sup>2</sup> Gary Ferguson, N.D.<sup>3</sup>

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.

<sup>1</sup> North Carolina State University  
<sup>2</sup> University of Illinois  
<sup>3</sup> 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>.



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,<sup>1,2</sup> Timothy Ford, Ph.D.,<sup>3</sup> John Doyle,<sup>2,4,5</sup> Larry Kindness,<sup>1,2,4</sup> Urban Bear Don't Walk,<sup>2,4,6</sup> Mari Eggers<sup>1,7</sup>

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.

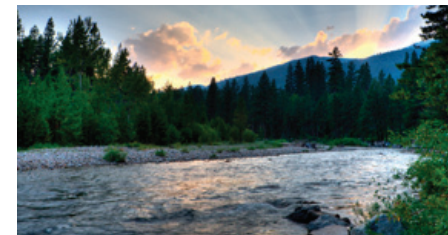
LifeLine Tribal risk assessment modeling software will be used to assess the overall risks to the community from contaminated water sources. Potential outcomes from this research include a better understanding of the environmental risks of water sources associated with a subsistence-based lifestyle of 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.



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



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.<sup>1</sup>

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.



<sup>1</sup> 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>.

## Upcoming 2012 Webinar

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.



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



## Appendix E: Additional Resources

### 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>

Tribal Environmental Health Research Program: <http://www.epa.gov/hcer/tribalresearch>

### 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://www.hhs.oregonstate.edu/ph/tribal-grant-main-page2>

Space-Time Aquatic Resources Modeling and Analysis Program (STARMAP) 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 (TOSNAC): <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/>

U.S. Department of Agriculture: <http://www.usda.gov/news/pubs/indians/open.htm>

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/>



