

Reverse Site Visit (RSV) Report

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The following is a summary of the Reverse Site Visit (RSV) panel's assessment of the intellectual merit and broader impacts of your Research Infrastructure Improvement Track-1 project and progress towards attainment of its goals. Based on this assessment, the panel identified the project's strengths and weakness and put forward recommendations to further strengthen the team's efforts.

A) INTELLECTUAL MERIT

The stated overarching goal (Goal 1) of the iUTAH project is "*...to create sustainable infrastructure improvements to benefit water –related science and technology throughout the state, increase national research and development competitiveness, and expand our workforce of researchers, educators and practitioners to ensure a vital economy and sustainable future.*" To accomplish this goal, three research foci areas are identified: 1) Biophysical Ecohydrologic Systems, 2) Social and Engineered Systems, and 3) Coupled Human-Natural Systems.

In support of their research and educational mission the iUTAH team identified the following additional goals: (Goal 2) build on Utah's existing strengths in hydrologic modeling and cyber-infrastructure, (Goal 3) increase participation of underrepresented groups, (Goal 4) provide educational opportunities for a scientifically literate Utah workforce citizenry, and (Goal 5) to provide societally relevant science and education regarding current and future water resources.

In the context of intellectual merit we constrain our comments to Goal 1.

Goal 1. Enhanced research capacity of the biophysical, social and engineered water environment through work in 3 research foci.

Research Focus Area 1 –Biophysical ecohydrologic system : The year 1 goals and objectives are focused on the acquisition and installation of data collection equipment and the development and implementation of informatics needed to store and distribute these data.

Research Focus Area 2 –Social and engineered ecohydrologic system: The year 1 goals and objectives are focused on identifying existing data sources, developing connections with relevant stakeholder groups, and designing the Green Infrastructure Research Facility (GIRF).

Research Focus Area 3 – Coupled human-natural systems: The year 1 goals and objectives are focused on developing an inventory of relevant data and models, identifying linkages among research components, and developing collaboration.

Activities have begun in each of the three research foci. At this stage, considerable attention has been paid to the identification of needed data, the building of research teams and the development of the physical and institutional infrastructure needed to support related research and the extension of existing projects. Moreover, this research leverages preexisting efforts. The panel noted that several of these projects had significant graduate student involvement. GIRF is a new initiative and is being implemented ahead of schedule.

Furthermore, the iUTAH team has been quite effective in leveraging resources provided by the EPSCoR award. The number of grants submitted is impressive for the first year and the team is urged to continue this work. It is particularly important to continue to develop the ability of students and young investigators to be competitive in research funding competitions.

The panel was generally positive about the progress made to date by the research team. However, the specific questions associated with the research foci outlined in the proposal were quite general and the associated methods underspecified. The presentations made at the RSV helped to clarify and allay some of these concerns. The panel believes that in the coming year the iUTAH team should identify specific research questions, data needs, and analytical tools, and the connections among them, that are needed to meet study objectives. The panel wanted more detail on how the research foci will be implemented, integrated with each other, and integrated with climate change research. Decisions about which human populations are to be sampled, for example, need to be driven by a strong underlying understanding of their diversity and social context, as well as the specific questions being asked about how biophysical systems are affected by human systems.

Issues related to water use and management depend fundamentally on a social consensus on what is “an” optimal response and then a willingness to live with the consequences of the policy recommendations that arise out of this research. In the very design of research such as GIRF and Gradients Along Mountain to Urban Transitions (GAMUT) diversity needs to be integrated. Diversity, in this instance, needs to be framed not only in terms of opportunities being provided underrepresented groups but the contributions that those groups can make in terms of cognitive diversity.

The social science research incorporated in the iUTAH project shows potential for significant findings, and methodological advancement. There appears to be a general understanding about how the social science and biophysical components of the project are linked at a conceptual level. However, the details of these linkages have yet to be worked out particularly at the level of the field sites. While the team leadership acknowledges the difficulty of this process, we suggest that some of the challenges may be overcome by further integrating the research questions and, thus teams, across

disciplines. Such an approach will facilitate appreciation across disciplinary bounds. The social and biophysical sciences components need to proceed in a more integrated and less parallel fashion.

From the strategic plan, the team is planning to develop the conceptual model of coupled human-water system in year 2. However, some of the specific goals for year 1 were not demonstrated satisfactorily. These are 1) Identify critical linkages and potential thresholds of change, and 2) Design social science research protocols and instruments. The panel is concerned that these tasks are under resourced. These goals should have been achieved through a coupled research approach where biophysical and social sciences research share information and ideas across disciplines. In the next year, the research team can work to develop the coupled modeling framework, as proposed. Critical linkages and potential thresholds of change are important for creating an agent-based modeling framework that can show the dynamics of water supply and demand in Utah. The research team is encouraged to spend the time to develop an understanding for these drivers as soon as possible.

Supporting early career faculty is an essential component of infrastructure enhancement. It was not apparent in the annual review that early career faculty had a significant role in the project. Early career faculty should assume more prominent roles within the iUTAH project.

Finally, the panel is very concerned about the lack of a groundwater component. Without serious consideration of this vital component of the water budget, study objectives may be severely compromised.

Summary of Strengths

- The team is on track with most aspects of the project. Initial work to build the cyberinfrastructure needed to support future research and the early engagement of students in substantive research is impressive.
- The panel believes efforts to build interuniversity relationships will strengthen research infrastructure.

Summary of weaknesses

- The panel is concerned about the lack of a groundwater component.
- Social science research efforts have not progressed as stated in the strategic plan.
- In general, research questions and methodologies need to be more fully defined and integrated across disciplines. Timely attention to this issue is considered to be particularly important if research goals associated with coupled natural and human systems are to be achieved.

B) BROADER IMPACTS

The broader impacts of this study are addressed in goals 2 through 5 of the proposal.

Goal (2) Cyberinfrastructure: Considerable attention has been paid to the development of supporting cyberinfrastructure. Data from the Red Butte is, for example, available over the Web. This early commitment to making the data widely available is promising. However, the URL for the Web Application must be made more readily available as it is not currently on data.iutahepscor.org and Google does not easily find it.

It is also not clear what the requirements are for submitting a dataset to data.iutahepscor.org or what the expectations are for data listed on this site. For example, is there an implied minimum quality of the data if it appears on this list? What is the vetting process – what dataset is deemed in-scope and what is out of scope? (e.g., the Texas dataset in the current dataset listing seems to be out of scope). These submitted datasets do not seem to be searchable, and the data in these datasets is not directly accessible from this Web inventory page. The team is encouraged to rethink their design for building communities around data as there has only been one post to the discussion forum (dated Feb 22, 2013).

Goal (3) Increase participation of underrepresented groups: The panel wonders whether the iUTAH team considered a Native or Hispanic faculty member from the Utah university system to help with outreach activities. For example, University of Utah Professor Otakuye Conroy-Ben, a Native American with expertise in water quality and AISES (American Indian Science & Engineering Society) faculty advisory, could provide invaluable insight into ways to integrate Native American representation into the iUTAH project.

The team is also encouraged to examine institutional data on recruitment, retention, graduation, and placement of Native and Hispanic students attending Utah universities/community colleges and identify individuals from these groups who could benefit from undergraduate research experiences related to this project. The Four Corners School of Outdoor Education partnership and the outreach to the San Juan campus are a start among Native communities, but the iUTAH team should consider ways to engage the Utah tribal members relocated and living in urban Utah.

Other opportunities for recruiting students of color include SACNAS (Society for Advancing Chicanos and Native Americans in Science) and MEChA (Movimiento Estudiantil Chicana/o de Aztlan).

Goal (4) Educational opportunities for a scientifically literate Utah workforce citizenry: The education and outreach portions of the project appear to be strong, varied and well developed and may affect large numbers of the population. The integration of predominately undergraduate institution with the team's research agenda is a project strength.

A potential strength of the project is the engagement of a full range of students (K12 through graduate students). Partnerships seem strong and well distributed across the state. Citizen science activities (e.g., the rain barrel project) are likely to be effective in educating the public about a variety of water related issues. The focus on increasing participation of women is a strength. The project's connection to museums is a strong element of this project and has reached hundreds of children and adults.

Goal (5) to provide societally relevant science and education regarding current and future water resources: The ultimate development of models that can be used to predict the outcome of various policy decisions should be a powerful product that will be important for informing policymakers and the public on the ramifications of particular management approaches not only in Utah but elsewhere. There is a strong fit with the state science and technology plan.

Management and Evaluation: The management team seems to have an effective system in place for the tracking and evaluating progress. This internal monitoring system, together with regular communication, will help identify and address barriers and challenges.

While the iUTAH team communicated multi-pronged plans for external evaluation as part of their documentation, the panel has not had an opportunity to review evaluation results. As a result, it is not clear how the external evaluation contributes to the project success and how efforts by varying constituencies can be leveraged to provide a comprehensive picture of the quality and value of the project overall. A systematic overview of evaluation activities across major project goals and objectives (focus areas), associated milestones, internal and external measures (criteria and indicators), agreed upon standards, and evaluative conclusions that inform program improvements is important.

Summary of Strengths

- The broader impacts are generally strong.
- The panel commended the iUTAH team's efforts in cyberinfrastructure, education and outreach.

Summary of weaknesses

- The diversity initiative mentions "building diversity in higher education and a STEM pipeline among underrepresented groups." While progress was made in this area, this remains a challenge for the team.
- The panel noted that the ability to inform policy is weakened by a lack of focus on groundwater.

C) RECOMMENDATIONS

1. Demonstrate progress on social science research by designing social science research protocols and instruments before the end of Year 2.
2. Show evidence of a tight coupling between social and biophysical sciences through specific initiatives in joint research problems, questions, methodological procedures, and survey instruments.
3. Create a plan to address the lack of groundwater expertise.
4. Develop a precise set of requirements for contributing data and models to the iUTAH web portal.