

NSF EPSCoR Track 1 (2013-2018; pending): Managing Idaho's Landscapes for Ecosystem Services

Six research objectives will guide our efforts to explicitly link social and ecological processes associated with growth of three mid-sized cities in Idaho. First, the MILES team will **Characterize Patterns of Urban Growth and Ecological Change** to quantify how growth has occurred and ecosystem services have changed over time and how that change is manifested on the landscape. Second, is to **Identify Social Drivers of Urban Growth and Ecological Change** by quantifying how social institutions make key policy decisions and how society values and perceive ecosystem services. Third, these biophysical and social datasets will be used to construct a screening tool to **Identify Vulnerable Ecosystem Services** and their associated driving variables. The premise of this screening tool is that the social and biophysical datasets contain information regarding vulnerable components of the social-ecological system that can be extracted using a rapidly applied valuation approach. Fourth, focusing on vulnerable ecosystem services, the MILES team will **Construct an Integrated Modeling Framework** that links domain specific models of biophysical (e.g. hydrology, landscape, ecosystem) and social (economic, social behavior) processes using a scenario-based formulation. This will allow evaluation of ecological and social tradeoffs associated with urban expansion and related ecosystem services. Fifth, **Visualization and Virtualization Tools** will be constructed to facilitate the communication of the scenario modeling. Sixth, the resulting integrated modeling-virtualization framework will be used to **Generate and Communicate Knowledge of Social-Ecological Systems** by (a) promoting communication and intellectual exchange among researchers and students from diverse disciplines; (b) improving communication to the community about how their social-ecological system functions; and (c) providing decision makers with the best possible science to inform policy making associated with urban growth to promote sustainable ecosystem services.

Center for Sustainable Ecological Resources System (CeSERS):

An additional goal being developed through EPSCoR is to foster creation of A *Center for Sustainable Ecological Resources System (CeSERS)*. This Center will unite universities, state, federal, and industry partners to advance knowledge of multiple SES phenomena under different scenarios of resource development that will be transferable to regions beyond the state. CeSERS will facilitate community input, consulting expertise, new educational programs, and research and education proposals to various entities. RII leads are already working to ensure complementarity of CeSERS with the National Socio-Environmental Synthesis Center (L.Alessa, Science Review Board, and Jonathan Kramer, Director of Interdisciplinary Science, pers. comm.) and Arizona State University's Center for Social Dynamics and Complexity (Michael Barton, Director, pers. comm.).

Coeur d'Alene Basin Environmental Improvement Project Commission

The BEIPC's primary purpose is to work with the EPA and Idaho Department of Environmental Quality (IDEQ) to implement the Record of Decision (ROD) for OU-3 throughout the Basin and implement the Upper Basin ROD Amendment for portions of OU-3 and work in OU-2 included in the Amendment designed to advance the cleanup of heavy metals contamination. In addition, the BEIPC is involved in:

- Developing a comprehensive cleanup plan for the Upper Basin based on remedies selected in the Upper Basin ROD Amendment;
- Coeur d'Alene Lake management planning and implementation;
- Heavy metal contamination cleanup efforts at mining sites in the North Fork of the CDA River; and
- Leading multi-agency coordination in addressing potential flooding in the South Fork CDA River and Pine Creek drainages.

NASA: Biogeoscientific and Societal Characteristics of Extreme Fire Events

In this proposal we address the need to connect the biophysical impacts and trajectories of the post-fire environment as derived from Earth science research with impacts to human systems. This proposal applies directly to the RFP subcomponent objectives by applying biogeoscientific and social science metrics to:

1. Characterize the nature, magnitude, and distinguishing attributes of extreme wildland fire events;
2. Assess the full impact of the extreme wildland fire events (near-term and long-term) on both natural and human systems;
3. Characterize biophysical and social recovery processes and trajectories from selected extreme fire events; and
4. Understand how human actions to mitigate and/or recover from the impacts of past extreme wildland fire events have succeeded or failed, including the role that adaptive capacity and stakeholder knowledge play in effectively responding to fires.

NSF; Water, Sustainability and Climate: Sustainability Dynamics for Water Resources in a Rapidly Urbanizing and Climatically Sensitive Region.

This incubation proposal develops an organizing framework for the disciplined understanding of and planning for a water-dependent process of sustainable urbanization in the Spokane, Washington-Coeur d'Alene, Idaho Corridor (SCC).

***Objective One:** Systematically integrate data/products from existing biophysical and engineering model outputs including water quantity, quality, climate simulations, land use, and pollution sources.*

***Objective Two:** Collect new data on how human dimensions within the SCC impact sustainable management of water resources. Consistent with the CHANS approach, the following conceptual foci emerged from stakeholder engagement and scientific expertise.*

***Objective Three:** Integrate biophysical and human dimensions data through two parallel yet distinct modeling efforts.*

***Objective Four.** Build future interdisciplinary intellectual capacity through an education and engagement program that involves current and future partners and stakeholders.*

NSF; Research Coordination Network: Advancing Our Social and Environmental Understanding of Complex Mountain Landscapes and their Vulnerability to Environmental Change

The main objectives of the Complex Mountain Landscapes RCN model development are threefold:

- 1) Facilitate coordination, integration, and syntheses for existing programs and studies regionally and internationally;
- 2) Design collaborative interactive research, education, and governance projects with partners for the region and with other regions of the world; and
- 3) Create partnerships linking new informatics to produce linked, scalable models and methods that will help inform management decisions and better link non-governmental and governmental constituents who affect the resilience of these mountain systems.

NSF - Interdisciplinary Behavioral and Social Science (IBSS): Spatial Modeling of Socio-Economic-Cultural Determinants of Basin Scale Water Use (pending)

We propose a spatially distributed and conceptually integrated analysis of the social-economic-cultural determinants of outdoor water use. We will use a geographic information system (GIS) platform for multivariate analysis of social-economic-cultural (SEC) variables with summer outdoor household water consumption data and a stages-of-change model to incorporate analysis in the development and testing of conservation campaign messages. Our research questions are:

- To what degree are consumption levels spatially distributed across water districts (Objective 1)?
- How do combinations of SEC variables interact to explain water consumption levels, and do the predictors vary among high, moderate, and low use populations segments (Objective 2)?
- How does framing messages to address consumers at their classified stage-of-change, by including relevant SEC factors, affect water use and water conservation (Objective 3)?

NSF; Governing Complex Cultural, Jurisdictional, and Political Landscapes – Applying a Legal Pluralism Framework to Collaborative Resource Management Research, Theory and Practice (pending)

This study will apply legal pluralism to understanding the dynamics and possibilities of adaptive governance in two mountain landscapes that illustrate the most difficult challenges of regional resource governance. First, the Spokane and Coeur d’Alene river and transportation corridor of urbanized, lake, agricultural, and forested landscapes is legally divided by two states, two tribal governments, multiple local and special district governments, and opposing political cultures

Research Question: How can legal pluralism be applied to understand the variables that determine whether collaborative or competitive governance of natural landscapes will emerge across multiple institutional, legal, and cultural boundaries?

Spokane River Watershed Nonpoint Source Phosphorus Reduction Plan:

The NPS Reduction Plan:

- Recommends actions to reduce nonpoint source phosphorus.
- Provides a list of actions and Best Management Practices (BMPs) by subbasin and category for reducing nonpoint source phosphorus.
- Identifies land use, areas, and major land owners at the subbasin level to highlight potential nonpoint sources of phosphorus.
- Suggests who should take the next steps to identify local projects (actions) that would reduce nonpoint source phosphorus.

The NPS Reduction Plan provides answers to the following key questions:

- ‘What’ should be done to reduce nonpoint source phosphorus?
- ‘Where’ reductions of nonpoint source phosphorus should be focused?

Coeur d’Alene Lake Management Plan; IDEQ and Coeur d’Alene Tribe:

In an effort to address the many issues facing Coeur d’Alene Lake, the Coeur d’Alene Tribe (Tribe) and the State of Idaho Department of Environmental Quality (DEQ) collaboratively developed the 2009 Lake Management Plan (2009 LMP) with the goal: to protect and improve lake water quality by limiting basin-wide nutrient inputs that impair lake water quality conditions, which in turn influence the solubility of mining-related metals contamination contained in lake sediments.

Tier I is considered the essential core LMP program that will be the initial focus for funding and implementation. It has the following components:

1. Conduct water quality monitoring and utilize computer modeling to increase scientific understanding of water quality trends

2. Conduct a basin-wide nutrient source inventory to set implementation priorities
3. Use Management Action Tables to coordinate implementation of existing programs with LMP partners
4. Develop and implement an education and outreach program to increase the community's awareness of lake conditions and promote lake stewardship Tier II of the LMP includes: nutrient reduction projects, special studies, and coordination with TMDL program implementation.

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EPA - Environmental Information Exchange Network: Water Quality Exchange (WQX):

IDEQ and Coeur d'Alene tribe water quality data are available through the EPA supported program for sharing water quality data.

NSF - Bio-EaSM: Understanding Biogeochemical Cycling in the Context of Climate Variability Using a Regional Earth System Modeling Framework

Our *overarching goal* is to improve understanding of C, N, and H₂O interactions in the context of global change to better inform decision makers involved in natural and agricultural resource management. Our *rationale* is that by choosing among the most sophisticated models for each component, and either linking or fully integrating these models into a biosphere relevant Bio-EaSM, the integrated modeling framework will continually improve as each component develops. Furthermore, an integrated system may better capture the underlying biophysical and chemical processes, and human influences on them, and would therefore be more likely to predict non-linearities, activation thresholds, and unanticipated responses and feedbacks.

Specific Objective #1: To determine the influence of atmospheric processes on surface C:N:H₂O cycles.

- *Science Question:* How do future changes in inter-annual to decadal-scale climate variability patterns (e.g., ENSO and PDO) affect regional-scale coupled C:N:H₂O cycles?
- *Approach:* We will conduct long-term runs of the atmospheric meteorology and chemistry models to inform terrestrial and hydrologic biogeochemical models and explore the one-way effects of atmospheric change on surface biogeochemical cycles.

Specific Objective #2: To determine how ecosystem processes will be affected by climate change and climate variability and how these regional changes feed back to the atmosphere.

- *Science Question:* How do inter-annual to decadal-scale changes in coupled atmospheric, terrestrial and aquatic C:N:H₂O cycles affect regional meteorology, greenhouse gas fluxes, and other atmospheric trace gas cycling?
- *Approach:* The fully integrated atmospheric and terrestrial models will be run to explore both impacts of atmospheric change on bio-hydrological processes and the feedbacks from changes in the terrestrial system to regional and global atmospheric processes.

Specific Objective #3: To investigate alterations to and interactions among C:N:H₂O cycles from changes in land use within and across sectors, water use for irrigation, nutrient applications, and other production inputs under a range of climate change adaptation and mitigation policy scenarios.

- *Science Question:* How do proposed mitigation and adaptation strategies affect C:N:H₂O cycles at both the intensive (input use) and extensive (land use change) margin, and how might the impacts of these strategies feed back to regional meteorology, greenhouse gas fluxes, and ecosystem change, including both agricultural lands and managed natural landscapes?
- *Approach:* We will integrate behavioral models representing human systems into our integrated atmospheric/terrestrial process EaSM by dynamically linking to a spatially-explicit economic model

that simulates agricultural and forest resource management decisions under differing climatological, political, and economic environments.

Specific Objective #4: To produce scientific results that can support stakeholder decision-making related to agriculture, forestry, and resource management by designing, implementing, and assessing an interactive and iterative model development process between scientists, practitioners, and the public.

- *Science Question:* How does regular interaction between Bio-EaSM developers and resource stakeholders influence the perceived relevance and utility of Bio-EaSM to decision-making?
- *Approach:* Environmental communication experts, researchers, and extension specialists will work together to simultaneously (1) develop mechanisms for frequent, regular, two-way, interactive communication between model developers and practitioners, and (2) perform surveys and interviews of both the stakeholders and the scientists to map the evolution of perceptions of utility and relevance of the model to decision-making.

NSF/USDA; Watershed Integrated Systems Dynamics Modeling (WISDM).

Our overall goal for this program is to improve understanding of interactions between water resources, water quality, climate change, and human behavior in agricultural and urban environments, including exploring how primary water users can be involved in the research process to develop scientifically sound and economically feasible public policy. The WISDM approach integrates a system of existing and widely-applied models into an interdisciplinary framework that allows us to address the key issues surrounding the sustainability of water resources. This approach houses a complex integrated biogeochemical / economic model (BioEarth-Land) within a system dynamics modeling environment, a user-friendly, graphics-based approach that allows concerned stakeholders and scientists to jointly generate ideas for and explore adaptations to existing water regulatory institutions. The project mission is to:

- Understand how climate and land use changes have affected water quantity and quality in recent decades, and how will climate variability and change impact water quantity and quality in the next few decades
- Determine what agricultural practices (e.g., crop mix, fertilization, irrigation, and tillage) will promote agricultural productivity under a new hydrologic regime while preserving water quality and minimizing GHG emissions.
- Explore possibilities for how dam operation could evolve to meet irrigation needs associated with sustained agricultural productivity, along with competing in-stream flow and hydropower requirements, under anticipated climate variability and change.
- Consider how changes in demand and supply-side economic conditions and climate change affect water use across space and time, and how will (or can) regulatory institutions adapt as water becomes increasingly scarce.

Washington Department of Ecology - Spokane Valley-Rathdrum Prairie Aquifer Recharge Project:

The Spokane Valley-Rathdrum Prairie aquifer serves nearly 600,000 people in the Coeur'd Alene and Spokane areas in Washington State. It is a federally-designated "sole-source aquifer," meaning the region has no other sources of water and the aquifer needs special protection. Given the sole source aquifer designation, few alternatives are available for increasing water supply to the region.

A report called the *Spokane Valley-Rathdrum Prairie Aquifer (SVRP) Optimized Recharge for Summer Flow Augmentation of the Columbia River* was written for the Washington Department of Ecology (Ecology) by the state of Washington Water Research Center at Washington State University. The research was done as part of ongoing efforts to assure adequate water supplies in the SVRP aquifer and in

the Spokane River in the face of population growth, ever-increasing groundwater pumping and expected effects of climate change. Using Visual MODFLOW with the regionally-approved 1990-2005 MODFLOW-2000 model data, a comprehensive aquifer recharge and natural recovery feasibility study involving two water sources, multiple injection sites, and timing considerations was conducted with withdrawals occurring during periods of excess river flows in the Spokane and Pend Oreille watersheds.

USDA; Regional Approaches to Climate Change (REACCH):

This project is a coordinated regional agricultural project, funded by the National Institute for Food and Agriculture to improve the long-term profitability of the cereal production systems in the Pacific Northwest under ongoing and projected climate change, while contributing to climate change mitigation by reducing emissions of greenhouse gases.

REACCH includes efforts in research, extension, and education that integrates diverse elements including climate modeling, cropping systems modeling, economics, agronomy, crop protection, and others in a transdisciplinary manner. The project goals are:

- Develop and implement sustainable agricultural practices for cereal production within existing and projected agroecological zones throughout the region as climate changes.
- Contribute to climate change mitigation through improved fertilizer, fuel, and pesticide use efficiency, increased sequestration of soil carbon, and reduced greenhouse gas (GHG) emissions consistent with NIFA's 2030 targets.
- Work closely with stakeholders and policymakers to promote science-based agricultural approaches to climate change adaptation and mitigation.
- Increase the number of scientists, educators, and extension professionals with the skills and knowledge to address climate change and its interactions with agriculture.
- Develop the regional capacity for continued, long-term research, education, and extension efforts to mitigate and adapt to climate change.
- Address climate change effects with a transdisciplinary research, education, extension approach to enable researchers' stakeholders, students, the public, and policymakers to acquire a more holistic understanding of how agriculture is interrelated with climate change.

USDA/NIFA; Socioeconomic Impacts of Woodbased Biofuels Development Strategies on Northern Rocky Mountain Communities in the Northwest

The goal for this project is to determine the optimal system or mix of systems for integrating Northern Rocky Mountain woody biomass feedstocks into a planned Northwest regional liquid biofuel production system in the context of existing biomass uses, resources, and community needs. Specific objectives and activities are to: 1. Utilize discreet event simulation and mathematical modeling techniques to develop effective system pathways of each technology from source to point of sale, determine boundaries where benefits and impacts move outside of the study area, and assess the number of jobs created and other benefits. 2. Model the overall viability and profitability of bioenergy strategies for woody biomass from community, state and regional perspectives. 3. Utilize county and state input/output methodologies to evaluate the economic impacts and contributions of each technology, including backward economic linkages and the appropriateness of each strategy. 4. Interview local and state elected officials, economic development professionals, industry, and other key stakeholders about knowledge and perceptions of benefits, obstacles and tradeoffs of different bioenergy development scenarios 5. Engage an advisory board in guiding the project and helping interpret project results. The completion of this project will

provide a model for understanding bioenergy development from community, county, state and regional perspectives. This information will enable the development of a regional liquid biofuels industry with maximum benefits and minimum tradeoffs from community, state and regional perspectives.

Northwest Advanced Renewable Alliance:

Featuring a broad alliance of private industry and educational institutions, the Northwest Advanced Renewables Alliance (NARA) takes a holistic approach to building a supply chain for aviation biofuel with the goal of increasing efficiency in everything from forestry operations to conversion processes. Using a large variety of feedstocks, from construction waste to forest residues, the project aims to create a sustainable industry to produce aviation biofuels and important co-products.

NSF - ITEST: Strategies Project-Back to the Earth (i.e., BTTE)

This award will address a national call to increase the STEM workforce pipeline by supporting and improving the STEM educational experiences for Native American students entering grades 4-6 on the Coeur d'Alene (CdAT) and Spokane (ST) Indian tribal reservations. By drawing on culturally relevant experiences and activities that focus on STEM concepts and skills through investigations in the Coeur d'Alene and Spokane Subbasins that includes Lake Coeur d'Alene and Spokane River (referred to in this document as *CdAS Subbasins*) we will prepare and recruit students to enter the STEM workforce.

BTTE Project Goals and Objectives:

This project will deliver a summer and after-school program for CdA and Spokane tribal youth that provides relevant activities and experiences to engage them in STEM learning while exposing them to STEM career opportunities in their communities.

The **objectives** for the Back to the Earth program are to:

- Increase student knowledge in (1) STEM content, and (2) Design and inquiry skills;
- Enhance student attitude toward (1) STEM content, and (2) STEM careers;
- Increase teacher knowledge of (1) inquiry-based instruction, and (2) culturally relevant STEM content and pedagogies;
- Build community partnerships in the tribal community for a STEM workforce.

USGS; Idaho Department of Water Resources: Spokane Valley-Rathdrum Prairie Aquifer Atlas

In response to concerns about continued growth, water management issues, and water availability, a bi-state aquifer study was initiated in 2004 by the Idaho Department of Water Resources, the Washington Department of Ecology and the U.S. Geological Survey. The study reassessed the hydrology and water budget of the Spokane Valley-Rathdrum Prairie Aquifer. A key objective of the study was to develop a ground-water flow model to serve as a tool for estimating Aquifer dynamics, and the model was completed in 2007. Results of this study were incorporated in the Atlas.

Idaho National Laboratory, U. of Idaho; Northwest Knowledge Network (NKN):

NKN's mission is to make research data more accessible, comprehensible, usable and secure for data providers and data users, and to facilitate data usage across the disciplines by promoting commonly accepted policies, standards, and protocols; facilitating the application of modeling, mining, simulation and visualization tools; and supplying data and computing services that are adaptive to changing data storage and management needs.

The NKN research data management system will provide the following services to the research and outreach communities of our university and its partners. Additional services may be added as needed.

1. Backup data created by currently funded projects

2. Archival data once a project is complete and closed
3. Support staff (e.g. Metadata Specialists) who will work with researchers to catalog their data
4. A secure virtual system for researchers to share their data in a controlled environment
5. Provide public access to data
6. Access to high performance computing systems
7. A suite of support tools for discovery, visualization, analytics, data intensive modeling and simulation that will enhance interpretation, interoperability and application of data that will facilitate new research and will increase the overall utility of the system
8. Support staff (e.g. Computer Programmers) for custom development of research tools generated
9. For-fee data management services for agencies outside the university and INL network.

Department of Interior; Northwest Climate Science Center:

The Northwest Climate Science Center (NW CSC) is supported by a consortium of Northwest academic institutions primarily led by Oregon State University ([OSU](#)), the University of Idaho ([UI](#)), and the University of Washington ([UW](#)). The academic consortium and U.S. Geological Survey ([USGS](#)) provide capabilities in climate science, ecology, impacts and vulnerability assessments, modeling, and advanced information technology, all of which are necessary to address and respond to climate change in the Northwest. This partnership provides an opportunity to strategically address science issues of regional significance by blending academic and federal expertise and resources.

Participants in the NW CSC academic consortium include: Boise State University, Idaho National Laboratory, Idaho State University, Montana State University, Oregon Health and Science University, Oregon State University, Pacific Northwest National Laboratory, Portland State University, University of Idaho, University of Montana, University of Oregon, University of Washington, Washington State University, and Western Regional Climate Center.

The Northwest Climate Science Center (NW CSC) facilitates creation of objective scientific information and tools that Northwest managers of land, water, wildlife, and cultural resources can use to anticipate, monitor, and adapt to climate change. NW CSC products are currently under development. Once completed, this page will provide access to scientific publications, presentations, fact sheets, data, and other products that have been generated by research funded by the NW CSC.

NSF - UI IGERT award:

IGERT: Evaluating resilience of ecological and social systems in changing landscapes: a doctoral research and education program in Idaho and Costa Rica

Northern Rockies Team: Home to globally significant biodiversity and water resources, the mixed conifer forests of the US northern Rockies are influenced by social pressures including changing job markets; demand for recreation, wood, water, and other resources; and rural residential development. These forest have experienced pronounced changes in size and severity of fire and disturbances in water budgets coinciding with warmer springs, as well as bark beetle-induced tree mortality in recent decades. Climate shifts are already impacting western mountain ranges. The accelerated arrival of spring has resulted in a 30% decline in the March 1st snowpack water content. With warmer springs, forests are especially vulnerable to changing fire regimes. The forested mountains of Idaho receive a majority of their precipitation in the form of snow. In warm springs, snow melts earlier with likely but unknown interactions among a longer dry season, potentially larger and more severe bark beetle and fire effects, changes in watershed hydrology, and altered patterns of tree mortality and establishment.

The disciplines for the core team will be Fire Ecology, Social Psychology, Geography and Landscape Ecology, and Forest Ecology. In addition, participating faculty provide expertise in Watershed Science,

Disturbance Ecology, and Restoration Ecology. Students will collect field data and use remote sensing and spatial analysis to inform simulation modeling to evaluate landscape dynamics and implications for ecosystem services. Disciplinary questions to be addressed by the team include: What are the drivers of and interactions and feedbacks among landscape-scale disturbances? What are the long-term responses of vegetation recovery, soils, and carbon, water and nutrient budgets to these disturbances? How do these responses vary with soil and other site conditions, and which field and remotely sensed indicators of disturbance severity are most useful where? What are the causes and underlying physiological mechanisms of tree establishment and mortality, and how are they affected by changing snowpack and soil moisture? How has large-scale disturbance affected residential development patterns, fire hazard (actual and perceived), and social preference for policies of land management? Interdisciplinary questions include: What are the biophysical and social drivers of the occurrence, severity and pattern of fires, bark beetles, and residential development, and what are the short (1-10 yr) and long-term (10-30 yr) consequences of landscape-scale disturbances for biodiversity, ecosystem services, and resilience across social and biophysical gradients?

NSF, WSU IGERT award:

Nitrogen Systems: Policy Oriented Integrated Research and Education (NSPIRE)

Managing reactive nitrogen is one of the great scientific and social challenges of the 21st century. An even greater challenge may be translating our technical understanding of the underlying science of environmental sustainability to questions related to public policy. The vision of the NSPIRE project at Washington State University is to prepare Ph.D. students who have rigorous multi-disciplinary training in nitrogen cycling and an integrated view of nitrogen science coupled with the ability to effectively communicate with public policy makers and other stakeholders. Leaders in government and industry have identified such boundary spanning graduates as a highly needed asset for societal problem solving. NSPIRE integrates training across the range of disciplines inherent in the nitrogen cycle, including atmospheric science, hydrology, geology, ecosystem ecology, and the agricultural sciences, coupled with extensive training in the field of public policy related to environmental N.

The curriculum consists of:

- an integrated nitrogen cycle course;
- an interdisciplinary nitrogen methods workshop;
- a systems dynamics modeling course;
- a new and unique public policy studio course;
- a three-month paid fellowship with a policy formulating organization; and
- individual interdisciplinary integrated dissertation research projects.

The policy studio course will equip students with an understanding of the public policy formation process by applying system models and analytical frameworks to various policy domains and by working through a comprehensive case study while interacting directly with policy stakeholders. The internship will serve as a capstone experience and allow application of interdisciplinary training to real world situations. As these students and their faculty mentors integrate their research within a broader policy context, society as a whole will benefit as public policy decisions come closer to reflecting the best available scientific understanding of reactive nitrogen. IGERT is an NSF-wide program intended to meet the challenges of educating U.S. Ph.D. environmental scientists and engineers with the interdisciplinary background, deep knowledge in a chosen discipline, and the technical, professional, and personal skills needed to secure the nation's future and promote global sustainability.

NSF - Governing Complex Cultural, Jurisdictional, and Political Landscapes – Applying a Legal

Pluralism Framework to Collaborative Resource Management Research, Theory and Practice (pending).

The research goal is to demonstrate the application of a legal pluralism framework to comparative case analysis and theory building, and to strengthen engaged policy research partnerships in Idaho and Ecuador. The concepts and framework are applied to understanding the dynamics and possibilities of adaptive governance in a rapidly urbanizing and amenity-rich region of the Inland Northwest and a high Andean wetland in Southern Ecuador, both fragile mountain watersheds that are governed by multiple state, local, federal, and indigenous, and non-governmental agencies and actors. Legal studies and social anthropology/ethnography are combined to map the dynamic and interactive effect of overlapping institutional norms, regimes and regulations on regional plan implementation. An extensive literature review begin and conclude the research with data being integrated into the recently awarded RCN-SEES.