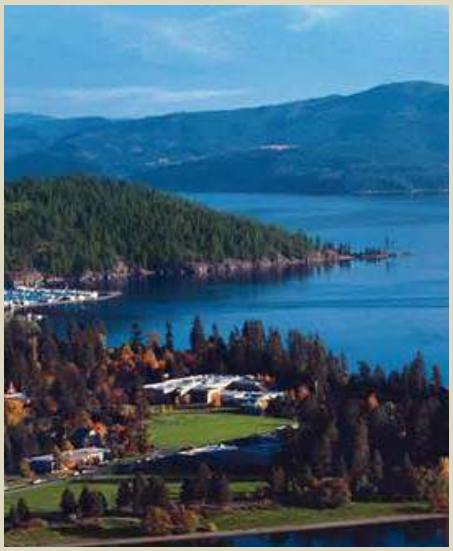



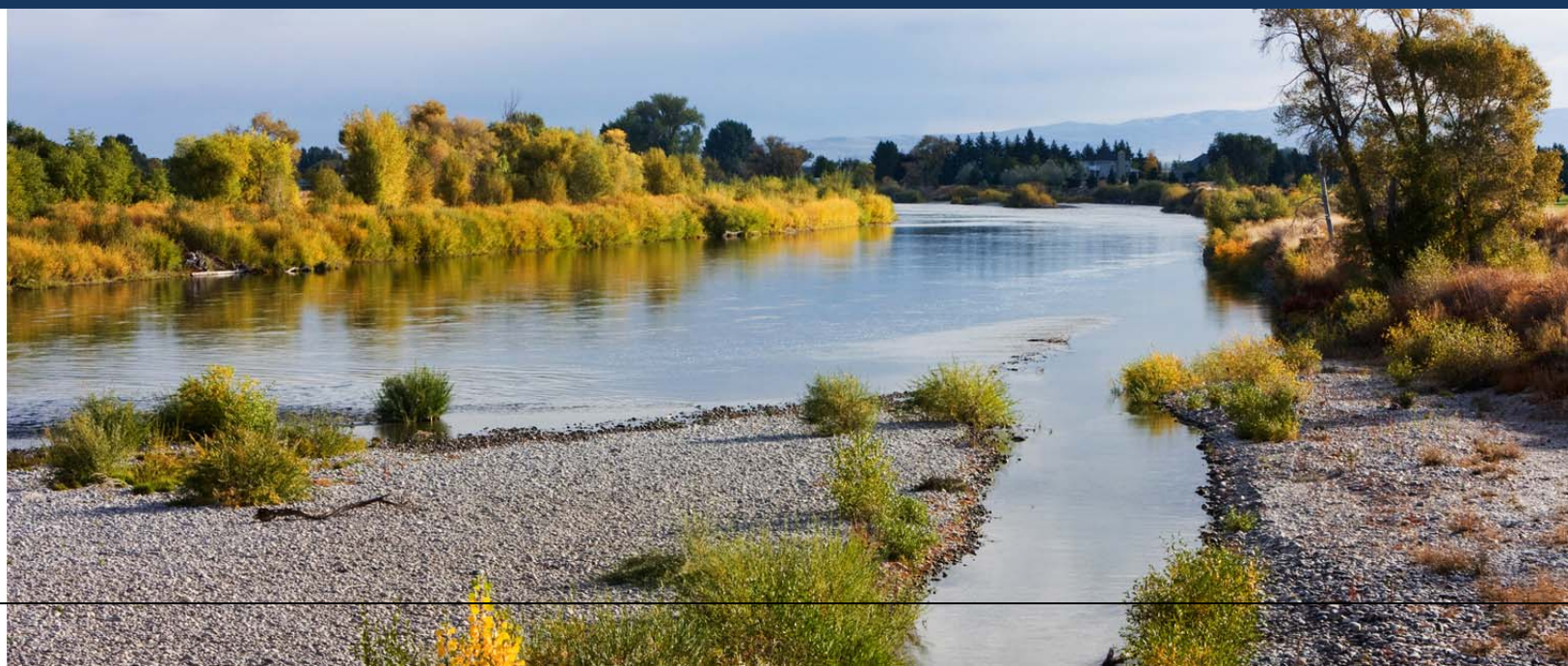

Managing **I**daho's **L**andscapes for **E**cosystem **S**ervices (**MILES**)



Idaho **E**xperimental **P**rogram to **S**timulate **C**ompetitive **R**esearch (EPSCoR)

Strategic **P**lan, **2**013-**2**018

Award No. IIA-1301792



ID EPSCoR Leadership and Administration

Idaho EPSCoR Committee, 2015

Laird Noh, Chairman; President, Noh Sheep Company; Idaho State Senate (retired)
Todd Allen, Professor, Director, Center for Material Science of Nuclear Fuels, Idaho National Laboratory
David Barneby, Vice-President (retired), Nevada Power and Sierra Pacific Power Companies
Maxine Bell, Idaho State Representative
Matthew Borud, Chief Business Development Officer, Idaho Department of Commerce
Douglas Chadderdon, President, Great Floors, LLC
Gynii Gilliam, Economic Development Specialist
Bill Goesling, Ex Officio, State Board of Education
Doyle Jacklin, Partner, Riverbend Commerce Park
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Leo Ray, President, Fish Breeders of Idaho, Inc.
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Peter Goodwin, EPSCoR Project Director/ PI
Rick Schumaker, Assistant Project Director/Project Administrator
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Jon Anderson, Executive Leadership Team
David Rodgers, Executive Leadership Team

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Ashley Bogar, Manager, Evaluation Director
Maria S. Horta, Financial/Administrative Assistant

Version 2015.2

GLOSSARY OF ACRONYMS

AL	Adventure Learning
BSU	Boise State University
C&V	Characterization and Vulnerability
CeSERS	Center for Sustainable Ecological Resources System
CI	Cyberinfrastructure
EOD	Education, Outreach, and Diversity
EPSCoR	Experimental Program to Stimulate Competitive Research
GIS	Geographic Information Systems
ID	Idaho
IDEQ	Idaho Department of Environmental Quality
IPTV	Idaho Public Television
iSEED	Idaho Social-Ecological Exploratory Dynamic awards
ISU	Idaho State University
IWG	Innovation Working Group(s)
LEWIS	Landscape Early Warning Information System
MILES	Managing Idaho's Landscapes in Ecosystem Services
MURI	MILES Undergraduate Research Internships
NKN	Northwest Knowledge Network
PAB	Program Advisory Board
PD	Project Director
PI	Principal Investigator
PUI	Primarily Undergraduate Institutions
REU	Research Experience for Undergraduates
RII	Research Infrastructure Improvement
RSV	Reverse Site Visit
S&T	Science and Technology
SBOE	State Board of Education
SES	Social Ecological Systems
SRP	Strategic Research Plan
STEM	Science, Technology, Engineering, and Mathematics
UI	University of Idaho
URM	Under-Represented Minority
URP	Under-Represented Population
USFS	United States Forest Service
VIZ	Visualization
V-Tool	Visualization-Tool
V-V	Visualization and Virtualization
WFD	Workforce Development

CONTENTS

EXECUTIVE SUMMARY

This *Strategic Plan* establishes the conceptual, programmatic, and administrative framework for accomplishing the goals and objectives of *Managing Idaho's Landscapes in Ecosystem Services* (MILES) [IIA-1301792]. It identifies clear goals and strategic priorities, and explains the specific actions to be undertaken. Likewise, it outlines metrics and milestones to ensure goals are met and outcomes achieved within the specified timeframe of the award (2013-2018).

Mission and Vision

MILES will advance the state of Idaho's capacity to solve complex social-ecological processes associated with urban growth of mid-sized cities. A critical need exists for fundamental science that supports the sustainable management of ecosystem services and informs policy. Rapidly growing, mid-sized urban population centers are altering proximal ecosystem services on which these communities depend, a trend of global significance. In the western United States, the expansion of the urban interface often involves disruption of agricultural production, water resources, and amenity-based services that are driving growth in the first place; these changes are coupled with shifts in societal demand and values. Landscape transformations are occurring against a backdrop of climate change, adding further uncertainty about the future. Idaho, through MILES, will contribute to the resolution of this grand challenge by engaging in innovative research, engagement and education. The **mission** of MILES is to:

1. advance understanding of changes in ecosystem services at the interface between urban and rural environments,
2. relate those changes to societal and climate drivers, and
3. provide science-based tools and training to inform policy decisions about the sustainable management of these ecosystem services.

This strategic plan lays out a 5-year path for achieving our **vision**: *to be widely recognized as a national leader and model state for applying coupled natural-human systems research focused on ecosystem services to inform sustainable development of mid-sized cities.* The actions proposed in this *Strategic Plan* will enable MILES to build critical research infrastructure resources in SES science, grow and diversify the STEM pipeline, and generate additional support for this emerging field.

Goal

The goal of MILES is to create new knowledge about relationships between ecosystem services, landscape change, and associated socio-economic systems, and establish the infrastructure to provide science-based decision support needed to sustainably manage Idaho's resources. Key objectives are to: (1) increase the human and physical resource base for advancing research capacity in the delivery and sustainability of ecosystem services; (2) advance fundamental science that informs landscape management policy; and (3) develop and implement education and workforce programs to prepare a diverse group of students to succeed in a 21st century economy. Social ecological systems (SES) theory posits that the ability to acquire, distribute, and conserve natural resources involves complex tradeoffs by human communities[1]. To create a sustainable balance between social and ecological well-being, socioeconomic systems must be explicitly linked to landscape change and ecosystem services.

[1] Palmer, M.A. 2010. Water Resources: Beyond Infrastructure. **Nature** 467:534-535.

MILES includes a statewide participatory research program committed to the concept of Idaho EPSCoR's "**ONEIdaho**" vision of an integrated, productive and creative research culture and community of Idaho researchers that transcends institutional boundaries. MILES researchers will work across institutions on pilot studies and case studies, fostering integration of science and stakeholders, integration of science disciplines, and integration of research and education. (See *Strategic Priority 1, Integration*.)

Work is motivated by three principal questions and will be addressed by transdisciplinary science teams -- comprised of faculty in ecology, economics, physical and human geography, hydrology, public policy, urban planning, computer sciences, communication and visualization. Key questions are:

1. *What are the patterns of ecosystem services change associated with settlements in each region, and what is the magnitude and rate of ecosystem change?*
2. *How do societal and climate drivers influence changing patterns of ecosystem services, and how do human communities respond to changes in ecosystem services?*
3. *How will these ecosystems and associated ecosystem services likely change into the future and what are the key decisions that may alter those trajectories?*

Direct Outputs

(1) establishment of a transdisciplinary culture across Idaho that will create knowledge of social and ecological systems.

(2) creation of the first ecosystem vulnerability screening tool.

(3) creation of advanced modeled and visualized/virtualized environments that generate plausible future scenarios for use in public discourse.

(4) greater capacity to communicate knowledge among researchers in diverse disciplines and between researchers and the broader community of stakeholders and citizens through a substantial investment in visualization expertise.

Related Outputs

(5) a new Center for Sustainable Ecological Resources Systems, a statewide focal point for enhancing and sustaining SES research.

(6) a Social Ecological Systems Coalition, a network of EPSCoR jurisdictions whose programs focus on SES and sustainability science, particularly in Western States.

Outputs: Enhanced Socio-Ecological Systems (SES) Capacity

MILES will substantially and sustainably enhance Idaho's SES science capacity with the addition of faculty, postdoctoral researchers, and students. Two new diversity coordinators will help to implement a statewide recruitment plan designed specifically to attract a higher percentage of women and under-represented minority (URM) participants in MILES-related activities. The proactive and early involvement of stakeholders will promote stronger collaborations and partnerships that will amplify the impact of the state's research and education capacity. With integration across several domains being a key strategic priority, partners will be engaged in MILES research, helping to inform and define the scope and nature of specific projects, interpreting scientific results, and assisting with dissemination (using innovative visualization and virtualization tools) to facilitate decision-making and inform policy associated with future mid-sized city growth.

Strong and sustained partnerships will provide a solid foundation for efforts towards a Center for Sustainable Ecological Resources Systems (CeSERS). This Center will advance knowledge of multiple SES phenomena under different scenarios of resource development that will be transferable to regions beyond the state. MILES will train the next generation SES science workforce, who will contribute to the Center and worldwide efforts.

Alignment with State S&T Plan

MILES is aligned with and responsive to State S&T planning and the Five-Year Strategic Research Plan for Idaho Higher Education. These have identified Ecological Health as a strategic growth area for Idaho, and emphasized Natural Resource Utilization and Information Management and Software Development as important areas for research collaboration. MILES also advances key priorities pertaining to economic prosperity, social well-being, and environmental protection and resource conservation. The state's rapidly changing environmental and social conditions mandate that focused investments be made to integrate the biophysical and socioeconomic domains, a critical step towards achieving a sustainable future.

Significantly, MILES leverages and builds on strengths at each of Idaho's universities (e.g., agricultural and natural resource programs, engineering, biological sciences, public policy, and economics). It also capitalizes on other identified advantages, including the state's natural resources, high level of coordination among its research universities, and existing intrastate networks that serve as a foundation for data collection. Idaho plays a leading regional role in data management through the Northwest Knowledge Network (NKN), and is well-connected to national initiatives. Strong existing collaborations with state, tribal, and federal resource agencies and other stakeholders ensure meaningful contributions to local, societal, and global issues.

Key Characteristics of MILES

- **Socially Relevant** - High impact, socially relevant research to serve humanity and improve the quality of life.
- **Collaborative -** Prioritizes collaboration among researchers and stakeholders for breakthrough advancements and high-impact outcomes.
- **Integrative** - Focused on integration of existing knowledge and data from social and biophysical sciences. A key objective is to build capacity to conduct integrative research, which requires ability to work in large functional teams.
- **Transdisciplinary** - Research, scholarship, and creative activity of the highest quality and significance to advance knowledge, innovations, and inventions.
- **Engaged** - Field-defining, large-scale multidisciplinary research involving public and private partnerships and stakeholders.
- **Flexible and Responsive** - Adaptable and responsive to emerging needs and findings identified by stakeholders.
- **Outcome-Driven -** Focused research and evaluation that combine scholarship and service to have a positive impact on policy, ecosystems, and people’s lives.
- **Sustainable** – Aligned with State and institutional strategic plans and priorities.

Section 1

INTRODUCTION

Strategic Planning Process

The strategic planning process was initiated by the Idaho EPSCoR State Committee, and led by the RII Executive Leadership Team. The intent was to create an actionable plan for implementing MILES in the short-term and create the necessary infrastructure to sustain and continue to grow its advancements. The plan was organized around four questions: (1) Who are we as ONEIdaho?; (2) Where do we want MILES to take us?; (3) What do we do to get there?; and (4) How will we know if we have achieved our goals?

Multiple meetings were held around the State, in Boise, Pocatello, and Moscow, Idaho. The Committee met with representatives from the State Board of Education, the Idaho EPSCoR Committee, University faculty in all project components, stakeholders, and NSF representatives Dr. Jeanne Small and Dr. Kelvin Chu. Informal follow-up meetings with participants and stakeholders continued throughout the months leading up to completion of the plan in November 2013. Through this work, we: (1) reaffirmed the goals or objectives toward which we will work over the next five years; (2) outlined the actions needed to move in these directions; and (3) outlined a state- and institutional-level framework, complete with metrics and milestones, for assessing progress. This plan was updated in 2015 to reflect external review and input and articulate metrics through the third project-year.

Overview of the Strategic Plan

This plan describes a series of specific goals, objectives and actions to enhance excellence in key priority areas to be integrated through science-based investments and case studies. *Integration* permeates all aspects of the *Strategic Plan*. The ONEIdaho concept, which links University of Idaho (UI), Boise State University (BSU) and Idaho State University (ISU), is embedded throughout the plan. The *Research* section outlines a plan to advance the fundamental science needed to determine what ecosystem services are most vulnerable, quantify and qualify the nature of the changes, and understand key societal drivers of that change. It also states how we intend to strengthen support for emerging inter- and transdisciplinary areas as well as advance Idaho toward a position of leadership in this bourgeoning field. In *Cyberinfrastructure* (CI), we offer a strategy to build the state's CI capacity for the express purpose of supporting the MILES research mission and creating new knowledge in CI science and technology. *Diversity and Workforce Development* emphasize the importance of increasing the number and diversity of students enrolled in and graduating from the state’s colleges and universities, with a key focus on attracting top-tier students to Idaho universities at the undergraduate and graduate levels, and providing outstanding education and research opportunities that will prepare them to excel in future careers. Our *External Engagement* work provides concrete strategies for increasing partnerships and collaborations, and increasing synergy in educational and research endeavors. Plans are also provided for *Evaluation and Assessment*, and *Sustainability*. We describe the organizational structure, responsibilities, and decision-making protocols necessary to achieve the strategic initiatives of this plan in *Management*. The plan includes specific, measurable outcomes (consistent with an external evaluation plan) and achievable in light of known risks and opportunities (see *Appendices*). It will support the overall development of higher education research in Idaho by supporting the statewide S&T plan.

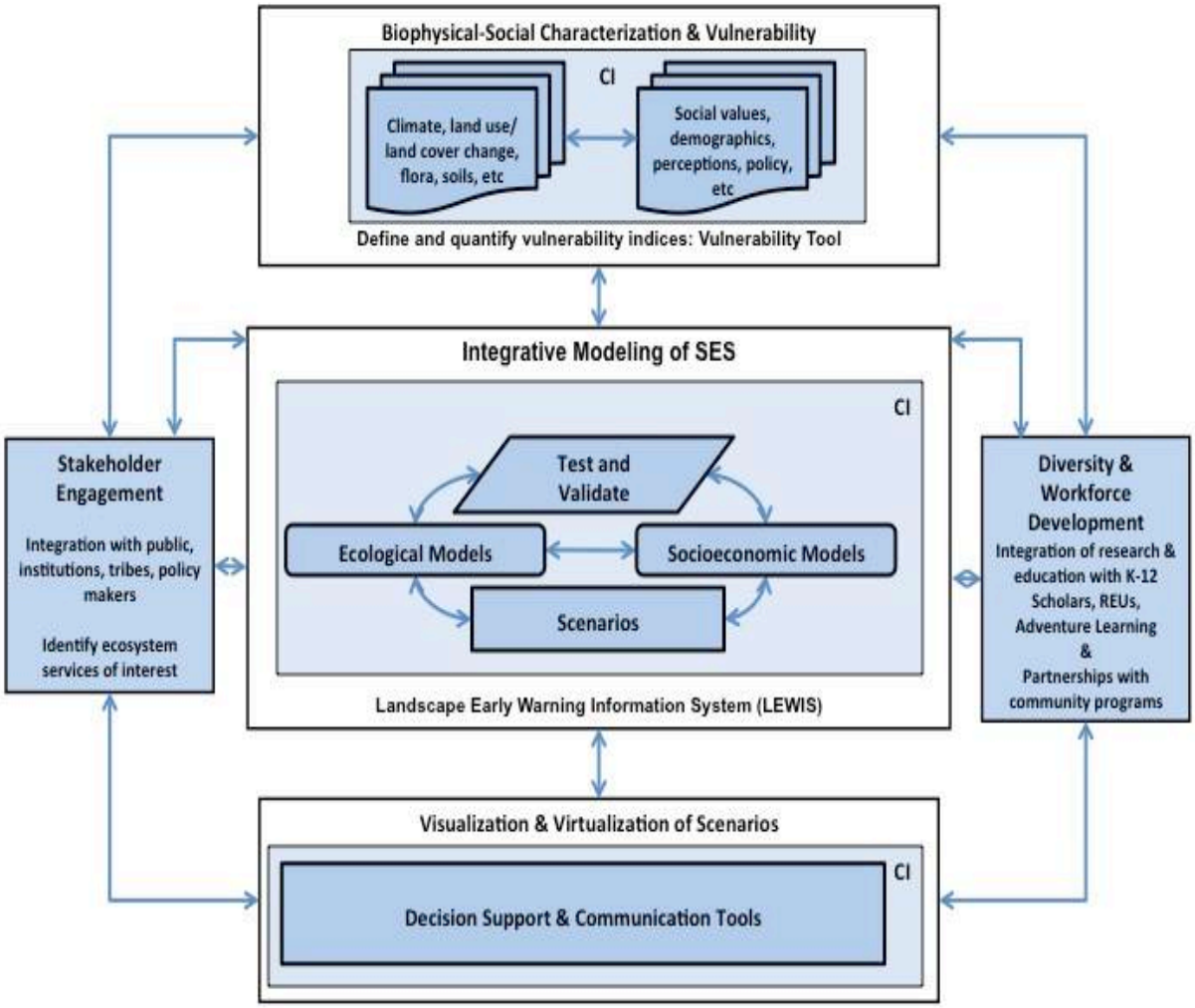


Figure 1. Flow diagram of Strategic Priorities in MILES.

Section 2

PRIORITY AREAS: GOALS

Integration (Sec. 3.1)

(1) Develop an actively managed process for the integration of science and stakeholders, of relevant science disciplines, and of research and education.

Research (Sec. 3.2)

(1) Develop an integrated understanding of how mid-sized cities and surrounding landscapes and ecosystems are changing in space and time, and how human institutions (e.g., perceptions, values, and behaviors) emerge, adapt to, and influence changes in ecosystems.
(2) Create an integrated conceptual and numerical framework to envision potential future scenarios in the context of projected change and associated institutional interventions.
(3) Develop a robust stakeholder engagement program.
(4) Invest in visual-analytic communication capacity.

Cyberinfrastructure (Sec. 3.3)

(1) Support data acquisition and storage, mapping, modeling, and scenario building.
(2) Assist with assimilating data to be used in modeling how mid-sized cities and associated landscapes/ecosystems are changing over space and time.
(3) Support data management and integration of survey data with geospatial biophysical data.
(4) Extend the capabilities in Geographic Information Systems (GIS) to social and economic sciences for spatio-temporal analysis for sharing, analyzing, and visualizing in real time.

Diversity (Sec. 3.4)

(1) Increase entry into and completion of undergraduate STEM degrees by women and minorities in MILES-related disciplines through targeted recruitment, engaged faculty, personal attention, peer support, enriched research experiences, and internships.
(2) Ensure two-thirds of Idaho's public PUIs are represented in MILES.

Workforce Development (Sec. 3.5)

(1) Increase number and diversity of students graduating from the state's colleges and universities.

External Engagement (Sec. 3.6)

(1) Work with stakeholders in each of the study area communities to integrate the social and ecological research with land managers, public decision makers; demonstrate relevance of SES science to ID citizens.
(2) Develop network of EPSCoR jurisdictions focused on SES research and sustainability science.

Evaluation (Sec. 3.7)

(1) Evaluate the impact of the project and assess goal attainment using performance measures including milestones, deliverables, outcome metrics, and five-year benchmarks.
(2) Utilize annual summative evaluation report for MILES program refinement and improvement.

Management (Sec. 3.8)

(1) Ensure the efficient and effective implementation of the RII award.

Sustainability (Sec. 3.9)

(1) Sustain the research capacity and infrastructure developed through MILES.
(2) Lead development of innovative new models and techniques for predicting trajectories of landscape change associated with the growth of mid-sized cities.
(3) Create infrastructure to support a national Center of Excellence in *Sustainable Ecological Resources Systems.*

PRIORITY AREAS: METRICS

Integration (Sec. 3.1)

	Yr-1	Yr-2	Yr-3	5-Year total
Number of stakeholder meetings/workshops	2	4	4	15
Number of stakeholders using MILES SES toolbox products	0	2	6	30
Number of media placements	0	4	9	30
Number of interdisciplinary teams/projects	3	4	6	12
Number of post-docs hired	4	6	6	6
Number of graduate students involved in MILES	5	6	8	15
Percent of strategic priorities/components represented in each team	50%	60%	80%	90%
Number of cross-disciplinary SES publications	0	2	4	15
Number of cross-disciplinary SES proposals	0	3	5	25
Number of cross-disciplinary SES convened conferences	0	0	0	1
Number of interdisciplinary presentations at conferences	3	6	10	30
Number of cross-disciplinary SES thesis/dissertation committees	5	5	7	15
Number of Innovation Working Groups	1	3	3	15
Number of stakeholders identified, contacted and engaged	50	60	70	300
Number of cross-institutional meetings convened	3	8	10	36

Research (Sec. 3.2)

	Yr-1	Yr-2	Yr-3	5-year total
Number of collaborative proposals, projects, and papers between stakeholders and university researchers	0	3	3	12
Number of surveys conducted	1	3	3	12
Number of focus groups	0	3	3	12
Number of interviews conducted	0	25	25	90
Assessment of ecosystem services at study areas (social perception)	0	3	3	3
Number of social network maps developed	0	1	1	3
Number of vulnerability and resilience assessments conducted	0	3	3	12
Number of users of SES toolbox in research	0	3	10	30
Number of Integrated Modeling Frameworks evaluated	1	2	6	6
Systems-level conceptual models	3	3	3	3
Number of demonstrations to stakeholders of developed modeling tools	0	2	3	5
Number of participants in integrated modeling training workshops	5	6	10	30
Number of proposals submitted using SES modeling tools	0	1	3	10
Number of collaborators included within research network map	0	20	30	120
Number of SES visualizations created	0	3	6	12
Number of virtual asset sets developed	0	15	30	50

Cyberinfrastructure (Sec. 3.3)

		Yr-1	Yr-2	Yr-3	5-Yr total
Data Management	Data sets populating common data core*	3	5	8	10
	Yearly increase of SES data sets cited in publications	0%	5%	5%	5%
	Yearly increase of SES metadata records available	0%	5%	5%	10%
Data Interoperability	Yearly increase in datasets that are integrated	0%	5%	5%	Interoperability Achieved
Visualization Analytics	Number of visualization platforms implemented	0	3	3	Visualization Analytics achieved
ONEIdaho Communication	Increased communication between researchers and institutions	Yes	Yes	Yes	Qualitative

Diversity (Sec. 3.4)

		Yr-1	Yr-2	Yr-3	Yr-5
MILES	Percentage of URM, PUI students/faculty and women as participants in all MILES activities				
	URM	15%	16%	17%	20%
	PUI students/faculty	10%	10%	10%	10%
	Women	45%	45%	45%	45%
MURI	Percentage of URM, women, and PUI students in WFD programs including MURI				
	URM	30%	30%	35%	40%
	Women	45%	45%	50%	55%
	PUI students/faculty	10%	10%	10%	10%
PUIs	Percentage of Idaho public PUIs involved in MILES initiatives hosted by Idaho research universities	65%	65%	65%	65%
Meetings	# of meetings annually promoting Diversity initiatives with statewide higher education STEM network	2	2	3	4

Workforce Development (Sec. 3.5) and External Engagement (Sec. 3.6)

		Yr-1	Yr-2	Yr-3	5-year total
Undergrad MURI	# of undergraduate students that complete MURI program	20	60	80	300
Undergrad PUI	# of participants at public PUI schools	6	6	7	20

		Yr-1	Yr-2	Yr-3	5-Yr total
Undergrad AL	# of Adventure Learning expeditions	0	3	3	12
Blog	# of blog hits before, during, and after AL expeditions	0	800	1200	4000
AL	Increased AL participant knowledge of ecosystem services	-	-	-	Annual pre- and post-survey
Grad students	# of Graduate students trained as mentors in AL	6	6	6	30
ID PTV	# of MILES-related products by Idaho Public TV (ID PTV)	0	1	2	3
SES Coalition	# of EPSCoR jurisdictions in SES Coalition	0	2	4	6
	# of non-EPSCoR jurisdictions in SES Coalition		0	1	3

Evaluation (Sec. 3.7)

		All Years
Reporting	Written Report From External Evaluator	Completed Annually
	Written Report From Program Advisory Board	Completed Annually
	Annual Report to NSF-EPSCoR	Completed Annually
	Faculty Activity Reporting (faculty self-assessment)	Completed Annually

Management (Sec. 3.8)

Strategic Plan	Write and Update Strategic Plan	Completed Annually
Reporting	Complete Annual Reporting	Completed Quarterly
RSV	Successful Reverse Site Visit and Response	Completed Year 2
Faculty Participation	Promote Broad Faculty Participation	Increase Annually

Sustainability (Sec. 3.9)

		Yr-1	Yr-2	Yr-3	5-Yr total
Faculty Hires	Complete Faculty Hires	0	8	11	11
Diversity/STEM Network	Statewide Diversity/STEM Network events	1	2	2	8
Funding Rate	Funding rate of cross disciplinary and multi-institution grants	0	5%	8%	>20%
Mentoring Plan	Mentoring Plans Implemented	initiated			Completed
Faculty-Stakeholder	Faculty Named to Stakeholder Groups	0	1	3	6

PRIORITY AREAS: MILESTONES

P = Primarily via Pilot Studies during initial phases of the project

Strategic Priority		Milestones	Y1	Y2	Y3	Y4	Y5
Strategic Priority 3.1	**Integration:** Science and Stakeholders (SH) 3.1.1	Engaged SH in research	P				
		Submitted research proposals with SH collaborators					
		Institutionalized SH/researcher relationships		P			
		Hosted MILES and SES interdisciplinary seminars/conferences/workshops					
		Virtualized/visualized multi-disciplinary data		P			
	Integration: Science Disciplines 3.1.2	Interdisciplinary research questions updated					
		New hires engaged in MILES research					
		Interdisciplinary Innovation Working Group products					
		Updated conceptual models					
	Integration: Research and Education 3.1.3	Created cross-disciplinary and multi-institutional thesis/dissertation committees					
		Graduated MS/PhD students with cross-disciplinary SES research experience					
	Integration: Programmatic 3.1.4	Convened Innovation Working Groups					
		Cross-institution research participation					
Strategic Priority 3.2	**Research:** Stakeholder (SH) Engagement 3.2.1	Identified SH semantic and ecological services value differences	P				
		Modeled/tested existing SH decision process	P				
		Compared SH decision process post-virtualization					

Strategic Priority		Milestones	Y1	Y2	Y3	Y4	Y5
	Research: Characterization and Vulnerabilities 3.2.2	Identified sites and ecosystem service bundles	P				
		Collected data/characterized sites	P	P			
		Conducted vulnerability assessments		P			
	Research: Integrative Modeling 3.2.3	Created conceptual models/integrative questions	P				
		Identified and initiated modeling frameworks					
		Produced model outputs					
		Active use of outputs by stakeholders		P			
	Research: Visualization and Virtualization (V-V) 3.2.4	Developed V-V tools	P	P			
		Produced V-V products		P			
		Active use of products		P			
Strategic Priority **3.3**	**Cyberinfrastructure**	Data flow plan created					
		Data flow plan utilized					
		CI research products created					
Strategic Priority **3.4**	**Diversity**	Engaged URM participants					
		Engaged PUI participants					
		Institutional/state diversity initiatives formed					
		Engagement of a diversity of stakeholders (elected, tribal, agency, industry, NGO, public)					
Strategic Priority **3.5**	**Workforce Development**	Engaged REU participants					
		Engaged PUI participants					

Strategic Priority		Milestones	Y1	Y2	Y3	Y4	Y5
Strategic Priority 3.6	**External Engagement**	Engaged Communities through AL activities					
		Engagement products used (e.g., social media)					
		Idaho Public Television media products created					
Strategic Priority 3.7	**Evaluation and Assessment**	Reports from external evaluator and PAB					
		Reports to NSF					
		Faculty reporting					
		Completed RSV					
Strategic Priority 3.8	**Management**	Updated strategic plan					
		Completed annual reporting					
		Annual EPSCoR meeting conducted					
Strategic Priority 3.9	**Sustainability**	Completed 11 faculty hires					
		Statewide diversity/STEM network functions					
		Obtained competitive SES funding					

Section 3

STRATEGIC PRIORITIES AND ACTION PLAN

Major Priority 1

3.1 INTEGRATION

Leads: Goodwin, Benner, Boll, Rodgers

Overview: MILES components are linked at several levels: (1) integration of science and stakeholders, (2) integration of the science disciplines, and (3) integration of research and education. ONEIdaho, which links UI, BSU and ISU cyberinfrastructure, characterization and vulnerability assessments, integrated modeling, and visualization-virtualization activities, also is embedded throughout the project.

Stakeholder engagement is an integral part of MILES: We have adopted a participatory framework in creating the research methodology. Stakeholders will be partners in both shaping the research questions and the research process, contributing to the production of new knowledge. With this methodology, MILES will build durable relationships between stakeholders and Idaho's EPSCoR institutions. A key supposition of the participatory framework is that researchers may initiate a working hypothesis, but that hypothesis can only become an actual research question after the hypothesis is shared, modified (as necessary), and accepted by the participants. It is an iterative process in which deadlines become planning windows and controlling for variables becomes part of the scientific method. The circular nature of MILES activities, as illustrated in Figure 1, and the concept of this strategic plan being a living document is fitting of this methodology. A challenge that accompanies the method is that it does not lend itself well to the creation of fixed milestones. Key targets, however, are identified in each of the Major Priority Areas.

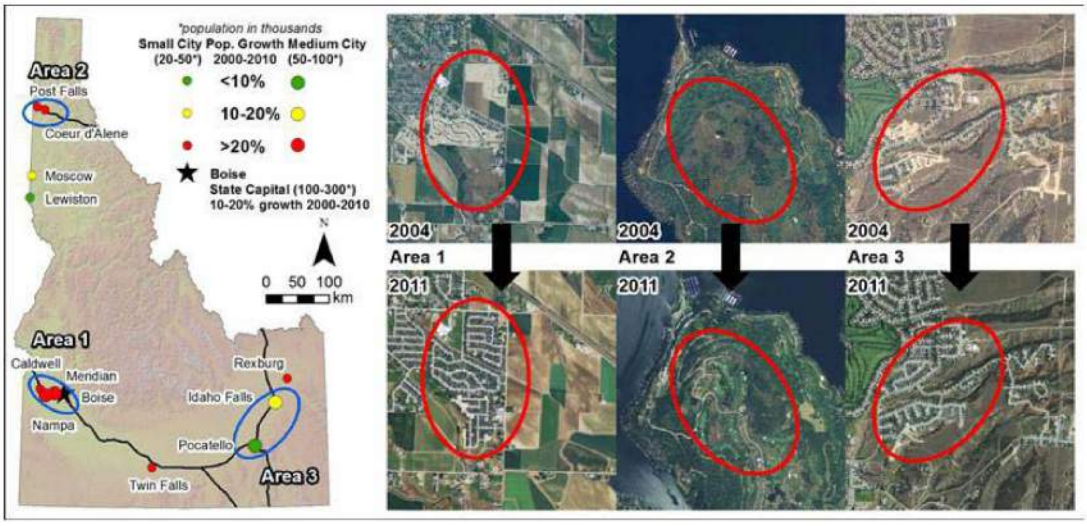


Figure 2. Locations in Idaho of three case study areas: (1) Boise (Treasure Valley), (2) Coeur d'Alene-Post Falls, and (3) Pocatello/Idaho Falls.

Approach: To advance this fundamentally integrative work, MILES will develop three, place-based case studies: (1) Boise, (2) Coeur d'Alene-Post Falls, and (3) Pocatello/Idaho Falls (see *Figure 2*). These locations provide diversity in comparisons of modeling, stakeholder involvement, and visualization, thereby allowing a broad approach to understanding coupled human-natural systems. Studying these areas will advance knowledge and theory to resolve which fundamental mechanisms in SES are conserved.

The capacity to integrate all domains of MILES will increase with time. As the program matures and new hires are placed, the integrative nature of the work and all its component parts will also mature. (See *Figure 1*.) Full integration will be achieved by an actively managed process, progressing from pilot case studies to full-fledged studies. The pilot case studies will be developed first to achieve project-wide integration immediately, at a manageable scale. They were chosen based on existing stakeholder connections, data availability, city-rural interface, and vulnerable ecosystem services. Future work will be guided by pilot study results.

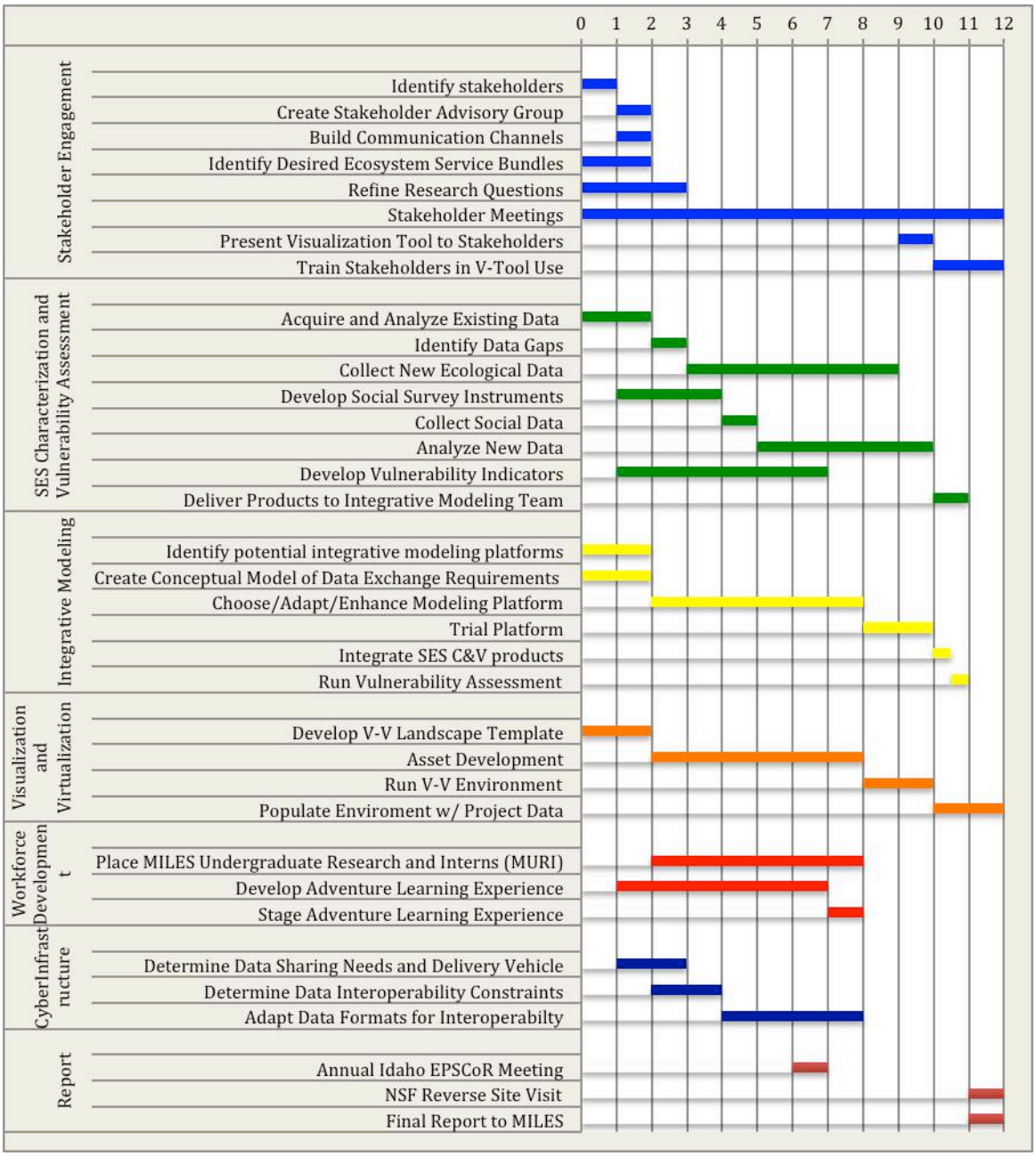
A Pilot Study to Demonstrate Integration

Site Selection: In the Coeur d'Alene-Post Falls area, Fernan Lake watershed will serve as a pilot site. A shallow 54 ha lake at the outlet of a 55.8 km^2 forested mountainous watershed, Fernan Lake provides source water for the Rathdrum Prairie Aquifer, the sole source of drinking water for over 550,000 people in the Coeur d'Alene/Spokane Corridor. Legacy and continuing input of phosphorus (P) to the lake results in summer-time blue green algae blooms, often accompanied by toxic cyanobacteria. The Idaho Department of Environmental Quality (IDEQ), United States Forest Service (USFS), and Fernan Lake Village has intermittently collected watershed and water quality data since 1990. Stakeholders requested research assistance in identifying causes of lake algae blooms. These stakeholders will form the basis of the Fernan Lake Stakeholder Advisory Group.

Approach: As an immediate first step, MILES will hire several graduate and undergraduate students and postdocs. Together with the stakeholders and research team, we will identify the desired bundle of ecosystem services to be addressed and refine our research questions. Based on existing data sets and newly collected data where gaps exist, we will characterize the biophysical and social landscape, and identify vulnerability indices for quantification. All data sets will conform to the MILES data management protocols. Concurrently, the integrative modeling team will work with cyberinfrastructure team members to select the platform for coupling of watershed-scale flow models, lake dynamics models and socioeconomic models appropriate for the science questions. The visualization and virtualization team will develop relevant assets (i.e. game environments) based on scenarios being developed by the integrative modelers, and present these to stakeholders. Iterating among the different groups, trial platforms will be fed with increasingly more project data and results, to mature the decision-making tool. A timeline example for the Fernan Lake pilot is shown in Figure 3, showing the flow of activities and outcomes in the different priority areas. Pilot case study designs, activities, and progress will be shared through monthly meetings across ONEIdaho teams and Interdisciplinary Innovation Working Groups (IWGs), culminating in face-to-face presentations and exchanges at the first EPSCoR Annual Meeting in April 2014.

Rationale: The purpose of starting with pilot case studies is to initiate the process of integration. After the pilot case studies, approaches and activities will transition from the pilot case studies to the Study Area case studies. Teams for each major MILES component will meet regularly to coordinate activities, exchange experiences, and support the design and planning towards the overall ONEIdaho MILES Goal. To fuel the process of statewide integration, the following are examples of IWGs that are planned: Conceptual Modeling & Data Integration, Stakeholder Engagement, Vulnerability Metrics, Integrative Modeling, and Visualization-Virtualization.

Figure 3. Example timeline for Fernan Lake pilot case study showing timing of activities across multiple MILES Priority Areas, as indicated by various colors (numbers at the top are months).



3.1.1. Integration of Science and Stakeholders
Lead: Tracy

Summary: MILES will develop a partnership of researchers, stakeholders and communities with a willingness to reframe research questions and methodology to increase relevance to end users.

Key Participants: Lindquist, Lybecker, and Wulfhorst

Strategic Priorities: Integrate a diverse set of stakeholders, ranging from citizens and communities of interest to agencies, institutions and policymakers in the: (1) development and refinement of research questions, (2) identification of current and desired ecosystem services, and (3) development and testing phases of decision support, communication, vulnerability, and visualization/virtualization tools.

Plans and Activities: (1) Identify stakeholders and create stakeholder advisory groups. (2) Build communication channels. (3) Identify data gaps and desired ecosystem bundles. (4) Host individual meetings, collaborative workshops, seminars and conferences: Faculty, post-docs, student teams and stakeholders refine research questions, explore existing data and develop research plan. (5) Train students (MURI students will work as agency interns where they learn about data collection, data management, decision-making processes, and how science informs policy). (6) Develop a web-based community information system for stakeholder communication and data sharing. (7) Develop relationships with media outlets within the three study areas so that the general public understands how and what MILES provides to communities. (8) Communicate science and visualized results for incorporation in decision-making and policy setting.

Accomplishments
Stakeholders are an integral part of SES research development and implementation.

3.1.2. Integration of the Science Disciplines
Lead: Boll

Summary: Integration of science disciplines will characterize SES, quantify vulnerability indices, develop, test, and integrate domain specific models, develop plausible future scenarios, and visualize results.

Key Participants: Flores, Frazier, Baxter, Lohse, and A. Smith

Strategic Priorities: Develop capacity to analyze problems in SES in a transdisciplinary environment by: (1) learning and adopting existing and/or new research integration methods; (2) learning and applying complex systems thinking theory; and (3) learning to work effectively in teams.

Plans and Activities: (1) Develop common integrating research questions for the case studies, and ensure necessary disciplinary expertise and research methodologies. (2) Increase disciplinary capacity in human resources through new hires (faculty, post-docs, and graduate students). (3) Form interdisciplinary Innovation Working Groups (IWGs) to tackle challenging scientific questions that cross disciplines, such as those at the social and natural sciences nexus. (4) Use and develop integration methodologies such as conceptual mapping, dialogue methods, data flow models, integration of domain models, integration of biophysical processes in virtual assets, and gaming environments. (5) Learn from and contribute new methodologies to the science of *team-science*, and the emerging integration and implementation science.

Accomplishments

- MILES participants work in teams across all relevant major priorities
- Greater ability to analyze complex SES problems
- Increased ability to produce relevant SES science to end users

3.1.3. Integration of Research and Education (and Workforce Development) Lead: Vierling

Summary: Research and education will be internally and externally integrated to build the STEM pipeline for future SES researchers and workforce entrants, and to engage the broader public in MILES activities.

Key Participants: Benner, Penney, and R. Smith

Strategic Priorities: Use research activities to: (1) increase the number and diversity of students enrolled in and graduating from the state's colleges and universities, and (2) build support for academic research activities among communities and stakeholders.

Plans and Activities: (1) Engage 300 STEM undergraduates in hands-on summer and/or academic year research experiences through the MILES Undergraduate Research and Internship (MURI) program. (Up to half of the MURI internships will be targeted to underrepresented groups.) (2) Utilize *Adventure Learning* expeditions across Idaho with coordinated online programming. (3) Provide iSEED (Idaho Social-Ecological Exploratory Dynamic) awards to faculty and graduate students to foster and pursue collaborative science with MILES. (4) Hold innovation workshops to engage scientists, educators, invited experts, students, communities, and stakeholders to build towards sustainability through grant writing.

Accomplishments

SES research and pedagogy are integrated at undergraduate, graduate and professional development levels

3.1.4. External Programmatic Integration Lead: Goodwin

Summary: MILES will exchange and share project knowledge through engagement with other SES and relevant EPSCoR programs.

Key Participants: Benner, Boll, Rodgers, Gosz

Strategic Priorities: Build an effective coalition of SES programs and researchers.

Plans and Activities: (1) Host biennial national conferences of SES researchers to disseminate information about MILES accomplishments, attract other scientists to collaborate with Idaho scientists, and culminate in large, regional-national proposals. (2) Build on existing relationships with scientists in other EPSCoR states to increase SES capacity. (3) Host Innovation workshops, which include nationally and internationally recognized experts, to increase transdisciplinary collaboration and ability to secure external funding. (4) Participate in the Tri-State Working Groups and leadership workshops. (5) Spearhead the development of the Social Ecological Systems Coalition, a network of EPSCoR jurisdictions whose programs focus on SES and sustainability science, particularly in western states (See *External Engagement*.)

Accomplishments

- Developed stronger researcher-stakeholder relationships
- Established effective communication between universities and stakeholders

Major Priority 2

3.2 RESEARCH

Leaders: Benner, Boll, Rodgers

Research Questions: Idaho EPSCoR, through MILES, seeks to determine what ecosystem services are most vulnerable, quantify and qualify the nature of the change, and understand key societal drivers of that change.
Three principal research questions guide this work:

(1) What are the patterns of ecosystem services change associated with settlements in each region, and what is the magnitude and rate of ecosystem change?
(2) How do societal and climate drivers influence changing patterns of ecosystem services, and how do human communities respond to changes in ecosystem services?
(3) How will these ecosystems and associated ecosystem services likely change into the future and what are the key decisions that may alter those trajectories?

Approach: To advance an integrated understanding of how mid-sized cities and surrounding landscapes and ecosystems are changing in space and time, and how human institutions (e.g., perceptions, values, and behaviors) emerge, adapt to, and influence changes in ecosystems, MILES will pursue six objectives to guide research activities: (1) characterize and quantify historical and current patterns of landscape change; (2) identify social drivers of urban landscape change that affect ecosystem services; (3) identify vulnerabilities in ecosystem services under urban growth scenarios; (4) develop integrative social-ecological models of the changing ecosystem services; (5) create virtualization environments and visualization tools to support the Landscape Early Warning and Information System (LEWIS); (6) generate and communicate knowledge of complex social-ecological systems.

As noted, this work will be done in a participatory framework with our stakeholders. Throughout the strategic planning process, MILES participants identified that Stakeholder Engagement is a pivotal activity -- one that provides a unique opportunity for ONEIdaho to be at the forefront of developing meaningful and sustainable methods of communication of knowledge of SES, and incorporation of this knowledge in decision-making processes. For this reason, objective (6) appears first in Section 3.2.1.

3.2.1. Stakeholder Engagement
Lead: Tracy

Summary: This activity will build research-stakeholder communication to align MILES research with stakeholder needs and transfer MILES knowledge to stakeholders. Stakeholder engagement represents the primary mechanism by which we ensure that MILES research activities will be social-ecologically relevant. A predominate focus will be on relationships (values and governance) and key drivers (i.e. urban growth and climate change).

Key Participants: Lindquist, Lybecker, and Wulfhorst

Research Objective: Generate and communicate knowledge of complex social-ecological systems.

Strategic Priorities: We will build a robust participatory framework that will incorporate stakeholder research needs in MILES research, institutionalize stakeholder engagement and relationships, and use knowledge and tools generated by MILES to interactively communicate complex scientific data to and among stakeholders.

Plans and Activities: (1) Hold individual and group stakeholder meetings. (2) Create external stakeholder advisory committees. (3) Utilize pilot case studies to inform full project development. (4) Develop effective stakeholder communication channels. (5) Develop and test Study Area decision-making models.

Integration with other Research Activities: This research activity directly relates to other MILES research activities in the following way:

- SES Characterization and Vulnerability: Provides entrance to SES stakeholder networks through relationship establishment.
- SES Characterization and Vulnerability: Develops channel for communication of research needs, process and reporting.
- Visualization: Uses visualization tools to promote interactive communication and interaction with and among stakeholders.

Integration with other MILES Priorities: This research activity directly relates with other MILES Priorities:

- WFD: Stakeholders will place and support MURI students.
- WFD: MURI and Adventure Learning participants will engage in stakeholder interactions.

Accomplishments

- Institutionalized relationships between research and stakeholder entities
- Established collaboration between faculty and stakeholders as a key element of ONEIdaho research programs

3.2.2. SES Characterization and Vulnerability
Lead: Baxter

Summary: This activity will characterize historical and current patterns of landscape change; map decision-making processes within SES systems; identify vulnerabilities as well as environmental and social drivers of change that affect ecosystem services related to urban growth scenarios. Characterization of SES will include analysis of existing datasets and collection of diverse new datasets reflecting spatial and temporal variations in biophysical and social parameters. Characterization and quantification of vulnerability relates to bundles of ecosystem services as guided by stakeholder engagement (Research Activity 1) and scientific analysis. Datasets will be used in three ways: (1) elucidate and compare patterns of landscape and societal change, (2) inform LEWIS, and (3) provide the framework and input parameters for integration of domain-specific models (see *Research Activity 3*).

Key Participants: A. Smith, Lindquist, Flores, Lohse, Frazier, Kolden, Wulfhorst, and 4 HIRES in *Spatial Social Science*, *Ecological Planning and Forecasting*, *Landscape Ecology/Epidemiology*, and *Socio-Environmental Science*.

Research Objectives: To characterize and quantify historical and current patterns of landscape change, identify social drivers of urban landscape change that affect ecosystem services, and identify vulnerabilities in ecosystem services under urban growth scenarios.

Strategic Priorities: We will determine social drivers and biophysical processes (past and current), identify ecosystem services critical to sustained growth and development of Idaho's changing urban communities, quantify future vulnerability of identified ecosystem services, and develop a vulnerability tool for early warning system.

Plans and Activities: (1) Utilize pilot case studies to inform full project development. (2) Identify common and site-specific SES parameters, drivers and vulnerabilities. (3) Compile archival datasets. (4) Collect new data as necessary to address identified data gaps. (5) Conduct vulnerability analyses. (6) Develop and apply cross-site comparison methodology. (7) Conduct pre-and post-project ONEIdaho Study Area social surveys. (8) Compare and analyze pre-and post- project ONEIdaho Study Area social network maps.

Integration with other Research Activities: This research activity directly relates with the MILES research activities:

- Stakeholder Engagement: Conducts baseline surveys (primary and secondary), focus groups and interviews, and pre-post surveys on ecosystem services at appropriate scales.
- Stakeholder Engagement: Engages in interactive process to determine hypotheses on future trends.
- Integrated Modeling: Informs selection of appropriate models for social and biophysical processes, and use of datasets for modeling.

Integration with other MILES Priorities: This research activity directly relates with other MILES Priorities:

- Cyberinfrastructure: Creates data management and interoperability tools.
- MURI: Involves undergraduate students with research and data collection.

Accomplishments

- Developed methodology to populate ecosystem services causality and social values maps
- Developed methodology to construct community narratives
- Developed a dynamic SES profile and characterization process
- Developed ecosystem service weighting tool kit
- Qualified and quantified value shifts with respect to resources/ecosystem services
- Developed and conducted SES Ecosystem Services and Vulnerability Assessments

3.2.3. Integrative Modeling of SES
Lead: Flores

Summary: This activity will use and develop conceptual and numerical models that link the social behaviors and biophysical system processes to elucidate SES-level understanding, and create user-friendly tools to promote science-based decision-making. Models identified and used will vary as a function of the site-specific characteristics and ecosystems identified. Once models with appropriate datasets have been identified, an integrative platform will be selected, either an existing platform modified for our purposes, or a new platform developed. The integrative modeling platform will be used to produce future scenarios reflecting potential change of the biophysical and social landscape as related to ecosystem services and their vulnerability.

Key Participants: Boll, Kobs, and 4 hires in *Ecosystem/Landscape Modeling*, Numerical *Modeling and Simulation*, *Spatial Systems Modeling/Visualization*, and *Eco-Informatics*.

Research Objective: To develop integrative social-ecological models of changing ecosystem services.

Strategic Priorities: We will: (1) build integrative modeling frameworks that incorporate biophysical and social behavior models and data sets related to ecosystem services and landscape change, (2) connect

models in integrative platforms, and (3) identify SES vulnerabilities and thresholds in alternative future scenarios.

Plans and Activities: (1) Identify and adapt integrative modeling platform for project use. (2) Assess stakeholder user needs for modeling tools. (3) Utilize platform to identify SES vulnerabilities in scenario environments. (4) Train stakeholders and project researchers in integrative modeling platform use.

Integration with other Research: This research activity directly relates with the other MILES research activities:

- Characterization and Vulnerability: Provides training on models for social and biophysical processes so appropriate datasets are available for modeling.
- Characterization and Vulnerability: Obtains feedback on ecosystem service vulnerabilities.
- Visualization-Virtualization: Develops visualization and virtualization of model scenarios.
- Stakeholder Engagement: Develops protocols to assess and evaluate the efficacy of scenario modeling for end-user needs.
- Stakeholder Engagement: Hosts workshops and novel training materials and interfaces so models are accessible and adopted by broadest audience possible.

Integration with other MILES Priorities: This research activity directly relates with other MILES Priorities:

- Cyberinfrastructure: Creates data management and interoperability tools.
- MURI & WFD: Develops modeling/computational science and engineering opportunities for underserved and K-12 students.

Accomplishments

Increased diversity and breadth of biophysical processes, social institutions, actors, and ecosystem services addressed through integrative modeling

3.2.4. Visualization and Virtualization
Lead: Anderson

Summary: This activity will develop and implement visualization tools and virtualization environments to develop new Visualization and Virtualization (V-V) science and capacity and promote communication and engagement between researchers and stakeholders groups. Visualization and virtualization tools development focuses on communication of spatially and temporally complex concepts resulting from scenario modeling produced iteratively in 2.2.3.

Key Participants: Glenn, Delparte, A. Smith, and 2 hires in *Social Network Modeling* or *Evolutionary Game Theory*, and *Interdisciplinary Scientific Visualization*.

Research Objectives: To identify state-wide collaboration capacity in SES science and to create virtualization environments and visualization tools.

Strategic Priorities: The primary approach of this activity is to build sensory-rich mechanisms to communicate the products (e.g. scenarios) in the stakeholder environment. We will implement, develop and apply visualization tools to integrate urban planning and ecosystem science as well as promote translation of model scenarios in visualizations, develop a state-wide network map of science collaboration, and produce interactive experiences for intelligent decision-making through integration of science models and virtual assets.

Plans and Activities: (1) Develop, test and refine V-V tools and environment. (2) Deploy V-V platform in stakeholder environment. (3) Build and refine network map of ONEIdaho research capacity.

Integration with other Research Activities: This research activity directly relates with the MILES research activities:

- Stakeholder Engagement: Provides demonstrations of visualization tools and virtualization assets.
- Integrative Modeling: Presents scenarios of future alternatives for ecosystem services visualized/virtualized.

Integration with other MILES Priorities: This research activity directly relates with other MILES Priorities:

- Cyberinfrastructure: Creates data management and interoperability tools.
- MURI & WFD: Develops modeling/computational science and engineering opportunities for underserved and K-12 students.

Accomplishments

- Increased diversity of collaborations across ONEIdaho researchers and stakeholders
- Integrated urban planning and ecosystem science in future scenarios SES planning tool
- Developed methodology to integrate science models within virtual assets

Major Priority 3

3.3 CYBERINFRASTRUCTURE

Lead: Glenn

Summary: New cyberinfrastructure (CI) research is needed to effectively integrate, characterize, and visualize social and biophysical data. The major goals of CI are to develop novel and efficient methods to assimilate data to be used in modeling and visualization; support data management and communication with stakeholders; and develop capacity in visualization.

Key Participants: Delparte, Sheneman, A. Smith, Anderson, Jamil, Weber, Kobs, Flores, Dialani, Cutchin, and 1 *Data Interoperability* hire.

Strategic Priorities: We will improve our CI capacity in areas of data management, data interoperability and informatics, visualization and visual analytics, and communication.

Plans and Activities: (1) Develop/execute data policy to promote most efficient data and metadata storage and transfer. (2) Identify, develop, and implement common data architecture, formats, data sets, and data access mechanisms for the data core. (3) Identify, develop, and implement a framework for efficient data integration, mining and retrieval. (4) Implement data integration for site characterization and vulnerability assessments. (5) Identify visualization software/hardware requirements of faculty and stakeholders.

Integration with other MILES Priorities: CI activities will support the other MILES priorities in the following ways:

- Research - Stakeholder Engagement: Make data available and intuitive; use visualization to engage and inform; facilitate stakeholder input and data contributions.
- Research - Characterization: Ensure data integration and interoperability research for knowledge discovery and modeling; develop flexible visualization platforms for large-datasets to ensure wide usage.
- Research - Integrative Modeling: Ensure information retrieval/data mining, machine learning and agent based modeling; (e.g. pattern recognition and extraction for improved data-model fusion).
- Research - Visualization and Virtualization: Develop flexible, interactive visualization platforms for large-datasets to ensure wide usage; novel multi-scale/modal solutions for visualization; develop infrastructure in hardware and software for stakeholder informed near-real-time modeling.
- Research: Provide tools, methods, and approaches for data processing and management of the dataset collected and generated by the project.
- Integration: Provide visualization tools to enhance communication between researchers, researchers and stakeholders, and researchers and the community.

Accomplishments

- Data products discoverable, accessible, useful
- Yearly increase in datasets that are integrated
- Visualization platforms implemented
- Greater productivity and capacity through team building

Major Priority 4

3.4 DIVERSITY

Lead: Penney

Summary: MILES will recruit and train individuals in the STEM fields who are female or underrepresented minorities (URMs; specifically aimed towards people of Native American and Hispanic descent). Specifically, we aim to achieve 20% URM participation, 10% primarily undergraduate institution (PUI) participation and 45% participation of women in the overall MILES program at the college and university level. We will identify and recruit URM students in Idaho high schools, PUIs, and universities, train mentors for them, support the advancement of URM students through new partnerships between Idaho high schools and institutions of higher education, and sustain Diversity activities at participating institutions.

Key Participants: Benner, R. Smith, Vierling, M. Solomon, 2 *Diversity Coordinator* HIRES.

Strategic Priority: We will increase URP and URM participation in research and the STEM pipeline with a specific emphasis on females, Native American, and Latino populations. The RII diversity goals will be accomplished through the MILES Learning Community Initiative, which will drive the program's diversity and workforce development activities. Over $1M will be invested in (1) increased recruitment and collaboration with programs that serve women, minority, students from PUIs, and students with disabilities, (2) undergraduate research and internships, (3) supplemental support for MILES faculty to recruit URM graduate students and postdoctoral fellows, and (4) supplemental funding to recruit and offer new EPSCoR faculty positions to minority candidates.

Plans and Activities: (1) Launch the MILES Learning Community Initiative. (2) Hire two new Diversity Coordinators at BSU and ISU, whose positions will be funded internally after several years of MILES support. (3) Develop and implement a recruitment plan to aggressively attract URM and female faculty and staff to new MILES positions at the three research universities. (4) Utilize campus ambassadors at PUIs to recruit students for MILES. (5) Over five years, progressively increase the percentage of URM participants from 30-40% and female participants from 45-55% in MURI, by leveraging the enhanced PUI networks and existing Idaho STEM bridge programs. (6) Engage various units associated with State Board of Education to implement diversity targets in higher education.

Integration with other MILES Priorities:

- Research: New faculty and staff will be key participants in MILES research teams.
- Research: MURI students will contribute to research activities directed by MILES scientists.
- Research: All Adventure Learning participants will learn about SES research activities.
- Cyberinfrastructure: MURI students will be assigned to CI team members.
- Workforce Development: WFD activities will be primary means of recruiting URM and female students.
- Sustainability: Universities will fund URM/females in new faculty and diversity coordinator positions after MILES funding ends. Enhanced STEM pipeline for future URM/female students.

Accomplishments

– Broadened participation of URM and female populations in all MILES initiatives

- Sustained employment of URM and female faculty/staff to attract and mentor additional URM and female students
- Enhanced STEM pipeline for URM and female students from high school to PUI and/or research university to STEM-related fields of Idaho's economy
- Defined and implemented Diversity initiatives for higher education throughout Idaho

Major Priority 5

3.5 WORKFORCE DEVELOPMENT

Leads: Penney and Vierling

Summary: MILES aims to raise the profile of STEM knowledge and career development opportunities existing within the state to strengthen the enrollment and retention of students in higher education STEM fields, particularly those aligned with the MILES research theme. Two coordinated activities are planned to provide hands-on experience to students and train STEM mentors.

Key Participants: Benner, R. Smith, Green, Miller, Ebener, two new *Diversity Coordinator* hires.

Strategic Priorities: We will increase the quality and quantity of STEM students and train mentors to enhance the STEM pipeline.

Plans and Activities: (1) Involve "Ambassadors" at two-thirds of Idaho's Primarily Undergraduate Institutions to participate in and promote EPSCoR opportunities. (2) Create opportunities and strengthen retention and quality of undergraduate students pursuing STEM degrees by participating in SES research activities through the MURI program. Over five years, 300 students will be trained, with some working during the school year and others during the summer. (3) Train 30 graduate and undergraduate students over five years to be mentors of younger STEM students to increase communication and instructional skills among young scientists.

Integration with other MILES Priorities: Workforce Development directly relates to other MILES priorities:

- Research: MURI undergraduate students will contribute to research activities directed by MILES scientists.
- Cyberinfrastructure: MURI students will be mentored by CI team members.
- Diversity: We will focus on recruiting URM and female students for all Workforce Development activities.

Accomplishments

- Increased quality and quantity of STEM students
- Established networks between faculty at PUI and research universities, to help sustain STEM pipeline

Major Priority 6

3.6 EXTERNAL ENGAGEMENT

Lead: Vierling

Summary: Within Idaho, MILES will demonstrate the relevance of SES science to Idaho citizens through the use of experiential learning activities, social media, programming networks in local communities, and video segments. Audiences will range from high school and college students, to teachers and community leaders, to public television viewers. Beyond Idaho, MILES will organize a coalition of scientists within changing environments that have high potential to contribute to a global and transferable knowledge base on sustainability issues. Coalition scientists will engage in studies related to adaptation and changing environments that serve their respective State's unique needs while contributing to a global, and highly transferable, body of knowledge.

Key Participants: Engagement within Idaho: Benner, R. Smith, K. Eitel, Green, Miller, Glenn, two new Diversity Coordinator hires. Engagement beyond Idaho: Gosz, Benner, Boll, and Rodgers. Prospective Coalition States: States likely to participate in the Coalition include Alaska, Idaho, Maine, Montana, New Hampshire, and Rhode Island.

Strategic Priorities: Increase public awareness of SES science within Idaho, and develop an SES Coalition involving a network of scientists from EPSCoR states whose programs focus on SES research and sustainability science.

Plans and Actions: (1) Engage Idaho citizens and students in MILES activities by producing three video segments for distribution by Idaho Public TV. (2) Each year, develop and conduct Adventure Learning experiences at study areas to create networks of programming among high school teachers and students, PUI Ambassadors, undergraduate and graduate students, and local communities to increase awareness of MILES activities and their relevance to Idaho citizens. (3) Solidify membership of participating SES Coalition states; establish conceptual, administrative, programmatic, and financial infrastructure; host working group meetings and workshops; pursue collaborative research proposal development. (4) Foster ongoing collaboration within the Tri-State Consortium (ID, NV, and NM) through Innovation Working Groups that cross state, institutional, and disciplinary boundaries.

Integration with other MILES Priorities:

- Research: Within Idaho, the Adventure Learning high school students, teachers, and mentors will learn about SES research activities in place-based and online contexts.
- Cyberinfrastructure: Online programming of Adventure Learning occurs in coordination with CI team.
- Diversity, WFD: Ambassadors at Idaho's PUIs will promote MILES activities to their diverse student body.
- External Engagement: Beyond Idaho, the Tri-State Consortium and SES Coalition will focus on SES research initiatives, accomplishments, and funding opportunities.
- Sustainability: SES Coalition activities will advance ID's goal to create Center of Excellence in SES Science

Accomplishments: (1) Established networks of high school teachers, community mentors, and faculty at PUIs and research universities to increase awareness of Social Ecological Systems research and its relevance to Idaho citizens. (2) Increased communication and instructional skills amongst young

scientists. (3) Increased awareness of Social Ecological Systems research and its relevance to Idaho citizens. (4) Established SES Coalition.

Major Priority 7

3.7 EVALUATION AND ASSESSMENT

Leads: Goodwin, Schumaker

Summary: The progress of MILES towards its goals will be evaluated using a comprehensive assessment plan with both quantitative and qualitative methods. The plan includes a diverse Program Advisory Board (PAB) of independent external experts who will provide the breadth of knowledge necessary to adequately monitor and evaluate progress against stated goals and objectives. Recommendations provided by the external evaluators and committees will be used by the project during their annual review of the strategic plan. The process will focus on assessing progress of the award towards meeting the External Engagement, Workforce Development and intra- and inter-jurisdictional collaboration goals.

Key Participants: Rodgers, Boll, Benner, Shaw (Metrica), external PAB

Strategic Priority: Conduct comprehensive evaluation and assessment of all MILES-related activities to provide a basis for addressing challenges, building on program progress and achievements, and informing future directions.

Plans and Activities: (1) Formalize and document an evaluation and assessment plan within 90 days of *Strategic Plan* approval. (2) Apply a metric tracking and reporting database for all project participants. (3) Document faculty performance through quarterly updates and annual faculty reports. (4) Solicit project feedback annually from external and internal advisory committees. (5) Solicit formal and informal input from MILES partners. (6) Incorporate recommendations and outcomes from the project external evaluator (Metrica), PAB, and MILES partners in the project's self-evaluation and regular course correction process.

Integration with other MILES Priorities: The evaluation plan will explicitly assess all program activities to ensure an integrative approach and alignment with MILES priorities.

Accomplishments

- Document and communicate successes
- Utilize evaluation and assessment activities to improve performance

Major Priority 8

3.8 MANAGEMENT

Leads: Goodwin, Schumaker

Summary: The Idaho EPSCoR Director (Goodwin), Associate Director (Shumaker), and the leadership team (Benner, Boll, and Rodgers) will oversee organization and implementation of the project. They will work with component leads to provide scientific and Education, Outreach and Diversity (EOD) leadership as well as oversee the human and physical resources necessary to ensure timely completion of activities and delivery of outcomes. The EPSCoR office will coordinate project management, reporting, and event planning, while a multi-tier team consisting of team leaders in all Strategic Priority areas will be responsible for aligning needs with project goals.

Key Participants: Rodgers, Boll, Benner, and component leads.

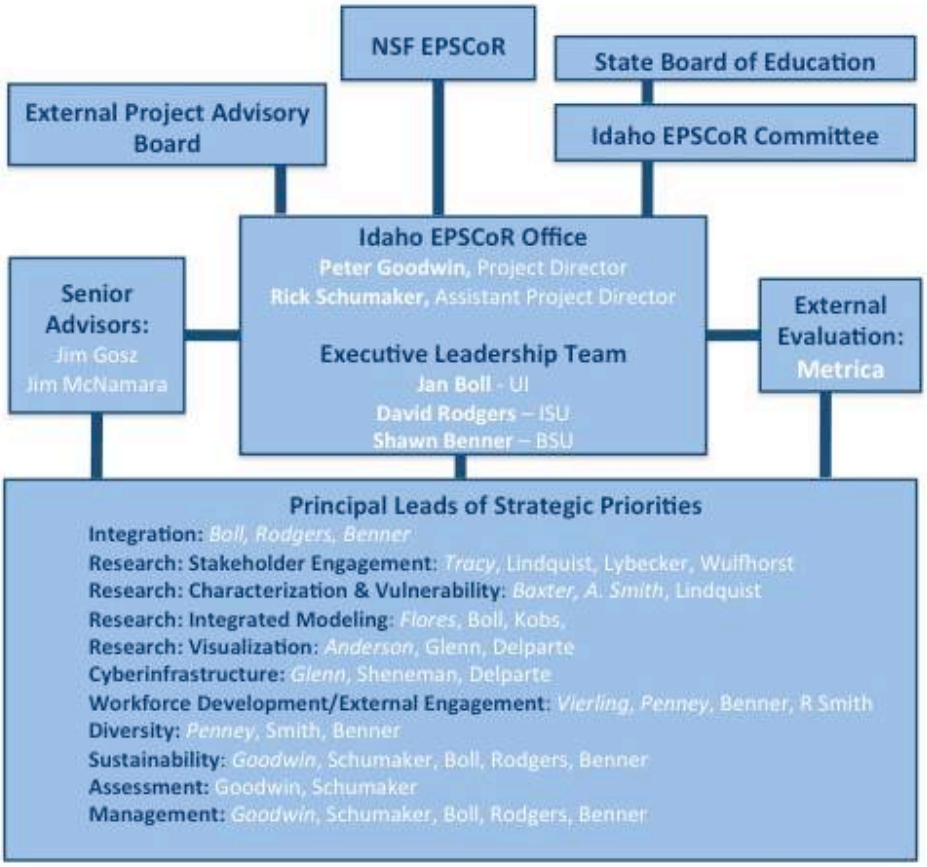


Figure 4. Idaho NSF EPSCoR MILES Organization Chart.

Strategic Priority: Successful implementation of the MILES project.

Plans and Activities

(1) Oversee the strategic planning process, inclusive of completing and revising the document.
(2) Oversee nested meetings to accomplish MILES goals, including regular leadership team, regular EPSCoR staff meetings, regular site meetings, annual "All Hands" meeting, and three statewide 'topical' meetings.
(3) Incorporate advice and recommendations in a timely manner.
(4) Support stakeholder engagement through meetings and communication support.
(5) Oversee fiscal management through monthly budget meetings among executive leadership.
(6) Conduct reverse site visits.
(7) Maintain programmatic review through transparent communication and solicit feedback regularly from partners for evaluation of progress.
(8) Communicate regularly and effectively with NSF and other EPSCoR jurisdictions.
(9) Communicate regularly and effectively with the PAB and external evaluator.
(10) Mentor new faculty and provide other technical/programmatic assistance (See Section 9, Sustainability).
(11) Complete annual report.

Integration with other MILES Priorities: The management will work to ensure all program activities are integrated with MILES priorities.

Accomplishments

- Achieved RII goals and objectives and met performance metrics.

Major Priority 9

3.9 SUSTAINABILITY

Lead: Goodwin

Summary: NSF's investment in Idaho will provide essential infrastructure that will enable the development of competitively funded research that will serve as a base for a future national Center of Excellence. Growth will be supported by (1) progressive transferring EPSCoR funded faculty and manager positions to state support; (2) establishing MILES as a self-supporting, nationally important research community; (3) building the competitive research enterprise around MILES so that new research programs can be supported through competitive grants; and (4) leveraging private sector support through stakeholder partnerships.

Key Participants: Schumaker, Benner, Boll, Rodgers

Strategic Priorities: We will create lasting research capacity in SES science by growing our faculty and staff and expanding their capacity to create competitive research knowledge.

Plans and Activities

(1) Initiate and execute faculty hires.
(2) Provide critical administrative support to allow early career EPSCoR faculty to focus on research, participate in RII education and outreach elements, and pursue funding opportunities. This includes limiting teaching assignments to one course a semester for new hires.
(3) Increase mentoring and professional development opportunities to create a cadre of faculty leaders competitive in their disciplinary domains and transdisciplinary initiatives.
(4) Provide a host of technical supports, including cross-disciplinary grant writing and proposal development assistance.
(5) Support faculty-stakeholder relationship building.
(6) Develop and nurture State, regional, national and international partnerships.
(7) Build understanding and support for coupled natural and human systems research within their units by supporting faculty and student participation.
(8) Position Idaho to be the home of a national Center for Sustainable Ecological Resources Systems and a leader in a SES Coalition.

Integration with other MILES Priorities: Sustainability activities are designed to create an integrative statewide approach to SES, and build long-term capacity in the MILES priority areas.

Accomplishments

- Growth of research capacity in SES
- RII goals and objectives achieved
- SES competitiveness sustained beyond the award