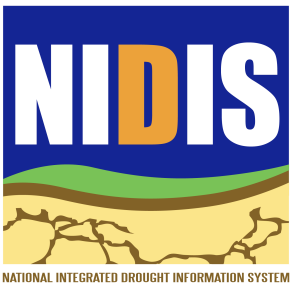
Climate Change, Drought and Early Warning on Western Native Lands Workshop Report

9-11 June, 2009 Jackson Lodge, Grand Teton National Park, WY



Completed March 2010

G. Collins, M. Hiza Redsteer, M. Hayes, M. Svoboda, D. Ferguson, R. Pulwarty, D. Kluck and C. Alvord

Climate Change Drought and Early Warning on Western Native Lands
9-11 June, 2009, Jackson Lodge, Grand Teton National Park, WY

The National Integrated Drought Information System Act, (Public Law 109-430, December 2006): "An Act to establish a National Integrated Drought Information System within the National Oceanic and Atmospheric Administration to improve drought monitoring and forecasting capabilities."

INTRODUCTION

The National Integrated Drought Information System (NIDIS) convened a workshop to initiate a long-term commitment to providing tribes with the drought information and resources needed to better monitor and respond to inter-annual drought conditions and long-term climate changes. These efforts by NIDIS are grounded in the commitment to help facilitate and establish long-term partnerships between tribal constituents and federal agencies, universities, and other entities in order to meet the federal trust responsibility.

This workshop report summarizes findings from the workshop, highlighting 1) data collection and monitoring gaps, 2) interdisciplinary research needs, and 3) financial capital and institutional framework recommendations. Workshop discussion and this report highlight definitive projects and research needs that possess clear capabilities for implementation into a current institutional framework or contain specific decisive recommendations for achieving project goals.

National Integrated Drought Information System (NIDIS)

The NIDIS Act of 2006 (Public Law 109-430) mandates a multi-agency approach that focuses on, (i) communication and awareness of drought and drought impacts, (ii) improving and integrating information from monitoring and forecasting networks into drought planning, (iii) engaging communities to ensure that the needed indicators and triggers for proactive drought risk management are identified and addressed, and, (iv) the development of regionally-specific information sites that act as clearinghouses for information at different scales. The NIDIS provides a prototype for climate information services to support preparedness and adaptation climate varies and changes.

BACKGROUND

Workshop Need

Drought and climate variability and change impacts will be different from region to region. If, as predicted, climate change results in increased water scarcity in some areas, and stresses on other natural resources, tribal use and protection of resources could face significant challenges. For example projections show that tribes in the Pacific Northwest will face warming streams and changes to the hydrologic cycle that further threaten the survival of salmon populations; likewise higher temperatures and increasing aridity in the Southwest might exacerbate tensions between tribal and non-

tribal interests and rights over the region's limited water resources. At the same time a number of tribal lessons are available to address climate change. Tribes have great physical and cultural resources that can help the US deal with climate risks through renewable energy development and wilderness protection in the face of climate change. A major focus of our discussions centered around ensuring that as climate changes, the drought information needed to help meet trust responsibilities will include credible, timely and relevant tools to enable Native communities to adapt and mitigate local impacts.

Workshop Description

Over 40 representatives from several western tribes including Northern Arapaho, Swinomish, Taos and Hualapai, tribal colleges such as Dine College, as well as federal, research, and NGO's, and natural resource managers convened to address drought monitoring needs gaps and projects on tribal lands. Workshop discussion was broken down into topic-based sessions with the majority of discussion focusing drought-monitoring technologies, products, and needs, cultural resources, energy development, and defining the federal trust responsibility as it relates to federal drought monitoring efforts. Underlying objectives included: understand and identify barriers to mitigating drought conditions, identify specific projects and/or areas of research that address or help deconstruct barriers, and finally, identify the partnerships and institutional structure needed to carry out project goals. Experts delivered short topical presentations followed by small group discussion sessions led by invited workshop presenters and steering committee members. This report is a summary of workshop recommendations, including an executive summary (Table 1) of a major overarching recommendations intended to inform future efforts.

Table 1: Workshop recommendations fall under four major categories and example projects

Key Recommendations to Address Early Warning Drought Monitoring on Western Tribal Lands

The Federal Trust Responsibility
Communication and Translation of Federal Trust Responsibility
Assess the Current Status of Federal Trust Responsibility Among Tribes
Assessment of What is Working: i.e. Tribal Relations with the EPA
Data Collection & Monitoring Gaps
Expand Remote Sensing Capabilities
Improve Streamflow Monitoring on Tribal Lands
Tribal Engagement & Inclusion in Data Collection
Interdisciplinary Research Needs
Impacts & Risk Assessment
Assessment of Current and Projected Drought Risk, Impacts & Vulnerabilities
Energy Impact Assessment
Drought Product/Index Development
Water Supply Assessment & Improved Management and Control of Water and Natural Resources
Water Supply Assessment: Ground and Surface Supplies
Adjudication and/or Solidification of Water Rights
Increased Interaction with Federal Agencies and the Bureau of Indian Affairs (BIA)
Development of Knowledge Systems: Staging Multi-Road Collaborations
Communicating Drought Monitoring Technologies/Datasets/Products
Climate and Water Workshops
Expand Grant Writing & Related Resources
Development of Esteemed Elder Program
Renewable Energy Scoping & Development
Renewable Energy Scoping and Development
Renewable Energy Feasibility Studies
Energy Audits
Renewable Energy Template
Renewable Energy Portal
Institutional Framework & Financial Capital
Engaging Tribal Communities & Building Awareness
Submit Proposals for Federal Funding Sources: Federal Agency and Related Collaborations
NOAA Tribal Liaison
IPCC Tribal Linkages
Partnerships with NOAA Regional Integrated Sciences and Assessments (RISA) programs and proposed Landscape Conservation Cooperatives (LCCs)
Tribal College Engagement
Partnerships with Universities

KEY FINDINGS AND OPPORTUNITIES TO ADDRESS EARLY WARNING DROUGHT MONITORING ON TRIBAL LANDS

FEDERAL TRUST RESPONSIBILITY

Introduction

The federal trust responsibility; the legally binding relationship between federal and tribal governments to nurture tribal well being, is introduced first to help frame research needs and guide central objectives identified throughout this workshop. The federal trust responsibility (hereafter trust responsibility) characterizes the legal relationship that exists between the federal government and American Indian Tribes (Pevar 2004). In sum, the trust responsibility is intended to promote and guarantee the overall welfare of tribes and individual Native Americans. "This includes an obligation to provide those services required to protect and enhance Indian lands, resources, and self-government, and also includes those economic and social programs which are necessary to raise the standard of living and social well-being of the Indian people to a level comparable to the non-Indian society" (American Indian Policy Review Commission 1977). Indicative of established trust responsibility principles, all actions relating to tribal property, resources, and money is under the control of the federal government, or approval by federal agencies or appointed officials under the authority of Congress to delegate management and carry out these tasks. In turn, Congress is obligated to uphold the trust responsibility, employing the methods and requirements of a legally binding fiduciary contract or relationship. In a broad sense, trust responsibilities are extended to all federally recognized tribes and individuals, however Congressional actions narrow expectations on a case-by-case basis (American Indian Policy Review Commission 1977).

In relation to NOAA and NIDIS, identifying active trust responsibilities is important to prioritize drought monitoring, and on a broader scale, NOAA activities on tribal lands. The federal trust responsibility has an inconsistent history, evolving judicially through Congressional actions, Supreme Court decisions, and Executive Referendums. This section provides a judicial history of the federal trust responsibility, a concise summary of central tenants, and applications to NOAA and NIDIS activities.

Central Tenants and Applications of Federal Trust Responsibility

- Congress has the ability to expand, shrink, or terminate the trust relationship with tribes. Congress has terminated its trust relationship with 109 tribes (Pevar 2009).
- Specific federal trust responsibilities are established on a case-by-case basis between tribes and Congress. Congress announces intent to create a trust. (Morisset 1999).
- Once a trust was established or recognized between a tribe and Congress, the federal government assumed a fiduciary role. (United States v. Mitchell, 436 U.S. 206, 25, 1983).
- Congressional statutes are commonly used as the means to create the services and programs needed to uphold trust responsibility. (Pevar 2004).
- In a broad sense, the language of defining trust responsibility implies all tribes, however the Department of Interior has narrowed protection to include only federally recognized tribes and individuals (Pevar 2004).
- Individual Native Americans, both on and off the reservation are entitled to protection under the trust responsibility (Morisset 1999).

- Congressional actions recognizing specific trust responsibilities is the most effective method to legally establish the trust relationship and legal protection.
- The more specific the obligation defined, the higher the duty of care (Navajo Nation v. United States, 263 F3d 1325).
- The federal government and agencies may not take actions including adopt laws, regulations, or policies that would "compromise their fiduciary responsibilities to those tribes." (*United States v. Mitchell*, 436 U.S. 206, 25, 1983).
- Fiduciary responsibilities "are established by law and require no proof" concerning natural resources found on or have an impact to tribal lands and resources. This includes mineral, timber, water, grazing lands, and oil and gas resources. In turn, managerial entities (BIA) failure to properly manage resources would violate the statutory terms of the trust relationship (*United States v. Mitchell*, 436 U.S. 206, 25, 1983).
- The federal trust responsibility applies to all federal entities and agencies including any federal action, decree, or decision (Pevar 2004).
- Tribal property including natural resources, and money are protected by the trust obligation on the federal government (Morisset 1999).
- Off-reservation activities that negatively impact tribal property or resources, i.e. upstream water pumping that affects water supplies, mining tailings that pollute ground water supplies, etc are protected (Morisset 1999).
- There is no requirement by the government to sell tribal natural resources for profit.
- Tribes with an established trust responsibility are eligible to take part in federal programs including health-care, employment, loan, housing, and education. (American Indian Policy Review Commission 1977)
- Tribes can file suit and collect damages against federal officials who breach established trust obligations. Tribes cannot file suit against Congress, only the agencies and officials carrying out Congressional actions. In application, tribes have commonly used the trust responsibility to prevent federal agencies from selling or mismanaging tribal land and resources, diverting water from reservations, or denying access to property. (Pevar 2004)
- Trust obligations are used as a lens to interpret ambiguous federal treaties, rules, and statutes, allowing tribes to ensure that no injuries to tribes will be suffered as a result of the interpretation of such treaties, etc.
- The Claims Court regularly acts as the entity that applies general principles of trust relations. (Morisset 1999)

Federal Trust Responsibility and Early Warning Drought Monitoring

Introduction

Pinning down the federal trust responsibility in an operational context is complicated given the judicial history. Recommendations for this section focus on laying down the framework necessary to assess the role of trust responsibility in developing an early warning drought information system on tribal lands. There are three areas in which NIDIS and partnering agencies could better communicate and understand the federal trust responsibility as it applies to NOAA and western tribes: Communication and Translation of Federal Trust Responsibility, Assess the Current Status of Federal Trust Responsibility Among Tribes, Assessment of What is Working: Tribal Relations with the EPA. Whether trust obligations are legally recognized, it is important to ground Tribal and federal relationships, in this case, early warning drought monitoring efforts on tribal lands, in central tenants of trust and ensuring the well-fare of tribes and their resources.

Communication and Translation of Federal Trust Responsibility
Workshop participants made clear that communication and translation of federal trust responsibility is insufficient, leading to misinformation surrounding this relationship and application to federal/tribal relations. Workshop participants recommended drafting a concise comprehensive document explaining the federal trust responsibility including background, central tenants, and applications. Creation and dissemination of this information could help tribes and federal agencies come to the table with an understanding of expectations.

Assess the Current Status of Federal Trust Responsibility Among Tribes
Identifying established federal trust responsibilities by tribes and related agencies or officials is a necessary first step in framing early warning drought monitoring efforts in an obligatory context. Being clear about this information is crucial both to protect NOAA and related federal agencies as well as tribes in efforts to make clear of needs, priorities, and expectations on both sides.

In affiliation with the BIA and other cooperating agencies, an assessment of active federal trust responsibility activities that specifically relate to natural resource management, extraction, and use could further narrow efforts. A survey of current established trust responsibility relations is also significant in knowing how the trust responsibility functions in an operational role. Once established relations are compiled, agencies and affiliated offices could begin work on creating or further developing projects and identifying gaps and areas or projects that fall within the scope of trust responsibilities concerning drought monitoring and mitigation efforts.

Assessment of What is Working: i.e. Tribal Relations with the EPA
An assessment of active trust responsibility relationships that exist would provide insight as to possible exploration of trust responsibility interactions with NIDIS and NOAA. Workshop participants emphasized the importance of clarifying the role of trust responsibility at the front-end of federal agency involvement in tribal matters. For instance, the EPA's relationship with tribes commonly involves active participation and engagement from both sides. Assessment and documentation of this relationship could provide other federal agencies with a set of lessons learned and guidelines to build successful partnerships with tribes under the trust responsibility.

DATA COLLECTION AND MONITORING GAPS

Recommendations
Monitoring drought conditions is a primary hurdle in analyzing current conditions and emerging trends in precipitation, streamflow, and soil moisture, and other drought indicators. Without adequate data collection and corresponding tribal involvement with collection methodologies and applications, it is difficult for both tribal, federal, regulatory and research entities to assess the current drought conditions on tribal lands. Workshop participants emphasized the lack of current drought monitoring data for the Colorado Plateau, citing the recent efforts made by Climate Assessment for the Southwest (CLIMAS), which incorporated tribal observations and input as a model for improving data collection methods and monitoring accuracy. (Ferguson and Crimmins, 2009).

Expand Remote Sensing Capabilities
Remote sensing of drought conditions is one method for expanding drought monitoring on tribal lands, with benefits including limited use of ground measurements to collect and interpret data. Remote sensing technologies augment information available from conventional data sources,

such as surface measurements, and provide consistent continuous coverage at frequent intervals. Remote sensing measurements have broad applications for measuring a number of drought indicators depending on the surface characteristic or process being measured[1].
By capturing a better representation of accurate conditions, tribes could emerge as major users of remote sensing technologies and datasets as evidence to ascertain the need for increased funding support for early warning drought capabilities and drought relief strategies. Workshop participants recommended better communication of potential benefits of remote sensing technologies important to address apprehension tribes might have regarding start-up and operating expenses, and other questions associated with benefits of remote sensing technologies. In addition, scoping projects and funding support specifically geared towards improving remote sensing datasets and drought-monitoring gaps on tribal lands is another recommendation voiced by participants. However, remote sensing technologies still require the institutional structure and administrative and operational support needed to collect ground measurements, but provide data useful for monitoring drought impacts on resources.

Improve Streamflow Monitoring on Tribal Lands

Workshop participants acknowledged the need to expand streamflow monitoring efforts on tribal lands as a mechanism to better capture water supply and drought conditions. USGS streamflow gauges currently in place under represent the span of geographic, climatic, and hydrologic conditions that exist on western tribal lands. Gary Collins (Wyoming tribal liaison, Northern Arapaho) emphasized the importance of monitoring and in turn securing water supplies central to workshop discussions and achieving project goals. Collins continued by stating that without better monitoring of water supply conditions on tribal lands, it becomes difficult to get an accurate picture of inter-annual and long-term drought conditions on tribal lands, and how conditions have changed over time. Streamflow monitoring is key in risk assessment, and in the development and accurate representation of drought indices, products, and triggers that engage decisive action.

Tribal Engagement & Inclusion in Data Collection

Framing discussions on data collection was the necessity of tribal involvement in such efforts. This includes an understanding of datasets, methodologies for collection and interpretation, applications to drought monitoring, and climate models. Tribal involvement in data collection efforts allows federal and state partners advance regional monitoring that will ultimately work towards assisting tribes in strengthening monitoring and management efforts.

---

[1] Data from the visible, infrared and microwave portions of the EMS are used for monitoring various aspects of drought, including vegetation health and cover, evapotranspiration, precipitation amount and locale, soil moisture, snow cover extent, snow water equivalent (SWE), and snowpack temperature. Although observations from certain parts of the spectrum lend themselves better to specific surface properties, some drought indicators are hybrids of data collected from multiple areas. Observations collected by satellites are integrated into standardized indices (e.g., Normalized Difference Vegetation Index (NDVI), Palmer Drought Severity Index, (PDSI), Standardized Precipitation Index (SPI), or assimilated into land, water, or energy balance models. Satellite remote sensing observations are increasingly used in conjunction with ground and/or airborne measurements. Data produced from satellite observations are typically presented in map form to show the spatial variation of a drought-related index. Source: "NIDIS Remote Sensing Workshop: Showcase of Products and Technologies," Intermountain West Climate Summary, Alvord 2008.

There is also limited awareness among tribes regarding standard data collection methods and how data is used as inputs into climate models and drought indices. Technical data integration application and interpretation is currently of little use to tribes because it is poorly translated, and largely extends beyond the scope and relevancy of Native communities. Current observations by Native people are not clearly categorized or acknowledged as a formal data sets, and instead are usually treated as supplemental "anecdotal" evidence. Although some tribes have indicated that indigenous methods of drought observations are currently used, formal integration and collaboration with federal and state agencies is limited.

INTERDISCIPLINARY RESEARCH NEEDS

Impacts & Risks Assessments

Assessment of Current and Projected Drought Risk, Impacts & Vulnerabilities
Updated impact assessments provide valuable information concerning the evolution of impacts as it relates to varying climate and hydrologic conditions. Documentation and tracking of conditions on tribal lands could help build the observational framework useful in funding justification for federal disaster relief, project development, and increased monitoring.

Follow-up in coming months with workshop participants is needed in order to categorize and prioritize specific projects aimed at assessing drought vulnerabilities and impacts now and in the future. Workshop participants suggested different parameters to approach impact and vulnerability assessments. Suggestions include socioeconomic categories including geographic region, tribal demographics including economic conditions such as unemployment rate or revenue sources; or by physical conditions including geography, climate, or water availability. Further discussion surrounding the best method(s) to approach impact assessments is needed to better define projects and collaborations.

Energy Impact Assessment
Assessment of the impacts of development of various energy sources on tribal lands, resources, water supplies, bio-diversity, and cultural resources is prerequisite to building long-term energy projects on tribal lands. There is limited understanding of prospective impacts, especially with respect to renewable energy sources, but also of how more "traditional" forms of energy impact resources in comparison. Participants agreed that potential impacts need further investigation before large-scale infrastructure and energy supply contracts are pursued.

Participants warned that long-term changes in climate could make now suitable climatic and hydrologic conditions necessary for solar and wind energy production unsuitable in fifty or even twenty years due to the changing climate. Better understanding of climatic projections, specifically precipitation amount and timing is crucial in energy development discussions.

Drought Product/Indice Development
Commonly used drought indices do not fully represent drought conditions and severity on tribal lands (Ferguson and Crimmins, 2009). Current drought indices also have limited use and application for tribal leaders and members, citing different needs from traditional index users such as urban water municipalities. Workshop participants suggested that in conjunction with improved monitoring efforts, the development of tribal drought indices unique to tribal regions, conditions, and vulnerabilities would encourage coordination of drought relief and mitigation

within individual and tribal groups. Inputs to these indices would place increased weight on factors such as wind and precipitation extent, which have increased significance on some tribal lands. For instance, dust and sand commonly inhibits transportation on southwestern tribal lands and geographic extent and severity of precipitation events is localized, resulting in small pockets of drought relief, especially across the Colorado Plateau (USGS Navajo Nation Studies).

Water Supply Assessment & Improved Management of Water and Other Natural Resources

Introduction

Many of the challenges facing tribes result from insufficient direct control of natural resources. In addition natural resources, primarily in the case of agriculture, timber production, and tourism, are primary sources of income for many Indigenous groups including Native American Tribes (Macchi et al. 2008). Tribal communities are particularly vulnerable to inter-annual drought conditions as well as long-term changes in climate due to the inability to move to more suitable conditions, the lack of economic resources needed to invest in adaptive technologies, and the strain on resources to provide for the everyday living and traditional practices of a growing population (Hanna et al. 2007).

Managing natural resources on tribal lands is complex given the interplay between sovereign tribal governments and the federal government. However, engaging tribal communities in drought monitoring and impact assessment efforts requires encompassing different strategies other than those currently employed in federal and state drought planning and preparedness plans. Providing tribes with increased control and improved management of water and other natural resources requires assessment of current supplies and resources, and the development of tribal and federal regulatory infrastructure to better standardize and manage such resources.

Recommendations

Water Supply Assessment: Ground and Surface Supplies

Workshop participants called for a water supply assessment on western tribal lands, citing increasing regional development bordering tribal lands, increased natural resource extraction and renewable energy development, and unadjudicated water rights as reasons for better understanding the state of tribal water supplies. Water supply assessment would also provide necessary information key in water adjudication suits.

Workshop participants recognized the need to better distinguish individual projects within the broad scope of assessing water supplies on tribal lands. As a first step, the workshop steering committee will work in coming months to bring together representatives from tribes and corresponding federal and state entities to map out a framework for assessing water supplies on western tribal lands. Establishing a framework based on current assessments could assist entities and Tribes with a clear roadmap for the task of water supply assessments on respective lands. Coordinated efforts with federal and state partners are example agencies and institutions that could provide direct or advisory support. Potential graduate and undergraduate programs and students from tribal universities and colleges could provide data collection and synthesis support.

Adjudication/Solidification of Water Rights

Current research supports the solidification of water rights as a primary means for tribes to gain increased control over water supplies, and potentially could provide a significant revenue

stream for tribes exploring water markets to lease or sell water rights to municipalities (McNally 2007). Tribes were awarded water rights from the federal government attached to the date and year of the establishment of the reservation (Winters Doctrine). Water allocations in the West are governed by the *prior appropriation doctrine*, which allocates rights based on seniority system deemed as "first in time first in right." Many reservations were established in the late nineteenth, early twentieth century, and the seniority of these water rights well position Tribes to use, lease, or sell rights as a means to provide protection to these water supplies or lease and sell these rights at market prices. The problem is, that although these rights are recognized on paper, they are not solidified in such a way that tribes have access to actively control these rights. In a sense, these rights are ambiguous unless they are solidified or adjudicated in the judicial system. For this reason, the adjudication or these rights are crucial for adapting to changes and climate, but also as an economic means to empower tribes. This process is extremely lengthy (typically taking 7-10 years or longer) and expensive to take-on. Potential collaborations with regional law school departments could provide legal consulting for tribes wishing to begin the adjudication process or solidify a handful of rights. The creation of a document describing the adjudication process equipped with resources, contacts, and definitions could also provide tribes with useful recommendations concerning the adjudication process.

Increased Interaction: Bureau of Indian Affairs (BIA) and Other Federal Agencies
The BIA facilitates federal funding and corresponding projects operations between tribes and the federal government and plays an integral role in the management of tribal resources. Workshop participants recognized the need for increased interaction of cooperating agencies with the BIA, citing underrepresented interactions with the BIA in current tribal related projects and collaborations. Workshop participants suggested that agencies affiliated with expanding early-warning drought monitoring on tribal lands be responsible for engaging the BIA in current activities and projects. Increased effort to involve the BIA is in attempt to foster long-term collaborations and encourage coordination of projects between tribes, the BIA, and other affiliated entities.

Development of Knowledge Systems: Staging Multi-way Collaborations

Introduction
Development of knowledge systems in this context refers to the financial, educational, and otherwise support of providing tribes with the tools to better engage in drought monitoring efforts, to understand climatic risks on natural resources, especially water, and to provide tribes, particularly tribal colleges and leadership with the necessary business and finance skills important to promote self-sustaining management of renewable energy or other markets. Development of knowledge systems operates on short and long terms scales. In the near-term, expansion of tribal universities and colleges (TCU's) programs geared towards developing skills including grant writing, development of business plans, environmental monitoring techniques are recommended by participants. Engaging tribal colleges and universities also serves the long-term goal of engaging Native people in research efforts that use indigenous and Western methodologies to better monitor, adapt, and plan for drought conditions tied to climate variability and change.

Recommendations for this section are intended to provide federal agencies and related entities with project ideas to collaborate with interested tribal communities and leadership. This approach is intended to provide a framework for creating tribal partnerships while providing

climate and other educational services in a customized framework to interested tribes without requiring substantial financial investment by the tribes themselves. Providing tribal leaders and members with access to this information is also a mechanism to foster knowledge and expertise in related skills and sciences.

Recommendations and Projects

Communicating Drought Monitoring Technologies/Datasets/Products
Workshops and educational materials defining drought monitoring and corresponding technologies including ground and remote measurements and datasets, and related drought and precipitation indices could equip tribal leaders and members with the technical language useful in communicating with federal and research entities.

Climate and Water Workshops
Workshop participants recommended hosting educational workshops for tribal members, specifically with tribal colleges professors to address the current state of science as it relates to climate and regional water resources. As discussed earlier, better understanding of climatic projections, specifically precipitation amount and behavior is crucial in adaptive planning efforts. Presenting this information and addressing their uncertainties would allow tribes to incorporate culturally relevant mitigation practices in addition to current federal and state efforts. In turn, tribes would gain a better understanding of how entities are addressing current and future climate change and water resource challenges. Understanding and communicating current state of knowledge regarding climate science and water availability would allow tribes to communicate data and monitoring needs to federal and state agencies, and also critically help those agencies learn from tribal management experiences. Communication and translation of climate and water information provides a fundamental jumping point from which collaborations can further develop and focused drought monitoring efforts can grow.

Educational workshops could focus on topics including basic climate processes, observations of climate variability and climate change projections, human attribution, and GCMs as well as impacts on regional hydrologic processes, water management, water availability, prior appropriation and water right acquisition and adjudication.

Expanding Grant Writing & Related Resources
Funding remains a recurring challenge for tribes. There exists potential for tribes to draft and submit proposals for funding on projects proposed during the workshop. Workshop participants acknowledged a need for improving skills necessary to write proposals, and manage grants to promote self-sustaining tribal communities. Providing resources and consulting support to help tribes draft, coordinate, and submit proposals provides skills and experience crucial in securing support from federal agencies and programs.

Development of Esteemed Elder Program
In efforts to sustain and promote traditional knowledge, tribal representatives cited the need to include tribal elders in the development of data sets relevant to climate change. In affiliation universities and colleges, tribal representatives recommended that studies allow students to spend time with tribal elders, learning traditional knowledge, worldviews, language, and traditions. A tribal representative expressed a growing concern for “bio-cultural” loss, defined by a participant as the intimate innate connection that exists between tribal language, customs, and traditions and the biological health of their land, resources, and its inhabitants. Tribal

representatives explained that promoting and upholding traditional values is a crucial component in improving drought-monitoring efforts and adapting to a changing climate. This is especially critical for building lasting partnerships.

Renewable Energy Scoping and Development

Introduction

Increasing interest in developing domestic sources of energy to reduce dependence on oil, the current administration's support of expanding renewable energy options through energy grants, government subsidies, and associated tax credits to boost small-business development could well position tribes to become industry leaders. In addition, alternative energy development could place tribes in direct control of natural resource use and extraction, allowing tribes to have more power over land and resources. Expanding specific renewable energy efforts could potentially be aligned with tribal land use ethics by protecting the ecological integrity and biodiversity of global resources.

Discussion involving energy development on tribal lands was a major focal point of discussion by attending tribal representatives. As a result, energy development is highlighted as a separate component in the "building financial capitol" section. Workshop attendees focused discussions on energy production, specifically renewable energy as a primary means to secure financial capital, mitigate climate, and to potentially gain more control over natural resources.

A number of critical issues surrounding energy extraction and development, impacts, and adequate funding were identified. Tribal representatives emphasized the financial hurdles in developing the necessary infrastructure, technological capacity, steady funding, and promising profit returns that can compete in off-reservation energy markets. Impact to tribal lands and ecology, resulting from large-scale energy development is another prominent concern, especially with respect to water consumption rates needed to sustain efforts. Tying back to funding issues, participants expressed concern over the start-up investments required before energy production is viable, citing infrastructure and operational necessities in any long-standing energy market production.

Recommendations and Projects

Renewable Energy Feasibility Studies

Workshop representatives indicated a need for a renewable energy feasibility study that would provide Native communities with guidance on the financial requirements, technological capacity, infrastructure needed, and projected return values of renewable energy sectors, specifically focusing on wind and solar markets.

This study would focus on the regional climatic and hydrologic conditions required to operate large-scale renewable energy farms on tribal lands. The objective would be to provide interested tribal entities with recommendations primarily based on meteorological (temperature, precipitation, wind speed, cloud cover) and hydrologic (water availability by basin, current consumptive rates, future water development, and the legal approaches/requirements necessary to secure water rights.[2] Impacts resulting from implementation of renewable energy

[2] For instance, the rate of water consumption to implement and operate renewable energy facilities such as solar farms is often overlooked in renewable energy discussions. This study must address water

markets, including habitat fragmentation, large-scale land requirements needed, and impacts to water, and other natural resources and species would help provide a comprehensive overview of expected impacts tied to renewable projects. Suggested feasibility study locations include the Colorado Plateau, Pacific Northwest, and the Intermountain West regions to capture the geographic, climatic, and hydrologic variance across tribal lands in the West.

Energy Audits

Executive Order 12902 (Energy efficiency and Water Conservation at Federal Facilities) requires a "comprehensive facility audit [which includes a] survey of a building or facility that provides sufficiently detailed information to allow an agency to enter into energy or water saving performance contracts or to invite inspection and bids by private upgrade specialist for direct agency-funded energy or water efficiency investments." Workshop participants recommended the inclusion of tribal facilities and to include tribes in the auditing processes. Opportunities to engage TCU's and state and private colleges in conducting energy audits for tribal facilities would help develop local office capacities or lay the framework for partnerships between tribes and non-Native higher education institutions.

Renewable Energy Template

Regardless of the motivation to pursue alternative financial markets, bridging the gap between wanting to pursue alternative financial markets, and the know-how to begin was an issue brought up by workshop participants. Willingness of tribal leadership to begin exploring renewable energy markets is limited, because there is hesitation surrounding how best to proceed in an unfamiliar market. Workshop participants suggested the creation of an energy handbook or template, a resource to help equip tribes with the fundamental information and resources necessary to begin renewable energy pursuits. This template would provide a breakdown of energy markets by categories including financial capital, technological capacity, operation and management, with emphasis on probable return investments and methods to sustain and grow business strategies. In addition, a comprehensive list of contacts and resources that would help provide the necessary guidance to assist tribes along the way. Tribal representatives expressed the benefits of this template, citing that tribes do not lack the willingness to participate in renewable energy markets, but rather lack the know-how to take the appropriate steps crucial in realizing these goals.

Renewable Energy Portal

NIDIS collaborations and research are facilitated through the ' US Drought Portal' (http://www.drought.gov). Workshop participants recommended the creation of an internal energy portal as a central location to coordinate research, facilitate communication between tribes, and in general, establish long-term partnerships and build and sustain momentum surrounding renewable energy projects on tribal lands. This recommendation could apply to all sectors considered. In application, an energy portal could provide much needed information concerning the current renewable energy projects on tribal lands. Workshop participants acknowledged that it is difficult to know what projects are currently underway, where needs exist, and who is working with whom on renewable energy efforts. The energy portal could potentially serve as a proto-type for coordinating research and facilitating discussion for all

---

consumption rates given the already strapped water resources across the West. It must be noted that the whole Southwest has been identified as ideal for large-scale wind and solar farms, however the region lacks the hydrologic requirements currently needed for successful implementation.

drought monitoring and climate and water related efforts on tribal land. Efforts to launch a tribal lands portal are currently underway by NIDIS personnel.

INSTUTIONAL FRAMEWORK & FINANCIAL CAPITAL

Building Financial Capital

Engaging Tribal Communities & Building Awareness
Increased efforts to better communicate current conditions and impacts could provide firmer awareness across federal and state agencies, decision-makers, and ultimately the general public. Current tribal efforts in the Alaska region have helped build salience among decision-makers. More effective communication of impacts will help make current drought and related issues impacting western tribal nations to more visible and elevate it's importance to NOAA, state governments, and federal domestic policy. Documentation of impacts, and increased data collection and monitoring efforts is a necessary step in equipping tribes with resources needed in such efforts. Increased exposure and awareness via these efforts is a potential strategy for engaging tribal communities and creating long-term partnerships with federal agencies.

Submit Proposals for Federal Funding Sources: Federal Agency and Related Collaborations
A potential revenue stream includes proposal and grant submission to fund projects on tribal lands. Generating a consolidated resource provides incentive to build collaborations on both sides with the long-term goal of providing tribes with initial financial support to build a sustainable revenue sources. A potential first step is to provide tribes with a user guide to proposal writing. Collaborations with federal agencies and related entities provide tribes with both the institutional and financial resources needed for successful project implementation and also provides cooperating entities with opportunities to establish or grow a long-term working relationship with tribal governments.

Developing Institutional Framework

Introduction
Research concerning bridging the gap between science and decision-making suggests that boundary organizations, or entities that work in an intermediary role are effective in managing "boundaries between knowledge and action" while simultaneously enhancing the salience, credibility, and legitimacy of information these entities generate (Cash et al. 2003). Critical to this bridge is a collaborative framework between research and management (Pulwarty et al 2007). A major purpose of this workshop is to provide a viable framework for assisting tribes in early warning drought monitoring, and to a larger degree, provide the groundwork for adaptive and mitigation strategies to combat climate change. Consequently, a well conceived institutional framework is key to fulfilling the federal trust responsibility, to build long-term research partnerships, and to internally engage tribes. This section focuses on developing intermediary institutional framework or partnerships as an effective mechanism for implementing projects or programs indicated in this document.

Recommendations

NOAA Tribal liaison
NOAA has a limited role in fulfilling the federal trust responsibility or for actively engaging in research and monitoring activities that will assist tribes in drought management efforts.

Workshop participants suggested the establishment of regional NOAA tribal liaisons to facilitate projects and to better establish relations with NOAA, federal agencies, and tribes. This individual would work directly under the Dept. of Commerce Under Secretary and work towards potential objectives including:

Ensure federal trust responsibility with NOAA is fulfilled
Make recommendations to NOAA regarding major tribal research/monitoring/management needs and gaps to better equip tribes with self-managing natural resources and adapting and mitigating climate changes
Facilitate grant proposals that better equip tribes with early warning drought monitoring efforts including adaptation efforts and impact mitigation
Facilitate projects funded by NOAA
Communicate research needs and gaps between NOAA and tribal leadership
Communicate tribal research/monitoring needs
Provide annual assessment report to NOAA addressing current research efforts, implementation, and management with federal and tribal partners
Communication with Governor's office, state government to help guide efforts at the state scale
Provide NOAA with an evaluation of projects carried out
Provide recommendations for solidifying partnerships

Partnerships with RISAs and LCCs
Regional Integrated Sciences and Assessments (RISA) program support regional-based research concerning climate and related science that support local decision-making strategies. (RISA 2020 and http://www.climate.noaa.gov/cpo_pa/risa/).

Regional RISA programs and emerging Department of Interior Landscape Conservation Cooperative (LCCs) could act as intermediary entities between tribes and NOAA and other federal agencies. RISA and LCC's programs are well suited to support data collection, research, and outreach needs by translating and communicating complex technical information into user-friendly materials and outreach activities to support decision-makers, in this case, tribal leaders, employees and community members.

RISA supported research has been directly involved in assisting tribes, or has carried out projects and research with tribal applications. One recent example involves the Climate Assessment for the Southwest (CLIMAS), the regional RISA program for the Southwest continually addresses tribal-related research, providing impact assessments, water management and policy recommendations, and data collection and drought monitoring support. In May 2009, CLIMAS in affiliation with Arizona Cooperative Extension representatives visited the Hopi Department of Natural Resources (DNR) to provide advisory and technical support to better understand, monitor and record the extend and severity of drought conditions on Hopi lands. Based upon observations collected by the USGS, researchers identified severe monitoring gaps, citing that only 20 NWS Cooperative Observer (NWS-COOP) sites that collect temperature and precipitation data on Navajo and Hopi lands covering nearly 30,000 square miles insufficient for accurately representing current conditions (Ferguson and Crimmins, 2009). CLIMAS involvement with tribal members provides a framework for cross-agency and Tribal support. This is one example of RISA involvement of tribal issues. The RISA program in the Pacific Northwest, Climate Impacts Group (CIG), is involved with water quality and salmon fisheries tied to regional tribes, and the Pacific RISA program in Hawaii continues to play an advisory role in coastal issues affecting tribes.

Engagement with Tribal Colleges & Universities (TCU's)
Establishing long-standing partnerships with TCU's is fundamental in equipping tribes with tools and resources needed in early warning drought monitoring. TCU's are a crucial institutional framework from which to facilitate research, resources, and transfer of knowledge and dissemination of information. Developing a set of projects with direct input from tribal colleges and faculty could assist federal and affiliated agencies with an idea of where interests, research needs and gaps lie concerning drought monitoring, and also adapting to and mitigating climate change. This in turn could be used to prioritize efforts.

An assessment of current TCU faculty and related stakeholders currently engaged in related drought, water, and climate efforts would help formalize a network of established partnerships and also lay the framework for building new partnerships and establishing priorities for action.

Partnerships with State & Private Colleges
Creating and expanding partnerships with higher education institutions could provide a long-term working relationship with tribes, and assist with short-term projects identified in this document. Undergraduate and graduate programs involving physical and environmental sciences, civil engineering, and humanities departments/programs are sample departments useful. The role of universities could act as an operational component; carrying out the legwork identified for short-term projects. This potentially could help build lasting partnerships with tribal members and affiliated departments and universities and provide non-Native students with valuable experience and insight into complications of natural resource management. By partnering up with university departments, student projects or research themes could focus on an area/problem/project identified by tribal leaders and partnering tribal colleges.

Sample Projects:
Data Collection of Surface Measurements: streamflow monitoring, soil moisture, precipitation
Habitat restoration
Environmental Monitoring: fisheries, wildlife, invasive species
Energy Audit
Water Use Audit
Streamflow Monitoring
River and Stream restoration: rebuilding cutbanks, planting native vegetation
Grant Writing
Facilitate Business Plan/Proposal
Gray-water technology

Intergovernmental Panel on Climate Change (IPCC) Tribal Links
The IPCC is an organization formed by the World Meteorological Organization and the United Nations Environmental Programme whose aim is to provide an assessment of the current state of knowledge of climate change science (IPCC, http://www.ipcc.ch/organization/organization.htm). Workshop participants recommended the creation of a North American tribal liaison position to represent the interests, concerns, and worldviews of tribal communities worldwide, pointing out that indigenous people are disproportionately impacted by changes in climate. This tribal liaison could help coordinate regional-based tribal projects with affiliated entities as well as help communicate tribal concerns to IPCC committees.

Regional Drought Early Warning and Adaptation Pilots on Tribal Lands
The workshop participants identified critical sub-regions in the Colorado and Columbia River Basins as near term opportunities for collaboration. The Four Corners region, undergoing rapid hydrological and ecosystem changes due to prolonged drought was identified as the first priority. Drought impacts on salmon, hydropower, and base flows in the Columbia Basin was also identified.

CONCLUSION
The structure and organization of this workshop report was intended to serve as a roadmap for federal and state partners, providing specific recommendations with respect to projects and the institutional and technical capacity required to successful implementation. A common problem slowing efforts on tribal lands centers around the lack of well-defined collaborative partnerships between tribes and non-Native entities that lack trust, consistency, and follow-through on both ends. Establishing trust partnerships takes time, however armed with a clearer definition and understanding of trust obligations and a list of projects can help refine expectations on both sides, encourage open communication, and more efficiently implement lasting actions.

Workshop Steering Committee Members

Collins, Gary

Indigenous Waters Network
redcloud@wyoming.com

Darby, Lisa

National Integrated Drought Information Center (NIDIS)
lisa.darby@noaa.gov

Ferguson, Dan

Program Manager Climate Assessment for the Southwest (CLIMAS)
dferg@email.arizona.edu

Hayes, Michael

Director, National Drought Mitigation Center (NDMC)
mjhayes@unlnotes.unl.edu

Hiza Redsteer, Margaret

Geologist, Research Scientist United States Geological Survey (USGS)
mhiza@usgs.gov

Kluck, Doug

Climate Program Manager, NWS, NOAA Central Regional Office
Doug.kluck@noaa.gov

Pulwarty, Roger

Director, NIDIS
roger.pulwarty@noaa.gov

Rattling Leaf, James

Director, Geo-Spatial Applicantions and Resource Center, Sinte Gleska University
rattlingleaf@gmail.com

Wildcat, Daniel

Professor, Haskell Indian Nations University
dwildcat@sunflower.com

References

Alvord, C., 2008, NIDIS Remote Sensing Workshop: Showcase of Products and Technologies: Intermountain West Climate Summary, v. 4.

American Indian Policy Review Commission, Final Report: Washington D.C., Government Printing Office, 1977, p. 128-130.

Binder, L., and C. Simpson, 2009, RISA 2020.

Cash, D.W., Clark, W., Alcock, F., Dickson, N., Eckley, N., Guston, D., Jager, J., and R. Mitchell, 2003, Knowledge Systems for Sustainable Development: PNAS, v. 100.

Cherokee Nation v. Georgia, 30 U.S. 1, 1831.
Court, U.S.S., 1942, Seminole Nation v. United States, 316 U.S. 286.
Executive Order 12898 59 FR 7629, Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations, Volume Vol. 59, No. 32, 1994.
Ferguson, D., and M. Crimmins, 2009, Who's Paying Attention to the Drought on the Colorado Plateau?: Southwest Climate Outlook, v. July.
Hanna, J., and M. Squillace, 2007, Native Communities and Climate Change: Legal and Policy Approaches to Protect Tribal Legal Rights: Boulder, CO, Natural Resource Law Center, University of Colorado.
Intergovernmental Panel on Climate Change. http://www.ipcc.ch/organization/organization.htm.
Macchi, M., Oviedo, G., Gotheil, S., Cross, K., Boedhihartono, A., Wolfangel, C., and M. Howell, 2008, Indigenous and Traditional Peoples and Climate Change, International Union for Conservation of Nature.
McNally, M., 2007, Water Marketing: The Case of Indian Reserved Rights: Journal of the American Water Resources Association (JAWRA), v. 30, p. 963-970.
Memorandum 22951, Government-to-Government Relations with Native American Tribal Governments, Volume Federal Register Vol. 39, No 85, 1994
Morisset, M., 1999, Recent Developments in Defining the Federal Trust Responsibility (The Case of the Reluctant Guardian): Seattle, WA, Morisset, Schlosser, Homer, Jozwiak & McGaw.
National Integrated Drought Information System (NIDIS) Drought Portal. http://www.drought.gov.
Navajo Nation v. United States, 263 F.3d 1325, p. 1328-29, 2001.
Nyong, A., Adesina, F., and O. Elasha, 2007, The Value of Indigenous Knowledge in Climate Change Mitigation and Adaptation Strategies in the African Sahel: Mitig Adapt Strat Glob Change, v. 12, p. 787-797.
Regional Integrated Sciences & Assessments. http://www.climate.noaa.gov/cpo_pa/risa/.
Pevar, S., 2004, The Rights of Indians and Tribes: The Authoritative ACLU Guide to Indian and Tribal Rights: New York and London, New York University Press.
Pierott, R., and D. Wildcat, 1997, Native Tradition, Evolution and Creation: Winds of Change; a magazine for American Indians in science and technology, p. 70-73.
Pulwarty, R., Wilhite, D., Diodato, D., and D. Nelson, 2007, Drought in Changing Environments: Natural Hazards Observer, University of Colorado.
Seminole Nation v. United States, 316 U.S. 286, p. 296-297, 1942.
United States v. Mitchell, 463 U.S. 206, 225, 1983.
USGS Navajo Nation Studies, USGS Western Region Geology and Geophysics Science Center, http://geomaps.wr.usgs.gov/navajo/.
Wilkinson, C., 2005, Blood Struggle: The Rise of Modern Indian Nations: New York W.W. Norton & Company, Inc.
Woods, M., 1994, Indian Land and the Promise of Native Sovereignty: The Trust Doctrine Revisited: Utah Legal Review, p. 1496-1497.

APPENDICES

APENDIX I: Federal Trust Responsibility Background & A Brief History

Judicial Origins & History

The trust responsibility originated as an extension or application of numerous treaties the federal government entered in with tribes, originating between 1787-1871 (Pevar 2004). As defined, treaties are enacted as a binding agreement between sovereign nations, acknowledging autonomy and independent sovereignty on both ends. Characteristic to these treaties, tribes forfeited large sections of land in exchange that the federal government respect "the sovereignty of the tribes…would 'protect' the tribes…[and would] provide food, clothing, and services to the tribes" (Woods 1994). In *Cherokee Nation v. Georgia* 30 U.S. 1 (1831) in the opinion of Chief Justice Marshall, Indian Tribes, in "relation to the United states resembles that of a ward to his guardian." This theory was further developed much later in the *Seminole Nation v. United States*, 316 U.S. 286, 296-97 (1941), in which the Supreme Court held that: [The federal government] has charged itself with moral obligations of the highest responsibility and trust. Its conduct, as disclosed in the acts of those who represent it in dealing with the Indians, should therefore be judged by the most exacting fiduciary standards.

Fiduciary Relationships

From this point, the federal government has developed principle relations with tribal governments and individual Native people, using 'fiduciary standards' as a key term guiding the development and legal requirements concerning trust obligations and in general, the relationship between federal and tribal governments. At the basic level, the definition of a fiduciary relationship is defined as "a person to whom property or power is entrusted for the benefit of another; person who holds assets in trust for a beneficiary; "it is illegal for a fiduciary to misappropriate money for personal gain relating to or of the nature of a legal trust (i.e. the holding of something in trust for another); "a fiduciary contract" (*United States v. Mitchel*l, 436 U.S. 206, 225, 1983). Supreme Court decision further expanded the definition of "fiduciary ties" as it relates to the trust responsibility, stating that, "Many forms of conduct permissible in a workday world for those acting at arm's length are forbidden to those bound by fiduciary ties. A trustee is held to something stricter than the morals of the market place...Only thus has the level of conduct for fiduciaries been kept at a level higher than that trodden by the crowd" (*United States v. Mitchell,* 436 U.S. 206, 225, 1983).

Narrowing Trust Obligations: Establishing Breach of Trust Standards (Mitchell I and Mitchell II)

Much later in two Supreme Court decisions, *United States v. Mitchell, (Mitchell I)* 436 U.S. 206, 225 (1980); 25 U.S.C. 1601 (a) (Indian Health Care Improvement Act), and United States v. Mitchell (*Mitchell II*) the Supreme Court developed a set of principles for determining liability concerning breach or violation of the trust responsibility, and further developed the application of the fiduciary relationship, specifically as it related to management of timberlands in this case, with application to all natural resource management and extraction on Native lands. The ACLU Guide to Indian and Tribal Rights (2004) summarized the major principles laid out in *Mitchell II*, stating that:

> Federal officials instructed by Congress to manage, control, or supervise tribal resources are duty-bound by the trust doctrine (1) *consult* with the tribe in determining how best

> to use those resources, (2) to carefully analyze all relevant information regarding how to manage them, (3) to make their decisions based on the tribe's best interests, and (4) to maintain and provide to the tribe an accurate accounting of all transactions regarding these resources [emphasis included].

These standards helped formalize the role of the government by clarifying some of what is protected under the trust responsibility and further developing the role of the government in tribal property and natural resources. In summary, tribes are liable to collect damages for breach of the trust responsibility relationship unique to each tribe and/or Congressional action. Specifically this case established the United States as a trustee in the management of allotted timberlands. This court case did not establish central tenants of trust responsibility, but rather recognized that breach of trust is liken to breach of any fiduciary relationship in the United States judicial system. Evident in these two Supreme Court cases, federal trust responsibility extends beyond a strict legal requirement, and instead holds moral implications in interactions between the federal government and tribes.

Federal Trust Responsibility and Environmental Justice

The evolution of trust responsibility has fallen in sync with many issues and objectives of environmental justice principles. Environmental justice is concerned with resolving the inequitable environmental burdens that disadvantaged groups (race, region, and nations) bear. As defined by the EPA, environmental justice "is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies [and]….everyone enjoys the same degree of protection from environmental and health hazards and equal access to the decision-making process to have a healthy environment in which to live, learn, and work." (http://www.epa.gov/oecaerth/environmentaljustice/) The Clinton administration incorporated trust responsibility within environmental justice principles in two executive decrees.

Executive Order 12898

Executive Order 12898 requires the creation of an interagency working group within comprised of various executive federal agencies to identify and address disproportionately high and adverse human health or environmental effects of programs and activities on minority and low-income populations. In turn, working group findings coordinate and serve as a clearinghouse for each federal agency, to help coordinate research, collect, compile and examine data, to hold public meetings, and develop interagency model project concerning environmental justice. Although this Executive Order applies to all minority and low-income populations, it specifically mentions tribal programs due to the unique relationship between the federal and tribal governments.

Memoranda Fed. Registrar 22951: Memoranda, Government-to-Government Relations With Native American Tribal Governments, 59 Fed. Reg. 22951 (April 29, 1994)

This memoranda guides federal interactions with tribal governments "implemented in a knowledgeable, sensitive manner respectful of tribal sovereignty." Provisions of this document include building an effective day-to-day working relationship between executive department, federal agencies and sovereign tribal governments, and include tribal governments "prior to taking actions that affect federally recognized tribal governments." Additional specifications include removing procedural impediments that inhibit an effective working relationship, and

commitment by the executive department and agency to work with other federal departments and agencies to enlist support in cooperative efforts to accomplish goals. Although this memorandum does not establish a trust relationship, related language and stipulations it intended to tailor federal programs to the needs of Tribal communities and improve government-to-government relations. Provisions included in this memoranda can operate within existing trust obligations or serve as guidelines for establishing new trust relations.

Climate, drought and early warning on Western Native Lands
9-11 June, 2009 Jackson Lodge Grand Teton National Park WY

Early warnings of climate events and threshold points that affect cultural, economic, and environmental resources are becoming increasingly important for preparedness and adaptation as climate changes. In this context the issues of severe sustained drought and increasing rates of environmental change are critical to the future of the Western U.S. in the near and longer terms. The multi-agency National Integrated Drought Information System (NIDIS, in partnership with…Sinte Gleska, Haskell, IWN etc) is therefore convening a workshop on assessing and responding to drought and climate impacts on western Native Lands. This workshop will be held at the Jackson Lodge in Grand Teton National Park on 9-11 June 2009. We propose to use a watershed approach with key participants from Native communities and organizations, from major river basins west of the Mississippi River, involved in developing and protecting water and energy resources, wildlife and the environment. Invited participants will also include people from internationally shared water systems such as the Columbia, the Great Lakes and the Rio Grande and from national level organizations such as the NCAI and CERT. Lodging and travel support will be provided to invitees.

Climate change impacts will be different from region to region. If, as predicted, climate change results in increased water scarcity in some areas, and stresses on other natural resources, tribal use and protection of resources could face significant challenges. For example projections show that tribes in the Pacific Northwest will face warming streams and changes to the hydrologic cycle that further threaten the survival of salmon populations; likewise higher temperatures and increasing aridity in the Southwest might exacerbate tensions between tribal and nontribal interests and rights over the region's limited water resources. A t the same time a number of tribal lessons are available to address climate change. Tribes have great physical and cultural resources that can help the US deal with climate risks through renewable energy development and wilderness protection in the face of climate change.

The NIDIS Act of 2006 (Public Law 109-430) mandates a multi-agency approach that focuses on, (i) communication and awareness of drought and drought impacts, (ii) improving and integrating information from monitoring and forecasting networks into drought planning, (iii) engaging communities to ensure that the needed indicators and triggers for proactive drought risk management are identified and addressed, and, (iv) the development of regionally-specific information sites that act as clearinghouses for information at different scales. The NIDIS provides a prototype for climate information services to support preparedness and adaptation climate varies and changes.

In this workshop we propose to identify and discuss:

- Past, present and future drought-related drivers and impacts on western tribal lands and waters including changes in the nature and quality of the aquatic environment (including the coasts)
- Existing lessons from tribal communities on adaptation to drought and climate change
- Drought information coordination and delivery needed to inform proactive and sustainable development of energy, water and other natural resources on tribal lands in the context of climate variability and change
- Capacity-building needs especially in relation to Tribal Colleges and schools
- Guidance on tribal priorities for feedback to national NIDIS partners with trust responsibilities on incorporating climate change information, especially regarding drought, into planning and practice
- Partnerships needed to achieve the above

A major focus of our discussions will be on ensuring that as climate changes, the drought information needed to help meet trust responsibilities and tribal development and environmental protection goals will be relevant, credible, timely and useful.

Program Committee (to date)

James Rattling Leaf Sinte Gleska University
Gary Collins Indigenous Waters Network
Michael Hayes NDMC
Margaret Hiza Redsteer USGS
Doug Kluck NOAA
Roger S. Pulwarty NOAA
Daniel Wildcat Haskell Indian University

Climate change, drought and early warning on Western Native Lands
9-11 June, 2009 Jackson Lodge, Grand Teton National Park WY

Climate change impacts will be different from region to region. If, as predicted, climate change results in increased water scarcity in some areas, and stresses on other natural resources, tribal use and protection of resources could face significant challenges. For example projections show that tribes in the Pacific Northwest will face warming streams and changes to the hydrologic cycle that further threaten the survival of salmon populations; likewise higher temperatures and increasing aridity in the Southwest might exacerbate tensions between tribal and non-tribal interests and rights over the region's limited water resources. A t the same time a number of tribal lessons are available to address climate change. Tribes have great physical and cultural resources that can help the US deal with climate risks through renewable energy development and wilderness protection in the face of climate change. A major focus of our discussions will be on ensuring that as climate changes, the drought information needed to help meet trust responsibilities and tribal development and environmental protection goals will be relevant, credible, timely and useful.

First Day Tuesday 9 June 2009: Explorers Room

Morning

8:00-9:00 ***Continental Breakfast-Trappers Room***

Session I: ***Chairs- G. Collins, R.Pulwarty***

9:00-10:00 Welcome: The Workshop Steering Group
Opening statement*-Northern Arapaho Tribal Leader B. C'Hair*

Who is here? Why are we here? (Steering Group)
Logistics-M. Whitmire

10:00-10:20 Steering Group-The role of traditional knowledge in adaptation (Leads: M. Hiza Redsteer, G. Collins)

10:20-10:45 BREAK

10:45-11:05 Climate variability and Change in the Western U.S. (K. Redmond)
11:05-11:30 Experience from past efforts: National Assessment-Native Homelands (N. Maynard)
11:30-11:45 The National Integrated Drought Information System (M. Hayes)

11:45-1:15 LUNCH

Afternoon

Session II ***Chair-D. Kluck***

1:15-1:45 The Intergovernmental Panel on Climate Change (R. Pulwarty, D. Martinez)
1:45-2:30 Developing a National Climate Service (C. Koblinsky/R. Pulwarty)

2:30-3:00 Guidance/feedback for the rest of the meeting-Steering Group

3:00-3:20 BREAK

Session III ***Chairs: G. Collins, R. Pulwarty, D. Kluck, J. Rattling Leaf***
Roundtable discussions begin (8 persons per table)
Core climate/drought-related issues: Critical problems, existing lessons and practices, proposed activities and information needs for adaptation

3:20-5:00 Water resources (Discussion leads: B. Harper, D. Patton, S. van Cooten)

7:00 PM DINNER:
Presentation: The NIDIS US Drought Portal (M. Brewer, M. Svoboda)

<u>Second Day Wednesday 10 June 2009-Explorers Room</u>

Morning
8:00-8:30 ***Continental Breakfast-Trappers Room***

Session IV Chair: M. Svoboda
9:00-10:30 Wildlife, Ecosystems, and Rangelands (Discussion leads: G. Voggesser, R. Jones, B. Heinith)

10:30-10:50 BREAK

10:50-12:15 Energy (Discussion leads: M. Tano, B. Gough, K. Craven)

12:15-1:45 LUNCH

Afternoon
Session V Chair: G. Collins
1:45-3:10 Cultural resources (Discussion leads: M.Hiza, D.Martinez)

3:15-3:30 BREAK

3:30-5:00 Opportunities for Collaboration (Discussion leads: V. Depuis, D.Ferguson, J. Rattling Leaf, Federal Agency representatives)

- Cross-sectoral drought monitoring needs (including impacts)
- Capacity-building (in relation to Tribal Colleges and natural resources specialists)

7:00 PM DINNER
Fiddling champion: B. Heinith

<u>Third Day Thursday 11 June 2009-Explorers Room</u>

Morning-Continental Breakfast-Trappers Room
8:00-8:30 Opening Statement: B. C'Hair

Session VI ***Chairs: M. Schaff, G. Collins, B. Gough***
8:30-9:30 Recap- Discussion Reports
9:30-10:30 Discussion: Maintaining Trust responsibilities in a changing climate: Federal, Tribal and State partners with trust responsibilities: Incorporating climate information, especially regarding drought, into planning and practice

10:30-10:45 BREAK

Session VII Chairs G. Collins, R. Pulwarty
Discussants: M. Hiza Redsteer, K. Redmond, D. Kluck, D. Martinez
10:45-12:00 Listening Session: Partnerships of Native Peoples, States and Feds: Participation and Requirements from NOAA National Climate Service, Climate Assessments
12:00-12:15 Wrap-up-Next steps: Where do we go from here?

Workshop on Climate, Drought and Early Warning on Western Native Lands
9-11 June 2009
Grand Teton National Park, WY

PARTICIPANT LIST

Joel Ames
Tribal Liaison
U.S. Army Corps of Engineers, Omaha District
1616 Capitol Ave.
Omaha, NE 68102-4901
USA
Tel: (1) 402-995-2909
Fax: (1) 402-995-2013
E-mail: joel.o.ames@army.mil

Andrea Bair
Climate Services Program Manager
NOAA National Weather Service
125 S. State St.
Salt Lake City, UT 84138
USA
Tel: (1) 801-524-5137 x285
Fax: (1) 801-524-3182
E-mail: andrea.bair@noaa.gov

Mo Baloch
Senior Water Rights Engineer
U.S. Department of Interior
Bureau of Indian Affairs
1849 "C" Street NW
MS 4650
Washington, DC 20240
USA
Tel: (1) 202-208-6042
Fax: (1) 202-219-2407
E-mail: mobaloch@aol.com

Kirk Bemis
Hydrologist
Conservation Program
Zuni Tribe
P.O. Box 339
Zuni, NM 87327
USA
Tel: (1) 505-782-5852 x237
Fax: (1) 505-782-2726
E-mail: kbemis@ashiwi.org

Clay Bravo
Assistant Director
Hualapai Department of Natural Resources
P.O. Box 300
947 Rodeo Way
Peach Springs, AZ 86434
USA
Tel: (1) 928-769-2255
Fax: (1) 928-769-2309
E-mail: naturalresources1@citlink.net

Michael J. Brewer
U.S. Drought Portal Manager
NOAA National Climatic Data Center
151 Patton Ave.
Asheville, NC 28801
USA
Tel: (1) 828-271-4479
E-mail: michael.j.brewer@noaa.gov

William C'Hair
Tribal Spiritual Leader
Northern Arapaho Tribe
P.O. Box 396
Fort Washakie, WY 82514
USA
Tel: (1) 307-332-5006
E-mail: redcloud@wyoming.com

Gwendolyn Carter
Director, Water Resources Division
Nez Perce Tribe
P.O. Box 365
Lapwai, ID 83540
USA
Tel: (1) 208-843-7368
Fax: (1) 208-843-7371
E-mail: gwenc@nezperce.org

Cheryl Chapman
President
Matrix Consulting Group, Inc.
909 St. Joseph St.
#600
Rapid City, SD 57701
USA
Tel: (1) 605-399-2000
Fax: (1) 605-718-8742
E-mail: ckchapman@matrixcgi.com

Garrett Collins
Tribal Liaison
Indigenous Waters Network
18 Bronco Loop
Riverton, WY 82501
USA
Tel: (1) 307-851-5964 or (1) 307-851-1938
E-mail: redcloud@wyoming.com

Kimberly Craven
Senior Project Leader II in Tribal Energy Program
National Renewable Energy Laboratory
1617 Cole Blvd., Bldg 17
Golden, CO 80401-3393
USA
Tel: (1) 303-384-4335
E-mail: kimberly.craven@nrel.gov

Virgil Dupuis
Director of Extension
Salish Kootenai College
P.O. Box 70
Pablo, MT 59855
USA
Tel: (1) 406-675-4801
E-mail: virgil_dupuis@skc.edu

Dan Ferguson
Program Manager, Climate Assessment for the Southwest (CLIMAS)
Institute for the Environment
University of Arizona
P.O. Box 210156
Tucson, AZ 85719
USA
Tel: (1) 520-622-8918
Fax: (1) 520-792-8795
E-mail: dferg@email.arizona.edu

Kim Gottschalk
Staff Attorney
Native American Rights Fund
1506 Broadway
Boulder, CO 80302
USA
Tel: (1) 303-447-8760 X113
Fax: (1) 303-443-7776
E-mail: jeronimo@narf.org

Robert P. Gough
Secretary
Intertribal Council on Utility Policy
P.O. Box 25
Rosebud, SD 57570
USA
Tel: (1) 605-441-8316
E-mail: gough.bob@gmail.com

Robert F Gruenig
Senior Policy Analyst
National Tribal Environmental Council
4520 Montgomery Blvd., NE, Suite 3
Albuquerque, NM 87109
USA
Tel: (1) 505-980-6852
E-mail: bgruenig@ntec.org

Preston Hardison
Tulalip Tribes of Washington
7515 Totem Beach Rd.
Tulalip, WA 98271
USA
Tel: (1) 206-527-0119
E-mail: prestonh@comcast.net

Barbara Harper
Environmental Health Program Manager
Confederate Tribes of the Umatilla Indian Reservation (CTUIR)
750 Swift Blvd.
Ste. 14
Richland, WA 99352
USA
Tel: (1) 541-966-2804
Fax: (1) 541-966-2856
E-mail: bharper@amerion.com

Michael J. Hayes
Director
National Drought Mitigation Center
School of Natural Resources
University of Nebraska-Lincoln
819 Hardin Hall
3310 Holdrege St.
Lincoln, NE 68583-0988
USA
Tel: (1) 402-472–4271
Fax: (1) 402-472-2946
E-mail: mhayes2@unl.edu

Robert Heinith
Hydro Program Coordinator
Columbia River Inter-Tribal Fish Commission
729 NE Oregon
Ste. 200
Portland, OR 97232
USA
Tel: (1) 503-731-1289
Fax: (1) 503-235-4228
E-mail: heib@critfc.org

Margaret M. Hiza Redsteer
Research Scientist
U.S. Geological Survey
2255 N. Gemini Dr.
Flagstaff, AZ 86001
USA
Tel: (1) 928-556-7366
E-mail: mhiza@usgs.gov

Stan Holder
Bureau of Indian Education
Bureau of Indian Affairs
1011 Indian School Road
Room 332
Albuquerque, NM 87104
USA
Tel: (1) 505-563-5251
E-mail: sholder@bia.edu

Tom Iseman
Water Program Director
Western Governors' Association
1600 Broadway
Ste 1700
Denver, CO 80202
USA
Tel: (1) 303-623-9378
Fax: (1) 303-534-7309
E-mail: tiseman@westgov.org

Jesse James
NOAA National Weather Service
1520 E. Bannister Road
Kansas City, MO 64131
USA
Tel: (1) 816-926-3217
Fax: (1) 816-926-3105
E-mail: jesse.james@noaa.gov

Lori Johnston
Chair
Southeast Indigenous Peoples' Center
P.O. Box 4003
Eatonton, GA 31024
USA
Tel: (1) 706-461-6244
E-mail: water@seipc.org

Ron Jones
Manager, Grazing Management Office
Navajo Department of Agriculture
P.O. Box 4889
Window Rock, AZ 86515
USA
Tel: (1) 928-871-6604
Fax: (1) 928-871-6679
E-mail: ronjon__@hotmail.com

Douglas Kluck
Climate Services Program Leader
NOAA National Weather Service
7220 NW 101st Terrace
Kansas City, MO 64153
USA
Tel: (1) 816-268-3144
Fax: (1) 816-891-7810
E-mail: doug.kluck@noaa.gov

Chester J. Koblinsky
Director, Climate Program Office
NOAA Climate Goal Lead
NOAA Climate Program Office
1315 East-West Hwy., SSMC3, Rm. 12823
North
Silver Spring, MD 20910
USA
Tel: (1) 301-734-1233
Fax: (1) 301-713-0515
E-mail: chester.j.koblinsky@noaa.gov

Dennis Martinez
Co-chair
Indigenous Peoples' Restoration Network
P.O. Box 495
Douglas City, CA 96024
USA
Tel: (1) 530-623-5056
E-mail: iprn@snowcrest.net

Margaret Mayer
Dine College
P.O. Box 143
Tsaile, AZ 86556
USA
Tel: (1) 928-724-6722
Fax: (1) 928-724-6821
E-mail: mmayer@dinecollege.edu

Nancy G. Maynard
NASA Tribal College Program Manager
NASA Goddard Space Flight Center
Code 614.1
Greenbelt, MD 20771
USA
Tel: (1) 301-614-6572
Fax: (1) 301-614-5644
E-mail: nancy.g.maynard@nasa.gov

Annette Morgan
Wildlife, Fisheries, and Parks Program Manager
Hualapai Department of Natural Resources
P.O. Box 300
947 Rodeo Way
Peach Springs, AZ 96401
USA
Tel: (1) 928-769-2255
E-mail: naturalresources1@citlink.net

Nikos Pastos
Human Rights Coordinator
Center for Water Advocacy
Alaska's Big Village Network
8101 Peck Avenue
#M-88
Anchorage, AK 99504
USA
Tel: (1) 907-764-2561 or 406-459-1829
Fax: (1) 907-333-3009
E-mail: nikospastos@hotmail.com

Deborah Patton
Water Quality Programs Administrator
Inter Tribal Council of Arizona, Inc.
2214 North Central Ave.
Ste. 100
Phoenix, AZ 85004
USA
Tel: (1) 602-307-1548
Fax: (1) 602-258-4825
E-mail: deborah.patton@itcaonline.com

Roger Pulwarty
Director
National Integrated Drought Information System (NIDIS) Program Office
NOAA Earth System Research Laboratory
325 Broadway R/C DC1
DSRC 1D111
Boulder, CO 80305
USA
Tel: (1) 303-497-4425
Fax: (1) 303-497-7013
E-mail: roger.pulwarty@noaa.gov

Les Ramirez
Senior Partner
Law Offices of Les W. Ramirez
500 4th St.
Ste. 225
Albuquerque, NM 87102
USA
Tel: (1) 505-768-7000
Fax: (1) 505-255-6955
E-mail: leswramirez@netscape.net

James Rattling Leaf
Advisor for Science and Technology
Sinte Gleske University
5445 Friendship Circle
Black Hawk, SD 57718
USA
Tel: (1) 605-791-3033
E-mail: james.rattlingleaf@sdsmt.edu

Kelly T. Redmond
Regional Climatologist/Deputy Director
Western Regional Climate Center
Desert Research Institute
2215 Raggio Pkwy.
Reno, NV 89512-1095
USA
Tel: (1) 775-674-7011
Fax: (1) 775-674-7016
E-mail: krwrcc@dri.edu

Margaret Schaff
Attorney
Law Office of Schaff & Clark-Deschene, LLC
749 Deer Trail Road
Boulder, CO 80302
USA
Tel: (1) 303-443-0182
E-mail: mschaff@att.net

Jerry Sehlke
Advisory Scientist
Idaho National Laboratory
2525 N. Fremont Ave.
Idaho Falls, ID 83415
USA
E-mail: gerald.sehlke@inl.gov

Jim Shakespeare
Northern Arapaho Tribe
P.O. Box 396
Fort Washakie, WY 82514
USA
Tel: (1) 307-332-6120
Fax: (1) 307-332-7543
E-mail: arapahotribe@hotmail

Layha Spoonhunter
Northern Arapaho Tribe
P.O. Box 396
Fort Washakie, WY 82514USA

Erik R. Stegman
Program Manager,
Policy Research Center
National Congress of American Indians
1516 P Street, NW
Washington, DC 20005
USA
Tel: (1) 202-466-7767
Fax: (1) 202-466-7797
E-mail: estegman@ncai.org

Margaret Rose Stevens
Research Associate
American Indian/Alaskan Native Climate Change Working Group
4204 W. Mason St.
Oneida, WI 54155
USA
Tel: (1) 785-764-6283
E-mail: margaret.rose44@gmail.com

Mark Svoboda
Climatologist
National Drought Mitigation Center
School for Natural Resources
University of Nebraska-Lincoln
815 Hardin Hall
3310 Holdrege St.
Lincoln, NE 68583-0988
USA
Tel: (1) 402-472–8238
Fax: (1) 402-472-2946
E-mail: msvoboda2@unl.edu

Jolene Tallsalt-Robertson
Senior Hydrologist
Water Management Branch
Navajo Nation
P.O. Drawer 678
Fort Defiance, AZ 86504
USA
Tel: (1) 480-313-7401
Fax: (1) 928-729-4126
E-mail: jolenetrobertson@navajo.org

Mervyn L. Tano
President
International Institute for Indigenous Resource Management
444 South Emerson Street
Denver, CO 80209-2216
USA
Tel: (1) 303-733-0481
Fax: (1) 303-744-9809
E-mail: mervtano@iiirm.org

Suzanne Van Cooten
Hydrometeorologist
OU CIMMS/NOAA NSSL
120 David L. Boren Blvd.
Norman, OK 73026
USA
Tel: (1) 405-659-9621
E-mail: suzanne.van.cooten@noaa.gov

Timi Vann
Western Regional Coordinator
NOAA Northwest Fisheries Center
2725 Montlake Blvd. E.
Seattle, WA 98112
USA
Tel: (1) 206-860-3200
Fax: (1) 425-483-0316
E-mail: timi.vann@noaa.gov

Garrit Voggesser
Senior Manager
Tribal Lands Conservation Program
National Wildlife Federation
2260 Baseline Road
Ste. 100
Boulder, CO 80303
USA
Tel: (1) 303-441-5161
E-mail: voggesser@nwf.org

Larry Wasserman
Environmental Policy Manager
Planning Department
The Swinomish Indian Tribal Community
11430 Moorage Way
La Conner, WA 98257
USA
Tel: (1) 360-466-7250
E-mail: lwasserman@skagitcoop.org

Melanie Whitmire
Meeting Planner
Joint Office for Science Support
University Corporation for Atmospheric Research
P.O. Box 3000 - FL4, Rm. 2320
Boulder, CO 80307-3000
USA
Tel: (1) 303-497-8687
Fax: (1) 303-497-8633
E-mail: whitmire@ucar.edu

Dan Wildcat
Working Group Convener
American Indian and Alaska Native Climate Change Working Group
Haskell Indian Nations University
155 Indian Ave.
Lawrence, KS 66046
USA
Tel: (1) 785-832-6677
Fax: (1) 785-832-6643
E-mail: dwildcat@sunflower.com

Eric C. Wood
Physical Scientist
USGS Center for Earth Resources Observation and Science (EROS)
Sioux Falls, SD 57105
USA
Tel: (1) 605-594-6068
Fax: (1) 605-594-6529
E-mail: woodec@usgs.gov