

Project 15: Using Ecosystem Function and Traditional Ecological Knowledge Together to Build Resilience and Adapt to Climate Change in North America		Operating Year(s): 2015–2016
Planned Budget for Two Years: C\$250,000 Year 1: C\$150,000 Year 2: C\$100,000		
Strategic Priority/Subtheme: <ul style="list-style-type: none"> Sustainable Communities and Ecosystems / Priority Species and Ecosystems; and Sustainable Communities <p>This project addresses the Sustainable Communities and Ecosystems strategic priority and in particular the Priority Species and Ecosystems and Sustainable Communities subthemes. One of the many goals of indigenous communities' environmental and natural resource departments is to maintain and restore functionality of stream and wetland riparian and upland areas, which could protect these waterbodies' beneficial uses and values for indigenous communities. Traditional ecological knowledge (TEK) plays a significant role in indigenous communities' approach to natural resource management. One of the mainstays of indigenous communities' interactions with ecosystems is a deep and abiding view that humans are part of the environment. Conservation management by indigenous communities is guided by a respect for the relationships between species, their habitats, and fostering ecosystem resilience, which is critical to ensuring long-term sustainability.</p> <p>Indigenous communities' environmental programs are leading the way in the paradigm shift towards sustaining natural resources (e.g., wildlife, aquatic habitat) while managing for water quality. Traditional ecological knowledge (TEK) provides the foundation for integrated riparian management focused on riparian and upland ecological function relationships. In Canada, the federal government has funded the development of tools to assist in managing future risks from a changing climate by using TEK and Western science to help forecast impacts and develop risk management options. In the US, the indigenous people and USEPA cooperative stream and wetland applied research program uses the proper functioning condition (PFC) protocol to assess ecological function condition. In Mexico, no federal-level program yet exists; however, there are several local and state initiatives underway. These approaches focus on identifying ecological functions at risk and enabling self-healing connections between ecosystems. Resiliency appropriate for the biogeoclimatic setting sustains an area over time. Restoring resiliency is part of a process dependent on knowledge from indigenous people (with TEK), interdisciplinary collaboration, and monitoring and analyzing key leading indicators (vegetation, hydrology, soil and landform) of ecosystem functions. Implementation of appropriate actions serves to sustain and enhance desired ecosystem services (e.g., fish habitat, livestock and/or wildlife forage, water purification, carbon storage and nutrient cycling) in disparate climatic conditions.</p>		
How will this project address the cross-cutting themes? <ul style="list-style-type: none"> <i>Learning from and assisting vulnerable groups and indigenous communities</i> <p>Sharing and applying knowledge and tools of ecological function will clarify the impact of current land management programs affecting riparian ecosystems and/or water catchments. This knowledge and these tools will offer alternatives to managing and enhancing the type, quality, and magnitude of ecological goods and services received. Developing land-management and risk management strategies is an interactive and engaging collaborative process. This process uses information from both Western science and traditional ecological knowledge to understand</p>		

functions related to local site-specific potential. It begins by assessing the existing attributes of a site, to identify functions missing for each specific setting or how functions need to change, or how changing management can enable self-healing. Managers of land, water, ecosystems and infrastructures, and users of the ecological goods and services must collaborate to examine issues and problems via an integrated process.

- *Enhancing information-sharing, transparency, capacity building, and communication*

Terrestrial and aquatic ecosystems produce multiple goods and services. Ecosystem services take place on a spatial and temporal scale whose properties are inextricably linked with the quality of services provided. The vulnerability of an ecosystem to potentially degrading events has not, typically, influenced policy and management decisions because the protocol has been to rely on indicators to identify problems. This project provides tools and methodologies to measure and anticipate ecosystem vulnerabilities to climatic variability. It will also engage participants in discussions on various tools and approaches developed by the three countries to identify vulnerabilities and develop risk management strategies.

Project Summary (including a clear statement of project goal)

The goal of this project is to share tools to assess vulnerability that are available to indigenous communities in the three countries and to pilot new ones, and to demonstrate and test the concepts of integrated riparian and/or water catchment management. Specifically, the project will:

- share vulnerability assessment and management tools that have been developed specifically for indigenous communities;
- demonstrate different tools, including the Riparian Proper Functioning Condition Assessment and Integrated Riparian Management tool, to multiple indigenous leaders and representatives;
- work with indigenous communities, local managers, and stakeholders in Canada and Mexico and, at one study area in each country, demonstrate these concepts and apply them to the local watersheds and management situations;
- derive lessons from the collective experiences, including the identification of key leading performance indicators for the sustainability of an ecosystem and effectiveness of best management practices (BMPs), and correlate alterations in ecosystem functions and water quality with changes in land-use practices;
- evaluate the indicators against historic trends in the designated Mexico and Canada study areas;
- analyze three key metrics—a) vegetation diversity, type and location, b) landform and channel pattern, profile and dimension, and c) water quality related to hydrology—as influenced by land use, restoration, and management, in the two study areas;
- develop trilateral capacity to share tools and experiences; and
- develop an ecological monitoring program as part of an adaptive management plan/strategy that assists in reducing uncertainty from climatic variability.

The best environmental sustainability management decisions are made when communities are given easy-to-use decision support tools and meaningful data. The sharing of tools to assess vulnerability and demonstrate and test the concepts of integrated riparian and/or water catchment management, highlights the benefits of multiple approaches to environmental protection, capitalizes on synergies derived from protecting human and ecosystem health, and reduces the likelihood that policy decisions will have unintended negative consequences. Indigenous communities need to make strategic decisions. It is important to have knowledge, timely data, and cost-effective decision support

tools within reach to meet objectives and goals.

Functional ecosystems are resilient to disturbances, in contrast to non-functional ecosystems, which fail to adequately process surges in water flow from upland and upstream inputs. Also, ecosystem degradation affects human health and safety, which requires communities to respond and implement adaptive measures. Understanding how ecosystems work and the goods and services they provide will assist decision-makers in identifying the connections between form, function, management, and monitoring. This will allow decision-makers to better address the underlying causative factors behind ecological degradation. Improved knowledge of aquatic and upland interactions, at local to watershed scales, is essential to evaluating and designing land management alternatives for stream and wetland resources.

Short-term Outcomes (at halfway point)

1. Awareness created about functionality and vulnerability assessment concepts and their utility in focusing management and monitoring; as well as exchange of technical information and local knowledge through the coordination of workshops on these concepts in the US, Mexico and Canada.
2. Experts and local stakeholders share and gain knowledge at workshops in selected study areas in Mexico and Canada, about water management tools used at the community level in the three countries.

Long-term Outcomes (by the end of the project)

1. Assessment of risks and opportunities in designated Mexican and Canadian study areas, using traditional ecological knowledge and other information to understand functions related to potential ecological condition throughout a water catchment; and assessment of vulnerabilities of communities to projected climate change.
2. Case study reports, assessments, and study-area adaptive management plans, including monitoring indicators.

Longer-term, Environmental Outcomes (post-project)

The people and agencies engaged in this project will gain experience from hands-on application of vulnerability assessment/management and ecosystem function management concepts. This will enable them to expand this application to provide support to other indigenous and non-indigenous water catchments and riparian areas in need. They will also gain a better understanding of what tools are being used for water management at the community level in Canada, Mexico and the US and how to identify potential uses in their respective countries.

Dissemination of research results will include:

1. convening international meetings and trainings with internal and external stakeholders,
2. developing a quality assurance project plan (QAPP) for all data collected, and
3. producing quarterly and final reports, which will lead to publications in peer-reviewed journals.

Performance Measures (quantified SMART measures)			
Outcome	Measure	Target	Indicator
Awareness created about functionality and vulnerability assessment concepts and their utility in focusing management and monitoring; as well as exchange of technical information and local knowledge through the coordination of workshops on these concepts in the US, Mexico and Canada.	Number of participants at workshops on vulnerability assessment/management and ecosystem function. Before-and-after surveys of participants on level of knowledge of functionality concepts.	3 workshops, with indigenous community representation at each. 100% of workshop participants indicate increased level of knowledge of vulnerability assessment/management and functionality concepts.	Increase in number of workshops held on vulnerability assessment/management and functionality concepts in North America. Increase in the level of knowledge of these concepts in the three countries.
Experts and local stakeholders share and gain knowledge at workshops in selected study areas in Mexico and Canada about water management tools used at the community level in the three countries.	One study area selected each for Canada and Mexico. Number of participants at workshops and participating in CEC work, by area of expertise and organization/indigenous/agency collaboration within each country.	75% of stakeholders identified by Canada and Mexico participate in the workshops.	Increase in the number of study areas in Canada and Mexico focused on community-level water management tools, and in the number and variety of stakeholders engaged in this work.
Assessment of risks and opportunities in designated Mexican and Canadian study areas, using traditional ecological knowledge and other information to understand functions related to potential ecological condition throughout a water catchment; and assessment of vulnerabilities of communities to projected climate change.	Development of new and/or improved information on risks and the opportunities to improve ecological condition and increase community resiliency in selected Mexico and Canada study areas, using TEK and other information.	Appropriate information developed for each study area on risks and opportunities, using TEK and other information.	Increase in the amount and availability of information in the three countries.
Case study reports, assessments, and study-area adaptive management plans, including monitoring indicators.	Publication of case study reports, assessments and management plans.	100% completion and dissemination of case studies, assessments	Increase in the availability of publications on the integration of TEK and

		and management plans.	Western science related to functionality and vulnerability assessment for riparian management in North America.	
Tasks necessary to reach the environmental outcome 1) Coordinate knowledge sharing/transfer and prioritize management actions 2) Implement ecosystem management practices and assessments and develop monitoring activities 3) Produce reports of study area assessments, and study-area adaptive management plans, which include monitoring indicators				
Task #1) Coordinate knowledge sharing/transfer and prioritize management actions				
Subtask	Project outputs	How does the subtask/output move the project toward the environmental outcome	Timing	Budget (C\$) (activities)
1.1 Coordination workshop with managers, scientists and other stakeholders to plan and select tools for vulnerability assessment/management and ecosystem function	Workshop with managers, scientists and other stakeholders to share lessons learned on vulnerability assessment tools and ecosystem function, data needs, and adaptive management planning process, and to identify management priorities and near-term actions.	<p>The group will identify successful strategic actions to conserve and restore ecosystem processes and ecosystem services (e.g., native species), and to support local communities in adapting to potential climate-change effects.</p> <p>Identification of TEK management methods in stream and wetland habitats.</p>	Summer 2015	Year 1: \$45,000 Year 2: \$0
1.2 Translation of documents	Translation of documents for initial train-the-trainers document		Fall 2015	Year 1: \$5,000 Year 2: \$0

Task #2) Implement ecosystem management practices and assessments and develop monitoring activities				
Subtask	Project outputs	How does the subtask/output move the project toward the environmental outcome	Timing	Budget (C\$) (activities)
2.1 Study-site visits and on-site ecosystem function workshops with local stakeholders, including a field assessment and education and outreach activities with private landowners, managers, park visitors, and other stakeholders. The workshops will include exchanges on climate-change adaptive management planning, and ecosystem functionality assessments, will identify study sites in Mexico and Canada, and will create a work and quality assurance project plan.	<p>Workshop reports and assessments from study sites, including recommended conservation actions and monitoring on public and private lands to improve landscape and community resilience.</p> <p>Comparison of management alternatives using TEK, and current and future climate change scenarios.</p> <p>Development of quantitative indicators of stream and wetland riparian vegetation and of stream channels.</p> <p>Initiate work on climate-change adaptive management planning in the Mexico and Canada study areas.</p>	<p>Ecosystem management practices will help to maintain or restore the ecological functions, connectivity, and resilience to climate change.</p> <p>Participation by and engagement with communities, visitors and other stakeholders will help to build support for protection implementing an adaptive management plan and monitoring, to increase the long-term sustainability of project outcomes.</p> <p>Study areas will provide a case study for collaborative efforts to develop conservation targets and increase sustainable ecosystem services.</p>	<p>Fall 2015–Spring 2016</p> <p>Summer 2016–Spring 2017</p>	<p>Year 1: \$100,000</p> <p>Year 2: \$80,000</p>

Task #3) Reports of study area assessments, study-area adaptive management plans, which include monitoring indicators				
Subtask	Project outputs	How does the subtask/output move the project towards the environmental outcome	Timing	Budget (C\$) (activities)
3.1 Dissemination of case studies reports developed for study areas, including study-area adaptive management plans and monitoring indicators	Reports, journal articles, and information dissemination on website	Scientific validation of TEK management plans	Spring 2017	Year 1: \$0 Year 2: \$20,000

Explain how this project meets the selection criteria adopted by Council in the Strategic Plan (see below)

The goal of all projects funded by the CEC will be to support the efforts of the Parties to conserve, protect and/or enhance the North American environment. The following criteria will guide the Secretariat, Working Groups, Committees, and other appropriate officials of the Parties in considering cooperative activities for Council approval under operational plans. These selection criteria do not apply for activities to be funded through the NAPECA grant program.

- **How does the project contribute to achieving Council's strategic objectives as described within the current Strategic Plan, or as related to other priorities subsequently confirmed by Council?**

The best environmental sustainability management decisions are made when communities are given easy-to-use decision support tools and meaningful data. The sharing of tools to assess vulnerability, and to demonstrate and test the concepts of integrated riparian and/or water catchment management, highlights the benefits of multiple approaches to environmental protection, capitalizes on synergies derived from protecting human and ecosystem health, and reduces the likelihood that policy decisions will have unintended negative consequences. Indigenous communities need to make strategic decisions. It is important to have knowledge, timely data, and cost-effective decision support tools within reach to meet objectives and goals.

- **Are the proposed objectives North American in scope? In other words, how are the proposed results relevant to protecting the environment in North America? (For example, what would Council members announce to the press at the successful completion of this project?)**

Assessment of vulnerability and riparian functions provides North American decision-makers with the connections between form, function, management, and monitoring, which will allow them to better address the underlying causative factors behind ecosystem degradation and restoration. In most streams, loss of riparian functions causes a significant portion of non-point-source pollution. The loss of riparian function and physical form unravels the assimilation processes. With the loss of ecological functions, stream and wetlands riparian areas are no longer able to dissipate energy, sequester pollutants, facilitate sediment deposition, and take up nutrients through plant growth. Instead, pollution can wash into water bodies from wherever it had been and/or would have been stored. In non-functional stream and wetland riparian areas the aquatic environment itself becomes a source of water pollution. Managing for water quality must focus on the drivers of physical functions (vegetation, hydrology, soil and landform). These early indicators will provide data to managers, of the type of interventions needed to prevent the loss of assimilative processes and prevent the progression of water quality deterioration such as found in many communities in Canada, Mexico and the US. In areas with high dependence on riparian functions for water quality, assessing ecological function using proper functioning condition (PFC) protocols has the potential to be more effective than chemical/biological sampling.

Local qualitative assessments of stream function and biophysical alterations, when incorporated with quantitative in-stream monitoring, empower resource managers to evaluate adaptive management alternatives, prioritize resource allocations, and identify indicators to be monitored. By focusing on stream and wetland riparian functions, a long-term sustainable restoration of the water body, with greater resiliency and assimilative capacity, can be realized.

Furthermore, the discussion around the different tools used for community-level vulnerability assessment and management in the three countries will contribute to a better understanding of what is currently being used in this sector and could be used or adapted to other communities within each country.

- **What specific, clear and tangible results will be achieved and how will progress toward each result be measured over time? Identify performance measures to be used to indicate success at reaching all outcomes and/or performance.**

Through this project, awareness will be created within communities in the three countries about functionality and vulnerability assessment concepts and their utility in focusing management and in monitoring, and as well there will be an exchange of technical information and local knowledge through the coordination of workshops on these concepts, in the US, Mexico and Canada. The knowledge gained by participants at these workshops will be measured through pre- and post-workshop surveys. Target: 100% of participants report increased knowledge after the workshop.

At the Mexican and Canadian study area workshops and field assessments, experts and local stakeholders will share and gain knowledge about water management tools used at the community level in the three countries. The number and variety of stakeholders participating in

these study area workshops will determine the knowledge transfer potential of these activities. Target: 75% of stakeholders identified by Canada and Mexico participate in the workshops.

The study area risk/opportunity assessments using traditional ecological knowledge and other information will support the ability of communities to make strategic resource management decisions, through better understanding of the functions related to potential ecological condition throughout a water catchment, and of the vulnerabilities of communities to projected climate change. This work will be measured through the successful completion of the assessments. Target: Appropriate information developed for each study area on risks and opportunities, using TEK and other information.

By the end of this project, case study reports, assessments and study-area adaptive management plans, including monitoring indicators, will be completed and available for use by other communities across North America. Target: 100% completion and dissemination of case studies, assessments and management plans.

- **Explain why the CEC is the most effective vehicle for the Parties to use in undertaking this project, considering these points:**

This project directly responds to the CEC's strategic priority on Sustainable Communities and Ecosystems and builds international collaboration. It is consistent with the CEC's approach of using science to increase ecosystem resilience. This project focuses on improving ecological functions, to create an adaptive management planning process for the sustainability of essential and culturally sensitive ecosystems. In line with the CEC's cross-cutting theme to learn from and assist vulnerable and indigenous communities, the project uses Western science and TEK to strengthen institutional and individual stewardship.

- **Any other public, private or social organizations that work on such activities**

In the US, the Department of the Interior (DOI), Bureau of Land Management (BLM) and National Riparian Service Team (NRST) have been instrumental in developing the ecosystem protocol and use for managing public lands.

Canada has developed tools to assess community vulnerabilities to projected climate change and to do community adaptive management planning.

In Mexico, the National Commission for the Development of Indigenous Communities (*Comisión Nacional para el Desarrollo de los Pueblos Indígenas*—CDI) is in charge of coordinating actions and/or resources with federal, state and municipal institutions, as well as with social and private organizations, to promote sustainable development, recognition of cultural heritage, intercultural relations, and rights of indigenous people and communities. Within the Ministry of Environment and Natural Resources, two organizations are involved in work related to this project: the National Commission for Knowledge and Use of Biodiversity (*Comisión Nacional para el Conocimiento y Uso de la Biodiversidad*—Conabio) and the National Commission for Natural Protected Areas (*Comisión Nacional de Áreas Naturales Protegidas*—Conanp).

- **Opportunities to cooperate and/or leverage resources with such organizations**

This project will use protocols developed by BLM. Coordination with DoI and the Department of Agriculture (DoA), US Forest Service (USFS) and Natural Resources Conservation Service (NRCS) is dependent on the location of the designated study areas in Mexico and Canada and on common goals.

Conabio has identified Priority Regions for Conservation, among which 70% are located within indigenous territories. Conanp has a specific division in charge of indigenous communities living in protected areas, as almost 30% of the total surface of protected areas is owned by indigenous groups. It is estimated that indigenous lands are among the best preserved natural ecosystems but also harbor the most marginalized communities. Conanp is currently implementing several programs related to this project: subsidies programs to promote participation of indigenous communities in conservation actions; certifications program for areas voluntarily devoted to biodiversity conservation; and programs for the development of indigenous communities, which include capacity-building, social assessments, and inclusion of indigenous people into protected areas' councils. Lastly, a new project is being implemented in collaboration with Conabio and CDI, aiming to promote the fair and equitable sharing of benefits arising from natural resources (Nagoya Protocol). Additionally, Conanp is currently leading the implementation of a Global Environment Facility (GEF) project named Resilience (Strengthening Management Effectiveness and Resilience of Protected Areas to Safeguard Biodiversity Threatened by Climate Change). This project involves 17 protected areas in Mexico and could link with the present project, providing technical assistance in issues related to climate change, as well as providing some funding, as long as the pilot site in Mexico coincides with one of the protected areas.

- **Does the project propose a clear timeline for implementation of the activities, including a target end-date for CEC involvement? Where applicable, describe how the work will continue after CEC involvement ends.**

The current project is a 2-year project that will pilot new tools in two study areas in North America. The work will involve three phases: an initial planning and knowledge-sharing phase (first workshop); a subsequent phase involving study area workshops, on-site field assessments, and management plans development (study area workshops); and a final information dissemination phase. It is hoped that through this final phase the tools, protocols and management strategies developed through this project will continue to be used and adapted by other communities in the three countries after the life of the project.

- **Where applicable, identify with reasonable specificity:**

- **The target audience, as well as its receptivity and capacity to use the information that may be produced as a result of the project**

Primary target audiences are indigenous communities across North America, and private landowners. In addition, cities, states and federal land management agencies have benefitted from ecosystem function research. Ecosystem function research is designed to build capacity within the participating indigenous community and or agency. This research integrates traditional environmental

knowledge (TEK) with ecosystem function and ecological and environmental risk science. Indigenous environmental planning efforts will serve to help people:

- become familiar with assessing functional condition of ecosystems;
- learn about fate and transport of contaminants;
- hone information access skills, which can be used to achieve adaptive management goals;
- work with a case study to gain practical experience; and
- be introduced to vulnerability assessment, riparian proper functioning condition, and integrated riparian management.

○ **The beneficiaries of capacity building activities that the project may include**

Indigenous communities have been accumulating traditional ecological knowledge (TEK) for millennia. TEK plays a significant role in an indigenous community's approach to natural resource management. Indigenous conservation management is guided by a respect for the relationships between species, their habitats, and fostering ecosystem resilience, which is critical to ensuring long-term sustainability.

Ecosystem function research is designed to provide transferable applied research in stream and wetland ecological processes. Knowledge of ecological functions allows a manager to see how an indigenous community's cultural practices can be affected by the way an ecosystem absorbs and releases water, nutrients, and toxins. Such knowledge includes:

- relationships among water, vegetation, and landform;
- nutrient and trace-metal solubility;
- fate and transport of sediment, nutrients, and trace metals (e.g., mercury);
- phyto-detoxification;
- aquatic benthic macro-invertebrate criteria; and
- how to incorporate TEK into environmental and ecological risk assessment.

○ **The relevant stakeholders, with particular attention to communities, academia, NGOs and industry, and their involvement and contribution to a successful outcome**

- Karen Richardson, CEC, Secretariat
- Daniel Heggem, USEPA ORD NERL Environmental Sciences Division, Las Vegas, NV
- Marie-Eve Neron, Climate Change Programs, Aboriginal Affairs and Northern Development Canada
- Yves Theriault, Climate Change Programs, Aboriginal Affairs and Northern Development Canada
- Ivy Chan, Environmental Public Health, First Nations and Inuit Health Branch, Health Canada
- Robert K. Hall, USEPA Region, San Francisco, CA

- Sherman Swanson, Department of Natural Resources and Environmental Science, College of Agriculture, University of Nevada, Reno
- John Lin, USEPA ORD NERL ESD Landscape Ecology Branch, Las Vegas, NV
- Daniel Mosley, Contractor, Walker River Paiute Tribe, Fernley, NV
- Elizabeth (Betsy) R. Smith, USEPA ORD, Sustainable and Healthy Communities Research Program
- Mariana Bellot Rojas, General Director for Institutional Development and Promotion, National Commission for Protected Natural Areas (*Comisión Nacional de Áreas Naturales Protegidas*—Conanp), Mexico
- Sergio Sánchez López, Division of Wetlands and Coastal Areas Affairs, Conanp
- Laura Martínez Pepin, Division of International Cooperation, Conanp
- Noé J. Navarrete Zamora, Division of Indigenous Communities in Protected Areas, Conanp
- Miguel Juárez Flores, Division of Indigenous Communities in Protected Areas, Conanp
- Martín Cadena Salgado, Coordinator of the GEF Resilience project, Division of Strategies for Climate Change, Conanp
- National Commission for the Development of Indigenous People (*Comisión Nacional para el Desarrollo de los Pueblos Indígenas*—CDI), Mexico
- Lucila Neyra, Coordination of Biological and Genetic Resources, National Commission for the Knowledge and Use of Biodiversity (*Coordinación de Recursos Biológicos y Genéticos, Comisión Nacional para el Conocimiento y Uso de la Biodiversidad*—Conabio), Mexico