SmartStart
EDUCATIONAL CONSULTING SERVICES

Evaluation of the Idaho, Nevada, and New Mexico NSF EPSCoR Track 2 Project

Final Summative Evaluation Report
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Section 1. Executive Summary

1.1 Overview of the project

On September 1, 2009 Idaho, Nevada, and New Mexico NSF EPSCoR joined projects forming a consortium of EPSCoR states with similar research agendas related to climate change and water resources. The consortium model significantly increased opportunities for scientific collaboration and enhances each state's ability to secure competitive funding and tackle complex climate change research agendas. The mission of the National Science Foundation (NSF) Experimental Program to Stimulate Competitive Research (EPSCoR) is to assist NSF in its statutory function "to strengthen research and education in science and engineering throughout the United States and to avoid undue concentration of such research and education."

The primary goal and three objectives of the Tri-state EPSCoR project are:
Project Goal - Knowledge transfer
    Objective 1 - Connectivity
    Objective 2 - Interoperability
    Objective 3 - Cyberlearning

Tri-state EPSCoR outreach, training, and educational project components include:
- Idaho McCall Outdoor Science School (MOSS) summer institute
- Idaho/ Nevada / New Mexico Data Portals
- Nevada summer science institute for teachers
- New Mexico CI for Industry
- New Mexico SCC/GUTS summer teacher institute and student programs
- Tri- state Consortium annual meeting and workshops
- Tri- state cyberinfrastructure training opportunities
- Tri- state Cyberlearning Summit
- Tri-state educational materials development
- Tri- state Interdisciplinary Modeling Course

Two types of evaluation have been conducted for EPSCoR project: (1) a formative evaluation to monitor implementation of project components and give ongoing feedback to the principal investigators, and (2) a summative evaluation to assess the quality and impact of the project in reaching its stated goals and objectives. Both types of evaluation use a combination of qualitative and quantitative indicators.

1.2 Summary of findings

Key findings address the achievement of project objectives. A complete description of key findings and recommendations can be found in Section 4 of this report.

Objective	Key Findings	Objective met?
Objective 1 – Connectivity Promoting communication and collaboration by improving connectivity infrastructure	Seven percent of impact responses focused specifically on how improved connectivity has impacted research and ability to communicate with other scientists and an additional 35% focused on collaborations that have been developed.	**Yes**
Objective 2 – Interoperability Promote discovery through enhanced interoperability between models and other software components, improved access to and usability of Consortium data products	Four percent of impact responses focused specifically on how improved interoperability has impacted research and communications. Interoperability is being developed through the tri-state data portals. Achievement of this objective is still in the beginning stage. As the portals develop, the utility of their content will become more apparent to tri-state educators, scientists, and students.	**In progress**
Objective 3 – Cyberlearning Enhance learning through graduate student and postdoc development; extending cyberenabled science education into schools; and improving outreach to business and industry.	Numerous cyberenabled institutes, trainings, programs, workshops, courses, and seminars have been conducted throughout the tri-states. All received extremely high ratings for usefulness and goal achievement by participants. Programs have reached out K-12 educators and students, undergrads, grads, postdocs, and faculty as well as the general public and Native American populations. Almost all programs will be sustained after the grant period ends. Greatest impacts were noted in increased collaborations, research development, and knowledge.	**Yes**

General recommendations

It is clear that this project has made tremendous progress and has had significant impacts on Idaho, Nevada, and New Mexico's cyberinfrastructure and Cyberlearning capabilities. Baseline data, benchmarks, annual milestones, and evaluations of individual project activities were developed and collected by the previous evaluator in year 1 and can be found in the year 1 evaluation report. However, it was a challenge for the new evaluator to assess the extent of progress made on this Track 2 project because the change in the evaluation plan in year 2 of the project, due to the change in the evaluator and the focus of the evaluation, made integration of year 1 with years 2 and 3 data difficult. The evaluator makes the following recommendations for future projects:

1. Component leads should develop project benchmark and annual milestone expectations for each project goal and objective.
2. The evaluator will use the benchmarks and milestones to develop metrics that will be used to assess achievement of all project benchmarks.
3. The evaluator will work with component leads to establish baseline data for all metrics.
4. Component leads should update benchmark and milestone tables as the project progresses and submit annual reports of progress made on benchmarks.
5. The evaluator will track progress made on benchmarks based on project leads' reports.
6. The component leads and evaluator should develop a project logic model as a snapshot of their progress. The logic model should be based on project benchmarks.
7. All project activities should be assigned under the supervision of a component lead and component leads should monitor implementation and outcomes of project activities that are assigned to their component.
8. The evaluator will meet quarterly with project leads to assess progress, provide feedback from evaluation results and plan implementation of recommended changes.

Section 2. Introduction

2.1 Background of the project

On September 1, 2009 Idaho, Nevada, and New Mexico NSF EPSCoR joined projects forming a consortium of EPSCoR states with similar research agendas related to climate change and water resources. The consortium model significantly increases opportunities for scientific collaboration and enhances each state's ability to secure competitive funding and tackle complex climate change research agendas. Project leads, scientists and educators from the three states met in New Mexico, November, 2008 and Idaho, December, 2009, to create a coordinated Cyberinfrastructure (CI) research and development plan to serve both as a platform for future climate change research collaborations and the foundation for the Tri-state NSF EPSCoR project.

The mission of the National Science Foundation (NSF) Experimental Program to Stimulate Competitive Research (EPSCoR) is to assist NSF in its statutory function "to strengthen research and education in science and engineering throughout the United States and to avoid undue concentration of such research and education."

EPSCoR goals are:
- To provide strategic programs and opportunities for EPSCoR participants that stimulate sustainable improvements in their R&D capacity and competitiveness;
- To advance science and engineering capabilities in EPSCoR jurisdictions for discovery, innovation and overall knowledge-based prosperity.

EPSCoR objectives are:
- To catalyze key research themes and related activities within and among EPSCoR jurisdictions that empower knowledge generation, dissemination and application;
- to activate effective jurisdictional and regional collaborations among academic, government and private sector stakeholders that advance scientific research, promote innovation and provide multiple societal benefits;
- To broaden participation in science and engineering by institutions, organizations and people within and among EPSCoR jurisdictions;
- To use EPSCoR for development, implantation, and evaluation of future programmatic experiments that motivate positive change and progression.

Project goals

The primary goal and three objectives of the Tri-state EPSCoR project are:

Project Goal - Knowledge transfer

The Track 2 project will promote knowledge transfer to scientists, educators, students, and citizens within and beyond the Consortium by enhancing state CI, and to enable the community science that is required to address regional to global scientific and societal challenges.

Objective 1 - Connectivity

Significant effort will focus on promoting communication and collaboration by improving connectivity infrastructure within the Consortium. Proposed and future Consortium efforts related to improving research competitiveness, STEM education, and economic development rely on this basic infrastructure.

Objective 2 - Interoperability

The Consortium will promote discovery by supporting community-based climate change science through enhanced interoperability between models and other software components, improved access to and usability of Consortium data products through the adoption of standards-based data management and access models, and new data assimilation, analysis, and visualization capabilities.

Objective 3 - Cyberlearning

The Consortium will enhance learning by focusing particularly on graduate student and postdoctoral researcher development; extending cyberenabled science education into middle and high schools and extracurricular programs; and improving outreach to business and industry.

Project components and activities

Tri-state EPSCoR outreach, training, and educational project components include:

- Idaho McCall Outdoor Science School (MOSS) summer institute
- Idaho/ Nevada / New Mexico Data Portals
- Nevada summer science institute for teachers
- New Mexico CI for Industry
- New Mexico SCC/GUTS summer teacher institute and student programs
- Tri- state Consortium annual meeting and workshops
- Tri- state cyberinfrastructure training opportunities
- Tri- state Cyberlearning Summit
- Tri-state educational materials development
- Tri- state Interdisciplinary Modeling Course

2.2 Background of the evaluation

Two types of evaluation have been conducted for EPSCoR project: (1) a formative evaluation to monitor implementation of project components and give ongoing feedback to the principal investigators, and (2) a summative evaluation to assess the quality and impact of the project in reaching its stated goals and objectives. Both types of evaluation use a combination of qualitative and quantitative indicators.

Guiding evaluation questions

Guiding evaluation questions are based on the goals of this EPSCoR project.

Intellectual merit

- How has the addition of research and cyber infrastructure (equipment, facilities, people, and training) provided by the EPSCoR project affected Nevada's, New Mexico's, and Idaho's competitiveness for research funding and sustained partnerships as per the outputs/outcomes/metrics listed for the overarching goal and each of the 3 objectives listed in the evaluation plan?

Impact on project participants, schools, universities, businesses, and communities

- What impact has participation in the EPSCoR programs had on the development and direction of participants' educational and career opportunities and choices?
- In what ways has participation in the EPSCoR programs increased participants' understanding and use of cyberinfrastructure?

Impact on participating organizations and the scientific community
- In what ways did participants' take the knowledge they acquired in EPSCoR programs and transfer it back into the classroom, school district, university, agency and/or community in a meaningful, productive way?
- How has involvement in the EPSCoR project benefited participating agencies, offices, divisions, departments, schools, universities, etc?
- In what ways have the participating agencies, offices, divisions, departments, schools, universities, etc. changed as a result of participation in this project?

Section 3. Evaluation Findings

3.1 Summative review of project components and activities

For this final, summative evaluation report, evaluation data for each outreach, training, and educational project component is summarized to assess the impact of the component over the course of the funding years. For each component, the evaluator describes the background of the project, evaluation methods, and findings. Figure 1 shows a summary of evaluations that were conducted for the Tri-state EPSCoR project during the three funding years. The coding represents the following:

Yes: Activity and evaluation were conducted

No-1: Activity was conducted, but not with Track 2 EPSCoR funds so Track 2 evaluator did not conduct evaluation

No-2: Activity was not conducted

No-3: Activity was conducted with Track 2 EPSCoR funds; evaluation was not conducted

Figure 1. Summary of evaluations conducted for the Tri-state EPSCoR project

Section of report	Outreach, training, or educational project component	Evaluation conducted?		
		2009-10	2010-11	2011-12
A	Data Portals – Idaho, Nevada, and New Mexico	No-2	Yes	Yes
B	Idaho McCall Outdoor Science School (MOSS) summer institute	No-1	Yes	No-1
C	Nevada summer science institute for teachers	No-2	Yes	No-2
D	New Mexico CI for Industry	No-2	No-2	Yes
E	New Mexico SCC/GUTS summer teacher institute and student programs	No-3	Yes	Yes
F	Tri- state Consortium annual meeting and workshops	Yes	Yes	Yes
G	Tri-state cyberinfrastructure training opportunities	Yes	Yes	Yes
H	Tri-state Cyberlearning Summit	No-2	No-2	Yes
I	Tri-state educational materials development	Yes	Yes	Yes
J	Tri- state Interdisciplinary Modeling Course	Yes	No-2	Yes

A. Data Portals – Idaho, Nevada, and New Mexico

Background of the project

Data portals that are being developed by each state are available at the following websites:

Idaho: https://sites.google.com/a/isu.edu/epscor-data-portal-idaho/
Nevada: http://sensor.nevada.edu/NCCP/Default.aspx
New Mexico: http://nmepscor.org/dataportal

Background of the evaluation

The evaluator has worked with the tri-state interoperability leads to develop two surveys:

- Data Portal survey of people who publish data to collect, in a common format, information that is needed by all three states to plan for, and initiate movement of data into the Cyberinfrastructure that is being developed in each state. When this survey was launched in 2011, seventeen requests (11 from Idaho, 6 from Nevada, 0 from New Mexico) to import data in to the data portals were made.
- Data Portal Survey of people who use the data to solicit feedback on the data portals as they are being developed. This survey was utilized at the end of two data portal trainings. Feedback was provided to data portal developers to provide suggestions to improve the data portal.

Survey results were included in the 2010-12 evaluation reports and are summarized below.

Summary of evaluation findings and recommendations

Development of the data portals has experienced tremendous progress over the course of this three-year project. All portals are in different stages of development and although the interoperability team meets and discusses best practices, each portal has been created somewhat independently. These portals have the potential for great impact on scientists, educators, and students throughout the tri-state region. The evaluator recommends that the data portal developers continue to work together to develop best practices and learn from each other's challenges. It is also recommended that an ongoing assessment of the data portals be conducted. A feedback form should be placed on each portal website so users can make suggestions to data portal developers. Data portal developers should work collaboratively with educators and curriculum developers to present data in a manner that is useful to teachers and students. Lessons should continue to be developed that utilize data sets contained in the portals.

B. Idaho McCall Outdoor Science School (MOSS)
Summer Institute
Background of the project

The mission of MOSS (http://www.uidaho.edu/cnr/moss) is to facilitate place-based, collaborative science inquiry within the context of Idaho's land, water and communities. The program provides experiential learning opportunities for students, educators, and scientists to foster the critical thinking skills necessary to address complex problems. MOSS has expertise in the areas of inquiry-based K-12 STEM education, graduate education in STEM inquiry teaching, in-service teacher education in STEM inquiry teaching, and connecting university research with K-12 classrooms. Since its founding in 2001, MOSS has engaged nearly 14,000 K-12 students and over 90 graduate students in authentic, inquiry based STEM education programs.

Dr. Karla Eitel, Assistant Professor of Conservation Social Sciences at the University of Idaho (UI) is the Director of Education for MOSS. Two components of the MOSS program are funded by the NSF EPSCoR. The first component is the CyberLearning website (http://mossi.tfhsbruins.com/index/index/) which aims to get students and teachers connected to concepts that EPSCoR scientists are studying related to water resources in a changing climate. The site includes background information about climate models, water resources, scientists working on the EPSCoR grant, and an interface for uploading hydrologic data to the Consortium of Universities for the Advancement of Hydrologic Science (CUAHSI) Hydraulic Information Systems (HIS) database. A five-person team will collaborate to further develop the CUAHSI HIS database interface and content pieces for the site. The team includes a MOSS graduate student, an Environmental Science teacher from Twin Falls High School, a Technology teacher from Twin Falls High School, and a graduate student in Dan Ames' (Idaho State University) lab. Plans for further development of the site include visualizations of Idaho specific climate and water related data (using an interface like Google Public Data Explorer), an interactive map embedded with water related data and videos of field data collection, and classroom lesson plans that utilize the site as a learning tool. The data upload interface will be enhanced and made fully functional by the end of the project in August 2011. Project leaders plan to obtain feedback on the site at the two summer 2011 teacher institutes and hope to pilot test activities at the July 2011 Geospatial Tools workshop for teachers.

The second component of MOSS that was funded during the summer of 2011 by the Tri-state EPSCoR is week 1 of the MOSS Summer Institute for K-12 teachers (http://www.uidaho.edu/cnr/moss/teachereducation). The 2011 Summer Institute was conducted from June 23 – June 26, 2011 at the University of Idaho McCall Field Campus. Ten teachers attended a series of workshops on various topics related to climate change presented by university scientists. Teachers also had the opportunity to work alongside the scientists to discover the latest information in climate and water research and how it can be integrated into their classroom instruction. The goals of the teacher institute are:

- To give teachers a chance to experience field science research and learn about current projects being conducted in Idaho
- To work with teachers and scientists to create projects that can be conducted in classrooms throughout the state
- To provide an opportunity for our MOSS teachers to gather for a time of reflection and renewal after a long school year

Background of the evaluation

The summer institute evaluation form was developed by MOSS summer institute program leaders. It was designed to determine the overall quality of the workshops and the main concepts teachers learned. A full evaluation report was included in the 2010-11 Quarter 4 report and is summarized below.

Summary of evaluation findings

Participants in the 2011 McCall Outdoor Science School

All ten K-12 teachers from six different high schools, within the Tri-State consortium and one homeschool teacher, completed the Idaho MOSS Summer Institute evaluation form. No demographic data was collected on gender or ethnicity.

Quality and usefulness of the 2011 McCall Outdoor Science School

Respondents rated presentations given by scientists at the workshops on a four-point Likert scale from *poor* to *excellent*. All respondents rated each of the five workshops as either *good* or *excellent*. There were no ratings of s*o-so* or *poor*. Interestingly, only 30% of the respondents rated the workshop on Climate Science as *excellent* while none of the other workshops had less than a 60% rating of *excellent*.

All teachers reported that they would recommend this program to other teachers. The majority stated they would recommend this program because of the opportunity to interact with scientists, share information with other teachers, and hands on learning. Selected comments are listed below.

- *I highly recommend this program to another teacher. It is great to connect with scientists working in their fields, to talk about how climate change is affecting water in our local areas, and see what they are studying.*
- *I would recommend this program to another teacher because I enjoyed the other participants, the instructors and the location of the camp. I have not had an environmental science course before this and greatly enjoyed the hands on experience. The instructors provided us with interesting information and experiments and demonstrations that we can actually do with our students. The graduate students were knowledgeable nice, and helpful. The camp is in a beautiful location with good facilities and tasty food.*

C. Nevada Summer Science Institute for Teachers

Background of the project

The Nevada Summer Science Institute (SSI) for high school teachers was hosted by the Clark County School District (CCSD) during the summer of 2011. The institute was a partnership between the University of Nevada, Las Vegas (UNLV) Curriculum and Professional Development Division and CCSD. It was intended to educate teachers about climate change and the methods used to study and learn about this topic. The SSI also helped teachers develop ways to incorporate information regarding climate change into their curriculum. A UNLV curriculum development team provided the curriculum for the SSI. The 2011 SSI was held in Death Valley. It included an information session, a classroom component, and a field experience. The field experience included an overnight camping trip to a high elevation area in Death Valley National Park. Participants camped in tents and cooked outside. In 2012, due to funding cuts and priority shifts the institute was not offered in 2012 so the partnership was not possible.

Background of the evaluation

The 2011 SSI evaluation form was developed by the summer institute program leaders and was designed to determine if the four goals were met. A full evaluation report was included in the 2010-11 Quarter 4 report and is summarized below.

Summary of evaluation findings

Participants in the Nevada Summer Science Institute

Thirty-seven teachers completed sign-in sheets and 36 teachers completed the evaluation survey (97% response rate). The sign-in sheet captured demographic information such as gender, affiliated institution, years taught in Clark County School District (CCSD), and Nevada Teaching License endorsement subjects. Seventeen different schools were represented by teachers participating in the science institute. The three schools with the most teachers in attendance were Green Valley High School (5), Western High School (5), and Clark High School (4). Most respondents have been teaching in the CCSD between one and nine years (78%). Only one person reported having been in the CCSD for 20 or more years. The majority of participants have a Nevada Teaching License endorsement in biological sciences (75%).

Quality and usefulness of the Nevada Summer Science Institute

Participants rated each of the components of this institute on a four-point Likert scale that ranged from *not helpful at all* to *very helpful*. The components rated were graduate credits, stipend, final project, content, pedagogical strategies, field experiences, Moodle, and collaboration with other teachers. Each was rated as *very helpful* on average indicating participants found all aspects of the institute helpful.

Impact of the Nevada Summer Science Institute

Participants rated the level of goal achievement for each of the four summer institute goals on a 3-point Likert scale from 1 to 3 (1=*did not meet goal*, 3=*exceeded goal).* For each of the four goals, all participants reported the goal was *met* or *exceeded*. Participants also explained how participation in this institute has helped them reach each of the four goals. As shown in Figure 2 the institute met each of its intended goals and teachers indicated a number of important impacts on their knowledge, teaching practice and networking.

Figure 2. Nevada Summer Science Institute key findings and achievement of project goals

Goal	Key Findings and Comments	Goal met?
Goal 1 - Increase teacher content knowledge	• 66% reported goal was exceeded • *We were given plenty of information before, during and after the camping trip to be able to better understand what we were looking at.* • *I now know a great deal more about Death Valley, its history and dropstones.* • *I learned information about earth's strata that I did not know before.*	**Yes**
Goal 2 – Develop an understanding of climate change, through space and time, at Death Valley National Park:	• 64% reported goal was exceeded • *Learned a lot about! I typically focus on a narrow subject, but there are so many climate change connections and Death Valley was a great place to learn about them.* • *Loved the blend of location and online material to help understand climate change on a geological timescale.* • *The info and online lesson that used Google Earth and fossils to map the movement of Earth's plates to infer climate change was interesting.*	**Yes**
Goal 3 – Experience using models for implementing scientific argumentation (MEL)	• 61% reported goal was exceeded • *MELs provided a fantastic critical thinking platform for science!* • *Now I feel very comfortable using the MEL – both designing and integrating it into the classroom.* • *What a great tool! I am excited to start using as soon as I get back in the classroom. Gives me something to look forward to in August.* • *Good activity. Easily adaptable for use in the classroom.*	**Yes**
Goal 4 – Provide opportunities for collaborative planning and networking	• 58% reported goal was exceeded • *Met new teachers and had ample time to discuss topics.* • *Group work was efficient and productive.* • *Collaboration planning and teamwork helped with MEL development, data collection and technology use*	**Yes**

D. New Mexico CI for Industry
Background of the project
During the summer of 2010, New Mexico EPSCoR facilitated a focus group to identify and clarify the needs of the business and industry communities in New Mexico. In light of those findings, the State Committee decided to collaborate with Fast Forward New Mexico, (http://www.fastforwardnm.org/) to increase cyberinfrastructure awareness and promote economic development opportunities. Fast Forward New Mexico (FFNM) has a number of different sponsors[1] including internet providers, NM EPSCoR, and local and national non-profits. FFNM offers free, hands-on computer and internet training and classes for personal use and business development in communities in New Mexico. Classes are held public libraries, community centers and other community settings. EPSCoR Track 2 funding enabled expansion of the program to three high-need and/or Native American communities:

- Silver City – General audience English-speaking communities
- Crownpoint – Navajo communities
- Espanola/Ohkay Owingeh Pueblo – Spanish-speaking and Native American communities

During the 2011-2012 project year, FFNM conducted 24 computer training classes, hosted two cyberinfrastructure guest speakers, conducted four case studies, and initiated collaborations with small business owners in these three communities.

Background of the evaluation
FFNM developed pre and post-surveys to assess the quality of their presentations and the impact of their trainings on targeted areas of improvement (knowledge, interest, ability, and awareness of resources). They developed a pre/post survey for each of three audiences: General audience, Navajo communities, and Spanish-speaking communities. Each of the three survey versions was slightly different and the pre- and post-surveys were slightly different from one another. Participants were asked to complete the surveys online at the training lab and before and after their training. While survey data was collected from participants in each session, more data was collected from the Silver City general audience classes than from either the Crownpoint or the Ohkay Owingeh Pueblo classes. A full evaluation report including the survey instruments was in included in the 2011-12 Quarter 1 report and is summarized below.

Summary of evaluation findings
Participants in the CI for Industry project
A total of 24 trainings were offered during the current reporting period: Twelve classes in Silver City, eight classes in Crownpoint and four classes in Espanola/Ohkay Owingeh Pueblo. A description of the number of participants, classes offered, and total hours are shown in Figure 3. Demographic questions were included in the pre-survey only and not answered by all participants. The majority of respondents learned about the trainings through the library (n=137), made less than $10,000/year (31%), were 61 years or older (59%), had no children living in the home (37%), and currently had internet access in their homes (68%). Because data collection was uneven across the three sites it is not clear how representative these demographic characteristics are of all training group participants.

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[1] http://www.fastforwardnm.org/about/sponsors

Figure 3. Computer trainings offered by Fast Forward New Mexico

	Silver City – General audience	Crownpoint – Navajo communities	Ohkay Owingeh Pueblo and Spanish speaking communities
	#	#	#
Participants	118	115	25
Classes	12	8	4
Total hours	708	690	150

Quality of the CI for Industry project

Questions about the quality of the training and the presenter were included only on the general audience and Spanish-speaking post-survey. Only fifteen people completed this section of the post-surveys. Participants rated the quality of the computer trainings and the trainer. On average participants found the training was well-organized, used practical hands-on activities, covered an appropriate number of topics and skills, and fostered positive classroom interactions. The trainer was rated as professional, knowledgeable, flexible and responsive to questions, and succeeded in creating a comfortable and enjoyable learning environment. Thus, the results indicated that respondents felt very positively about the training and the trainer.

Impact of the CI for Industry project

As shown in Figure 4 there is evidence that the program was effective in meeting targeted areas of improvement. Findings indicate the program increased participant's knowledge, ability and confidence in basic computer skills. In addition, the overwhelming majority of participants indicated that they were more aware and interested in CI resources available through their library.

Figure 4. CI for Industry key findings and achievement of program goals

Target area of improvement	Key Findings and Comments	Goal met?
Increase knowledge, ability and confidence in using basic computer operations	Significant gains were found from pre- to post-survey scores suggesting that the trainings improved participants' knowledge, ability, and confidence in using basic computer operations.	**Yes**
Improve attitude about the importance of computer skills	Participants' attitude toward the importance of computer skills increased in six out of seven areas, however, none of the gains showed statistical significance. The area of self-image (skills that affect sense of independence confidence, or relevance) showed greatest increases.	**In progress**
Increase awareness that the library offers resources beyond books and circulating media.	38% agree, 53% strongly agree	**Yes**
Increase likelihood to consider other programs and trainings offered at the library.	30% agree, 63% strongly agree	**Yes**
Increase awareness of the library as a resource for improving digital and computer skills.	34% agree, 58% strongly agree	**Yes**
Increase awareness of the library as a resource for small businesses and business related skills.	35% agree, 57% strongly agree	**Yes**
Increase interest in exploring the library's digital resources and databases.	36% agree, 57% strongly agree	**Yes**

E. New Mexico New Mexico GUTS & Supercomputing Challenge (SCC)

Background of GUTS

Growing up thinking scientifically (GUTS) means learning to look at the world and ask questions, develop answers to the questions through scientific inquiry, and design solutions to their problems (www.projectguts.org). It is a summer and after-school science, technology, engineering and math (STEM) program for middle school students. It was designed to be a feeder program for the Supercomputing Challenge. The four main components of the GUTS program are:

- **Student Round-ups** - Conducted in June/July
- **Summer Teacher's Institute** (STI) - Teachers attend classes at New Mexico Tech and learn computer modeling and how to help their students with their modeling projects.
- **Roundtables** - Conducted at the end of each semester in which teams present and discuss.
- **Supercomputing Challenge Expo**. – Students attend this end-of-year culminating event.

Background of the SCC

The main goals of the Supercomputing Challenge program (www.challenge.nm.org/) are to teach teams of middle and high schools students how to use powerful computers to analyze, model and solve real-world problems and to teach computational thinking in science and engineering to high school students. The teams have mentors that provide support and answer questions for them throughout the year. There are a variety of different activities throughout the year in which the teams or their teachers participate, including:

- Summer Teacher's Institute - teachers are taught computer modeling and how to help their students with their modeling projects
- Summer Roundups - workshops are given locally for teams and teachers on an as-needed basis. These workshops teach computer modeling, how the challenge works, and other materials to both students and teachers.
- Kickoff - teams have introductory classes on modeling, data analysis, and other topics related to the SCC
- Proposals - teams write a proposal for a project that is reviewed and commented on by members of industry and academia
- Interim Reports and Evaluations - teams write up their progress about halfway through the year. The teams travel to a college near them and present their current work. These presentations and reports are also reviewed and commented on by members of industry and academia and suggestions are given to help the teams and/or their projects and point out areas to focus on to help them complete their projects
- Final Reports - teams write up a final report at the end of the year. The final reports are judged to determine finalists but feedback is given to all the teams.
- Expo - the culmination of the year - teams presents their work to panels of judges and receives feedback on their presentations and reports. Awards, scholarships, and prizes are given to many different teams, not just the winners. It is held at Los Alamos National Lab (LANL).

Goals of GUTS and SCC programs

GUTS and SCC share the same five goals:

Goal 1: Maintaining interest in interest is staying with the program for the entire year, especially for female and under-represented minority students.

Goal 2: Increase students' knowledge in computational thinking

Goal 3: Increase student's skills in computational modeling

Goal 4: Increase student's self-efficacy in computational thinking

Goal 5: Increase students' desire to enroll in computing classes and pursue higher education and/or a career in computing

Background of the evaluation

In collaboration with the project leads, the evaluator created a survey for SCC and GUTS students to assess achievement of program goals. The survey assessed participants' perception about whether the program met each goal and asked them to rate their own abilities/interest and perceived gains. A paper-pencil survey was administered at the end of the Supercomputing Challenge Expo. Data was also collected from project leaders regarding the number of schools/clubs, teachers, facilitators, students and other individuals involved in the programs. A complete report of the evaluation can be found in the 2011-12 Quarter 3 report.

The Summer Teacher Institute survey was developed by the summer institute program leaders and was designed to assess participant demographics, quality of implementation of the STI, and impact participation will have on teachers and students. The survey was comprised of 17 questions. The first section of the survey asked respondents to report on general information such as school affiliation, position, number of years in computer science and current skill/comfort level. The next section asked participants to rate the quality of the workshop and how well the workshop prepared them to perform a series of activities. Lastly, teachers were asked about their plans for the upcoming school year, intentions on implementing SCC/GUTS programs, and any barriers to implementing those programs. A complete report of the evaluation can be found in the 2010-11 Quarter 4 report.

Summary of evaluation findings

Participants in the GUTS and SCC programs

The primary participants in GUTS and SCC are high school students, their teachers, and volunteer facilitators from academia and industry. The number of SCC volunteers hasn't been closely tracked over the years, but the project lead indicated that in the past few years about 80 volunteers help at the kickoff and 80 to 90 help at the end-of-year Expo. Between 300 and 500 students have participated in each program over the past years since the SCC/GUTS program began. As shown in Figure 5, the number of schools involved in each program has increased considerably over the past four years: from 15 to 39 for GUTS and 31 to 57 for SCC. The majority of students who participated in each program were female and Caucasian, however, about a quarter of participants were underrepresented minority students. Participating students were in grades 5 to 12 and most students had a GPA over 3.00. Nearly a third participated in the free lunch program, an indicator of lower-income.

Figure 5. GUTS and SCC school and district level participation across all years

	2008-09	2009-10	2010-11	2011-12
GUTS				
Clubs (Schools)	15	30	25	39
SCC				
Districts	14	20	18	26
Schools	31	49	50	57

Participants in the GUTS program consists of facilitators, teachers, and students. As shown in Figure 6, student participation increased the most during the 2009-10 academic year whereas facilitator and teacher participation increased the most during the 2011-12 academic year.

Figure 6. GUTS program participants
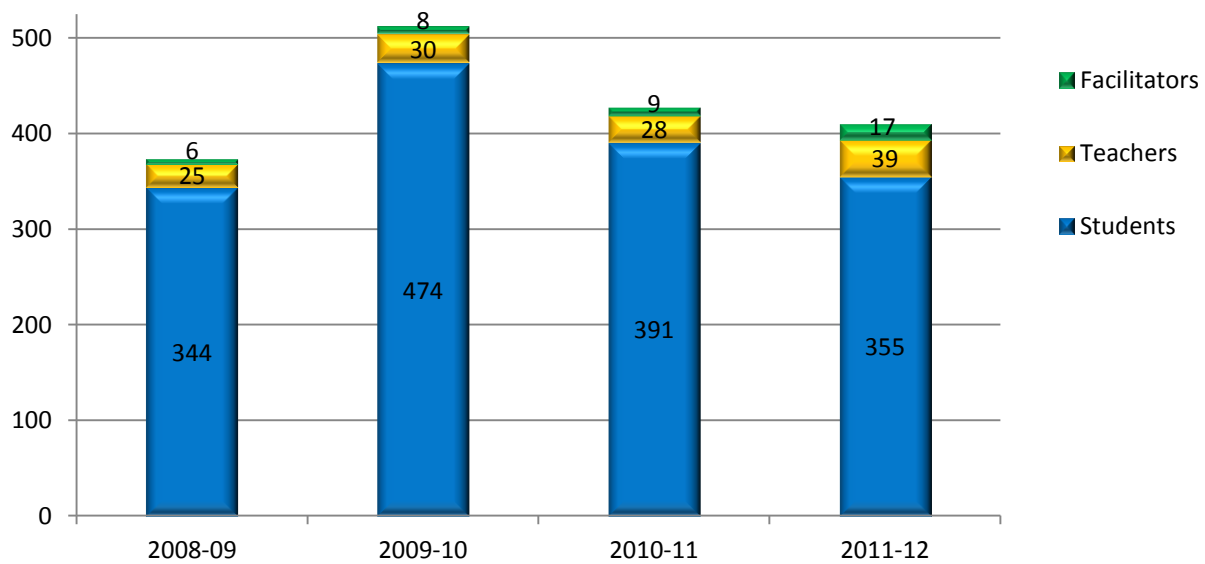
Participants in the SCC program consist of teachers and students. As shown in Figure 7, teacher and student participation showed marked gains in the 2011-12 year.

Figure 7. SCC program participants
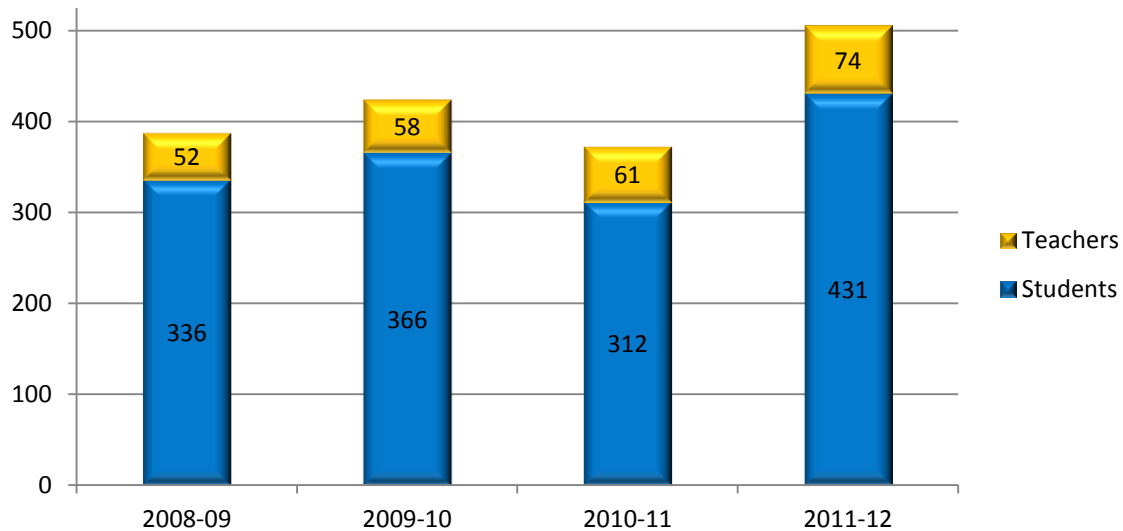
Quality and usefulness of SCC/GUTS program components

Teacher participants indicated the teaching materials, delivery of instruction, and the organization of the STI were *very useful*.

Respondents commented on the most valuable and enjoyable STI activity. Most participants felt that the hands on projects were most helpful followed by the opportunity to collaborate with other teachers.

- *I really found it valuable to have real time to work on the Starlogo code and gain more understanding of how to manipulate the program. I am more confident in directing my students. I really enjoyed meeting other teachers and working with them to see how they process.*
- *I loved the Networking! The project work was very rewarding. I met and spent time with great people and I will be sad to leave. I had fun and learned a tremendous amount. I hope to continue discussions, networking and communicating with my new found friends.*

As shown in Figure 8, there is evidence that the program was effective in meeting SCC and GUTS program goals. Findings indicate that the student program was successful in increasing participants' interest, knowledge and skills in computational modeling, confidence, and desire to enroll in computing classes. In addition, the overwhelming majority of teacher participants at the Summer Teacher Institute indicated they were more prepared to deliver STEM materials to students instructionally.

Figure 8. SCC/GUTS program key findings and achievement of program goals

Program goals	Key findings and comments	Goal met?
Student participant findings		
Goal 1: Maintain interest is staying with the program for the entire year, especially for female and under-represented minority students	Over half the students reported that the program either excelled at this goal or achieved it very well. At least 70% of participants in both programs reported good or great gain in their curiosity about computational modeling and in their enjoyment in working with computers	**Yes**
Goal 2: Increase students' knowledge in computational thinking **Goal 3:** Increase students' skills in computational modeling	Over half of the participants in both programs reported that the program achieved very well or excelled at achieving this goal. Half, and in many cases over 70% or more, agreed or strongly agreed with nearly all the statements regarding their skills, abilities, and knowledge in computational modeling. At least 70% of participants in both programs reported good or great gain in their knowledge, skills and abilities related to computational modeling.	**Yes**
Goal 4: Increase student's self-efficacy in computational thinking	Over 70% of SCC students agreed the program achieved this goal very well or excelled at achieving its goal of increasing confidence in computational thinking. Over half of each group was confident about their ability to present information and using technology in presentations. Over half also believed they have what it takes to be a good programmer. Over 75% of each group was confident in their ability to work on a team	**Yes**
Goal 5: Increase students' desire to enroll in computing classes and pursue higher education and/or a career in computing	Over half of the participants in both programs reported that the program achieved this goal very well or excelled at achieving the goal of increasing their desire to enroll in computing classes. Over 75% of students strongly agreed they anticipate completing a college degree. Sixty percent of SCC students plan to pursue a degree in a science related area, compared to less than 40% of GUTS students. Thirty-three percent of SCC students are interested in learning more about computational modeling, compared to 11% of GUTS. Approximately 50% in each group plan to work in a computer related field.	**Yes**
Summer teacher institute findings		
Goal 1: Introduce teachers to complex science and computational tools and methods	Over half of participants indicated an intermediate to advanced level of comfort in understanding complex systems. More than 70% of participants indicated an intermediate, advanced, or expert level of comfort in using software to graphically display numeric data and being able to use such tools to facilitate student learning.	**Yes**
Goal 2: Advance teachers' knowledge, understanding, and skills	More than half of participants indicated feeling very to extremely prepared in delivering STEM material to students.	**Yes**
Goal 3: Prepare teachers to support Supercomputing Challenge and/or Project GUTS teams	More than half of participants indicated that they expected to implement any of the following: CS4HS approaches (60%), Computational modeling approaches (91%), and mathematical modeling approaches (87%). Additionally, participants also indicated plans to start a Project GUTS afterschool club (56%) and incorporating the GUTS/SCC material into classroom curricula (56%).	**Yes**
Goal 4: Provide ongoing support to teachers who will recruit and assist students in STEM endeavors	More than half of participants indicated they would like ongoing support in developing NetLogo coding skills.	**In progress**

F. Tri-State Consortium annual meeting and workshops

Background of the project

The three member states of the EPSCoR Tri-State Western Consortium held joint meetings in 2009, 2010, 2011, and 2012. Each meeting intended to facilitate collaboration and partnerships between scientists and institutions in the three states. The meetings served as an important setting for communication among the participants in Track 2 and brings together participants in the three states' Track 1 EPSCoR grants, the Track 2 EPSCoR grant, and some are affiliated with neither grant.

Background of the evaluation

Evaluation of the meetings has varied over the years. Registration and evaluation survey data has been used to assess participation, usefulness and satisfaction, and impact of the Tri-State Consortium Annual Meeting. According to the previous evaluator, web-based evaluation form was administered to individuals who had been registered for both the 2009 and 2010 meetings. The form included questions about demographics, their reasons for attending the meeting, quality assessments, benefits, suggestions for improvement, and improvements in collaboration. The current evaluator developed evaluation instruments assessing participant demographics, reasons for attending the meetings, quality, benefits, suggestions for improvement and collaborative efforts. Instruments were designed to give useful feedback to project directors. Evaluation surveys developed by the current evaluator were reviewed by project directors, and improvements and suggestions were incorporated into the surveys. The current external evaluator administered an on-line survey to 2011 meeting participants. For the 2012 meeting, paper-pencil evaluation forms were administered to attendees. Complete evaluation reports for the 2009 and 2010 meetings were included in the Year 1 report written by a previous evaluator. A complete report of the 2011 meeting was included in the 2011 Quarter 2 report and the complete report of the 2012 meeting was included in the 2012 report completed by the current evaluator. The evaluation process and findings are summarized in this report.

Summary of evaluation findings

Participants in the Tri-State Western Consortium Annual Meeting

As shown in Figure 9 meeting attendance has steadily increased each year and the number of undergraduate and graduate students has increased considerably. One hundred people attended in 2009, 174 in 2010, 188 in 2011and 191 in 2012. In the 2012 Meeting evaluation, respondents indicated which of the prior meetings they attended. Of the 56 respondents[2], eleven had attended the first meeting, 24 had attended the second meeting and 23 had attended the third meeting. Consequently, 10% of the people who attended the first meeting, 24% of the people who attended the second meeting, and 23% of the people who attended the third meeting also attended this meeting. Variation in attendees is an indication of broadening participation in this Track 2 project. It may also indicate that students have graduated and moved on to other locations and because sessions change each year different people choose to attend the conference based on their area of expertise and interest.

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[2] Day 2 evaluation form

Figure 9. Tri-state Consortium attendance
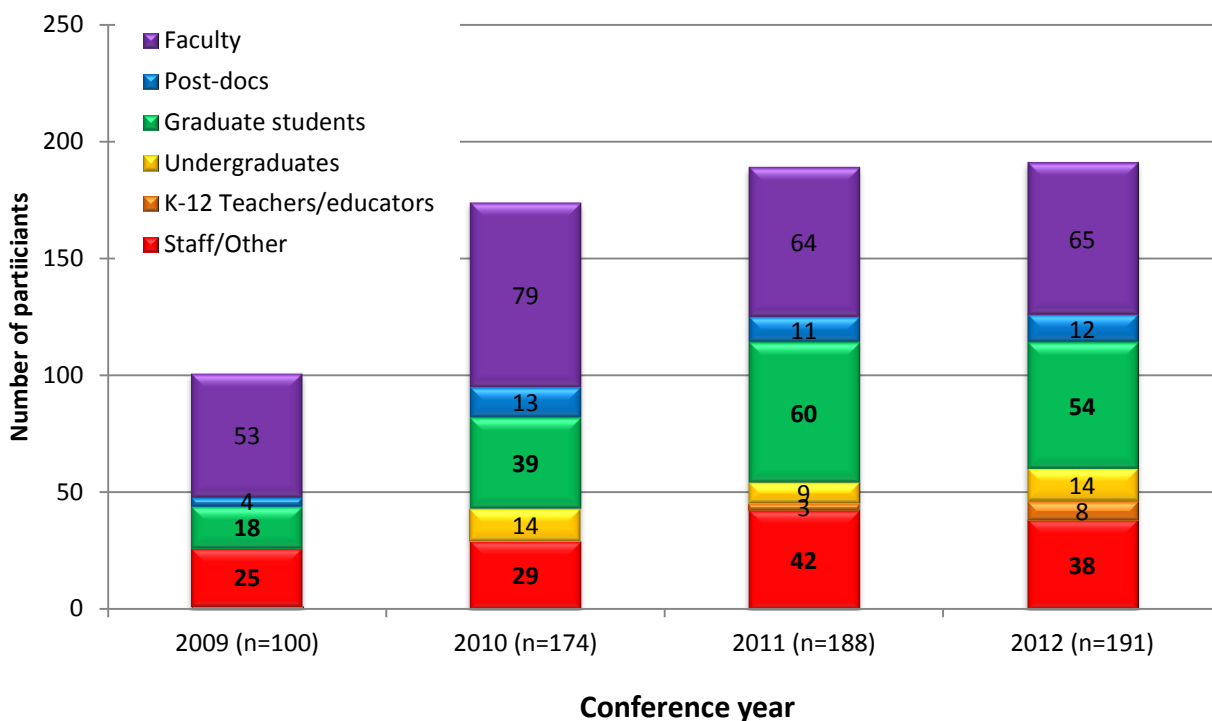
As illustrated in Figure 10, meeting participants have come from many different institutions across the Tri-state area.

Figure 10. Institutional affiliation of Tri-state Consortium participants by state

Institutional affiliation of participants		
Idaho	**Nevada**	**New Mexico**
Boise State University College of Southern Idaho Idaho State University Idaho National Lab EPSCorR State Office ID	Desert Research Institute University of Nevada, Las Vegas University of Nevada, Reno NSHE State Office	New Mexico Highlands University New Mexico Tech. New Mexico State University University of Idaho University of New Mexico Diné College NM Museum Natural History Santa Fe Institute EPSCorR State Office NM NMCAC

Quality and usefulness of the Tri-State Western Consortium Annual Meeting

In each year of the past three years participants have rated the quality of sessions offered at the meetings on a 5 point scale. The rating scale varied each year. In each year participant ratings indicated the positive impression of session quality, with most ratings in the 3-4 range. In the 2012 year, participants indicated the usefulness of sessions and whether they achieved program objectives. Most sessions were rated in the 4-5 range, indicating the meeting was successful in providing high quality sessions.

Impact of the Tri-State Western Consortium Annual Meeting

Professional activities

Following both the 2011 and 2012 meetings, respondents indicated they were either *very* or *highly* likely to use the information they had gained in the workshops and meetings in their research, classroom or work. In 2010, 2011 and 2012, meeting participants indicated professional activities in which they engaged as a result of attendance at the previous Tri-state meetings. As shown in Figure 11, in each year, the most frequently cited activity was the generation of ideas that improved participant's research.

Figure 11. Percentage of participants reporting professional activities that resulted from attendance at prior to Tri-state Consortium meetings[3]
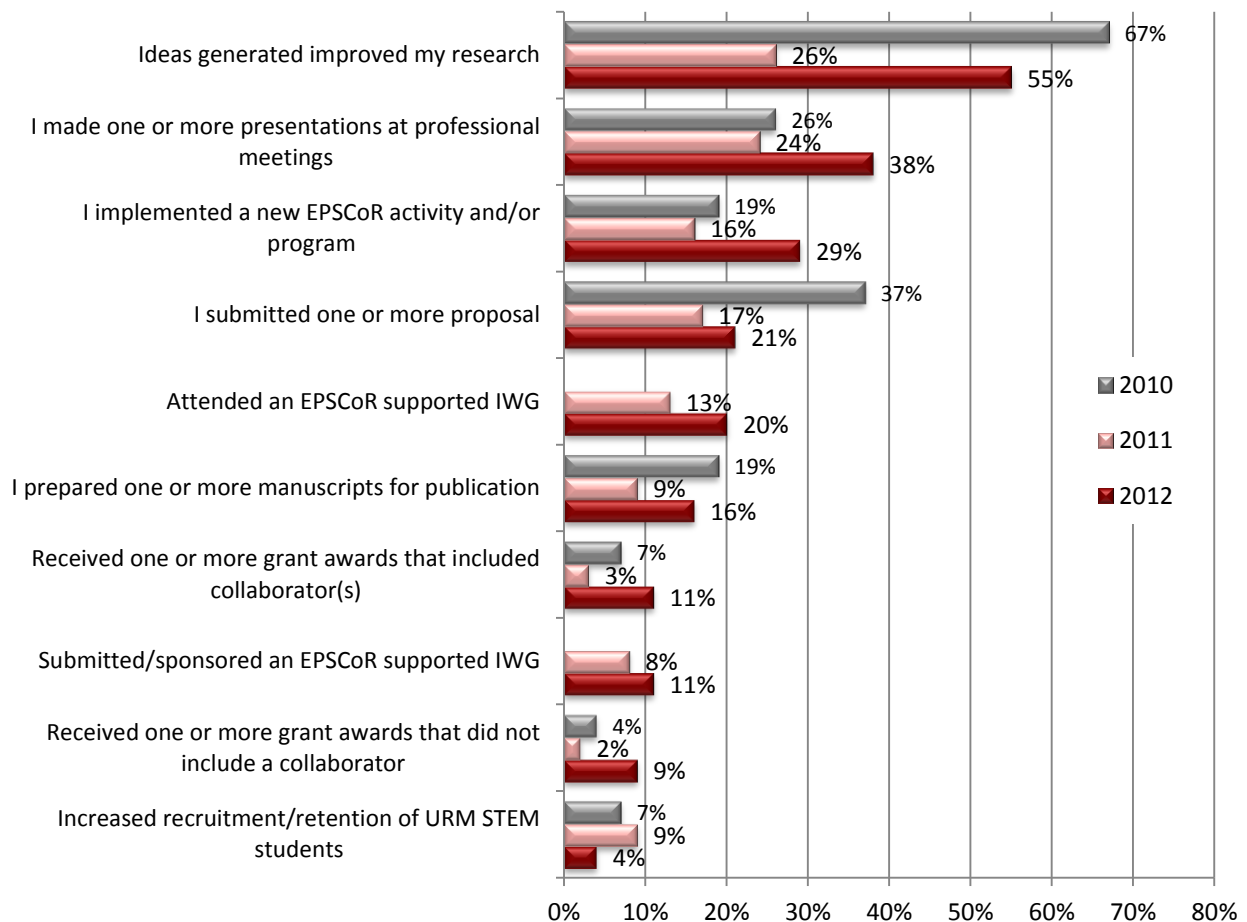
Collaborations

When asked their reasons for participating in the meetings, participants each year most frequently cited the opportunity to collaborate. The majority of participants in the 2010, 2011 and 2012 meetings strengthened collaborations that resulted from this or prior Tri-state Consortium meetings. As shown in Figure 12, 50% or more of 2011 and 2012 respondents reported initiating new and strengthening existing collaborations.

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[3] Items about Innovation Working Groups (IWGs) were not included in the 2010 Meeting evaluation form.

Figure 12. Percentage of respondents strengthening or initiating new collaborations while attending Tri-State Consortium
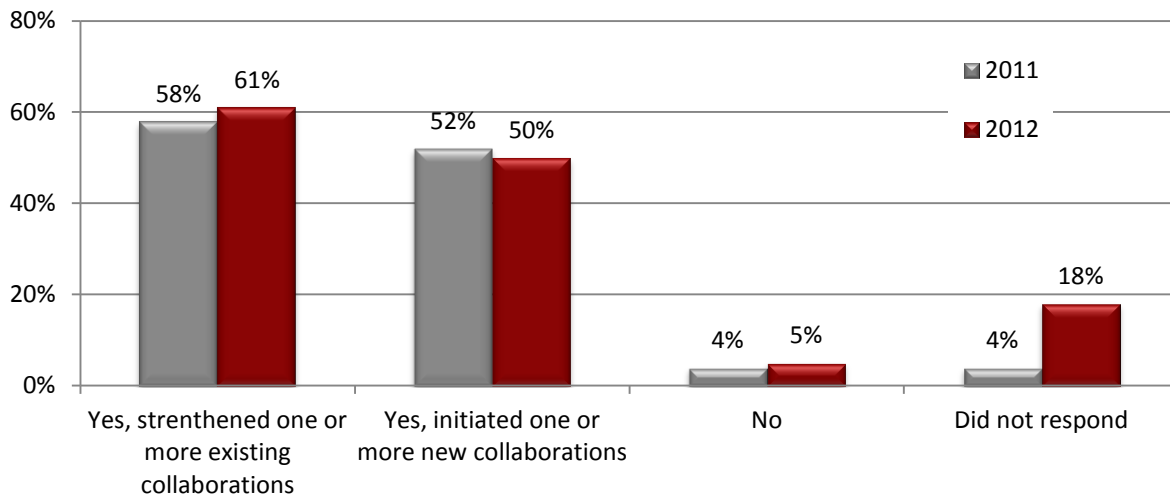
Meeting goals met

For the 2012 meeting evaluation only, respondents rated the how well the meeting met the stated goals of the meeting organizers. As shown in Figure 13, the largest proportion of respondents indicated that the meeting was successful in meeting all of its goals. Its strength was in facilitating collaboration.

Figure 13. Tri-State Consortium key findings and achievement of program goals

Goals	Key Findings	Goal met?
Goal 1 - Knowledge: Increase understanding of climate research and education	51% Good 35% Excelled	**Yes**
Goal 2 - Collaboration: Increase collaboration and interdisciplinary efforts between the tri-state participants	30% Good 54% Excelled	**Yes**
Goal 3 - Increased opportunities: Increase common regional scientific, education, outreach and CI opportunities	49% Good 29% Excelled	**Yes**
Goal 4 - CI Integration: Provide a venue for further CI integration	36% Good 27% Excelled	**Yes**
Goal 5 - Diversity: Facilitate implementation of Tri-state diversity strategic plan	44% Good 23% Excelled	**Yes**

G. Tri-state CyberInfrastructure (CI) Training Opportunities

Background of the project

Cyberinfrastructure (CI) Training Opportunities grants fund opportunities for EPSCoR participants to broaden their knowledge of cyberlearning and climate change research. Faculty and students in the tri-states could apply for and receive funding to attend national workshops on computation and climate change.

Background of the evaluation

The CI Training Opportunities survey was developed by program leaders at Idaho State University and revised by the evaluator. The purpose of the survey is to assess the value of the CI training opportunity and the impact of participation in the CI Training on participants. The survey is comprised of fifteen questions. The first seven items ask participants to report on demographic characteristics. The next two items ask participants to report on whether the training they attended met their expectations. Participants responded to these items using a 5-point scale (0=*N/A*, 1=*did not meet my expectations, 4=far exceeded my expectations).* The next four open-ended items ask respondents to report whether the training enhanced their ability to conduct research and/or increased their knowledge and skills of climate change and cyberinfrastructure literacy. The last two items were open ended questions. The first item asked participants to comment on the application and award process. The second item requested participants to offer general comments or suggestions regarding the CI training they attended. The project leader emailed the evaluation to all CI training attendees. The project leader then emailed all completed surveys to the evaluator.

Summary of evaluation findings

Participants of CI trainings

The number of individuals supported by CI Training Opportunities has varied over the three funding years: 3 sought funds in 2009-2010, 20 in 2010-2011, and 9 in 2011-2012. In 2010-2011 the program held a Parallel Computing Course attended by participants in the tri-state area which contributed to the larger number of participants for that year compared to the others. The number of participants by gender and state is shown in Figure 14.

Figure 14. CI training participant gender by year and state
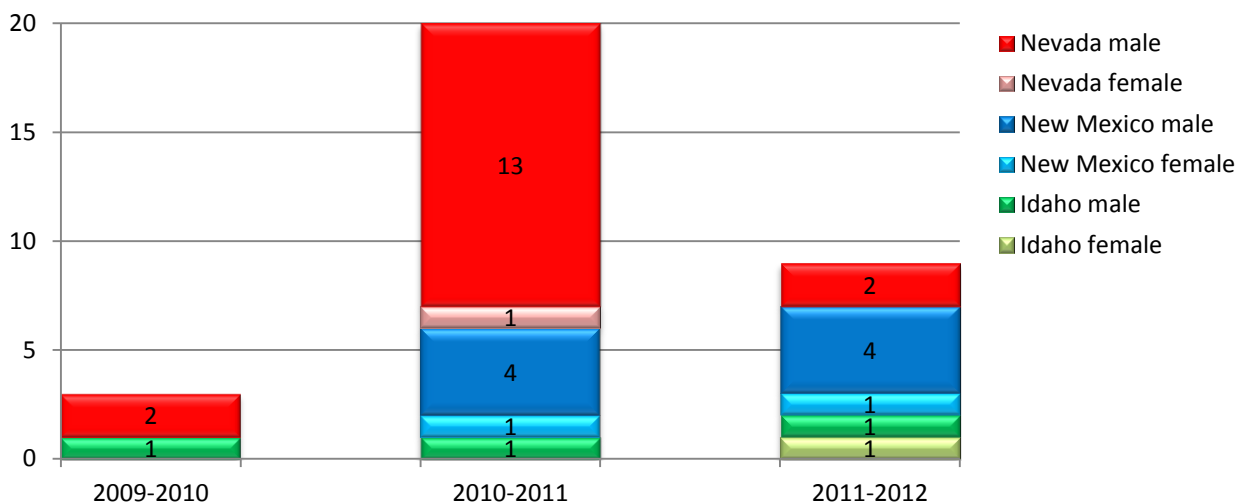
The number of underrepresented and non-underrepresented minorities who participated in CI training activities by state is shown in Figure 15.

Figure 15. CI training URM and non-URM participants by year and state
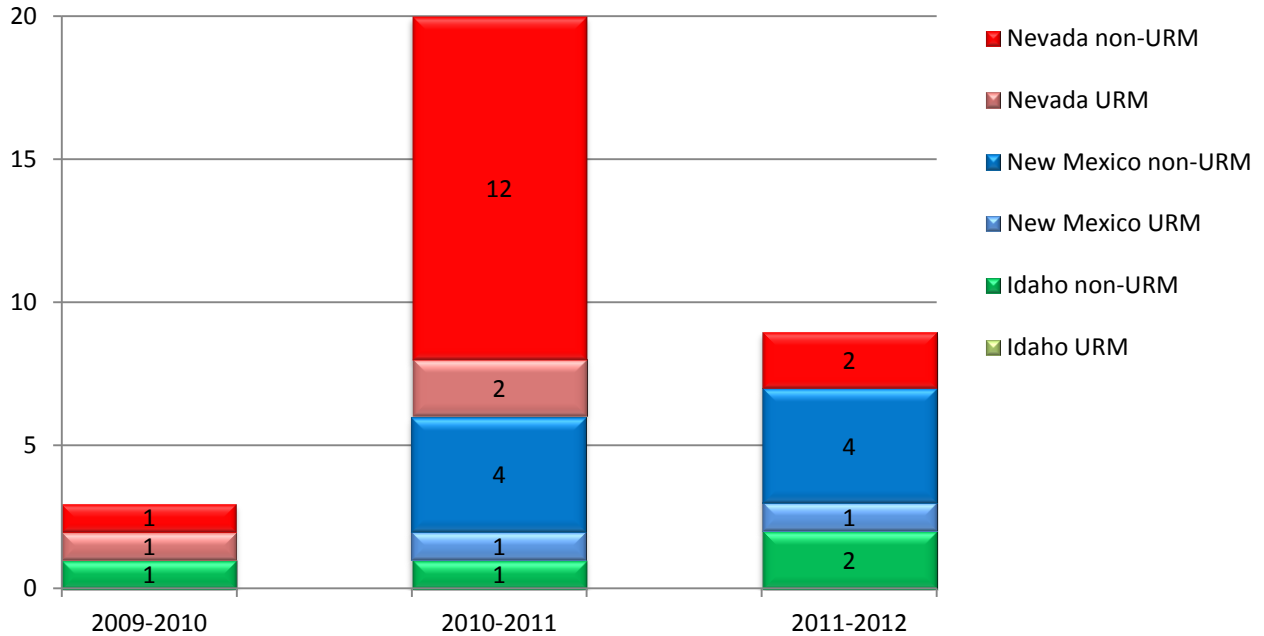
Impact of the CI Training Opportunities program
Figure 16 lists all the training activities that CI Training fund recipients attended each year by state. Funds were used to support attendance at a wide variety of workshops and conferences. Nevada had more participants than the other states. Also shown is participants' ratings of whether the experience *met* or *exceeded* their expectations for improving their scientific capabilities and CI-literacy. For most workshops, the majority of participants believe the experience exceeded their expectations in both their scientific capabilities CI literacy.

Figure 16. CI training opportunities achievement of program goals

Workshop attended	Number of participants			Increased scientific capabilities?	Increased CI-literacy?
	ID	NM	NV	Average Rating	Average Rating
Total receiving funds	**4**	**10**	**18**		
Year 2009-2010					
Process-Based Analysis of Lidar Topographic Data–Workshop[4]	1	-	-		
WRF Users Workshop	-	-	1	Met	Met
CI Summer Institute for Geoscientists	-	-	1	Exceeded	Exceeded
Year 2010-2011					
CUAHSI Conference on Hydrologic Data and Information Systems	-	1	-	Exceeded	Exceeded
AWRA Summer Conf: Integrated water resources management	-	1	-	Exceeded	Met
2nd IEEE International Conference on Cloud Computing Technology and Science	-	1	2	Exceeded	Exceeded
Workshop on Active Internet Measurement	-	-	2	Exceeded	Met
IEEE International Parallel & Distributed Processing Symposium	-	-	6	Met	Met
Securing the Cloud: Hands-On	-	-	1	Exceeded	Exceeded
Conferences in Shanghai, China and Hong Kong	-	-	1	Exceeded	Met
Parallel Programming and Cluster Computing	1	2	2	Exceeded	Exceeded
Supercomputing C10 Education Program	-	-	1	Met	Met
ACM CHI 2011	-	-	2	Exceeded	Exceeded
ACM SIGCOMM	-	-	1	Exceeded	Exceeded
Year 2011-2012					
ISO19115/19139 Geospatial Metadata Training	1	-	-	Met	Exceeded
2012 AWRA Spring Specialty Conference GIS & Water Resources VII	-	1	-	Exceeded	Exceeded
SC11 (Supercomputing) Conference: Tutorials, Workshops, Technical Sessions, Exhibition	-	3	2	Met	Met
3rd Santa Fe Conference on Global and Regional Climate Change	-	1	-	Met	Met
Weather Research and Forecasting (WRF) Model User Tutorial	1	-	-	Exceeded	Exceeded

Participants described how the training increased their awareness, skills, and knowledge in cyberlearning/cyberinfrastructures, and/or their scientific knowledge. They also indicated how the training enhanced their abilities and how they will apply what they learned. Key comments by participants are included in Figure 17 and illustrate the program has had a meaningful impact on both CI literacy and participants' skills and research programs.

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[4] Demographic data but no evaluation form was available for this workshop participant.

Figure 17. CI Training workshop comments

<table>
<tr><td>**Key comments about the impact of CI Training workshops**</td></tr>
</table>

Will this training enhance your ability to conduct research in your scientific field?

- *Yes. Computer modeling and manipulation of large datasets are critical skills in the field of hydrology. Learning to use the WRF model and more generally how to compile and run computationally intensive models will be extremely helpful as I more forward in my research. I was also introduced to several additional datasets and tools that will potentially be very useful.*
- *It taught me about new ways to better use our computing hardware, like GPU acceleration.*
- *Showed me areas where different programming languages could possibly improve the performance of my code.*
- *The interactions and contacts made with the professionals and peers at the training will result in follow-on research grant submissions, publications and possible future collaborations.*

Has this training increased your awareness, skills and knowledge in the area of cyberlearning and/or cyberinfrastructure literacy?

- *I learned about cloud computing and how it can be used for research.*
- *I have better understanding of how large-scale parallel models are implemented on supercomputing clusters.*
- *I learned what national laboratories and supercomputing centers offer in terms of educational programs (and curricula) and outreach efforts. I also learned of materials for do-it-yourself supercomputers (Little Fe).*
- *It provided insight into a particular standard, the intricacies of that standard, and the possibilities of manipulating it to improve discovery of datasets in information systems.*

Will you be able to apply what you have learned to your studies, research and/or career?

- *Yes. Knowing more about parallel computing will help me work on larger problems without being as limited by the restricting of normal computing. I will be able to develop better visualizations by using parallel computing.*
- *Yes. With the knowledge gained through the workshop, I will be able to convert my computationally expensive programs to benefit from the parallelism on the UNLV supercomputing cluster.*
- *The conference helped a lot in getting me exposed to the recent topics being researched in the community. It also helped greatly in getting to know the researchers.*

How has this training increased your awareness, skills and knowledge in the area of climate change or other scientific disciplines?

- *It increased my understanding to develop data-intensive scientific software applications and their complexities involved in designing and constructing the infrastructure and framework. Real-time access to a large amount of data requires careful and sophisticated designs of both hardware and software to provide reliable and secure data storage and delivery.*
- *In lectures regarding the model physics and various parameterizations I learned a great deal about meteorology, climate, and weather modeling. Conversations with other tutorial participants also presented a great opportunity to learn about other fields and topics of current research.*
- *We discussed the current and future state of Internet measurement and analysis. Through this workshop, many well-known and successful researchers get together from all around the world working on CI related topics. Attending this workshop gave me the opportunity of meeting with all this well-known researchers. Additionally, I presented our research project. This gave me the opportunity of getting many valuable comments and suggestions about our project*
- *The training has increased my awareness, skill and knowledge in the area of scientific computation and problem solving. I learned ways of distributing tasks and/or data to improve (less solving time, larger problem size, smaller component size…) the problem solving process especially with computers.*

H. Tri-state Cyberlearning Summit

Background of the project

The Cyberlearning Summit was a two day conference held on January 26-27, 2012 in Jemez Springs, NM. The purpose of the Summit was to bring together EPSCoR participants who have been working on K-12 cyberlearning activities in the tri-states. The summit had three focus areas:

- Educational programs for students and/or teachers (e.g., GUTS, SCC)
- Curricular Materials (e.g., UNLV climate units)
- Resources for using data (e.g., the MOSS HIS portal, visualization tools)

Background of the evaluation

The evaluator created an evaluation form for the meeting in consultation with program staff and posted it online at www.zoomerang.com.. After the summit concluded a link to the evaluation form was emailed to the list of participants provided to the evaluator by program staff. After the initial emailing, two reminder emails were sent requesting that participants complete the evaluation form. A full evaluation report was included in the 2011-12 Quarter 2 report and is summarized below.

Summary of evaluation findings

Participants of the 2012 Cyberlearning Summit

Twenty-three (88%) of the twenty-six registered participants completed the summit evaluation form. Most of the survey respondents were white (83%) and more than and half of these participants were female (52%). Individuals from a wide variety of institutional affiliations and positions attended this summit. Six attendees hold positions at The University of Nevada, Las Vegas (26%) and five hold positions at the University of Idaho (22%). The largest groups represented were university faculty members and graduate students (17%) each. Secondary education professional and individuals who worked for programs aimed at middle and high-school students were also in attendance.

Quality and usefulness of the 2012 Cyberlearning Summit

Participants rated the level of usefulness of each of the summit's sessions on a five-point Likert scale from *not useful at all* to *extremely useful*. Overall, the sessions were used very positively: on average they were rated as *very* or *extremely useful*. Many expressed appreciation for hearing about the educational opportunities occurring in other states and the collaborations the summit fostered.

Meeting goals met

For the 2012 meeting evaluation only, respondents rated the how well the meeting met the stated goals of the meeting organizers. As shown in Figure 18, the largest proportion of respondents indicated that the meeting was successful in meeting all of its goals. Its strength was in facilitating collaboration.

Figure 18. Cyberlearning Summit key findings and achievement of program goals

Goals	Key Findings	Goal Met?
Goal 1 - Learn more about the activities, programs, and materials that have been supported by NSF EPSCoR in three states.	22% achieved well 74% excelled	**Yes**
Goal 2 - Identify components that are suitable for scaling and/or disseminating to other locations.	44% achieved well 30% excelled	**Yes**
Goal 3 - Identify mechanisms, including funding opportunities, to scale and/or disseminate components.	44% achieved well 30% excelled	**Yes**
Goal 4 - Develop publications to share information about cyberlearning activities, programs, and materials.	26% achieved well 13% excelled	**In progress**

Selected comments

- *During the session wrap-up, I identified the following next steps for me - active participation in development of an IWG that will seek to formalize a tool for capture/archive, identifying(author, jurisdiction, content, cognitive model, delivery, etc.) and presenting in/formal learning activities developed by TSC EPSCoR.- in the above context - contact NSDL to understand/share how TSC might upload content to this source (and keep EPSCoR recognition) - identify Department of Ed representatives from ID, NV, NM that will attend/participate in TSC Annual Meetings in April - Design a K-12 hands on learning activity (working snow pillow) for snow water equivalent measurement and present it at TSC meetings in April - take active part in upcoming EPSCoR dialog for grant renewal.*

- *I will attend a working group session to continue work on a common curricula collection at the Tri-State Conference in Idaho. I am working with other participants to develop a student lab activity simulating the collection of Snotel data.*

I. Tri-state educational materials development

Over the course of this project, each state has assembled teams to develop educational materials for STEM secondary school teachers. Each state used a different process to develop, assess, implement, and disseminate materials. The current lists of curricular materials that have been developed within the three states are posted at the following websites:

Idaho: http://www.idahoepscor.org/DrawOnePage.aspx?PageID=237
Nevada: http://climatechange.education.unlv.edu/?q=node/153
New Mexico: http://nmepscor.org/content/teaching-resources

Recommendations

The evaluator recommends that a tri-state searchable database of science-based educational materials be created that can be accessed as a STEM education resource throughout the three states and ultimately throughout the country.   Each lesson should have searchable tags (ie. scientific topic, tittle of content standard, name of lesson, lesson contents, pedagogical model, and target grade level). The database should include an Amazon review and rating system and a blogging/suggestions capability. Curriculum developers nationwide should be able to submit curricular materials to be posted on this website. Creation of this database could be submitted as an innovation working group or national level proposal. The database should be piloted with teachers then advertised and presented at tri-state and national conferences.   An example of what this database should contain is shown in Figure 19.

Figure 19.   Example database for tri-state educational materials

Scientific Topic	Tittle of Content Standard	Name of Lesson	Lesson Contents	Pedagogical model	Target grade level
Idaho					
Data visual-ization	Science: Goal 1.6: Understand Scientific Inquiry and Develop Critical Thinking Skills Goal 1.5: Understand Concepts of Form and Function Math: Goal 3.4: Understand the concept of functions.	Visualize your data!	Data Graphing Hands-on activities PowerPoint List of lab equipment	5E Inquiry	6 - 12
pH	Math: Goal 1.1: Understand Systems, Order, and Organization Goal 1.2: Understand Concepts, Processes of Evidence, Models, Explanations Goal 5.1: Understand Common Environmental Quality Issues, Both Natural and Human Induced	Field-based pH lesson	Field tests	5E Inquiry	5 - 12
Citizen science	Goal 1.6: Understand Scientific Inquiry and Develop Critical Thinking Skills	How to be a Citizen Scientist	Field activities Brainstorming Designing a field research question or connecting to an existing program	Open Inquiry	5 - 12

The evaluator makes the following recommendations for future curriculum development efforts:

- Conduct a tri-state training session to teach prospective curriculum development leaders how to effectively development quality curricular materials. Require all curriculum development leaders to attend the training before they submit a proposal to develop curriculum.
- Curriculum developers within and among the three states should work collaboratively with a coordinated plan so efforts are not duplicated and materials are standardized.
- Identify a specific, research-based, effective process to develop curricular materials.
- Align curriculum with state standards (and Common Core Standards after they are developed). Identify standards that the curriculum addresses.
- Develop curriculum that utilizes data sets contained in the state data portals.
- Include a process to assess the quality, usefulness, and impact of the educational materials. Work with the evaluator to develop this process.

J. Interdisciplinary modeling (IDM) course
Background of the course
Funding for this four-hour graduate credit course, Interdisciplinary Modeling: Water Related Issues and Changing Climate, was provided by the Track 2 EPSCoR project. Dr. Laurel Saito was the Instructor of Record. As outlined in the course syllabus, the Interdisciplinary Modeling Course introduces participants to models that are available in different disciplines. Students learn how such models might be applied together to address water-related issues regarding climate change, address issues of variability and uncertainty in implementing interdisciplinary approaches, and gain experience in working in interdisciplinary teams to apply interdisciplinary modeling approaches to increase knowledge about water-related issues regarding climate change. Students will:
o   Discuss the philosophy of modeling
o   Become aware of models in different disciplines used to address water issues related to climate change
o   Work in interdisciplinary teams to explore issues and approaches associated with interdisciplinary modeling

Course Goals:

Goal 1: Increase awareness of models used in different disciplines to model water-related issues and climate change.

Goal 2: Increase knowledge of the challenges of applying models in an interdisciplinary context

Goal 3: Improve skills and confidence working in interdisciplinary teams to address complex issues

Goal 4: Increase confidence in doing interdisciplinary modeling

Goal 5: Increase enthusiasm for working with interdisciplinary modeling approaches for addressing water-related issues and climate change

Goal 6: Increase interest in interdisciplinary modeling

Background of the evaluation
The full evaluation results of the IDM course are included in this report, instead of a summary of findings, because survey results have not been reported previously. The evaluator developed four evaluation instruments to assess the quality of implementation and goal achievement: faculty course evaluation form (Appendix B), student pre-post survey (Appendix C), follow-up survey of previous participants (Appendix D), and daily course evaluation forms (Appendix E). The surveys were posted online at www.zoomerang.com. The course instructor was provided with direct links to the survey which she then provided to participants.

Evaluation participants
2012 IDM Course participants
Twenty-one students attended the 2010 IDM course and 25 attended the 2012 IDM course. Demographic characteristics of the 2012 IDM participants are shown in Figure 20. Participants were primarily male (68%) and Caucasian (68%) however 12% were from under-represented minority groups. Although not representative of the state's diversity (e.g., Nevada is 27% Hispanic/Latino, 8.6% Black and 1.6% American Indian), it may reflect the demographic characteristics of individuals in these professional fields. A third indicated their major was hydrology/water resources, 29% indicated their major was biology/ecology/wildlife and the remainder had a variety of other majors.

Figure 20. Demographic characteristics of IDM course participants

	IDM Respondents (n=25)	
	#	**%**
Gender		
Male	17	68%
Female	8	32%
Ethnicity		
African American/Black	0	0
Asian	4	16%
Caucasian or White	17	68%
Hispanic or Latino	2	8%
American Indian or Alaska Native	1	4%
Native Hawaiian or other Pacific Islander	0	0
Other: White/Asian	1	4%
Primary area of study/major		
Atmospheric Science/Physics	1	4%
Biology/Ecology/Wildlife	7	29%
Computer Science	1	4%
Economics	2	7%
Engineering (including Civil Engineering)	2	7%
Environmental Science	1	4%
Geography	1	4%
Geosciences	1	4%
Hydrology/Water Resources	8	33%
Planning, Natural Resources	1	4%

IDM Follow-up survey participants

The follow-up survey was completed by 43 students who participated in the IDM course the four times it was offered. As shown in Figure 21, the largest proportion (49%) who completed the follow-up survey took the course this year, although about a third took the course in 2010.

Figure 21. IDM follow-up survey participants by year

	Follow-up survey respondents (n=43)	
	#	**%**
Participation by year		
2005	7	16%
2008	1	2%
2010	14	33%
2012	21	49%

2012 IDM Faculty participants

Twenty-six IDM faculty completed a course evaluation. As shown in Figure 22, faculty were majority white (69%) and male (89%). As with IDM participants, the characteristics of faculty are not representative of the state of Nevada, they may be of faculty in these fields. Nearly three quarters were guest lecturers and the majority had participated in the course one time (58%). They came from a variety of institutions across the country, although most were from the Nevada, Idaho and New Mexico.

Figure 22. Demographic characteristics of IDM course faculty

	IDM Respondents (n=26)	
	#	%
Gender		
Male	23	89%
Female	3	12%
Type of instructor		
Co-instructor	7	27%
Guest lecturer	19	73%
Ethnicity		
African American/Black	0	0
Asian	3	12%
Caucasian or White	18	69%
Hispanic or Latino	4	15%
American Indian or Alaska Native	1	4%
Native Hawaiian or other Pacific Islander	0	0
Number of times participating		
1	15	58%
2	9	35%
3	2	8%
Institutional affiliation		
Boise State University	2	8%
Desert Research Institute	4	15%
New Mexico State University	4	15%
University of Idaho	3	12%
University of Nevada, Las Vegas	1	4%
University of Nevada, Reno	5	19%
University of New Mexico	2	8%
UNAVCO	5	19%
University of Washington	1	4%
Cornell University	1	4%
University of Miami	1	4%
Sandia National Laboratories	1	4%

Evaluation of IDM course components

Overall usefulness and quality of course components

On the post-survey, IDM participants rated how much various aspects of the course helped their learning on a scale of 1-5, 1=*no help*, 5=*great help*. Mean ratings for each component are shown in Figure 11. Ratings can be considered to trend towards positive or negative based on the following scale:

Great help   4.21 – 5.00
Much help   3.41 – 4.20
Moderate help   2.61 – 3.40
A little help   1.81 – 2.60
No help   1.00 – 1.80

As shown in Figure 23, most aspects of the course were rated as *much help* to their learning of interdisciplinary modeling concepts. The availability of online notes or presentations was rated *excellent* as was the perception that the instructor was supportive of the student as an individual learner. Students were less positive about the assignments and feedback. They rated the feedback on their work as *average* and graded assignments as *below average*.

Figure 23. Participant helpfulness ratings of IDM course components

Aspect of the IDM course	Rating
Structure of the class	
The instructional approach taken in this class	3.58
How the class topics, activities, reading, and assignments fit together	3.92
The pace of the class	3.42
Class components	
The lectures	3.50
Participating in class discussions	3.75
Laboratory exercises	4.17
The case studies	4.08
Assignments and feedback	
Graded assignments	2.50
Interdisciplinary modeling project	4.05
Feedback received on my work	3.38
Class resources	
The virtual textbook	4.00
Online notes or presentations posted by instructor	4.50
Class binder of materials	3.79
Information given	
Pre-course information about course content (i.e.: schedule, syllabus, location, etc.)	3.83
Information about course assignments	3.83
Information about course expectations	3.92
Support for participants as an individual learner	
Interacting with the instructors during and outside of class	4.46
Working with peers as part of the class	4.38

Participants' ratings of specific class activities are shown in Figure 24. Specific class activities were rated as being *moderate* to *great help* to their increase their learning of interdisciplinary modeling concepts with most rated as *much help*. Students rated doing class projects highest, whereas the Statistical Modeling lecture and doing evaluations of lectures was rated lowest.

Figure 24. Mean quality rating of IDM class activities
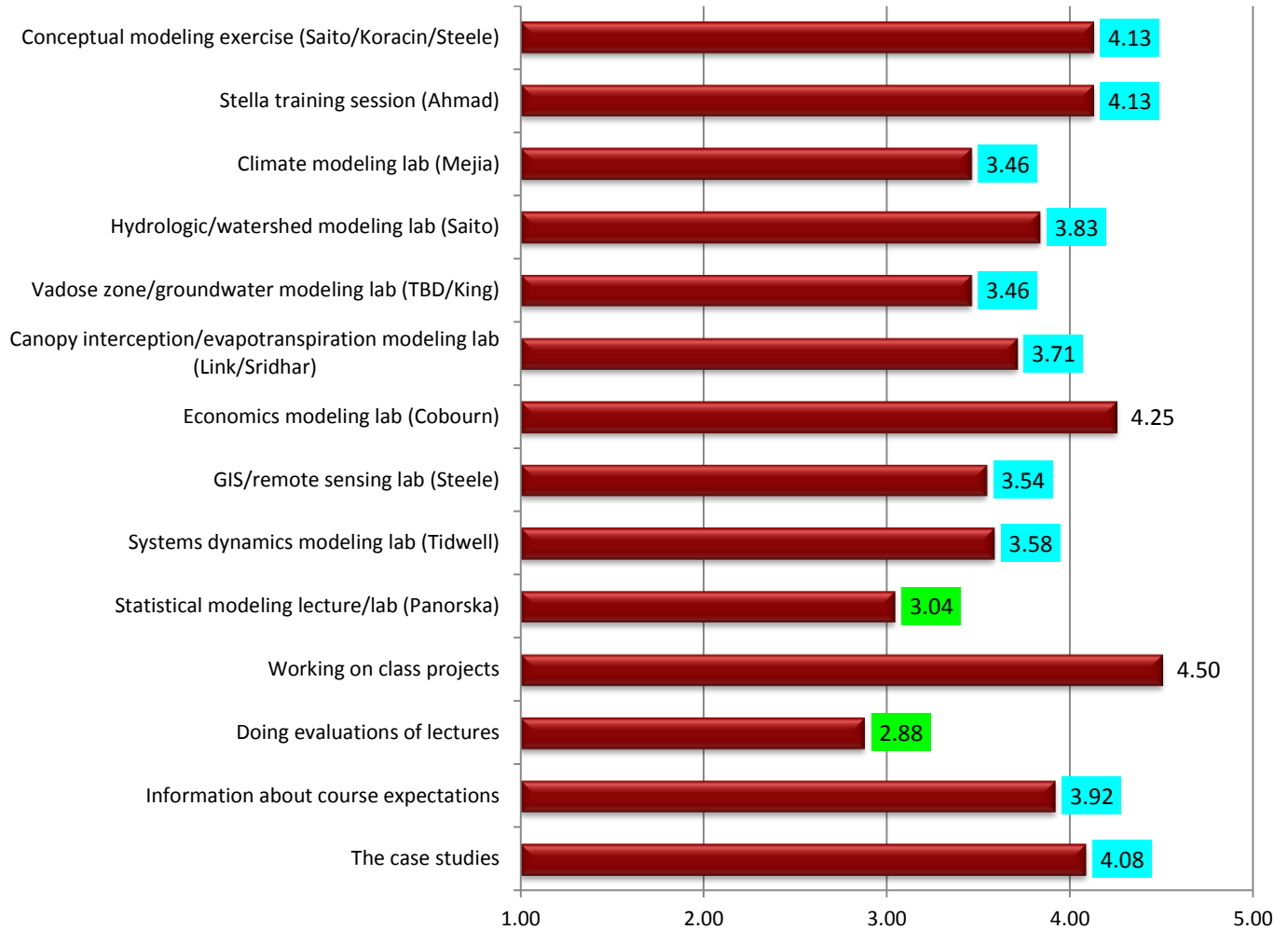
Participants commented on activities they found most effective, class topics that were not necessary and additional topics they would like to see covered. Responses are shown in Figure 25.

Figure 25. Participant comments about IDM topics and class activities

Activities participants found most effective
• *Classes that also had hands on activities were the most helpful in understanding the material. For example, Dr. Steele's GIS lecture was super helpful, since we actually got to do some GIS work.*
• *I found the course to have a variety of teaching approaches (lecture, lab, and one-on-one interaction with professors). Given the individuality of each student's learning style, it is difficult to say which approach is best. For myself, I found the labs and the one-on-one interaction the most helpful.*
• *I really liked the case study approach to explaining exactly how models are used in interdisciplinary studies.*
• *I think integrating lecture and lab exercises are most effective. I enjoyed that we had both, but perhaps in the future having the lab immediately following the associated lecture would help integrate the ideas better into our minds. Additionally, I think structuring it such that we have a day or even just a half day to recover midway through the course would be helpful for absorbing all of the material.*
• *Labs and interaction. The class goes too quickly for simple lectures, with most of the material being absorbed in review. I found most of the learning /in/ the class happened with lab exercise.*
• *Lecture and Lab together and working on the project was a big help.*

Class topics that were not necessary
• *Any of the lectures that did not have an accompanying lab component seemed out of place to me (e.g., mathematical modeling). It made it more difficult for me to be able to figure out how to apply the material to everyday scenarios.*
• *I appreciated the breadth of topics covered, because it is important to be exposed to the types of work being done in different disciplines. However, the depth of several of the topics was often overwhelming. Instead of trying to go too in-depth, I think it would have been useful to actually do what was being discussed (ie. labs).*
• *It would have been better to have less case study lectures.*
• *A bit too much focus on interception and ET in my opinion. I would have preferred to spend more time in Stella.*
• *The statistical part of the class is important, but the lecture is aimed at a lower level, which makes it not quite useful. It would be better in the future to skip some introduction content and go to some higher level stuffs.*
• *Although mathematics is the backbone of system dynamics modeling, the mathematics lecture was not that helpful for gaining skills in system dynamics. Also Darko's climate lecture was not that informative.*

Additional topics that should be covered in class
• *I think water law, policy, and management should be covered in this class because it plays a big role in how and what decisions can be made when managing water resources and if they can be carried out.*
• *I would have like to have been presented case studies where system dynamics use was laid out more clearly in a water/climate issue.*
• *I would have liked to see more statistical modeling.*
• *Phycology - this plays a great role in the understanding of group dynamics and would help people not only know their own personality and others around them but it helps people break down the differences in communication barriers and build team cohesion.*
• *Introducing students to computer programming would be really helpful. It will help them to develop model in any programming language or even help them understand use of System Dynamics Modeling software like Stella in more details. I think there are many parts of Stella requires some understanding of computer programming.*
• *More on economics modeling. For example, the taught economics modeling was very interesting and it was highly effective. But the model was not related with water and climate change. Similarly, the real topics of economics to be taught in this class is optimal control theory. It would be nice if we were taught about how can we develop a theoretical model and then we convert it into empirical model in STELLA.*
• *More advanced and applied statistics lecture/lab.*
• *Weather modeling would have been a good mix for short term forecasting. I would think a topic like this would be relevant to topics such as flash floods, which can occur in untimely circumstances.*
• *Water laws and policies. How do we include those and their effects in a model?*

IDM daily course evaluations

IDM participants rated daily course components on a Likert scale from 1=*extremely low* to 5=*extremely high*. They also explained how they will benefit from the knowledge they have gained, made suggestions to improve the presentations, and listed additional concepts they would have liked the presenter to have covered. Means can be considered to trend towards positive or negative based on the following scale:

Extremely high   4.21 – 5.00
High   3.41 – 4.20
Medium   2.61 – 3.40
Low   1.81 – 2.60
Extremely low   1.00 – 1.80

Day 1 Monday June 4

Twenty-five participants completed the evaluation of day 1. Course components rated in the *high* to *extremely high* range were the *Ethics of modeling and why model presentation, Conceptual modeling exercise,* and *GIS, remote sensing and snow hydrology modeling* presentation. The *Weather and climate modeling* presentation was rated in the *medium* to *high* range, and the M*odel concepts and issues* presentation was rated in the *low* to *medium* range. Ratings and comments are shown in Figure 26.

Figure 26. Ratings of IDM day 1 activities

Topic	Rating
8:15-9:15 Ethics of modeling and why model (Saito)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	4.32
Knowledge you gained about this topic.	3.96
How **beneficial** is what you have learned to you professionally and/or personally?	3.96
Effectiveness in increasing your understanding of the applications of this type of modeling.	4.00

Benefit of knowledge:
- *I will remember to document assumptions as I work through building a model.*
- *It will help my research and improve my understanding of models and model coupling.*
- *Validation/verification/calibration arguments are very useful for understanding how to philosophically test models.*
- *I will benefit from an understanding of the grassroots of modeling. The responsible steps/ethics discussion was something that I had not received in a typical graduate course.*
- *It was a good introduction to understand some of the terms and characteristics of the models*
- *More familiar with the basic concepts and limitations of models will help me to make better modeling decisions.*

Suggestions to improve presentation delivery:
- *I think there were some modeling terms that the instructor may need to explain more to those less familiar with modeling such as initial and boundary conditions.*
- *It was very clear and well thought out.*
- *Maybe a comparison between the ideas of validation/verification/calibration between the two required readings.*
- *The climate presentation had a bit too much jargon.*
- *Maybe talk more about bad things to do with modeling a bit more and common ethical problems.*

Additional concepts to cover
- *A point was made that knowledge should be based on scientific knowledge. There are many types of knowledge, and different ways of knowing. Could models be based on traditional, local knowledge? Perhaps we will discuss this later this week.*
- *I would've liked more integration of the first required reading (Caswell, 1976) because I think it addresses some important philosophical arguments about verification vs. Falsification. This was eluded to in lecture but not expressly discussed.*

Topic	Rating

- *A few more examples*
- *Misuse of modeling, although it appears to be covered later in the course.*
- *The first required reading wasn't really mentioned.*
- *A little more about the terms and differences about validation, confirmation and verification.*
- *Perhaps more into the issues encountered when trying to perform modeling in interdisciplinary teams (e.g. Communication issues, issues with defining a problem, etc.)*
- *I know this is the first day, and I'm sure if it was on a later day it would have been covered, but covering the last couple slide topics such as who is the audience, and what is the purpose of the model, especially since those topics came up in our group discussion*

9:15-9:55 Model concepts and issues (Koracin)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	2.60
Knowledge you gained about this topic.	3.28
How **beneficial** is what you have learned to you professionally and/or personally?	3.20
Effectiveness in increasing your understanding of the applications of this type of modeling.	3.12

Benefits of knowledge:
- *I thought the content was good that was discussed and I liked the history of the modeling*
- *The slide handouts will be handy for a review of modeling.*
- *This presentation gave me a better idea of the different types of models that can be used in science.*
- *The knowledge that was shared today will benefit the work I am currently doing for the urban heat island of Las Vegas, NV. Darko's presentation has brought upon variables to consider while modeling atmospheric phenomena.*
- *Overall, it is good to get an idea of the model types and the basic concept behind the formation of models from scientific concepts. This will help with the approach to modeling problems.*

Suggestions to improve presentation delivery:
- *The slides with equations felt out of place and disrupted the flow of the presentation, and I did not understand what the take-home message is. Slides with conceptual diagrams were more helpful.*
- *Explain modeling terms more for those who have less experience, create more figures, use more examples, and include discussion with students more.*
- *Very difficult to follow the text-heavy slides, particularly those that had font of less than 24pt and entire sentences.*
- *Koracin is clearly very sharp, but the monotone nature of his style is an obstacle. If he were to speak more to a lay audience, such as his explanation of why climate change models have real basis in truth, he is quite instructive.*
- *More examples and or conceptual representations. The equations were a little difficult to follow for someone not familiar with the topic.*
- *The amount of information on each slide was difficult to internalize. The speed of slide transition made it difficult to take notes or follow effectively.*
- *It was hard to understand how the different modeling types (e.g. model of data, model of theory, etc.) applies to what we are doing. Also hard to understand how artificial intelligence information applied to what we are doing. Maybe if the lecturer used some examples for how these apply to our interdisciplinary modeling.*
- *Definitions should be handed out a head of class to be read so that the presentation could be more interactive and the slides could be less wordy*

Additional concepts to cover
- *More concrete examples*
- *I already have some familiarity with the different modeling types, so this was a good lecture for reinforcing what i have already been exposed to. However, i can see how it could be daunting for people new to modeling. Maybe more diagrams to help explain the model types to people new to the subject.*
- *More basic ideas and issues about modeling would have been helpful such as issues of scale and time, and how those issues play themselves out in real-word interdisciplinary modeling examples. Also there wasn't much of any discussion for issues and difficulties in using models with stakeholders who are managing the landscape.*

Topic	Rating
10:05-12:00 Conceptual modeling exercise	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	4.00
Knowledge you gained about this topic.	3.76
How **beneficial** is what you have learned to you professionally and/or personally?	3.84
Skills gained in conducting this type of analysis or model.	3.75
Effectiveness in increasing your understanding of the applications of this type of modeling.	3.88

Benefit of knowledge:
- *Made me think about all different variables and disciplines that need to be considered when developing a model.*
- *It was great to discuss and learn how models are coupled with other disciplines. It gives me ideas on how I can incorporate my model with others.*
- *Valuable activity because I could see how people from different disciplines think and approach topics differently.*
- *Communications between groups is a key factor in the inter-disciplinary modeling. This discussion provides an opportunity of how an inter-disciplinary discussion would be.*
- *I may be implementing GIS in my work. Steele's presentation has given me more insight on what to look for when determining snow pack and vegetation in ArcGIS.*
- *I benefited from an understanding of the difficulties inherent in collaboration. It reinforced the idea that disciplines other than my own have systematic modeling difficulties.*
- *It definitely opened my eyes to the need for good and open communication between disciplines. There is a need to be able to see beyond your own box in order to appreciate the value other disciplines can bring to the table.*

Suggestions to improve presentation delivery:
- *Smaller groups and more time may have been helpful; it was a bit chaotic and disorganized trying to have ~10 people come to a general consensus within an hour.*
- *This activity would have benefited from a clear question. We could discuss the connections between the two types of models, but we really needed a question to focus our discussion.*
- *More input from the instructors at the table or more guidance as the purpose of the assignment. Perhaps let us choose which topic we would like to contribute.*
- *Keep the groups focused on something more concrete that is provided ahead of time in order to reduce aimlessness. Let the activity of dealing with the problem reveal challenges to interdisciplinary modeling.*
- *More hands on training. I wish we could have done more than one scenario.*

Additional concepts to cover
- *More human input encouragement*
- *Perhaps it would be good to have some key points to bring up in the discussion in addition to the class discussion. For example, the 10 heuristics of modeling that is in the extra reading material.*
- *Although it's tough to cover quickly, we could have briefly discussed HOW to have interdisciplinary dialogue, overviewing concepts such as defining scale, going over definitions, etc.*
- *Working with attribute tables and .shp file manipulation*

1:00-2:55 Weather and climate modeling (Koracin)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	2.84
Knowledge you gained about this topic.	3.44
How **beneficial** is what you have learned to you professionally and/or personally?	3.36
Skills gained in conducting this type of analysis or model.	3.40

Benefits of knowledge:
- *Good background for me because I may couple some downscaled climate models to some hydrologic watershed models I am working with.*
- *My Ph.D. dissertation is related with climate change. This will definitely help me to include one more chapter, related with global climate change issue, in my dissertation.*
- *I really didn't know anything about weather and climate modeling before, so learning an overview will let me have a better understanding in the future*
- *The second half of the presentation (climate modeling) was extremely useful and the figures and explanations were really helpful. I am excited to apply this information to the climate modeling lab on June 10th and hopefully I will be able to incorporate several of the different scenarios into my own research.*
- *Understanding that climate modeling efforts are intensive and potentially difficult gives me a new respect for the*

Topic	Rating

field. I'm looking forward to the lab!

- *This is my first class of GIS. I found it really interesting and useful. This class has encouraged me to take some more advanced course on GIS for using it on climate change modeling.*
- *Gave me a better understanding of how different models can give even different results of current landscape details (i.e., snow cover/vegetation). Hopefully I will be able to incorporate some of these scaling issues into my research.*
- *Great presentation. I learned a lot. This talk helped me the understand the remote sensing products. I will think about underlying mechanisms of MODIS and other products when I read the publications.*
- *The snowmelt runoff model presented in the slides seemed much simpler than the principal component analysis approach I've read is used by the NRCS for the Rio Grande. This model may be something for my agency to look into since we are involved in delivering irrigation waters.*
- *I will possibly use some of the methods of satellite data and using it for mapping snowpack for my research, and even if I don't use it, I walked away with a better understanding of how NDVI and NDSI work. Great presentation!*

Suggestions to improve presentation delivery:

- *Provide background reading; use more figures/examples on slides, increase discussion with students.*
- *This lecture came later in the day, and so concentration was difficult. I would suggest slides less busy and more colorful pictures to help keep focus. The social intensity of the subject matter did help.*
- *Some introduction how to make use of public available GCM output data can be included. For example, how to access the data, any simple way to use the global data for some regional work as a first try.*
- *More diagrams explaining some of the concepts, the wall-of-text slides could get tedious after 8 hour day.*
- *There was a lot of text and mathematical equations in the first half of the talk. In particular, equations were difficult for me to follow because I do not have a background in differential equations, and given the diversity in the classroom I doubt I am the only one.*
- *Less text, more examples.*
- *Less text in the slides and more interactive activities. Also more concrete examples would be helpful for me in the first part of the presentation.*

Additional concepts to cover

- *I think the lab should be right after the presentation*
- *The use of weather prediction in practice, for example, for agricultural use.*
- *Lots of concepts here and a lot were new to me. A little more explanation, perhaps through diagrams.*

3:05-5:00 GIS, remote sensing and snow hydrology modeling (Steele)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	4.40
Knowledge you gained about this topic.	3.92
How **beneficial** is what you have learned to you professionally and/or personally?	3.88
Skills gained in conducting this type of analysis or model.	4.00

Benefit of knowledge:

- *Overall the presentation was great, and I like the coupling of the lecture topics with a hands-on exercise. I had never come up with an NSDI before, and using Excel to determine applicability of various bands to detecting a specific land-cover type was very neat.*
- *I appreciated the hands on GIS work, it made me understand on a deeper level how the modeling process works.*

Suggestions to improve presentation delivery:

- *Provide background material on remote sensing ahead of time.*
- *Teach how we can generate the data to create images that were shown in the slide.*
- *Dr. Steele did a fantastic job preparing and executing the presentation and GIS/remote sensing exercises.*
- *Felt more like an intro remote sensing class. It would have been great to hear a bit more about the snow cover model in more depth.*

Additional concepts to cover

- *More in detail about how to obtain data from the various sources, but maybe we will cover this later.*
- *More GIS concepts overall.*
- *More of the basics terms, since I'm not familiar with this topic, that would help me to have a better understanding.*
- *This was a good intro to remote sensing. I've had some remote sensing experience, so I didn't learn much more, but it was good review. My 3's in question 18 are not a reflection of the quality of the presentation; they are more a reflection of my previous exposure.*

Day 2 Monday June 5

Twenty-five participants completed the evaluation of day 2. All course components were rated in the *high* to *extremely high* range. Average ratings and comments are shown in Figure 27.

Figure 27. Ratings of IDM day 2 activities

Topic	Rating
8:00-9:55 Systems of dynamics modeling (Ahmad)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	4.29
Knowledge you gained about this topic.	4.17
How **beneficial** is what you have learned to you professionally and/or personally?	4.00
Effectiveness in increasing your understanding of the applications of this type of modeling.	4.04
Benefit of knowledge: • *I have never used STELLA before and now believe it will be helpful for my research project.* • *This gives me another model to consider in my proposed research.* • *It helped me to get the bases for understanding how the system dynamics models works and it introduced me to the option on a new helpful tool.* • *It's a way that my project could possibly be extended. This presentation teaches me a way to connect to more stakeholders about what I do.* • *Allows me to consider a different approach to complex community ecosystem models.* **Suggestions to improve presentation delivery:** • *An opportunity to apply this learning experience to our independent research to make it directly applicable.* • *Instead of focusing on all of Stella's options, maybe use it in several different modeling problems* • *I liked working with Stella during the class. Maybe if Dr. Ahmad went a little slower with some of the Stella work, that would be helpful. Sometimes I missed a step and got behind. Also making the screen font bigger* **Additional concepts to cover** • *More Stella.* • *How to bring external data (e.g. excel worksheets) into Stella.* • *Could have talked about more specific examples of how system dynamics models have been used in real situations.* • *More interdisciplinary concepts. Perhaps more into the issues encountered when trying to perform modeling in interdisciplinary teams (e.g. communication issues, issues with defining a problem, etc.)*	
10:05-12:00 Introduction to Stella lab (Ahmad)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	4.04
Knowledge you gained about this topic.	4.25
How **beneficial** is what you have learned to you professionally and/or personally?	3.83
Effectiveness in increasing your understanding of the applications of this type of modeling.	4.00
Benefit of knowledge: • *This will be something for me to consider as I narrow down my research topic.* • *If Stella is available it may be useful to make a conceptual model to represent my more complex interdisciplinary hydrologic model.* • *Would be useful when interacting with engineers who use this approach.* • *STELLA seems very user friendly. If I get the opportunity, I would like to learn more about it and possibly implement it towards statistical problems.* **Suggestions to improve presentation delivery:** • *There are some important aspects not covered, such as how to run the model and how Stella may combine with other models. I would be hear that in the presentation.* • *I think it would have been better to switch between sharing Dr. Ahmad's computer and watching him work on each of our screens and tinkering with STELLA ourselves. I was lost a few times, so it really helped to be able to see what he was doing once we shared the view of his computer.* • *It would be nice if students were given some problem and were told to develop model.* • *Ahmad's went a little fast with his presentation. I have never used STELLA before so I just felt he could have slowed things down and gave greater explanation on what he was doing.*	

Topic	Rating
Additional concepts to cover	
• *I believe we'll go into more depth during the lab week, so as of now I have nothing to add.*	
• *It would be nice to have a deeper introduction to the software.*	
• *Importing data from other program*	
• *More coverage of some of the more advanced functions of STELLA would have been nice.*	
1:00-2:55 Vadose zone modeling (Heinse)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	4.54
Knowledge you gained about this topic.	4.04
How **beneficial** is what you have learned to you professionally and/or personally?	4.00
Effectiveness in increasing your understanding of the applications of this type of modeling.	4.00

Benefit of knowledge:
- *Having the extra knowledge definitely gives me a better appreciation of the Vadose zone. Knowledge is always good, and this gives me another potential dimension in my research.*
- *This definitely will help me for my research, but I for sure will need to expand the little that I learned today taking a complementary class... But it was great as an introduction to the topic.*
- *Some idea about major issues to be considered while developing systems dynamics model for my research.*
- *It's always good to know what is happening at ground level in regards to the atmosphere. This presentation has helped me take into account even more ground level phenomena.*
- *Much better understanding of soil water plant interaction. Useful for my study in watershed restoration. I really appreciated a break from power point presentations, and Dr. Heinse has a great teaching style. A discussion of modeling the VZ with bigger concepts like landscapes and social communities would be helpful*

Suggestions to improve presentation delivery:
- *The only thing is that for people that does not have previous knowledge on the topic it gets little hard to keep up the pace and understand all the details on such interesting but complex topics.*
- *Some actual numbers and run the actual model. Build a more intuitive conception of a model with numbers.*

Additional concepts to cover
- *He could have given a demonstration on vadose zone models.*
- *More practical work with modeling vadose zone processes - maybe doing simple mathematical solutions of a real world problem would be helpful.*

3:05-5:00 Groundwater modeling (King)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	4.40
Knowledge you gained about this topic.	3.96
How **beneficial** is what you have learned to you professionally and/or personally?	3.92
Effectiveness in increasing your understanding of the applications of this type of modeling.	3.92

Benefit of knowledge:
- *MODFLOW is potentially useful, and the discussion of current and historical local events and how it relates to water and water modeling was very useful.*
- *I got acquainted with some major issues in ground water modeling. I can use this knowledge for my research requirement paper that currently I am writing.*
- *The groundwater issues are fascinating. I hope to apply this to my understanding of phreatophytic plant issues.*
- *It's always good to know what is happening at ground level in regards to the atmosphere. This presentation has helped me take into account even more ground level phenomena.*

Suggestions to improve presentation delivery:
- *There were a lot of calculations, but it was good that he provided examples of how to use them.*
- *I would have liked to see examples of how modeling was used in the projects Dr. King shared with us. What are the questions they are trying to answer with modeling?*
- *I really liked the case studies of groundwater modeling issues and would have liked to have seen more of them.*
- *I wonder is it possible to move the excise section in the same day with the lecture? That might be better for us to learn both the underline theory and application techniques.*

Additional concepts to cover
- *Could have expanded a little more about groundwater modeling instead of talking about the concepts*
- *Limitations of MODFLOW and the different packages available in MODFLOW.*

Day 3 Wednesday June 6

Twenty-five participants completed the evaluation of day 3. Course components rated in the *high* to *extremely high* range were Addin*g people to the equation, Hydrologic/watershed modeling, and Vegetation-atmosphere, canopy interception modeling* presentations. The mathematical modeling presentation was rated in the *average* to *good* range. Ratings and comments are shown in Figure 28.

Figure 28. Ratings of IDM day 3 activities

Topic	Rating
8:00-9:55 Adding people to the equation (Wulfhorst)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	4.12
Knowledge you gained about this topic.	3.64
How **beneficial** is what you have learned to you professionally and/or personally?	3.56
Effectiveness in increasing your understanding of the applications of this type of modeling.	3.52

Benefit of knowledge:
- *When I talk with other modelers, I think it is important to be clear about the purpose of modeling for each specific case. For example, a social scientist can be involved in modeling in order to understand how iterative modeling processes help stakeholders engage, OR a social scientist could collect data to be used as input in an integrated model...or both!*
- *I will use what I learned about interacting with groups of people when conducting science or trying to implement practices.*
- *Incorporating people into models is an interesting idea and will be important when I try to translate my work into something that can be used for policy.*

Suggestions to improve presentation delivery:
- *Just to have more time to finish the brain storm exercise. I like the presentation, it was dynamic and interesting.*
- *Explain the concepts of agent based models a little more and explain the exercise a little more.*
- *Some of the sociology terms used were unclear for non-sociologists.*
- *Needs a higher level of specificity, presentation was confusing.*
- *It's really interesting for me as one who majored in a physical science discipline. If it is possible to have a real world ongoing application about the coupling of sociology and physical science (like hydrology).*

Additional concepts to cover
- *I would've liked a more thorough explanation of the online tool prior to the group workshop. However, the discussion in the class was good in regards to the issues of incorporating sociological data.*
- *More discussion about what social phenomena might look like as part of an integrated model...if on a slider or continuum, how would a program like STELLA compute the relationship between a social slider and an ecological component?*
- *Character of local knowledge and successful examples of any type of analysis (didn't need to be an actual model which was not the presenter's expertise).*
- *This topic is totally different from what I'm doing. It is great to know something new. I would like to know something fundamental in social science, like the statistic methods and how to collect data.*

10:05-12:00 Mathematical modeling (Telyakovskiy)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	3.76
Knowledge you gained about this topic.	3.16
How **beneficial** is what you have learned to you professionally and/or personally?	3.28
Effectiveness in increasing your understanding of the applications of this type of modeling.	2.96

Benefit of knowledge:
- *The beginning of the presentation was a good refresher of how to use mathematical models.*
- *I really enjoyed the lecture and can see many applications of this type of modeling. I hope to take a math modeling class in the future.*
- *There were a few key points that helped me understand some mathematical techniques, but it was a little too technical for me to be able to directly apply what I learned.*
- *The good news is now I know something about differential equations (very limiting though). Although it is a long*

Topic	Rating

way before I will use them, this talk help me understand how people do their researches in some areas that differential equations are often used.

- *Although I am not very mathematically minded, it was a valuable presentation, and I now have a place to look if I have questions.*
- *Dr. T did a great job of trying to make complex mathematics understandable to the non-math members of the audience (which is a very difficult thing to do) and he was very entertaining.*

Suggestions to improve presentation delivery:

- *Alex has great humor and he gave an interesting talk. I would have liked to know which step in the modeling process we were discussing as he explained different equations. Were they for specific variables, or were they for testing the model itself?*
- *This lecture could be more effective if it was accompanied by exercise or homework.*
- *He was a very good/enthusiastic presenter, but I felt he went into too much detail about the differential equations. It was a little hard to follow his presentation.*
- *Go slower in his explanation of concepts...maybe narrow it down more and focus on basics. Include more specific examples of how mathematic models can be applied.*
- *Assumed too high a level certainly for me, but apparently for many. The style was terrific, really liked the energy, but the examples were too abstract. Using the actual problem helped, but needed more concreteness.*

Additional concepts to cover

- *I would like more emphasis on the concepts behind the model types and their applicable uses. I've had lots of math background, unfortunately I haven't exercised the more advanced subjects in many years, so I got hung up on the explicit explanations.*
- *More statistical modeling.*
- *It was hard to know what we were modeling. I know we covered all the groundwater/infiltration information, but I was consistently confused what we were exactly modeling.*
- *Basics behind concepts.*
- *Something more fundamental, I really need to be walked in to this area at the very beginning.*
- *Is it possible to include more content about numerical modeling? I feel that I used numerical methods much more than analytical method; though sometimes I still cannot get the numerical methods work correctly.*

1:00-2:55 Hydrologic/watershed modeling (Stone)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	4.58
Knowledge you gained about this topic.	4.08
How **beneficial** is what you have learned to you professionally and/or personally?	4.29
Effectiveness in increasing your understanding of the applications of this type of modeling.	4.04

Benefit of knowledge:

- *With my work consisting of using urban canopy modeling, the canopy model brings several questions to mind. I would really like to look more into canopy model, and see how it compares to the urban canopy model.*
- *I don't think I will use this for my research, at least not on the short run, but it is really good information to know. I really like it.*
- *I've never had to conceptualize a hydro model before, so it was helpful to discuss what variables one should consider including with the snow model example.*
- *I really appreciated the big picture perspective, especially of the first few slides.*
- *It was really good, I liked the exercise, it make us think and make the lesson much more interesting and dynamic As of yet, this subject will likely be only peripherally related to my work, though I understand how it may become focal in the future. Dr. Stone is a very talented instructor and good at explaining complex material.*

Suggestions to improve presentation delivery:

- *Include different models that are commonly used for watersheds.*

3:05-5:00 Vegetation-atmosphere, canopy interception modeling (Link)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	4.66
Knowledge you gained about this topic.	4.33
How **beneficial** is what you have learned to you professionally and/or personally?	4.04
Effectiveness in increasing your understanding of the applications of this type of modeling.	4.17

Benefit of knowledge:

- *It was a really good presentation. It was very interesting and the presenter made it interactive and dynamic which I*

Topic	Rating
think it is the best approach to keep our attention for 2 hours on a road. Also the terminology wasn't as technical as in some or the other lessons and that make it easy to understand and follow.	

Suggestions to improve presentation delivery:
- *The beginning part regarding "what is modeling" seemed a little redundant considering we are 3 days into the class (although it did illicit a good response from the audience, so perhaps that was the overall goal and was successfully achieved).*
- *Maybe some interaction with other students on trying to predict/analyze processes.*

Additional concepts to cover
- *Include interception methods in all different forest/vegetation types or regions, e.g. conifer forests vs. deciduous vs. brush.*
- *Taking an actual example, but that will probably come in the lab.*

Day 4 Thursday June 7
Twenty-five participants completed the evaluation of day 4. All course components were rated in the *high* to *extremely high* range. Average ratings and comments are shown in Figure 29.

Figure 29. Ratings of IDM day 4 activities

Topic	Rating
8:00-9:55 Economics Modeling (Elbakidze)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	4.36
Knowledge you gained about this topic.	4.12
How **beneficial** is what you have learned to you professionally and/or personally?	4.08
Effectiveness in increasing your understanding of the applications of this type of modeling.	4.04

Benefit of knowledge:
- *This presentation will make me think more on how people will adjust if Las Vegas were to implement new standards for their water quality for my study. It also keeps me aware on how science can impact humans.*
- *I will probably need to consider the economic impact of laws and public land management agency resource management plans, particularly on those who depend on public land for their livelihood.*
- *I don't know how this can relate directly to my research, at least in the short term, but surely I think it is gonna be useful to me at some point.*
- *This was a good introduction to econ for me. It is a new way to approach problems, and definitely gives me another way to approach stakeholders.*
- *My passion for this subject is personally, not professionally, driven. It is related to my work in how I apply it to my understanding of the motivation and actinos of stakeholders concerning the effects of conservation actions.*
- *The idea in natural resources economic is totally new for me. It is interesting for me to know how economist's perspective. And I also want to try how the benefit of different water usage (hydro power vs. irrigated agriculture) can be modeled.*

Suggestions to improve presentation delivery:
- *Spend a bit more time on the interdisciplinary hydrologic economic model, and maybe some other similar projects.*
- *It was really good. The presenter was very good, I like how he used a lot of examples and make the class participate and the presentation dynamic. It was easily to follow and to understand.*
- *Give readings on basics of economics ahead of time so that more time could be focused on the environmental and modeling aspects.*
- *None significant. Perhaps prepare less material appropriate to time, though I would have liked to have touched on everything in the slides due to personal interest.*

Additional concepts to cover
- *It would be great to talk through all the slides. However, time limit.*
- *He could have included more hands on modeling with economics (instead of just lecture).*
- *I'd like to know more about contingent valuation - perhaps an example of what such an instrument looks like and how*

Topic	Rating

it is implemented.
- *It would nice to learn something about the topic of the markets for environmental services, how they have been progressing on the last years and what are the expectations for them in the future.*
- *I would have liked the presenter to cover more about tradeoffs dealing with environmental goods.*
- *Tragedy of the commons.*
- *Non-market valuation techniques.*

10:05-12:00 Ecological modeling (Boykin)

	Rating
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	4.36
Knowledge you gained about this topic.	3.96
How **beneficial** is what you have learned to you professionally and/or personally?	3.88
Effectiveness in increasing your understanding of the applications of this type of modeling.	4.04

Benefit of knowledge:
- *Although Dr. Boykin's studies focus on a larger scale and higher level (community) than mine, his studies provide good examples of conducting modeling projects with limiting data.*
- *I look forward to discussing ecological modeling with the wildlife ecologist I am working with. I am not sure if we will use badger occupancy in a model, but it was good to learn of ways such data has been applied.*
- *It helped show me how hydrologic models could be used in the ecology field and can indirectly be used for mapping species.*
- *Ecological modeling will be very important in my research. Even though this was more large scale than what I am interested in, the concepts are still important.*
- *This is directly related to my work, and as much as I have gone over this material, I still learned from this presentation.*

Suggestions to improve presentation delivery:
- *Less repetition in wildlife data gathering and more general on pitfalls and cautions as well as do's and recommendations.*
- *A lot of the terms were not defined. I frequently do this kind of work so it was easy for me to follow but I think a lot of the non-biologists might have had problems understanding terms like "phylogenetics."*

Additional concepts to cover
- *From his professional use of models and applicability, what would he suggest to be the most valuable thing/tool/knowledge upcoming students need to know to make them more valuable and open-minded modelers to impact the human/natural/environmental world.*
- *More in depth coverage of vegetative succession.*
- *More plant based modeling--plant processes.*
- *Look forward to the ecosystem services tie-in.*
- *I would have liked to see other models besides habitat suitability analysis. Perhaps time prevents this. The 3 on knowledge gained is more a reflection of my previous exposure rather than the content of the lecture. Overall it was a good lecture and good introduction to the topic.*

1:00-2:55 Thermal stratification modeling (Kreamer)

	Rating
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	4.48
Knowledge you gained about this topic.	4.28
How **beneficial** is what you have learned to you professionally and/or personally?	3.80
Effectiveness in increasing your understanding of the applications of this type of modeling.	4.00

Benefit of knowledge:
- *It is a very interesting talk in general. Dr. Kreamer brought me into a new area and provided very clear and interesting details. I don't think I will work in similar areas like his in near future, but I will go through the slides again and think about the processes in the lake systems. It will be beneficial for me to a better understanding of science in general.*
- *It helped introduce me to an aspect of surface water hydrology and modeling that I was not aware of before and that I could potentially use in the future.*
- *I will use this presentation for modeling impact of climate change on water demand.*

Topic	Rating
• *I have background in surface hydrology and some hydrogeology, however I've never really focused on Limnology. Most of my surface water deals with rivers, so this was a great lecture for me.*	

Suggestions to improve presentation delivery:
- *None significant. Perhaps prepare less material for the time constraints. Slow down speaking and relax. The lab exercise, though it had hiccups, was very informative and effective in conveying the subject.*
- *Maybe cover less and include the rest as supplemental information.*
- *Make it shorter and concise would help to follow the presentation better...*
- *Too many slides that weren't included in the handout or PDF. I couldn't see.*

Additional concepts to cover
- *More coverage of the governing equations regarding thermal stratification of lakes.*
- *Either more time for the lab, or have had the lab pared down to fit the allotted time.*

3:05-5:00 Evapotranspiration modeling (Sridar)

Topic	Rating
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	3.76
Knowledge you gained about this topic.	3.64
How **beneficial** is what you have learned to you professionally and/or personally?	3.56
Effectiveness in increasing your understanding of the applications of this type of modeling.	3.68

Benefit of knowledge:
- *This will be very useful to me because I need to calculate ET for my research and this presentation help me to understand this process better and also I learn that there are several ways to calculate this variable.*
- *This presentation gave me in-depth idea about ET which I will use for modeling rio-grande water management model on which I am currently working.*
- *Most of the atmospheric science classes I have taken have dealt mostly with upper air perturbations. It's nice to expand more knowledge of the meteorology that occurs in the surface. This science can benefit me when I deal with more mesoscale features.*
- *I will benefit of this in being able to use modeling ET to be able to do a mass balance of the soil. For instance, how much salt is being left behind.*
- *I am not sure how to apply ET modeling explicitly but understanding being exposed to the concepts could be an important conduit for communication with more specialized people.*

Suggestions to improve presentation delivery:
- *I feel a little unbalanced about the pase of the presentation. Too slow in the fundamental part but too soon for the modeling/studying part. I guess most students in the classroom should know the fundamentals well.*
- *How might evapotranspiration data be integrated with data about the social system? The explanation regarding irrigation demand was interesting. What other relationships (and problems) exist between people and ET that require modeling?*
- *It did suffer from the usual difficulties of coming last in a long day - perhaps an exercise or prop or discussion to shake things up under those circumstances*

Additional concepts to cover
- *Evaportranspiration. But there are many different simplified formulations for different situations (what data we have, what kind of research region we are in, and so on). It will be very interesting and helpful to show how some of those simplified formulas come out, what are the additional assumptions being made, etc*

Day 5 Friday June 8

Twenty-five participants completed the evaluation of day 5. All course components were rated in the *high* to *extremely high* range. Average ratings and comments are shown in Figure 30.

Figure 30. Ratings of IDM day 5 activities

Topic	Rating
8:15-9:00 Why the past matters (Biondi)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	4.52
Knowledge you gained about this topic.	4.28
How **beneficial** is what you have learned to you professionally and/or personally?	4.08
Effectiveness in increasing your understanding of the applications of this type of modeling.	3.96
Benefit of knowledge:	

- *While a really interesting lecture, I am not sure how I will use this in my research. The resolution of the climate records and how they can work together was very interesting.*
- *This lecture, accompanied with the history lecture, was quite eye opening in the importance of the perspective of history, both geological and historical.*
- *History definitely is important for placing a problem into the proper context. I saw a presentation recently using tree rings to look at historical climate in the Las Cruces area, and it makes one realize that the current drought we are experiencing is not out of ordinary.*
- *Exponentially grew my understanding of past ecological data sources, and expanded my thoughts of how to capture.*

Suggestions to improve presentation delivery:
- *The end felt a little rushed.*
- *I enjoyed the interactive egg exercise! I'd like to see more examples of this sort of modeling integrated with socio-economic data/information, if available.*
- *I wish this presentation could have been longer. I wanted to hear more.*

Additional concepts to cover
- *I would have like to hear the stuff on the rest of the slides on fire history!*
- *Would have loved to hear rest of his lecture.*
- *It might be interesting to have a short introduction about commonly used proxy data, like tree rings, lake sediments and so on; and how those data might be incorporated in modeling for other discipline?*

Topic	Rating
9:00-9:45 Use and misuse of models (Wilson)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	4.40
Knowledge you gained about this topic.	4.12
How **beneficial** is what you have learned to you professionally and/or personally?	4.16
Effectiveness in increasing your understanding of the applications of this type of modeling.	4.04
Benefit of knowledge:	

- *I think that it is always important to know how models can be skewed, intentionally and unintentionally. I think it is also really important to remember that models are meant to fit nature, not the other way around.*
- *This was a critical lecture, showing the perspective of what it is like working with models in the private sector as well as their use in court.*
- *Even though we have already covered some of the concepts it think this presentation help me to understand them better. Also I learned the importance of think twice before given things for settle to avoid committing common misuses on the modeling.*
- *Understanding the potential misuse of modeling efforts stresses the importance of transparency.*
- *Important for upcoming modelers to know problems associated with interpreting and reporting results.*

Suggestions to improve presentation delivery:
- *This definitely helps me by understanding what to do and what not to do in developing models.*
- *This was a very helpful presentation! I was just discussing models their and potential use with my PhD colleague yesterday, and we were getting mixed up on the different purposes for which one might apply a model. This presentation helped us pinpoint the distinctions between prescriptive models and other types.*
- *Would have liked to have seen some more case studies.*

Topic	Rating
Additional concepts to cover	
• *Talk about some of the examples of lying with statistics and how it happens both intentionally and unintentionally.*	
• *Looking at how different model outputs can give you different views of how well the model is working.*	
• *Great job expressing the problem in general. I want to know more about use and misuse in a more specific sample.*	
10:00-10:45 Issues of scale (Saito/Mejia)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	4.36
Knowledge you gained about this topic.	4.12
How **beneficial** is what you have learned to you professionally and/or personally?	4.24
Effectiveness in increasing your understanding of the applications of this type of modeling.	4.12

Benefit of knowledge:
- *The base information was well focused, and the atmospheric info was well based in a concrete example, so this helped me see how the abstract could manifest itself in a concrete experiment.*
- *The ideas introduced in this lecture are quite interesting to me, especially at that time when my paper has been suggested by reviewers to elaborate in uncertainty discussion. I plan to try MC in analyze the uncertainty later.*
- *Downscaling issues are helpful for me in understanding the assumptions behind the regional climate models I incorporate into my research.*

Suggestions to improve presentation delivery:
- *I could not read the charts or graphs on the power point presentation or on the printed copy of the power point. I think a group discussion session during which students discuss the different scales they work with and draw them out on a similar spatial-temporal chart would have been interesting and informative.*
- *I'm still a little unclear about how dynamical and statistical downscaling differ, so maybe a little more time explaining that to non-climate modelers would be helpful.*
- *A bit definition heavy which can make the material a little dry.*
- *I just wished for this presentation we had a little more time to cover all the material.*

Additional concepts to cover
- *I would have liked to hear more about how dynamical downscaling techniques work.*
- *It would have been nice to have had more time to elaborate on some of the concepts. Due to the shortened time, the presentations felt rushed.*
- *Some figures are hard to read. Even from computer.*
- *Wish this would have been a full 2 hour class it is really a big issue and could have gone into far more depth of the downscaling I wanted to get into the science and math of it more.*

10:45-11:30 Uncertainty and calibration (Saito/Tracy)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	4.32
Knowledge you gained about this topic.	4.20
How **beneficial** is what you have learned to you professionally and/or personally?	4.20
Effectiveness in increasing your understanding of the applications of this type of modeling.	4.08

Benefit of knowledge:
- *Good to think about how to use statistic in modeling the system. Also explanation of Bayesian statistics.*
- *It gave me a better understanding of how to evaluate uncertainty in the models I am using and the background behind those estimates.*
- *It's good to know other scales aside from meteorological when downscaling with other coupled models.*
- *I knew little about this area. Thank you guys making me understand this.*

Suggestion to improve presentation delivery:
- *I think this presentation would've been more helpful if it had been in a full 2 hour lecture block.*
- *I would have liked more explanation on how to ground-truth one's model with stakeholders (realism section).*

Additional concepts to cover
- *I wish this was a 2 hour lecture instead of a 45 minute lecture. ET would have been a better 45 minute lecture.*
- *I would have liked more discussion in assuming data distributions.*
- *Different methods for estimating the uncertainty of model outputs.*
- *I guess maybe it would be better to also cover some part of the statistical downscaling method, and a companion lab of some simple quick way of downscaling.*
- *More on the Monte Carlo method should have also been a 2 hour class*

Day 6 Saturday June 9

Twenty-five participants completed the evaluation of day 6. All course components were rated in the *high* to *extremely high* range. Average ratings and comments are shown in Figure 31.

Figure 31. Ratings of IDM day 6 activities

Topic	Rating
9:00-9:45 CSDMS Modeling (Peckham)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	4.48
Knowledge you gained about this topic.	4.28
How **beneficial** is what you have learned to you professionally and/or personally?	4.20
Effectiveness in increasing your understanding of the applications of this type of modeling.	4.20

Benefit of knowledge:
- *It was interesting to learn about how so many different models/computer software can work together to produce one outcome. Definitely want to look more into this.*
- *It was really beneficial to learn about the supercomputer as well as getting the idea of a "stone soup" model as opposed to one "super model." For my research, I found this lecture very important.*
- *I am working on data and model interoperability toolkit/framework so it was a nice presentation to understand the one way to tackle the issue.*
- *Will try to use model, but perhaps best that I can then use for a multi-disciplinary team.*
- *This is extremely exciting. When reading the paper for this class, I had no idea the project was so far along already. I hope they generate enough buy-in from the scientific community to keep this project moving forward! I will be sharing this with modeled at my agency for sure.*

Suggestions to improve presentation delivery:
- *I think this was an excellent presentation. It was nice to see how everything we have been talking this couple of days has been applied.*
- *A few more definitions, but overall great presentation.*
- *Maybe show a live example of the CSDMS program.*
- *Step by step of actually using the software to run a model. maybe give a hypothetical example (e.g. modeling erosion on a hill slope) and walking through the steps.*
- *I actually want to see a real run of the model, as it is online already.*
- *I think maybe good if we can have a live demo of the CSDMS.*

Additional concepts to cover
- *More technical details about implementation and also limitations of the system.*
- *I would have liked to see examples of the models that are currently available with the CMT.*
- *Specific use and examples of the model. If can be used by a more lay approach.*
- *I still felt like it was a little black box like. Due to time constraints, I couldn't ask more about that.*
- *I wondered about a metadata sheet that talked about numerical methods/solving techniques and things like that.*

Day 7 Sunday June 10

Twenty-six participants completed the evaluation of day 7. All course components were rated in the *high* to *extremely high* range. Average ratings and comments are shown in Figure 32.

Figure 32. Ratings of IDM day 7 activities

Topic	Rating
8:00-9:55 Lab: Climate modeling (Koracin)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	4.23
Knowledge you gained about this topic.	3.96
How **beneficial** is what you have learned to you professionally and/or personally?	4.11
Effectiveness in increasing your understanding of the applications of this type of modeling.	4.15

Benefit of knowledge:
- *I really enjoyed this lab. I've never been exposed to climate modeling, and this was a good introduction.*
- *I wish I would have been exposed to this previous to starting my MS, I would have incorporated it into my research*
- *It could help me to better explain in an educational setting how climate models operate.*
- *This lab exercise is extremely useful for my research. However I have to learn more on it.*
- *I may use downscaled GCM data, so this was super useful in how downscaled GCM data is developed and can be acquired. Great lab!*

Suggestions to improve presentation delivery:
- *I would have liked a review of the greenhouse gases and their interactions with each other and the rest of the atmosphere. I wasn't quite sure what to change or expect to see in the output.*
- *The model program was interesting to mess around with but the purpose of our in-class exercise was a bit vague.*
- *I think more time doing the lab and less time with lecture about the lab would be helpful.*
- *The model takes far too long to run during the lab. It would be much more effective to set up the model and then look at output from a model that has already been run.*

Additional concepts to cover
- *Homework and discussing more how downscaled GCM data could be applicable to research.*
- *An introduction of how to access and use existing GCM simulation data might also be an interesting topic to cover.*

Topic	Rating
10:05-12:00 Lab: Hydrologic/watershed modeling (Saito)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	4.50
Knowledge you gained about this topic.	4.35
How **beneficial** is what you have learned to you professionally and/or personally?	4.31
Effectiveness in increasing your understanding of the applications of this type of modeling.	4.34

Benefit of knowledge:
- *I liked the opportunity to learn and use Stella!*
- *It is beneficial to actually be able to learn how to use STELLA.*
- *STELLA is potentially very useful to my research, and as such, this lab was useful.*
- *The trial and error approach really helped me understand how to apply models to STELLA and will come in handy if I do ever set up a model using that program.*
- *I liked trying to turn a simple water balance equation into a model. While conceptually it was simple, it was difficult to translate it into model components.*
- *I benefited a lot from this activity. I really liked how there was a period of the class where we had to figure out how to model the problem at hand.*
- *This was a great way to apply Dynamic Systems Modeling to hydrology. The hands-on experience was great.*

Suggestions to improve presentation delivery:
- *The equations from the journal article were a little confusing. I think I could have done better constructing equations from scratch so I would understand where they came from.*
- *More useful if instructor had shown all modeling all equations first and given another set of equations as exercise.*
- *I liked the little exercise in Stella this time than the one before. It helps me to understand the program better.*

Additional concepts to cover
- *Maybe throw in some reservoirs and/or inter basin transfers, though it was helpful to keep the model simple.*
- *Would be nice to learn about other hydrologic models and how they are used to model watersheds ie GSFLOW.*

Topic	Rating
1:00-2:55 Vadose zone/groundwater modeling lab (TBD/King)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	3.96
Knowledge you gained about this topic.	3.73
How **beneficial** is what you have learned to you professionally and/or personally?	3.65
Effectiveness in increasing your understanding of the applications of this type of modeling.	3.77

Benefit of knowledge:
- *I'm not a vadose zone expert, but it was neat to see what factors go into this type of modeling, and how it affects soil moisture.*
- *I've already used hydrus, so for me personally it wasn't super helpful. But it was helpful for folks in other disciplines to see what that kind of modeling entails*
- *It was good to at least know that this program exist, I think for my research this may be very helpful*

Suggestions to improve presentation delivery:
- *Maybe explain more of the options and what they mean, including the interpretation of outcome.*
- *Maybe link it with a Ref-ET output to show interdisciplinary linkages.*
- *This activity could have easily been faster paced.*
- *Good, easy activity. Could do a more applied scenario in lab (like some of Robert's lab's and assignments have been in Soil Physics) - having a big rainstorm, and predicting the amount of runoff and how that could affect other aspects of system (flooding, vegetation, fisheries, etc.).*

Additional concepts to cover
- *The model is kind of not user-friendly. Maybe an explanation of important parameters will be helpful.*

3:05 - 5:00 Lab: Canopy interception/evapotranspiration modeling (Link/Sridhar)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	4.23
Knowledge you gained about this topic.	4.04
How **beneficial** is what you have learned to you professionally and/or personally?	3.81
Effectiveness in increasing your understanding of the applications of this type of modeling.	4.04

Benefit of knowledge:
- *The canopy interception model wasn't something I was familiar with at all so it was great to learn about but I don't know if I can apply that to my studies.*
- *I love simple yet effective approaches. I may not use this much at my office, but it is still a valuable component to know and understand.*
- *Evapotranspiration is crucial to downscaling in a climate model. It would be interesting in comparing and contrasting the meteorological variables to the Penman-Monteith Model to see if it's in agreement to the GCM.*
- *The canopy interception model seemed very intuitive after this activity. I would have probably neglected interception in basic models before this lab.*

Suggestions to improve presentation delivery:
- *I would have liked to work through the whole lab.*
- *The first part (determination of canopy interception parameters) was confusing because of how qualitative it was.*
- *If the instructor had explained how he picked up the parameter value from the graph. He just asked the number with a student with hydrology background. But did not explain how the number was generated.*
- *We got into the nuts and bolts of the model, but it was in a applied situation (thinned vs. non-thinned).*

Day 8 Monday June 11

Twenty-five participants completed the evaluation of day 8. All course components were rated in the *high* to *extremely high* range. Average ratings and comments are shown in Figure 33.

Figure 33. Ratings of IDM day 8 activities

Topic	Rating
8:00-9:55 Lab: Economics modeling (Cobourn)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	4.56
Knowledge you gained about this topic.	4.36
How **beneficial** is what you have learned to you professionally and/or personally?	4.12
Effectiveness in increasing your understanding of the applications of this type of modeling.	4.20
Benefit of knowledge: • *I really liked this lab. I learned a lot about economics modeling, and it will be very useful information in the future.* • *This class was especially useful for me to learn teaching technique. From the view point of content, this is some sort of basic for a resource economist.* • *Good reference for future projects that may involve simple economical modeling.* • *It was beneficial just to learn more about this topic. Very interesting.* • *This will help me to incorporate guidance based on economic analysis of certain areas.* • *Economic modeling will always be important. I especially benefited from plugging different values to see how they changed the system. Even though I do not know much about economics, I felt like I understood the modeling.* **Suggestions to improve presentation delivery:** • *Only to refer to the variables a bit more as what they were, tended to forget what the values meant.* • *I would like to gain more understanding about the processes. Explaining the terms will be very helpful.* • *More practical examples* • *So necessary to go through each test, but try to focus on how to capture the effect of changing factor on variables we are interested in.* **Additional concepts to cover** • *Some examples of differences between values in economics and the other social sciences.* • *Some practical examples of how we could apply this to water resources*	
10:05-12:00 Lab: GIS/remote sensing (Steele)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	4.00
Knowledge you gained about this topic.	3.84
How **beneficial** is what you have learned to you professionally and/or personally?	3.72
Effectiveness in increasing your understanding of the applications of this type of modeling.	3.80
Benefit of knowledge: • *Really difficult to see what each instructor is doing on the projected screen. It would help if we could share the instructor's screen and watch how he/she navigates through each tool we work with every once in a while, then set us free to work with it on our own.* • *Hard to follow. The excel table was poorly marked and many of the steps were not included in the handout.* **Suggestions to improve presentation delivery** • *Maybe go a little slower through model stuff or check and make sure everyone is caught up.* • *I think that another GIS tutorial would have been a greater benefit.* **Additional concepts to cover** • *Limitations of SRM, specifically headwaters that may not have snowmelt that discharges to streamflow (i.e. closed basin large alpine lakes).* • *I would have liked to see more about models in ArcGIS*	
1:00-2:55 Lab: Systems dynamics modeling (Tidwell)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	4.24
Knowledge you gained about this topic.	3.80
How **beneficial** is what you have learned to you professionally and/or personally?	3.84
Effectiveness in increasing your understanding of the applications of this type of modeling.	3.84

Topic	Rating

Benefit of knowledge
- *It gave me a better idea of how to incorporate different subjects into a policy-related situation.*
- *really enjoyed seeing how changing variables affected model. liked having to decide on policy decisions, that made process concrete*
- *I hope to facilitate some participatory modeling with my research team and stakeholders in our research area, so this presentation was a huge help in terms of helping me think about how to begin the process of designing a participatory process, as well as a participatory model.*
- *It is my first time to face such a complex model about watershed management. It is the first time I feel the complexity of watershed management and how the different interest of people might affect the decision in watershed management. Several ideas representing in this model will be quite useful for me in my future work, especially those about the human activity, interaction between different groups of people and so on.*

Suggestions to improve presentation delivery:
- *Get rid of some of the material we had already covered.*
- *Maybe combine the Stella, watershed and this modeling into one whole day and build a large model that takes all day to really get our hands dirty in creating a dynamic model.*
- *I really enjoyed working with the model provided during this lab, and it was a great idea to split us up into different stakeholder groups.*
- *It was really good and interesting class. The presenter was very good and the presentation really clear.*

Additional concepts to cover
- *Not just an interface model I was expecting to create our own dynamic model and was disappointed with the lack of interaction with under the hood concepts of the modeling in this lab*
- *How one could do this modeling oneself*
- *It would have been useful to learn more about the program used to create the model.*

3:05-5:00 Statistical modeling (Panorska)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	4.12
Knowledge you gained about this topic.	3.64
How **beneficial** is what you have learned to you professionally and/or personally?	3.88
Effectiveness in increasing your understanding of the applications of this type of modeling.	3.60

Benefit of knowledge:
- *Working with climatological data, we look for extremes. It's good to know that there are several of ways of going about looking for extremes, and also to always take into account the errors that go along with statistics.*
- *Really enjoyed the brief overview of the PCA which is used extensively in volume forecasts*
- *The dust bowl example in particular is something that I am interested in looking further into with regard to desert risks with ongoing climate change.*
- *This lecture was exactly what I expected from the course. I really liked the list of references--I could see using this in the future if I need to learn more about a certain aspect of statistics.*
- *I am learning that statistics are unavoidable! (But also manageable with the right knowledge.*
- *Statistics are always useful. The broad overview was a good refresher to concepts I have already been exposed.*

Suggestions to improve presentation delivery:
- *I've had a few stats classes, so I was already familiar with a bunch of the material presented. I'm not sure how much would have been grasped by people that are new to stats. It would be a choice between covering fewer topics more in-depth, or just leaving it broad. The hardest part is the wide-range of math background in the audience.*
- *Maybe include more examples and visuals of different techniques applied to water and climate, but overall good.*
- *I would have liked a more interactive lab rather than another lecture.*
- *I think she could use the main lecture notes as a reading or outline that students can have on hand or read ahead of time. It would have been nice to see one example explained and demonstrated more thoroughly.*
- *Good job in covering a large amount of topics that are interesting to us. But I guess some topics might not need to be included, since most of the students should have taken some intro/intermediate level statistics courses.*

Additional concepts to cover
- *Doing an actual lab*
- *Better explanation of the statistical models*
- *If it is possible, some discussion about the spatial dependence, how to model the spatial dependence might be quite useful and interesting.*

Day 9 Tuesday June 12
Twenty-five participants completed the evaluation of day 5. All course components were rated in the *high* to *extremely high* range. Average ratings and comments are shown in Figure 34.

Figure 34. Ratings of IDM day 9 activities

Topic	Rating
8:00 - 9:55 Lab: Ecological modeling (Boykin)	
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	4.40
Knowledge you gained about this topic.	3.96
How **beneficial** is what you have learned to you professionally and/or personally?	3.92
Effectiveness in increasing your understanding of the applications of this type of modeling.	4.00
Benefit of knowledge: *STELLA seems to be the popular model in this class, and I believe it would be quite useful for atmospheric connections.* *This class was useful for me to learn a bit more on STELLA but I am not using (probably) ecological model in my research. So ecological model is not that much useful for me with my current focus.* *I have run these type models in an excel environment and through programming in C, it was neat to see them implemented in Stella. These models are a great way to illustrate the main concepts of Dynamic Systems Modeling.* *Gave me some ideas for integrating an ecological component into the group project and also how to perhaps incorporate the stock-flow model into my own studies.* *Understanding wildlife population modeling.* *It helped me to understand better how to use and integrate ecological modeling into a systems dynamics framework.* **Suggestions to improve presentation delivery:** *Although it was nice having a short activity, I preferred if it was longer to learn more about this type of modeling.* *A little more explanation of some of the variables and how they function.* *Modeling habitat area, relation to land use conversion.* *I would like to have some specific skills in Stella explained. So we can learn more.*	

Course format
Students and faculty provided feedback about the structure and format of the course. The lectures were primarily conducted during the first week and labs were primarily conducted during the second week. Less than half of student participants (38%) found that this was an effective way of delivering the material. Students explained why they did not like the format:
- *A mix of labs and lectures for the first week would be more desirable.*
- *Having 8 hours a day of lectures made it difficult to fully concentrate for every lecture even though the topic may have been interesting or important. I think having the lab the same day as the lecture would be more effective.*
- *I think it might be better to have one lecture then the related lab.*
- *I think it would be better if we can have lectures in the morning and let student work on their projects in the after lunch or 2pm. This way they don't get tired with lectures and they will also not get tired of working long hours to finish projects.*
- *I think labs should have been mixed in with lectures to keep the students interested and focused.*
- *I think the labs should go with the lectures, and the lectures should be broken up with exercises/activities.*
- *I would have liked to get the lecture then practice the concept*
- *I would have preferred to have a lecture followed by the associated lab. It would have broken up the monotony of the first week.*
- *I would have preferred to have the lab paired with the lecture. It's fresher in my mind and it also helps to mix up the activity level a bit.*
- *I would've preferred if the labs had immediately followed the associated lectures. There is so much information that going back and forth makes it difficult to absorb all of the material most efficiently.*
- *If lecture was followed by lab then it would be more effective. During lab time, it was difficult to remember the lecture.*

- *It would be easier to apply lessons from lectures to the lab if they occurred sequentially.*
- *See previous comment. It was difficult to sit through 8 hours of lecture and keep my brain engaged. I would have liked the labs (more of them) to be interspersed.*
- *The labs following the lecture would have cemented the concepts more, and the lab experience would have been enriched with the more familiar concepts and subtleties.*
- *The lectures were too tiring after a while. Labs would have been a nice break and change of rhythm.*

Some students who agreed it was an effective format provided some additional information:
- *While not without fault, I feel this may be the best way given the constraints, as it allows for class members to become comfortable with each other through shared hardship, which facilitates the labs. Also the best time to absorb the lecture is at the beginning when everyone is fresh.*
- *I thought doing lectures first and then labs was fine, I would just have the lectures have more hands on activities, like Dr. Steele's lecture, or Franco's lecture.*
- *Being exposed to the material at two different points in the course served a good review*

In contrast to students' perception, the vast majority (89%) of faculty respondents found the format an effective way of delivering material. Those faculty explained:
- *Very effective. Making the notes available to students of every presentation after the class is also good. I would recommend there has to be some mechanism to see if they have read the assigned reading material.*
- *Yes, but keeping lectures and labs together would be better to avoid lecture overload.*
- *The format is presented in an effective way. I still believe that lectures am and labs pm would be better for students.*
- *Seemed to work fine.*
- *I think it was beneficial for the students to have a lab later than the lecture. It allowed the material to settle a little.*
- *It's okay to break it up. In some ways, it would be nice to have lab and lecture paired, but it's also nice to revisit the ideas learned earlier later in the course. I think it might help with retention. If they're coupled, there might be a tendency to "forget" those units that students don't already favor.*
- *Yes, the format seemed to work well. Ideally, it would be in rooms that didn't have so much set 'structure' w/ lab desks, chairs, etc., but also moving rooms occasionally helped with the structure and format. The lectures were a good format, but would be better if lecturers built fewer slides and more interactive components to engage the enrolled students. Not all of them used this strategy.*

The two faculty who did not find the format effective explained:
- *I had a problem with proprietary software not available in the computer cluster designated for the class. I think we should try, as much as possible, to use open source code.*
- *Too condensed*

All of the faculty found the format an effective way of providing good examples of applying interdisciplinary modeling. They explained:
- *Last participating year was 2010. However I did find the format useful that year.*
- *It was a good mix of disciplines, both in terms of lecturers and students.*
- *It was effective in applying the concepts of water management under climate change conditions, covering a wide spectrum of sub-disciplines. Acequias are important but studies in the other two states could also be welcome. This is because we have students from all three states and we need to give them perspectives on each of their states water-related research exposure.*
- *A broad spectrum of components was offered. Maybe more social sciences would be valuable in the future.*
- *It seemed effective based on my limited observations as I was only able to participate one day.*
- *Yes, although I must say I did not attend most of the lectures*
- *I thought the format worked for my segment.*
- *My answer is really that I do not know as I did not participate in 2012.*
- *I think that the current format was very good. I believe that it was useful for the students to see the material at the conference. In order to improve the comprehension, it is useful to vary things during the course. If you have lecture, lab, after it again lecture, lab, then comprehension decreases. By adding conference with a very different material, it*

was possible for students to be attentive. If you have lectures/labs from 8-5 every day, it is very hard to concentrate this way for extended periods of time, with conference it was possible to focus for additional few days.

- *For the most part. Not all of the instructors emphasized this to the same degree, but each seemed to include that focus in some form. Perhaps more emphasis could be given to instructors with this as more of a "requirement" than a "guideline".*

Over 79% of faculty respondents preferred to have the course over two weeks. Similarly, 79% of students preferred to have course over two weeks. They explained:

- *As a student who works full-time, the two week session is easier to make time for than the three week session.*
- *I like two weeks better but lecture hours could have been better*
- *I liked that the class only took two weeks but I think a one day break in between the two weeks would have been nice and I wouldn't have minded staying an extra day to have that break. However, I would still have preferred a way to not have 8 hours of lectures for several days straight.*
- *I liked this format but thought Mon-Sat, Mon-Sat would have been better*
- *I prefer this way but please, please have at least one day off scheduled halfway through.*
- *I think two weeks are sufficient, although a little tight.*
- *I would not have taken the class if it was three weeks long, so I am glad it was only two.*
- *I would rather just get it out of the way honestly. Being away from home is difficult in many regards. Laundry, diet, as well as other issues would become much more difficult at 3 weeks.*
- *It is very nice to be finished early.*
- *Much easier to take 2 weeks for a class than 3 weeks during the summer, at least for the geoscientists*
- *The two week section is more preferable for me as I have a fulltime job and a family and 3 weeks would be more of a time commitment than would be worth it.*
- *This was fine, I liked being done earlier*
- *This was good to get it done with but the "The labs cover the same topics that were presented in the morning" needs to be done in the two week format*
- *Though I was extremely drained throughout the two weeks, I was relieved to have accomplished so much in such a short amount of time. It is too difficult to be away from work for three weeks. I wish we had at least one day off.*
- *Two weeks but lab followed by lecture*
- *Two weeks is convenient, and the intensity is difficult, but this group can handle it. A lab directly following the lecture would be best. Giving a brief description of the group project would have helped us put the material in context, and alleviated the need to get all the lectures in before the group project. Perhaps the more detailed info could come after what would be determined to be "core issues."*
- *Two weeks was already a significant commitment. Perhaps one free day in the middle? I felt like we were in a great field area but didn't have a chance to see any of it. I also would have appreciated free time on Sunday, mostly for religious purposes.*
- *Two weeks was good to just get it done, BUT I would add an extra day and have a day off in the middle.*
- *Wife would not have stood for three week option.*

Twenty-one percent of faculty respondents would have preferred a three week course as had been held in previous years. Twenty-one percent of student also would have preferred to have course over three weeks. They explained:

- *I think Saturday and Sunday should be free days because a lot of information is received in a short amount of time. The free days would give students time to process and unwind.*
- *I would prefer the three weeks course.*
- *I would've preferred a three week course because I do think the lectures and labs would be best taught together, and also having a day or two to recover from an intensive week would've made it easier for me to remember everything I'd learned.*
- *More time to absorb the material and rest on weekends.*
- *Students can use the break at time to relax or catch up with the intense material.*
- *There were days that I was so tired and wanted to pay attention but was just extremely burnt out*
- *Three weeks away would have made me think twice about taking this course.*

Currently, the course is offered all face-to-face. Faculty and students have similar opinions about whether it should continue to be offered face-to-face or if parts should be offered online. The majority of faculty (52%) and students (63%) prefer the course to be offered all face-to-face. Forty-three percent of faculty and 38% of students would like to see if offered partially online and partially face-to-face. No students and only one faculty member would have preferred it all online.

All but one faculty respondent agreed that this year's format was effective in bringing together more faculty at the same time allowing for inspiring more collaboration between faculty.

- *It was useful both to see the type of work other faculty were doing and meet individual faculty from other disciplines.*
- *Unfortunately I was not able to participate with the other faculty as much as I would like due to outside commitments, but the opportunity was certainly there.*
- *Certainly. This experience offered opportunities to discuss mutual research interests, proposal ideas and leveraging individual expertise in a great intensive educational setting.*
- *It was more effective to communicate and collaborate; however, the students had more pressure with block lectures. For students is better to have lectures am and labs pm on the sames subject.*
- *It seemed effective based on what I was able to observe.*
- *I was only able to attend a couple of days. Seemed to have about the same faculty participation as last time.*
- *My answer is really that I do not know as I did not participate in 2012.*
- *I believe that this year there was more interaction among the faculty. In the past faculty did not come for a long time, they would come for a day/two at most three. Now we had a number of faculty who came for longer periods of time. More interaction among the faculty.*
- *I cannot compare with last year, but it seemed that I only had the opportunity to interact with a couple of faculty. I think getting faculty to stay for the duration of the course is a tough sell, particularly since most are not receiving teaching credit for it from their institutions. It's just extra work (that we'd like to do, but nonetheless, 2 weeks is too much to ask).*
- *I think maximizing faculty involvement is important and adds value. It benefits the students for follow-up interaction as well as the faculty who also learn and generate new ideas*

The one faculty that did not agree that the format inspired more collaboration reported I d*id not see that many instructors from the time of my participation, which started on Saturday.*

Faculty offered other explanations about how the format impacted their level of involvement in the course. A couple indicated there was not much of in effect on their involvement, however most others explained ways in which they were able to be more involved:

- *Not really.*
- *No real effect*
- *I quite enjoyed it, and only wish I hadn't been so heavily committed when the course ran.*
- *A sequence of presentations was designed well. However, my presentations were on Mon and a lab next Sun, which separated theory and exercise for certain time.*
- *I was a guest lecture.*
- *I was not really involved until the second half of the course, so that detracted me to interact with most of the instructors, who came in the first week.*
- *Heard other core instructor and guest lecturer's case studies and background information*
- *More convenient for folks in town and likely easier for travelers*
- *More opportunity to meet other lecturers.*
- *This year I stayed for a longer period of time comparing to previous years. As a result I was able better see on how different parts of the course are related.*
- *It was okay to come in for just a day or two. This is preferred given that my institution gives me no credit of any sort for this type of activity.*
- *It allowed flexibility which was good, but it also facilitated being involved as needed and as interest allowed.*

Follow-up survey participants made a variety of suggestions about the format of the course. Several mentioned they would have preferred more of a mix of lectures and labs. Several also indicated that would have liked to have breaks over the weekends. All responses are listed below.

- *Make the course a full month if possible. Allow the teams to work towards actually publishing/building work plans. I think there are some great cross-university collaborations waiting to happen in the setting provided.*
- *A mix of lectures and models instead of 2 hour lectures for the first week*
- *I want to suggest a short break during 2-hour talks.*
- *The only suggestion that I have is to take fewer pictures.*
- *Have each day have a mix of lectures and labs, they don't have to be on the same subject, just for a change of pace. Have a field trip one day for maybe half of the day at least to somewhere outdoors where there could be some educational activity as well.*
- *Looking back on the course I would change up the project just a bit. I believe that it would be helpful to have all of the students working together on the same project with the ultimate goal as a paper for publication. While it could be somewhat difficult to complete, having the students working in class for a few hours each day on the research and paper would help facilitate the process.*
- *What about teaching the course in two phases over two months (or six weeks) in which during the first half students take the course online. A lot of introductory and disciplinary material could be covered during this period, then in the second half students could take the course live. With instructors and students focusing their time on modeling in an interdisciplinary environment. Perhaps instructors (from various universities) could even pair up with the modeling teams so that collaboration would be fostered both between the students and universities participating. The course would be more useful if it had an extra week or two, because the information is crammed into such a short period of time.*
- *Give the project in the first week and have days that are 1/2 lecture and 1/2 project to give the teams more time to work together. Maybe there would be an advantage to developing a model as a team during the first week and then doing lecture question and answer sessions the second week to refine their model.*
  If the course remains a two-week course, please consider at least one day off in the middle and extending one further day at the end.
- *Perhaps mix the proper lectures and labs on the same day. More hands-on training. Weekend breaks.*
- *I would not have class from 8-5 on Saturday and Sunday. Students need a break to be able to focus every day for the next week. I also felt the students at NMSU were at a disadvantage because they didn't live with the other students in the dorms so they didn't get to know them as well.*
- *Finally, I think it was kind of hard not having even just one day to rest, I think it will be nice to have a day off and maybe finish the course on Saturday instead of Friday, everyone performance may be better after a day off.I liked having it only be 12 days, however I would bump it up to 13 days and provide a day off halfway through. I liked the 2 week structure we used in 2012.*

Course logistics

Faculty and students rated logistical aspects of this class on a Likert scale of 1-5, 1=*poor*, 5=*excellent*. Means can be considered to trend towards positive or negative based on the following scale:

Excellent   4.21 – 5.00
Good   3.41 – 4.20
Average   2.61 – 3.40
Fair   1.81 – 2.60
Poor   1.00 – 1.80

As shown in Figure 35, all logistical aspects were rated between *good* and *excellent*. Faculty's ratings of most aspects are slightly higher than students' ratings.

Figure 35. Ratings of IDM course logistics
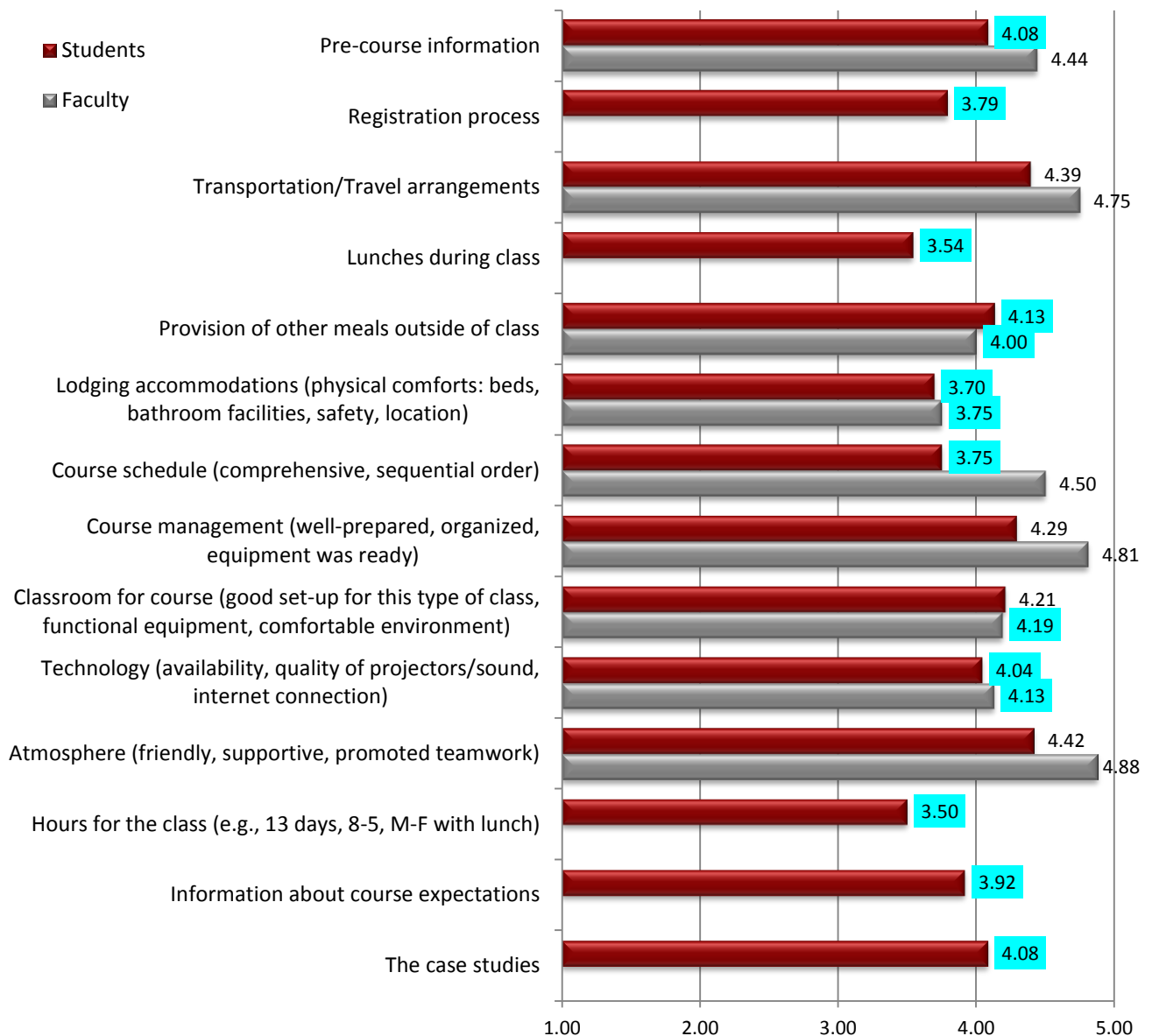
Factors that influenced students' and faculty members' decision to participate

As shown in Figure 36, half of the students enrolling in the course learned of it through their advisor and nearly half learned of it from course instructors or presenters.

Figure 36. Method of hearing about IDM course[5]
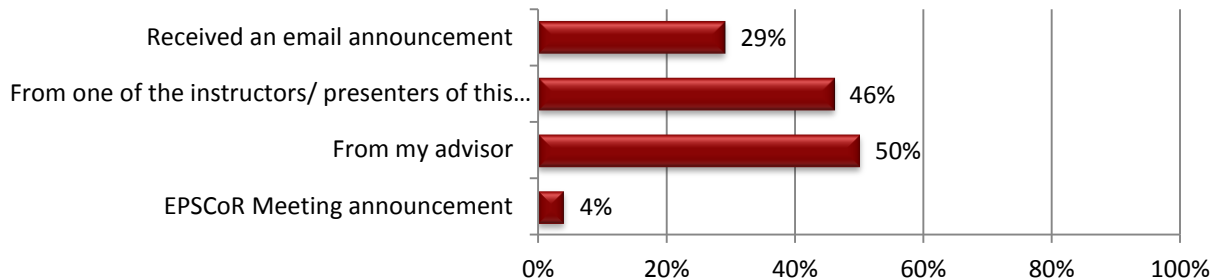
The majority of the students (83%) did not pay the tuition for this course. Of the students who were funded to take the course, only one would have enrolled in this course if he/she had to pay the tuition. A few suggested they might and the rest reported they would not. All responses are included below.

- *Yes.*
- *I would have paid for this course myself if the funding was not there as I believe the networking opportunities were of sufficient value because I do not need additional credits or grades.*
- *All of my other coursework is covered by my fellowship, so I do not budget for tuition costs. I would prefer to take 3 credits for free rather than paying for 3 credits.*
- *I am not sure. That depends on the financial situation. But if assuming I have some spare money, I would take this course.*
- *I depends. If I was in the early years of my Ph.D prgram, I will. But if I knew something about modeling already, I may not.*
- *I would not even be a graduate student right now if I had to fund tuition out of my pocket.*
- *Probably not.(3)*
- *I would have liked to, but would not have been able to afford it, so no.*
- *No (2)*
- *No, but not because of lack of merit for the class. With a family to raise, even "good" opportunities must sometimes be passed.*
- *No. But in hindsight I would have.*
- *NO. The course fee is too high for me if I need to pay by myself.*

The majority of the faculty (71%) and students (88%) would not have participated in this course if they had to pay for travel and lodging. The majority of faculty (79%) would continue to participate if they did not receive a stipend.

Suggestions for improvement

Faculty provided the following additional suggestions for improving the course:

- *Based on the 1st year, a better balance of ecologists, physical scientists and engineers among the students would have helped the discourse. Perhaps this balance was achieved in subsequent years.*
- *Insisting a publication quality project report and getting it published in some decent journals, would be useful. Because that will help them come prepared for the class. It may be a bit of an effort, but in the end they will have something to refer to in the real world on collaborative work.*
- *Less and more focused course content. More hands on interdisciplinary modeling. Try and match as possible the theory with the modeling exercise. I believe students get the most valuable experience from trying the modeling effort*

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[5] Percentages do not equal 100 because students selected more than one answer

themselves, often times the content of the lectures does not correspond with what the students end up doing and it is a bunch of interesting, yet wasted material. Not even to be used later.

- *The leads for case studies should be from among core instructors, not guest lecturers who are present only one or two days.*
- *Projects should suit student's research interest.*
- *To me it was very useful that I stayed for a longer period of time at NMSU comparing to the times course was offered before. I think that organizers should ask instructors to come to the course for a longer period of time. Not obligatory for the whole two weeks, but at least for three days.*
- *Coming in without knowing the students and their backgrounds made it a bit difficult to gauge what should be presented. There are probably already too many evaluations/surveys for the course, but a pre-survey or some way of gauging students' expectations from the various disciplinary units might be helpful in the future.*
- *I would alter the food format so there was variability. I realize that is a pain administratively, but it's worth it. I would also create longer breaks. I realize that constrains the presentation times, but the value gained from the informal group interactions (both socially and scientifically) is high. Overall, there's so much designed well, it doesn't need to change much.....just optimization! And, you shouldn't have to bring your own towel...which seems like a picky complaint, but the institution should be able to provide that service.*

Student respondents provided a variety of suggestions for improvement to this course. Students commented about the lengthiness of the lectures and suggested adding more lab time.

- *I wasn't a big fan of the room or the microphone situation. A room where you can see the screen would be better.*
- *If the site were close to study areas, I think a day or afternoon of field visits would have been nice for the class projects.*
- *My main suggestion would be fewer lectures interspersed with more labs. Perhaps instead of one big project, there could be a few smaller group projects that use more than just Stella. It would have been nice to have access to transportation (even public buses) in the evenings. We felt a little trapped and couldn't explore the area.*
- *No matter how this class is structured, due to the short time frame, whether 2 weeks or 3, there will always be criticism and complaining, often contradictory; but I just want to say that, personally speaking, this was a fine instruction and well worth my time.*
- *The course became monotonous by making 8 hour lecture. It would be possible to make more interesting by adding some extracurricular activities; e.g. field visit etc.*
- *The time frame was unrealistic and I wish I would have had more free time so that I was better rested and in a physical state to retain more information.*
- *The two hour lectures are a bit long, I would find 9-4 would be better hours, and 1.5 hour lectures that then include a 1.5 lab directly following would have been the best mix. This would then allow the groups to start earlier and spend more time on the project planning, enriching the outcome. Overall, this is an excellent course, and I cannot think of an endeavor more important in this day and age. Giving students the ability to begin to speak each other's languages will serve this population well throughout their careers. More classes such as these are essential for NSF's goal of science having broader application to the world. The knowledge gained and the concept of this course has changed my outlook on what is possible, both adding complexity but also inspiration.*
- *This is just my opinion but I would like to see a computer programming class which introduces to students from other disciplines to programming. For those who are interested can also pay little extra to attend 2-3 days of computer programming session before the actual class begins. This way they learn about interdisciplinary modeling and they will have computer programming skill/mindset to solve/implement it.*

Follow-up survey respondents provided suggestions as to how the course could be improved. Many suggested adding more hands-on modeling experiences.

- *I would say more hands-on modeling exercises.*
- *A series of lectures on an introduction to computer programming would really be helpful to majority of the students not only in near future but in the long run as well.*
- *I took the course in 2005, when I took the course, it felt to me like two separate courses jammed together into one. If I remember correctly, one half of the course focused on the concept of interdisciplinary modeling, while the other half focused on specific models. Although the link between the two was apparent, it felt like two separate mini-courses at the time. I also felt that the final project was a little too theoretical and intangible. Although the*

- *project did force us to collaborate and think about many of the details of developing a complex interdisciplinary model, I felt that it was a little too "in the clouds," and the project that my group proposed would have taken years to complete. I feel that we would have benefited more from actually constructing and/or working with a very simple model bridging two disciplines, rather than simply thinking about and discussing a complex model that bridged 3 or 4. That said, I found the course to be worthwhile and felt that it helped round out my curriculum.*
- *Hmm, I did this course a while ago (in 2005). I think that the generic nature of the course material taught along with specific examples and paper references were a winning formula.*
- *It was a great course. But when I took it, you guys tried to cram in too much stuff. That made it much less enjoyable. It was my first time staying up at Lake Tahoe, and you had scheduled things 12 hours a day! I never even got to see the lake except driving past it. The content and the people who presented though were very knowledgeable and I learned a lot. It was a great intro to modeling in disciplines I had no prior experience with.*
- *The most important part of this course to me was the modeling experience. It has been, and appears it will likely be the only interdisciplinary "modeling" course that I will be able to take as a student. Working in an interdisciplinary team was a great experience.*
- *Less theoretical content, more hands on inter-disciplinary modeling.*
- *Perhaps gear the class more towards learning about climate modeling and not learning so much about Stella model. Many jobs I am currently looking at ask for experience with specific hydrologic and atmospheric models such as VIC or WRF. Learning hands on about these types of models may be more useful for students.*
- *I would suggest that more time be spend using SD software in a class setting with problem-solving exercises and slightly less time be spent using field-specific software.*
- *Adding more on frameworks/workflows and real results interdisciplinary would be helpful. Kepler, OpenMI,*
- *Having a Psychologist presentation*
  1. Do a team building/personality ID survey so people can better understand themselves and communication
- *Make the classes more dynamic, maybe adding the labs and the lecture together. Also, if is going to be just the lecture, 2 hours are to much, maybe shorter lessons will be better. After a little more than an hour you start to lose your concentration and focus and it becomes really difficult to catch up again.*
  The labs were good, especially those were we actually get to play with the software a little bit. The couple of group dynamics were especially good, that helped to interact and get to know the other students and the different approaches to the problem in discussion, which I believed was very important for this course .
- *Also I would have liked to have seen more examples of how STELLA and other system dynamics software have been used in real life situations to solve complex problems.*
- *More hands on modeling experience would have been great!*
- *It would be nice if students are given to replicate few papers. Similarly more economics (especially optimal control theory would be nice). Finally, there was too little about climate change. One lecture and lab on what is climate change, how to measure it and what is the difference between climate change and weather change. would greatly benefit the course.*

> *Laurel did a fantastic job pulling this course together, some of the comments I heard indicated that some students took for granted things like, excellent time schedule of courses and presentations, food at a routine time and location, good food, clean rooms with AC, class materials and free internet. Also the diversity of professors and presentations is not an easy task to orchestrate. Time Link, Darko and Laural were most valuable because they were always around and interacted with us...it is was most beneficial to have professors around even after or before they presented despite their chaotic schedules at home...we all have those schedules I for one as well as many of the other students really appreciated these professors sticking it out with us! Thank you for a great course.*

Achievement of IDM course goals

Each goal was analyzed individually to identify the impact of participation in this class.

Goal 1: Increase awareness of models used in different disciplines to model water-related issues and climate change

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Participants completed pre- and post-survey questions to assess their perceived awareness of models used in different disciplines to model water-related issues and climate change. They rated their awareness on a Likert scale of 1-5, 1=*not at all*, 5=*a great deal* before and after participating in the class. The evaluator conducted an inter-item reliability test to ensure all items within each outcome area were positively related. A Cronbach's alpha score greater than 0.7 is valid. The alpha score for this outcome area (α=.743) is above the valid cut-off point. The evaluator conducted a paired-samples t-test to compare participants' pre-survey scores to their post-survey scores. A p-value less than .05 is considered statistically significant. Overall, participants demonstrated a significant gain in perceived awareness of models used in different disciplines to model water-related issues and climate change between the pre- and post-survey Also, males scored slightly higher than females on the pre- and the post-survey. Results are shown in Figure 37.

Figure 37. Participants' awareness of models used in different disciplines to model water-related issues and climate change by all and by gender
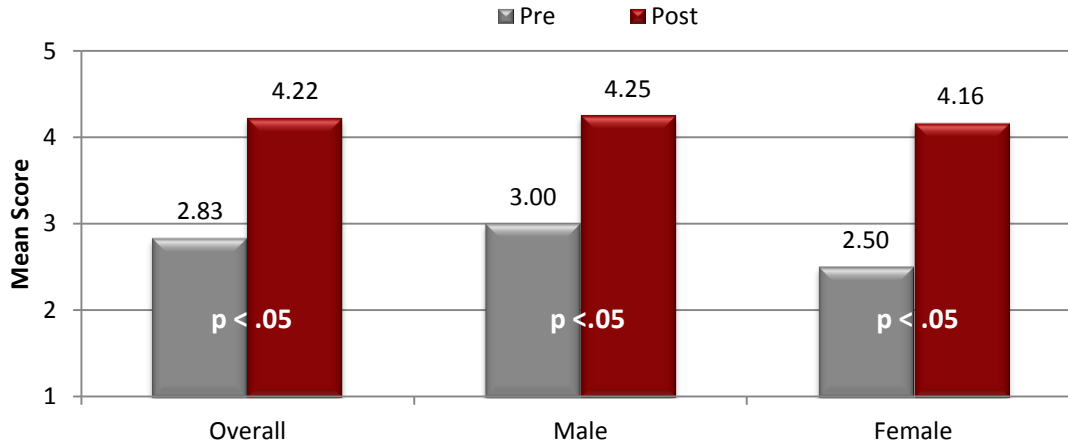
Goal 2: Increase knowledge of the challenges of applying models in an interdisciplinary context

Participants completed pre- and post-survey questions to assess their perceived knowledge of the challenges of applying models in an interdisciplinary context. They rated their knowledge on a Likert scale of 1-5, 1= n*ot at all*, 5=*a great deal* before and after participating in this class. The alpha score for this outcome area (α=0.896) is above the valid cut-off point. Overall, participants' knowledge of the challenges of applying models in an interdisciplinary context increased significantly. Again, males scored slightly higher than females on the pre- and the post-survey in their perceived knowledge. The overall, male, and female pre- and post-survey results are shown in Figure 38.

Figure 38. Participants' knowledge of the challenges of applying models in an interdisciplinary context by all and gender
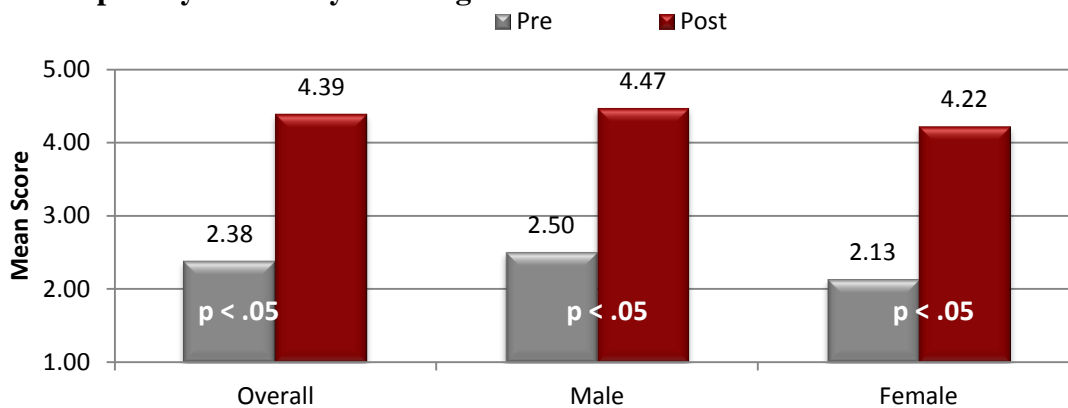
On the post-survey, participants rated knowledge and awareness they gained as a result of participating in this class. Statements were rated on a scale of 1-5, 1=*no gain*, 5=*great gain*. Results are shown in Figure 39. Between 58% and 92% of participants believe they experienced *good or great* gains in their awareness and knowledge. Highest gains were noted in *model concepts and issues, systems dynamics, economics, ecological modeling,* and *understanding the challenges*. Least gains were noted in the areas of *groundwater, mathematical, thermal stratification* and *evapotranspiration modeling*.

Figure 39. Participants' perceived gains in awareness and knowledge of models

Legend: ■ No gain ■ A little gain ■ Moderate gain ■ Good gain ■ Great gain

Topic	No gain	A little gain	Moderate gain	Good gain	Great gain
Ethics of modeling and why model		4%	17%	46%	33%
Model concepts and issues		4%	13%	38%	46%
Weather and climate modeling		4%	38%	46%	13%
GIS, remote sensing, and snow hydrology modeling		8%	29%	50%	13%
Systems dynamics modeling		8%	8%	42%	42%
Vadose zone modeling	4%	13%	25%	38%	21%
Groundwater modeling	13%	17%	17%	46%	8%
Adding people to the equation	4%	8%	21%	54%	13%
Mathematical modeling	4%	33%	25%	29%	8%
Hydrologic/watershed modeling		8%	29%	50%	13%
Vegetation-atmosphere,canopy interception modeling	4%		29%	38%	29%
Economics modeling		13%	4%	46%	38%
Ecological modeling			21%	63%	17%
Thermal stratification modeling	8%	13%	21%	33%	25%
Evapotranspiration modeling	8%	13%	38%	29%	13%
Why the past matters		4%	33%	38%	25%
Issues of scale			38%	38%	25%
The use and misuse of models		8%	13%	42%	38%
Uncertainty and calibration		8%	33%	33%	25%
Linked modeling approaches such as CSDMS	4%	4%	25%	63%	4%
Understanding the challenges of applying models in an interdisciplinary context			8%	29%	63%

x-axis: 0, 0.2, 0.4, 0.6, 0.8, 1

Participants completed pre- and post-survey questions to assess their skills and confidence in working in interdisciplinary teams to address complex issues. They rated their skills and confidence on a Likert scale of 1-5, 1=*not at all*, 5=*a great deal* before and after participating in the class. The alpha score for this outcome area ($\alpha=0.954$) is above the valid cut-off point. Overall, participants' skills and confidence in working in interdisciplinary teams to address complex issues increased significantly. Interestingly, females scored slightly higher than males on the pre- and the post-survey for skills and confidence in working in Interdisciplinary teams. The overall, male, and female pre- and post-survey results are shown in Figure 40.

Figure 40. Participants' skills and confidence in working in interdisciplinary teams to address complex issues by all and gender
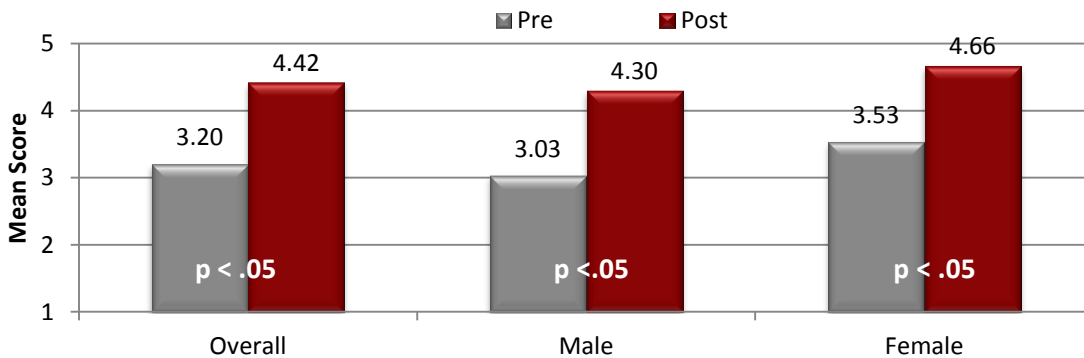
On the post-survey, participants rated their skills and confidence in working in interdisciplinary teams to address complex issues they gained as a result of participating in the class on a scale of 1-5, 1=*no gain*, 5=*great gain*. The percentages of reported gains are shown in Figure 41. Between 87% to 92% of participants indicated they experienced *good* or *great* gains in this area.

Figure 41. Participants' gains in skills and confidence in working in interdisciplinary teams to address complex issues
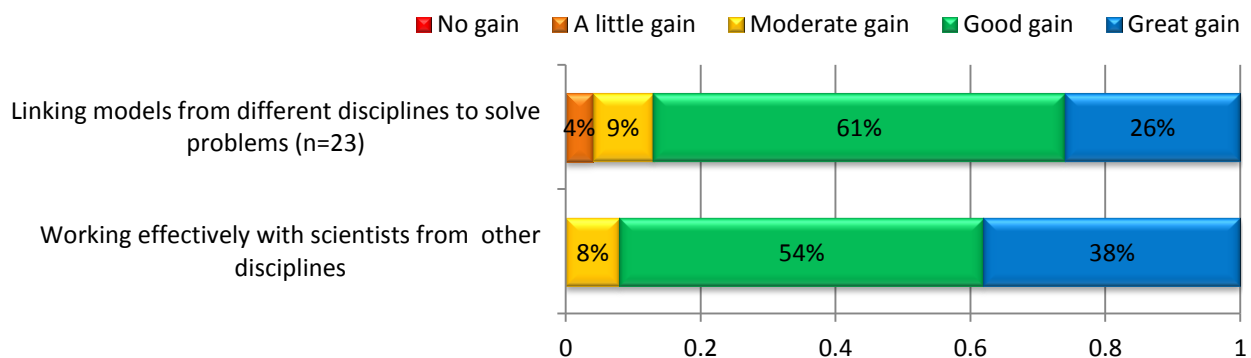
Participants explained skills they have gained. Many participants commented that they acquired skills in use STELLA to model and many also mentioned improved ability to work with individuals from other disciplines. All responses are included below.

- *Communicating across disciplines*
- *Conceptual knowledge of a great many more disciplines and some modeling knowledge. Appreciation for an aspect of the scientific method of starting simply and with what you know to then inform one's approach to the broader issues and goals.*
- *I developed some skill on linking economic activities with ground water and surface water models.*
- *I feel that I improved my teamwork skills.*
- *I have a much better understanding of what information can be added to most problems by other disciplines.*
- *I have gained some skills in being able to communicate with scientists from other disciplines and have also become acutely aware of both why we model as well as limitations in modeling. I also became familiar with several new techniques that I am excited to perhaps be able to apply to my own work (e.g., system dynamics modeling and GAP habitat modeling).*
- *I have learned to take into account the concern that other disciplines associate themselves with. I have also learned mainly how to model with STELLA, which has shown me how these disciplines interconnect to solve the issues to each their own.*
- *I have not worked with an economist in the past, so it was helpful to learn how economists think and what kind of data they might use for models.*
- *I have some experience already working on interdisclipinary teams on issues due to my office environment. However, I still gained insight into each of the disciplines that I do not have expertise in. I also gained some STELLA skills, which is useful for thinking/planning for implementation of real-world processes in a system dynamics model.*
- *I learned how to use STELLA, but I really don't feel like I learned how to link models. I do appreciate the exposure to a few other models.*
- *In Economics and working with people in other areas*
- *It was a very good and informative experience to work with people from different disciplines and seeing what and how they want to model to solve a problem.*
- *It was good to learn how to integrate various models from different disciplines into one working model.*
- *It was very beneficial to work with people from other disciplines and see how they think.*
- *Knowledge of different modeling techniques in different fields, systems dynamics modeling was a new think and seems very useful.*
- *Practice in skills with people*
- *The most beneficial skill is perhaps the conceptual understanding of modeling efforts.*
- *This class had made me realize that I already have some skills that are useful to interdisciplinary projects. I feel comfortable communicating with people from other fields and I also feel comfortable explaining my own knowledge to others. It also made me realize that I have actually done a lot more modeling than I was actually aware of.*
- *Understanding of interdisciplines*
- *Working with researchers from other discipline. Understanding the problem from a different perspective. Uncertainty and challenges in modeling.*
- *Working with STELLA was a great asset for me, but otherwise I'm going to have to let the material sink in before I can give a comprehensive answer.*

Participants completed pre- and post-survey questions to assess their confidence in doing interdisciplinary modeling. They rated their skills on a Likert scale of 1-5, 1=*not at all*, 5=*a great deal* before and after participating in the class. The alpha score for this outcome area ($\alpha=0.847$) is above the valid cut-off point. Overall, participants' confidence in doing interdisciplinary modeling increased significantly. Males scored considerably higher than females on the pre-survey and slightly higher than females on the post-survey. Females experienced more gains in confidence than males. The overall, male, and female pre- and post-survey results are shown in Figure 42.

Figure 42. Participants' confidence in doing interdisciplinary modeling by all and gender
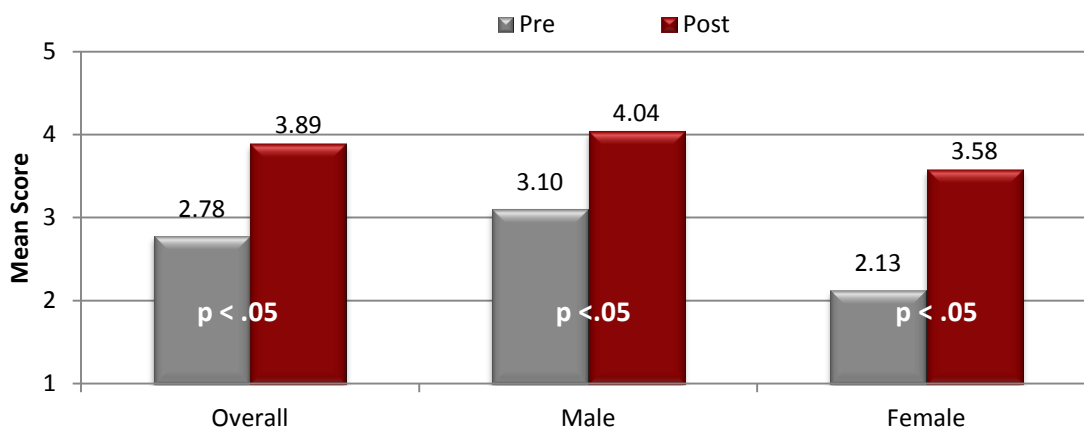
On the post-survey, participants rated confidence they gained in doing interdisciplinary modeling as a result of participating in the class. Statements were rated on a scale of 1-5, 1=*no gain*, 5=*great gain*. The percentages of reported gains are shown in Figure 43. Over 79% of participants indicated they experienced *good* to *great* gains in this area.

Figure 43. Participants' gains in confidence in doing interdisciplinary modeling
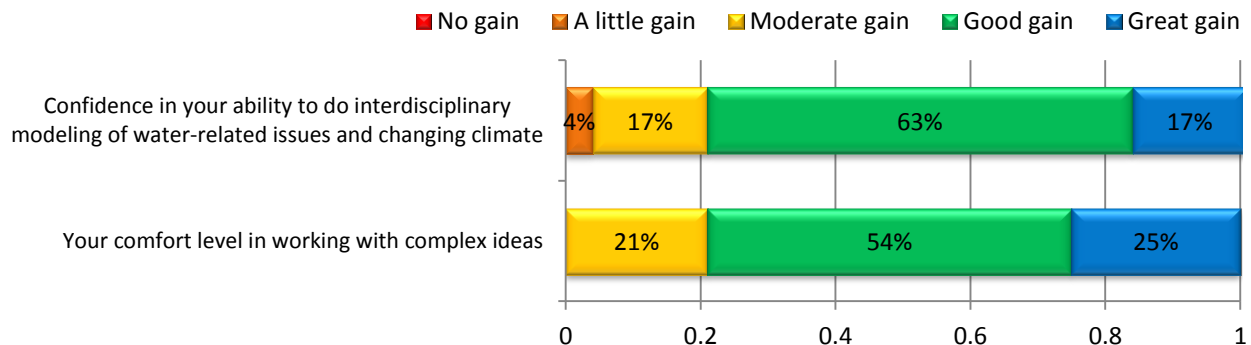
Participants commented about the various ways in which this class has improved their confidence in doing interdisciplinary modeling.

- *Actually, before the class I did not understand how difficult it will be to conduct a interdisciplinary water-related modeling project. Because of the help of this class, I gained some experience on this, and got some understanding about what might be the problem when doing such kind of projects.*
- *I can better visualize what it would/will be like to incorporate different disciplines in a system dynamics context. Before I had a vague idea, now I have a more concrete understanding.*
- *I feel like I been exposed to different types of models, but other than STELLA, I really don't feel like I would be comfortable using them myself because we didn't get much practice with them.*
- *I gained respect for the rigor of other disciplines and it was easy for me to defer to their expertise.*
- *I hadn't really worked with interdisciplinary modeling or the challenges that go along with it. I think this course better prepared me in that aspect.*
- *I have a better idea now of how I could bring my expertise to the table.*
- *I have gained a lot of confidence in doing interdisciplinary modeling from the beginning of the class.*
- *I have gained great confidence in interdisciplinary modeling.*
- *I have more ideas for future modeling work, and I understand more of the limitations. Knowing the limitations helps my confidence in moving forward and being able to weigh pros and cons of different aspects of modeling.*
- *It has given me more confidence to work with others, even when I do not understand certain aspects of certain things. I am also becoming more confident as far as presentations, and speaking in front of intellects.*
- *Much more confident in the subject, but still would find actually doing a complex model a big task. I would know where to start and try to find the right people to make a team.*
- *Practically speaking just beginning the understanding of what modeling is possible provides an opening for conceiving of what questions are possible to answer. It has reduced some of my expectations as I look at the complexity and expense involved in answering some questions, and yet refocused these questions to new directions.*
- *Scrambling to put together that project helped me to how well I can work with others and also how well I can work under pressure.*
- *The acequia project is very different from the type of research that I generally conduct, so I went into the project feeling like a fish out of water. However, after realizing we had already learned much of the material and that my group members had some knowledge of the system, I gained confidence in my ability to effectively start from scratch on an interdisciplinary project that in the end I became very excited about.*
- *This class taught me for communicating with people from other discipline*
- *Understanding that I cannot do everything and that incorporating the ideas of others is beneficial*

Goal 5: Increase enthusiasm for working with interdisciplinary modeling approaches for addressing water-related issues and climate change

Participants completed pre- and post-survey questions to assess their enthusiasm for working with interdisciplinary modeling approaches for addressing water-related issues and climate change. Participants rated their skills on a Likert scale of 1-5, 1=*not at all*, 5=*a great deal* before and after participating in the class. The alpha score for this outcome area (α=0.883) is above the valid cut-off point. Overall, participants' enthusiasm for working with interdisciplinary modeling approaches did not increase significantly (M_{pre} = 4.13, M_{post} =4.39, p = .132) nor did males or females separately exhibit a significant increase from pre- to post-surveys. The lack of significant gains is most likely due to participants' pre-survey means being very high.

On the post-survey, participants rated enthusiasm they gained for working with interdisciplinary modeling approaches for addressing water-related issues and climate change as a result of participating in the class on a scale of 1-5, 1=*no gain*, 5=*great gain*. The percentages of reported gains are shown in Figure 44. Between 83% and 92% of participants they experienced *good* or *great* gains in this area.

Figure 44. Participants' gains in enthusiasm for working with interdisciplinary modeling approaches for addressing water-related issues and climate change
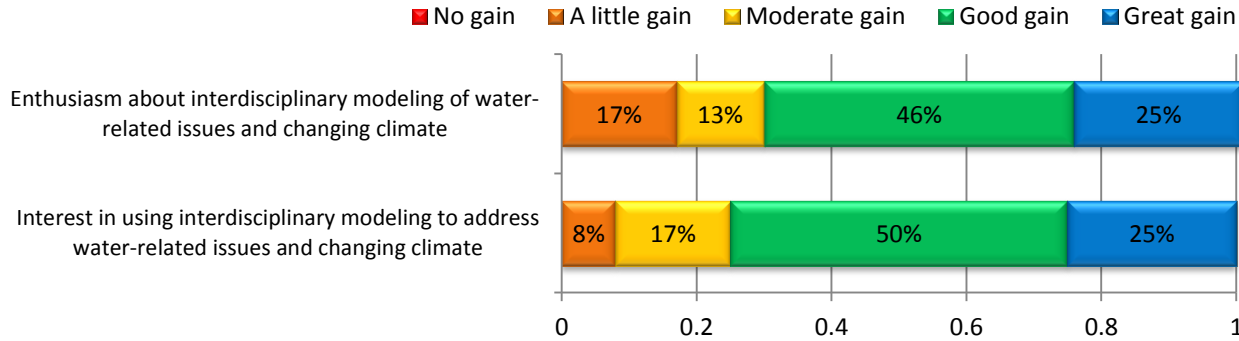
Participants commented on how participation in this class has changed their interest in doing interdisciplinary modeling. Many students mentioned that their interest increased or became more refined due to their participation.

- *Already interested and STELLA was a fun tool to learn that might be valuable*
- *Before the class, I only think about working on surface water hydrology with mainly snow/glacier melt input. After the class I understand that many different processes (ecology, human society) are related to water. Those processes can be and should be examined with interdisciplinary modeling techniques.*
- *I am more open to taking on the task, and more realistic as to the time and steps necessary in the process.*
- *I don't say this class changed my interest for interdisciplinary modeling. I would rather say I decided to enroll in this class due to my such interest.*
- *I have already planned to conduct some interdisciplinary modeling, so this course helped me see that certain things are possible. At least I did not walk away thinking interdisciplinary modeling would be pointless!*

- *I realized that there is a great potential for computer science to be a great help to other discipline. Researchers from other disciplines can collaborate with computer science researchers so they can focus on core research part and computer science majors can help them to deal with all computing tasks.*
- *I think I recognized the importance of working with other interested groups, particularly how making incorporating other disciplines may garner support for research.*
- *I understand more of what interdisciplinary modeling is and how it is used, and this has greatly increased my interest in doing this type of modeling.*
- *I wasn't aware before that there was such a need for this type of research, nor was I aware that there are relatively few researchers engaged in it.*
- *Increased it*
- *It has expanded my mind to take into account other phenomena in the science field.*
- *It has refined it, and made me more comfortable with the subject matter.*
- *It increased. The cursory coverage of multiple topics, approached and objectives peaked my interest.*
- *Prior to the class, I was more focused on surface water processes despite knowing that there are many external factors that affect surface water. Now, I plan on directing my research towards a more inclusive approach that takes into consideration other disciplines.*
- *Starting with the question why model was useful as this is a dominant question among many of our older school faculty. The perception of the scientist disconnected from the problem because they are disconnected from field work and ground truthing is shown to be a misconception. I now have much more confidence in the data available and brainstorming how to work with other disciplines.*
- *The class has definitely shown me how useful that type of modeling can be as most problems we need to address with regards to climate change are inherently interdisciplinary. That makes me want to think more about incorporating other disciplines into my own work.*
- *This course made me more aware that interdisciplinary modeling is a viable option for climate change-based research. Previously I had heard of interdisciplinary efforts but they always seemed logistically very difficult. They still are very difficult, but at least I now realize I can manage working in an interdisciplinary team.*
- *Would keep this idea open for future opportunities, I have a larger perspective about the use of models and their limitations.*

Participants completed pre- and post-survey questions to assess their interest in doing interdisciplinary modeling. They rated their skills on a Likert scale of 1-5, 1=*not at all*, 5=*a great deal* before and after participating in the class. The alpha score for this outcome area ($\alpha=0.885$) is above the valid cut-off point. Overall, participants' interest in doing interdisciplinary modeling increased significantly; however, when disaggregated by gender only females had statistically significant increases from pre- to post-surveys. The overall, male, and female pre- and post-survey results are shown in Figure 45.

Figure 45. Participants' interest in doing interdisciplinary modeling by all and gender
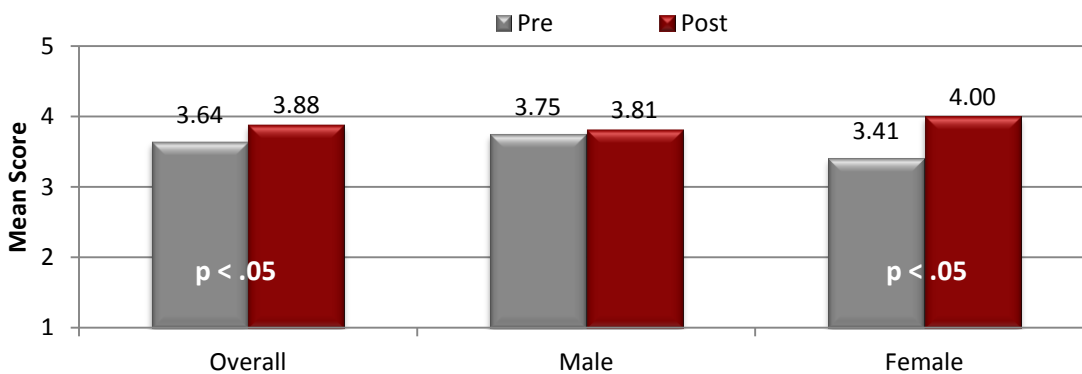
On the post-survey, participants rated interest they gained in doing interdisciplinary modeling as a result of participating in the class on a scale of 1-5, 1=*no gain*, 5=*great gain*. The percentages of reported gains are shown in Figure 46. Between 54% and 80% of participants indicated that they experienced *good* or *great* gains in this area.

Figure 46. Participants' gains in interest in interdisciplinary modeling
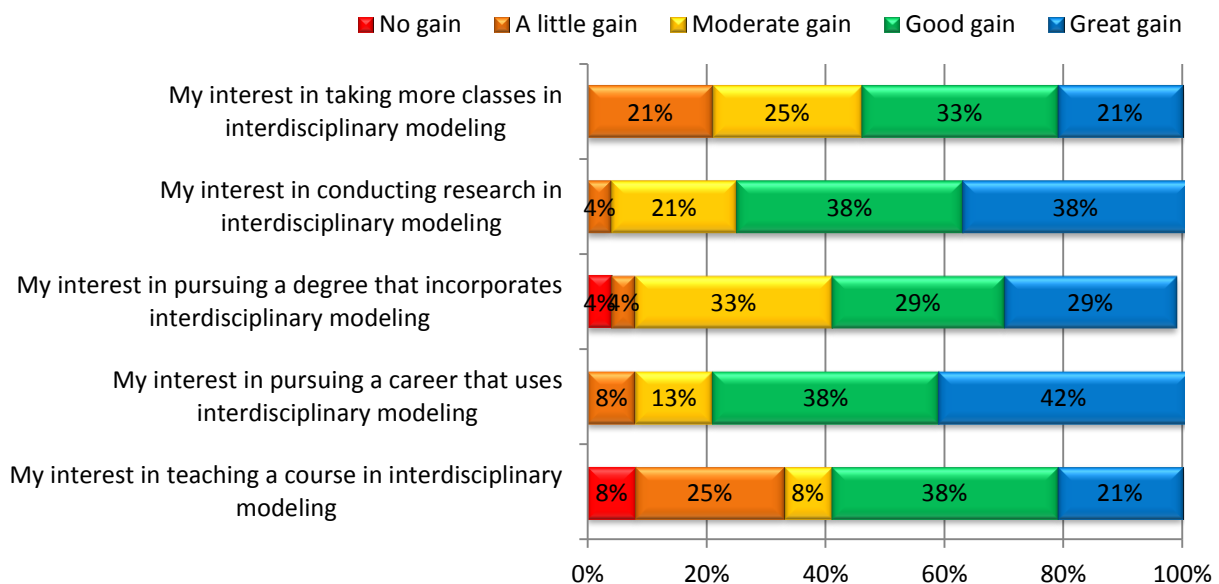
Participants commented how participation in this class has affected their interest in pursuing more education and or a career that uses interdisciplinary modeling. Several comments suggested participants felt more prepared to pursue interdisciplinary modeling as a career.

- *I am interested in how to integrate ecology with range management/animal science, as my background is in animal science.*
- *I got a taste of the thrill of working in an interdisciplinary setting. The results that come out of this research seem to be more realistic and therefore more useful. I feel that a career that involves this type of work would be fulfilling.*
- *I see a career involving interdisciplinary aspects as more interesting and challenging.*
- *I think that my career will definitely use interdisciplinary modeling. This course has increased my interest in pursuing more of a career that will use interdisciplinary modeling.*
- *I think this class makes me more qualified for research positions in climate change because I am able to show that I can work in an interdisciplinary team to try to tackle complex climate-related issues. As a consequence, I am currently looking for postdoctoral research positions regarding interdisciplinary biological complexity and/or climate change issues.*
- *I view interdisciplinary modeling as essential to the career landscape of these times.*
- *I've always been interested in working with other disciplines. This class was just a good stepping stone to help me put forth of working with other disciplines in my career.*
- *Interdisciplinary modeling is a complex process. the class provided a base for which to explore these issues and applications more-fully*
- *It did not change my interests at this point*
- *My current research project is interdisciplinary, and this class has given me a better perspective on how to collaborate with others.*
- *Now that I have a better idea for how interdisciplinary modeling works, I am more open to it and see the need for it in solving complex issues.*
- *Probably will not pursue a degree, but a career I expect to have some sort of interdisciplinary aspect, whether it's is modeling or collaboration to solve complex water-related problems.*
- *I do see this as a central skill necessary for almost all individuals to enrich their own discipline and the reach of their work. I intend to pursue a further understanding of the concepts and modeling principles applicable to my work with additional classes, and to create new and strengthen existing working relationships with individuals in these other disciplines.*

Participants commented how they will use or apply what they have learned in this class in their classes, research, and/or career. Many students commented they will be able to use what they have learned in their dissertation work.

- *Hopefully I will be able to incorporate a few of these models into my dissertation research, and as stated above, I hope to be able to use the skills I developed working in an interdisciplinary team to be able to conduct complex climate change related research.*
- *I got some idea from the class to investigate the relationship between the water usage of agriculture / hydro-power and the surface water runoff. It might be an interesting small sub-topic for my current work.*
- *I honestly do not know the answer at this moment. It will all depend on where my education, research, and career takes me.*
- *I hope to apply as much of it as possible.*
- *I hope to teach in the future, and it will help to have been exposed to a broad range of disciplines.*
- *I hope to work on complex water related issues after I finish my PhD. This class has given me the knowledge of that process to use system dynamics tools for these endeavors.*
- *I intend to pursue an interdisciplinary modeling team as support for the restoration of the watershed in which I live. Developing visualization of these principles and tools for work with local land managers will be the core of my work. Much of the local interaction will be working with individuals out in the field, with getting a bunch of people in one room for a meeting being the culmination of much other work. Modeling can help provide some answers to field questions as we go along, and then meetings can summarize this integrative work.*
- *I now understand the importance in communication, particularly in defining vocabulary, in interdisciplinary modeling.*

- *I want to pursue a career where I can use both animal science and ecology, maybe in helping ranch/farm managers integrate conservation practices on their lands.*
- *I will include more outside influences to my model as limitations/uncertainties that were not included.*
- *I will used the knowledge gained in this class in my dissertation. Once I will complete my dissertation, I hope, it will take me into the area of interdisciplinary modeling in my future career.*
- *If I can get a hold of STELLA I might use that for some of my research.*
- *Include other variables into my models I would have over looked*
- *It's too late in my M.s. career but hopefully in my professional career i will be able to apply what I've learned.*
- *My own research goal is to come up with my own ecological model of plant growth and this class has definitely helped me articulate just how I should go about doing that. Just the insight into the modeling process was invaluable to me and was worth taking the class alone.*
- *My research is very interdisciplinary, so this class will help me in that.*
- *Potentially model system dynamics of wildlife, hydrology, plant ecology and social systems for dissertation research.*
- *The most pertinent application will be knowing how to communicate with professionals from other discipline*
- *There might be some opportunities for my to use more conceptual models in my work and schooling to help explain ideas and concepts to people*
- *This class has helped me narrow down a dissertation topic that is both interesting to me and related to my duties at the office. Namely, issues related to surface/ground water consumption in a binational environment.*

Follow-up survey respondents explained whether or not the interdisciplinary modeling course inspired them in any way. Former students indicated increased proficiency, interest, and/or inspiration modeling as well as in interdisciplinary work. All responses are listed below by theme.
<u>Increased proficiency, interest, and/or inspiration in modeling</u>
- *I have gained a stronger appreciation for modeling and the value of different modeling systems.*
- *Yes, it encouraged me to keep learning about modeling and about how to use different models in cross-disciplinary research.*
- *Yes. Although my work hasn't directly involved modeling, it has a huge presence in my field (atmospheric science). I am still quite interested in gaining some more hands on modeling experience.*
- *The course encouraged me to pursue greater modeling proficiency and to recognize areas in which modeling could be implemented to broaden the scope of inferences that could be drawn from research projects.*
- *Yes. The level of talent of the instructors in the class inspired me to strive more to develop my career, so that someday I might be able to make as significant contributions that some of the instructors of the class are making.*
- *My professional project centered around a systems model for a watershed in northern New Mexico.*
- *We learned many interesting things in class about hydrologic modeling.*
- *I have explored modeling frameworks and workflows at greater depth.*
- *Yes. It was an exciting type of research that I think I could really enjoy.*
- *Yes, will include other components in modeling in future.*
- *Yes, after this experience, I think I will try to do some modeling for my thesis...*
- *Yes, a few of the lectures were phenomenal. the Vadose zone and history lectures spring to mind immediately. Anyway, I need time to absorb the material.*
- *It has gotten me interested in the available modeling software that is available.*
- *In a specific sense, it has peaked my interest in getting into ET modeling. Most of my work in the past has centered on quantifying surface flow and accounting of water in reservoirs. The presentations on ET were fascinating, and I am contemplating guiding my dissertation in that direction.*
- *It's given me some thoughts about how to go about my own modeling.*
- *I'm always interested in learning new things. Inspired? Not really...*

Increased proficiency and/or interest in interdisciplinary work

- *The course introduced me to the idea of interdisciplinary research and gave me an appreciation for its importance. Since taking the course, I have noticed that interdisciplinary research is becoming not only more common, but also expected, to a degree, in many RFPs.*
- *Yes, Yes, I became much more interested in other areas of science (than my own) and learnt that a lot can be acquired from different disciplines. I also become more inspired to participate in large multidisciplinary projects.*
- *The course helped make me more aware of the interdisciplinary aspects of water resources. It also introduced me to some of the tools and approaches available for interdisciplinary modeling approaches.*
- *It made me realize I have to study more, but more importantly I feel like I learned how to communicate and work with people from other disciplines. I am less frustrated with working with an interdisciplinary group compared to others who have never had the experience.*
- *It has made me more aware of the importance of multi-disciplinary modeling and the process of performing the research.*
- *Yes, it has made me more eager to work with other disciplines in the future.*
- *Absolutely. The course inspired me to pursue research from an interdisciplinary systems approach.*
- *Definitely has inspired me to seek out work in interdisciplinary settings. That's hard to do in today's work force (from the outside looking in).*
- *Yes - I've seen how interdisciplinary modeling can be advantageous for modeling complex water resource problems.*
- *It has interested me in taking more interdisciplinary classes.*
- *I now realize that all problems are really interdisciplinary, and collaborating is going to be crucial to work in the future.*
- *Yes. This course covered a large spectrum of water related areas. I got some knowledge that I've never had a chance to tap into, especially Economics and Mathematics.*
- *I am more motivated to use interdisciplinary resources.*
- *Yes, the course showed me many different things in other disciplines. The course project has also shown me how traditional community / technique of agriculture might be helpful for adaptation in a changing climate.*
- *The course provided a unique opportunity for exposure to many different aspects of modeling programs and their application. It was a wonderful opportunity for students to learn about how modeling is utilized in a variety of fields and to put the skills learned during the course into practice.*
- *Absolutely. As a result of my experience in the course I have submitted and been accepted to present at conferences that don't typically attract social scientists, and I have worked on several interdisciplinary projects that will eventually lead to publishing.*
- *Yes. I wish I can have a career in interdisciplinary modeling.*
- *It has been a great tool for developing skills for relationship building with people of differing backgrounds. It was very nice to have a "commons" type area for meals and events and evenings with many people in a team building the atmosphere.*
- *Yes, this course has inspired me to apply interdisciplinary principles to my overall approach, and to advocate for it within resource management paradigms. The concept has gotten much attention, but many disciplines require much work to integrate this approach into our actual practical applications.*
- *It has inspired me to learn a computer programming language such as python or Matlab. Also to keep in mind other disciplines in my future research and connections they may have.*
- *The course informed me to a much greater degree how I can incorporate some interdisciplinary aspects into my project.*
- *Yes, I've been thinking a lot about the kinds of social data one might need to integrate into a model to answer various questions. How can social data be reflected in stocks and flows, etc.*
- *It broaden my horizon to science and also help me to understand how a computer, when used in a right way, can be a great tool to speed up the research process and be a great facilitator for many other tasks.*
- *Not directly. It was good to learn the different modeling applications and the complexity of working on interdisciplinary projects.*
- *No. But it would have if I had taken a different path.*

Follow-up survey respondents commented on whether or not the interdisciplinary modeling course influenced their academic and/or career path. Many students commented that their academic or career path was influenced by their participation, with most suggesting they have increased motivation to pursue future work in interdisciplinary modeling. Many others indicated that though their path was not influence, their interest or competency was. Some also indicated that it was too early to tell if participation had made a difference in their academic or career plans.

Influenced by participation in IDM course

- *Skills obtained after the course, in part due to the course, led to successful population modeling research projects.*
- *Yes. I realized some disciplines have models with dubious theoretical underpinnings. I tried to stay away from those.*
- *Yes - in the manner described in question four. By spending time with the scientists participating in the class, I saw a glimpse of what someday I might become, or approximate.*
- *Yes. I used my experience from the course when I was working after graduating from UNR. Thanks to the learning experience during the course, I decided to move on to the Ph.D. course afterwards.*
- *Yes, it opened the opportunity for my current position, which it relates to inter-disciplinary modeling.*
- *It would. Unfortunately, the economy and the job market have more influence on my career path than my interest.*
- *Participation in the interdisciplinary modeling course, specifically because the course and final project required incorporation of information from seemingly disparate fields influenced my decision to pursue interdisciplinary research and modeling as a career.*
- *As a result of the course and my subsequent research, I could not see myself doing anything in my career that did not involve interdisciplinary research.*
- *Yes. I hope to do as much interdisciplinary work as possible throughout my career.*
- *Yes, this course has both made concrete what will be required to do the work I am following, but also has allowed me to focus my efforts and contemplate more collaborative relationships.*
- *Yes, I will try to use what I learn as the basis to keep learning about modeling to be able to use it for my thesis.*
- *I like the group project. The way people cooperated makes me feel comfortable to work with other people in the future in my research.*
- *My professional project centered around a systems model.*
- *I am conducting more basin level analysis which requires a broad range of experience.*
- *there is motivation for me to gain additional experience in person to person relations and to understand the dynamics of groups to better promote ideas*
- *This course has made me think more about my future career goals, and looking at how to incorporate range management with ecology.*
- *Now I am thinking about pursuing a career focusing on data interoperability challenges. I might find a job based on that but I will certainly look for it.*
- *We are staying on track for interdisciplinary system dynamics modeling, but it's not a done-deal yet. We're still discussing the parameters and how they might integrate.*
- *Only in that it has been helpful academically.*

Path not influenced significantly, but acknowledged gains in competency or interest

- *Although I'm not sure the course has significantly altered my academic and/or career path, I do think that, going forward, I am more open to collaborating with colleagues in other disciplines.*
- *My career goals have not been altered significantly by the class, but strengthened.*
- *Not at this time, however, I am interested in pursuing modeling in future endeavors.*
- *Not really. I was planning on completing my dissertation work and then working for the Pacific Northwest National Lab initially and still have that as my goal.*
- *Not directly, I have a better understanding of the complexity of working on interdisciplinary projects.*
- *Not really influenced my career path, but most likely has got me more prepared for my future endeavors.*
- *No, other than strengthening my resolve for natural resources work. May consider changing from a water to climate focus in the future.*

- *No, although I gained much knowledge and experience from this course, my decision to continue in scientific research was made beforehand.*
- *No. Given the economic climate at the time I graduated, any desire to work in a field that allowed interdisciplinary modeling was limited by the job market.*
- *I still plan to teach in the future (less research) but I feel more comfortable teaching about connections to other disciplines now.*
- *Not significantly, however it increases the chance that I might pursue interdisciplinary modeling approaches to research in graduate school*

<u>Not enough time since course completion to tell (11)</u>

Follow-up participants' additional impacts

Participants commented on whether they were able to use the knowledge and/or skills they learned in the interdisciplinary modeling course in their academic or professional life. The majority of former participants provided comments about how they have been able to apply IDM course knowledge and skills and some suggested they have only been able to apply course material somewhat. Smaller numbers of former participants indicated there has not been enough time for material to be applied and a few reported not having applied course skills.

<u>Able to apply IDM course knowledge and skills</u>
- *Yes, as part of my current dissertation research, I am using both watershed (rainfall/runoff and water quality) and reservoir (hydrodynamic and water quality) models. The output from the watershed models provide inputs to the reservoir models, so a thorough understanding of both is critical.*
- *Yes, after seeing the benefits that can be gained from working in an interdisciplinary environment, I now regularly seek input from scientists in several disciplines. Attending the course also helped me gain important international experience and management skills.*
- *Yes. Based on discussions in the course I included an individually based modeling component to my PhD dissertation.*
- *Yes. The broad overview of all the different types of environmental models has been of much use.*
- *Yes. I prepared a proposal for my office (USGS in Henderson, NV). The experience of preparing a proposal for this class helped me to understand the process involved in writing proposals that was very helpful in preparing my recent proposal.*
- *Yes, I have used it to explain the use of models during a watershed management class where I am a co-instructor.*
- *Yes. My Master thesis will be a comparison of different hydrologic models.*
- *Yes, my thesis involves modeling, so general concepts learned in the class have been helpful.*
- *Yes. I've been able to use the skills related to working in teams, systems modeling, and gathering scientific data.*
- *Yes. I am currently working as a geospatial analyst interacting with wide range of disciplines. The course provided a background to communicate effectively with diverse teams.*
- *Yes. I did research on Climate change*
- *Yes. I have been able to incorporate the scientific output of hydrologists, climatologists, and biologists into research on public policy issues, which is my primary field.*
- *Yes. I will be using the modeling skills I gained in this class for my interdisciplinary research at my university. I also hope to use the skills professionally in the future for stakeholder collaboration and interdisciplinary water resource management.*
- *Yes, I have used system dynamics modeling for both my master's and doctoral research. I also have decided to pursue and interdisciplinary course of training. Several times I have gone back to course material for references or to refresh myself on the basic ideas from another discipline.*
- *I was able to use the skills I learned in the course towards the completion of my master's thesis and I currently use many of those same skills in my job.*
- *I've used the edGCM in my modeling course for atmospheric science.*

- *I am currently working on a project that involves three disciplines. This course will help me try to see a problem from different perspectives.*
- *The skills will be useful for me in assembling a team to attempt to restore the watershed in which I live, and to other ecological restoration and planning in the future. These are essential skills to achieve more complicated and ambitious goals.*
- *I use it all the time especially for any class work or workshop (I moved onto a Ph.D. course after taking the class). I used a software I used in the class to classes I am currently taking. I look back notes and readings once in a while when I face some questions outside of my field.*
- *My research is to address challenges related to model and data interoperability. I gained a very good insight about challenges faced by the researchers from other disciplines related from computer science perspective.*

Some application of skills and knowledge from IDM course

- *Somewhat, the course gave us a broad spectrum of different modeling applications, which I have not used in my professional life, but other skills such have been utilized.*
- *Marginally. When I took the course in 2010 I was one year from completing my Masters. I think the information proved valuable to those in my professional social network, but I had already found a focus for my work. I have since been unemployed looking for professional work, so I have not had a chance to use the skills from this course to its fullest*
- *A bit. Mostly I've used the contacts that I made with fellow students more than anything.*

Not enough time since IDM course completion to apply knowledge and skills

- *I am just getting started, but hope and plan to.*
- *No, Just returned from the class have not had chance to do any work yet*
- *No, but I will be using some of the skills I learned in the future.*
- *Not enough has passed*
- *Not yet (11). But I hope in my further study and research I can make use of what I learned in this class.*
- *I will start.*
- *I have not had a chance to fully implement the skills given that I have just completed the course. However, I expect it to help in the future.*

No applications for IDM course knowledge and skills

- *No. My professional life took a route that does not involve interdisciplinary modeling.*
- *Not directly that I can think of.*
- *No. Since take interdisciplinary modeling in 2010 none of my academic or professional life has involved modeling.*

Former participants also indicated which of several identified activities they participated in as a result of their involvement in the IDM course. As shown in Figure 47, many indicated they participated in research, made a presentation, or sought additional education in science and/or water/climate related area.

Figure 47. Former participants' activities as a result from participation in IDM course[6]

	2012 IDM workshop follow-up survey respondents	
	#	%
IDM course-related activities (n=43)		
I participated in scientific research	17	40%
I took additional water/climate related courses	11	26%
I pursued an advanced degree in science-related field	11	26%
My interest in teaching a course related to IDM increased	10	23%
I submitted a grant proposal	4	9%
I made presentations	12	28%
I prepared a paper for publications	6	14%
I decided to pursue a career in science	9	21%

Participants clarified any activities that weren't on the list of available options:
Miscellaneous
- *I am in the process of preparing a paper for publication.*
- *Looking into environmental politics.*
- *I have the ambition to participate in more explicitly scientific research, take additional water/climate related courses, will affect my grant proposal approaches, and paper publication approaches.*
- *I am already doing my master's research, may influence future decisions.*

Performed activities but not as a direct result of the IDM course
- *Did all of the above, but certainly not as a direct result of this class.*
- *Several of the above, but none resulted directly from taking the course.*
- *Nothing has resulted directly from this course.*
- *Not directly that I can think of.*
- *I have done all of the above but not as a result of this course.*

Not enough time since course completion to do any of the following
- *Not enough time has passed.*
- *Nothing yet.*
- *I just finished the course, so there has not been time to achieve any of the listed items.*

Former participants indicated if they had or were pursuing degrees, in what area, and where they were enrolled. The majority of the participants had or were pursuing advanced degrees (Ph.D., M.S.), with 17 (40%) having a Ph.D. and 15 (35%) having a M.A./M.S. Participants reported the following details about their academic pursuits:
Ph.D.
- *Completed PhD in Mathematics*
- *Idaho, Ph.D.*
- *Ph.D in Computer Science*
- *Pursuing a PhD in Civil and Environmental Engineering (CEE) at Virginia Tech*
- *PhD, University of Tasmaina, Australia. Ecology of deepwater sharks*
- *Ph.D., Oregon State University, Hydrology*
- *Ph.D. Water Resources (interdisciplinary degree), University of Idaho*

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[6] Percentages do not add up to 100% because respondents could select more than one answer

- *University of Idaho, PhD, Geography*
- *Ph.D., Political Science, University of Nevada, Reno*
- *a PhD in water resources and Policy/law*
- *UNM, PhD, Economics*
- *PhD, University of Idaho, Water Resources*
- *PhD in Geoscience at Boise State University, working on a project that combines microbiology, geochemistry, and fluvial dynamics*
- *PHD degree in University of Idaho,*
- *Ph.D. in Economics at the University of New Mexico, Albuquerque, NM*
- *PhD Environmental Science*
- *PhD in Water Resources Engineering, NMSU.*

M.S.
- *Just finished a joint Master's in Regional Planning and Water Resources*
- *MS in Wildlife Ecology at NMSU*
- *UNR, MS in hydrology*
- *M.S. NMSU, Wildlife Science*
- *UNR, MS, hydrogeology*
- *UNLV, M.S in Biology*
- *I have completed my BS and two MS degrees. I am not currently pursuing further degrees.*
- *Just completed M.S. in atompsheric science from UNR, Reno*
- *UNR, Master's Geography*
- *University of New Mexico, Master of Water Resources*
- *UNM, MS Civil Engineering*
- *M.S. in Atmospheric Science at UNR*
- *Master on Water Science in NMSU*
- *Master's Degree in Wildlife Science*
- *Masters in Hydrology at New Mexico Tech*

Bachelor's
- *Civil Engineering, UNM*
- *BSU Civil Engineering*
- *UNM, Community and Regional Planning, Natural Resources concentration*

Not pursuing a degree, but working
- *Working*
- *Not pursuing degree currently*
- *Environmental Consulting company, Water Resources Engineer*

Participants also indicated if they were working, and to describe their position. Positions were mainly held in academic settings (48%) and in industry (38%), with the remaining portion unemployed.   Responses are organized by the theme:

Academic
- *Assistant Professor, Biological Sciences, North Dakota State University*
- *RA at NMSU in accordance with Master's Program*
- *Student, Model and data interoperability challenges*
- *Graduate research assistant*
- *NMSU, Research Assistant Professor*
- *President, Graduate Student Association, UNR*
- *UNM, RA*
- *Research Assistant at DRI*
- *Research assistant/grad student*
- *Graduate assistant*
- *Research Assistant, University of Idaho*
- *NMSU*
- *G.A.*
- *Postdoctoral Fellow, ifremer, France*
- *Assistantship at Pacific Northwest National Lab*

- *As a hydrology, and Hydraulic Engineer*
- *GeoEye doing image processing.*
- *I am a Hydrologist with the USGS in Henderson, NV*
- *Nevada Division of Environmental Protection; Environmental Science*
- *Groundwater Hydrologist part time Kinross Gold at Round Mountain NV*
- *I continue to work part-time doing groundwater remediation work for Tetra Tech EC, Inc.'s Irvine, CA office.*
- *MWH, water resources consulting*
- *Work is about half environmental modeling (mostly hydro and water quality) and half software development*
- *I worked as a hydrologist after graduating from UNR for two years*
- *Water Resources and Environmental Consulting in Fort Collins, CO*
- *working at Desert Research Institute, Reno mostly on drought and resources projects*
- *Sandia National Laboratories, Project Control Analyst*
- *Sandia National Labs, Environmental Systems Engineering R&D*
- *GIS Programmer, Contractor NMML*
- *USACE, geospatial analyst*
- *Hydrologist for a natural resource consultant*
- *USBR Civil Engineer (hydrology)*
- *Started a non-profit while at UNM for ecological restoration and planning*
- *GIS Manager at the International Boundary and Water Commission*

Not currently employed
- *Not currently working (7)*
- *Looking for work in the Bay Area*

Participants that were not working then clarified any details that may give more insight to their positions and situation:
- *Seeking Work*
- *Moving to the bay area (to seek work)*
- *In Houston*
- *Rock Climbing?*
- *I am pursuing or have earned professional certification in soil science (SSSA), geology (ASBOG), and hydrology (AIH).*
- *Just completed my Master of Science degree in Atmospheric Science. Pursing jobs and working temporarily at the Desert Research Institute, Reno*
- *I also am co-founder of an environmental consulting company and am completing my PhD degree this year.*
- *Seeking to be a county commissioner or similar*

Of the forty-nine follow-up respondents, twenty-nine (64%) reported that they currently work in interdisciplinary teams. The portion that indicated "yes" gave clarification to their positions:
- *Yes, to a degree. As part of my dissertation research, I work with a committee whose members represent the local wastewater treatment plant, the local drinking water utility, and an inter-jurisdiction planning agency. Water treatment, surface water quality, land use, and environmental management are addressed in a collaborative manner, and meeting discussions provide input for my research. Although my research is not conducted by an interdisciplinary team, it is partially guided by one.*
- *I am part of a Small Pelagic Fish and Mediterranean Sea contaminant group in France. These groups include ecologist, physiologist, mathematical modelers, oceanographers, organic and inorganic chemists.*
- *All of my teams are interdisciplinary. Typical teams include civil and other engineers, biologists, hydrologists, and other physical resource scientists.*
- *Lots of our projects have advisory boards with biologists, ecologists, etc.*

- *Working on the nitrogen cycling within a watershed with biogeochemists from different countries, a geographer, a biogeochemical engineer, and a hydrogeologist while addressing river water quality.*
- *My co-workers are geologists, engineers and hydrogeologists (I am a hydrologist). Our clients are public and private and are very diverse.*
- *I am in the course of setting up a graduate committee that will be composed of more than one discipline to assist in my interdisciplinary research.*
- *I am part of research team that received CNH-NSF funding for looking at human and nature interactions in Acequia irrigation systems in New Mexico*
- *I work with a hydrologist and I am an atmospheric scientist. We are working on the relationships between drought and water resources*
- *I support teams of different engineering backgrounds on defense related projects.*
- *I currently work with a team that includes hydrologists, economists, ecologists, geologists, SD modelers and GIS specialists as well as a number of professionals in government and private industry.*
- *My work for PNL*
- *I work as a GIS programmer with marine biologists at NMML.*
- *As a geospatial analyst I am required to collect data for all team members on a project and present the findings in a coherent spatial and temporal manner.*
- *I am currently working on two different water-related interdisciplinary projects.*
- *I work with ESA personal, State, Local and Tribal agencies as well as private land owners and contractors to accomplish a variety of stream restoration projects, fish barrier replacements, water quality and sediment sampling for EA and EIS requirements as well as water right permitting and wetland delineations per the Army Corps 1987 manual.*
- *Working in conjunction with Sandia labs. Primarily the hydrology department of Sandia.*
- *At work many people are employed by the USBR*
- *In our non-profit, we have architects, planners, a lawyer, and a conservation biologist. We conceive and execute projects together.*
- *My project is split up into different departments, however you can say that we are one team since we are all on the same project.*
- *For my masters I'm working on the a little part of the interdisciplinary "Acequias" project*
- *I am in an NSF-IGERT program at University of Idaho where we are put into PhD teams of diverse disciplines to ask research questions related to the resilience of the sagebrush ecosystem.*
- *My current research involves professors from three departments (geoscience, biology, and civil engineering) at two different universities. We are learning to communicate across disciplines.*
- *Our lab works with a lot of different agencies on various projects.*
- *Currently our team is working on the cryosphere and water resources in central Asia under a changing climate situation. Team members have background in climatology, glaciology and hydrology. We also have collaborators with background in human geography.*
- *I am working as Research Assistant for my Professor to develop economic model for the Middle Rio Grande Water Management Project. I am closely working with hydrologist.*
- *My research team includes a wildlife ecologist, ecohydrologist and plant ecologist (and myself, social science)*
- *We are working with the CNH group, coupling our hydrologic model with their acequia model.*
- *At work, I am involved in projects with engineers, hydrologist, environmental protection specialists, cultural resource specialists, and natural resource specialists.*

When asked if the participants currently work in any interdisciplinary teams that address water related issues or changing climate, twenty-nine (64%) participants indicated "yes." They described their tasks and positions:

- *I am currently working on an IBM for anchovy and examining the impact of rising temperatures and changes in primary production (magnitude and timing). The development and efficient implementation of this model has depended on the knowledge of biologists, lipid chemists, population and ecosystem modelers and theoretical scientist.*
- *All the interdisciplinary teams I work with address water resources. Climate change is often addressed in our projects, though it has not been the main topic of any of my projects to date.*

- *Modeling sea level rise and how it will affect the Sacramento-San Joaquin Delta.*
- *Yes, my research is focused on how farmers have adapted to climatic variability historically, and how those adaptation techniques might impact the sustainability of water management in the future.*
- *I work with a hydrologist and I am an atmospheric scientist. We are working on the relationships between drought and water resources*
- *My current team looks specifically at water related issues from an interdisciplinary perspective.*
- *historical, current, and future impacts of climate on water availability for microalgal biofuel production*
- *Not water related issues, but the effects of changing climate on marine mammal distribution and range.*
- *Much of the work of the USACE involves flood management and ecosystem restoration.*
- *I am currently working on two different water-related interdisciplinary projects.*
- *Yes but mostly on a local or small watershed scale based on funding and cooperative funding sources like SRBA funding grants in Idaho.*
- *CIRC is what we are working under at BSU now.*
- *Our non-profit projects have covered water issues in the upper Santa Fe Watershed, and in ephemeral systems, riparian systems, and the communities in a southern New Mexico watershed.*
- *My current project is based on climate modeling, and the short and long-term decisions made by the Las Vegas water management based on the models.*
- *I think this project include some of the scenarios for climate change.*
- *One of the central questions for our interdisciplinary research team is how climate change will alter ecosystem services (pasture for grazing, wildlife habitat, etc.) in the sagebrush system.*
- *Our interdisciplinary team is studying how fluvial geomorphology and microbiology influence the gas exchange (and production of N2O, a greenhouse gas) in streambed sediments.*
- *Currently our team is working on the cryosphere and water resources in central Asia under a changing climate situation. Team members have background in climatology, glaciology and hydrology. We also have collaborators with background in human geography.*
- *We want to understand the impact of changing precip and temperatures on invasive plants, wildlife communities and rural livelihoods in our research area.*
- *Yes, I have participated in teams involved in hydraulic modeling to create inundation maps, participated in flood operations to manage reservoirs during emergencies, and provide occasional GIS support to our environmental divisions.*

Faculty impacts of participation in the IDM course

Twenty-one faculty indicated whether participation in the course led to the strengthening of existing and the development of new collaborations. Fourteen respondents indicated participation strengthened existing relationships. Of those respondents, four indicated one collaboration was strengthened, four indicated two were strengthened, four indicated three were strengthened, and two did not specify how many collaborations were strengthened. Four faculty indicated they initiated one more collaboration, five indicated they initiated two new collaborations, and one initiated three more. Five faculty reported that they neither strengthened nor developed new collaborations. Faculty also indicated whether participation in this course improved their research or increased collaborations. As indicated in Figure 48, three quarters of the faculty reported they have generated ideas that have or will improve their research. A third collaborated or plan to collaborate with other researchers on a project, proposal, or paper.

Figure 48. IDM Faculty impacts[7]
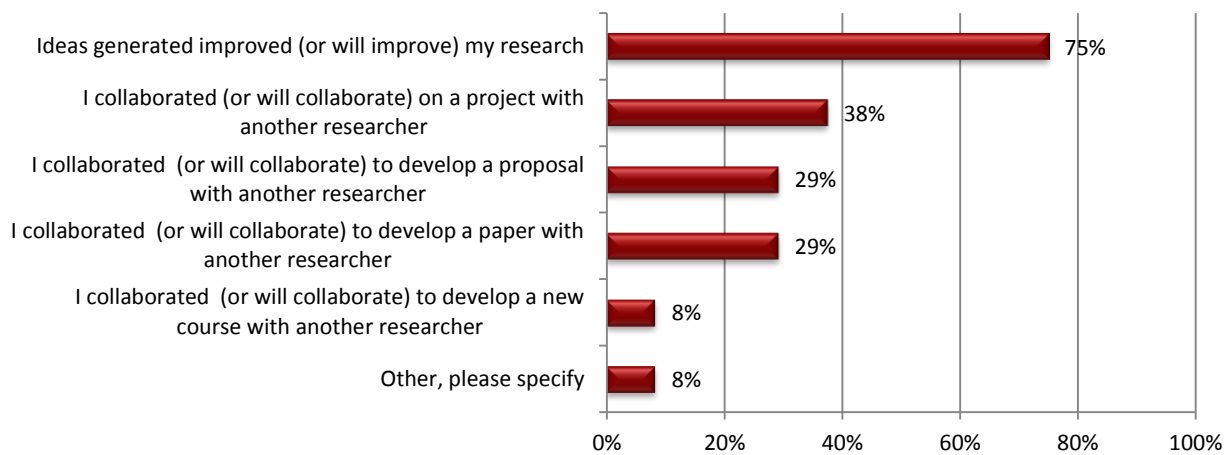
Faculty also described a variety of other ways participation had impacted them professionally. Many mentioned making valuable professionally connections. All responses are included below:
- *Overall understanding of model parameters and need for shared input/outputs to string models together.*
- *Enhanced the opportunity and ability to conduct interdisciplinary research that more explicitly integrated hydrodynamics with distribution, movement, feeding and bioenergetics of fish in lake and reservoir systems*
- *I unearthed some interesting and important papers in preparing a lecture on the history and philosophy of modeling. I also improved my understanding of modeling from preparing the lecture and participating in the first version of the course.*
- *I participate in the course a few years ago. Much of my research involves linking together models of different types, especially hydrological and ecological. The course made me much more conscious of developing the best way to link models.*
- *I did not know it existed before, and now I have run a student through it. I look forward to the outcome.*
- *Getting to know the western U.S water issues in general is useful. Having to know the expertise in different fields, provides a great headstart in assembling teams for a proposal, although it has not taken off yet. But, it should be discussed with the administrators (deans and chairs) the effort that goes into this class as we spend good amount of time since Feb, especially the lead faculty, otherwise it gets unnoticed. May be we should create a participation letter at the end that can go into our annual evaluation binders.*
- *Networking with other researchers.*

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[7] I had a Ph.D. candidate in the class, and I will certainly talk to him about collaborative possibilities.
Began conversations that may lead to future collaboration.

- *Learning approaches and methodologies from very different disciplines (e.g., economics, social, ecology) is very useful to develop new ideas and methods in my own field.*
- *I am more interested in collaborations with colleagues in the sciences.*
- *I think just the fact that this course was offered at NMSU that makes people more aware that this kind of courses exist.*
- *Increased knowledge of how to participate in a modeling course that embraced multidisciplinary approaches and methods, mathematical, qualitative, and geo-spacial.*
- *Mainly helped through broader connections in NV and ID*
- *It always good to see what other are doing in their respective fields*
- *It is always a pleasure to interact with motivated group of graduate students who are open to working outside their disciplinary boundaries.*
- *Networking*
- *Nice to get a sense of the diversity of types of modeling done by tri-state researchers.*
- *This course have shown me how different thing are interrelated. Multitude and complexity of the problems related to water resources and climate change.*
- *It is nice to have the opportunity to teach graduate students. It would be helpful if instructors were given some sort of documentation to take back to their institution so that they might receive some credit for the work done in the course.*
- *It helped me learn about some interdisciplinary modeling components that I needed to get more information on but never have the time or format to make a major commitment for, so it was a perfect dose!*

Key findings and recommendations for IDM course

1. **Course components and format** - Participants, faculty, and former participants provided numerous suggestions to improve the course. There were many differences of opinion regarding the format of the course. Some points of commonality were that most preferred a primarily face-to-face format and many suggested increasing the number of laboratory activities. Faculty tended to prefer the current format more than students, who would have preferred lectures broken up with more activities. Many students also commented that they would have preferred to have weekends off.
Consider student and faculty feedback regarding the format of the course, particularly regarding increasing the amount of time in laboratory activities.

Figure 49. Interdisciplinary Modeling course key findings and achievement of program goals

Goal Area	Key Findings	Goal Met?
Goal 1 – Awareness of models	The IDM course contributed to significant gains in awareness and knowledge of models used in different disciplines. Males scored slightly higher than females on the pre- and the post-survey. Participant comments from each day of the IDM course seminars indicated feelings of increased awareness and knowledge in addition for a desire to learn more. Participants want to look for ways to incorporate seminar topics in their own research.	**Yes**
Goal 2 - Knowledge of the challenges	Overall, participants' knowledge of the challenges of applying models in an interdisciplinary context increased significantly. Again, males scored slightly higher than females on the pre- and the post-survey in their perceived knowledge. Between 58% and 92% of participants believe they experienced *good or great* gains in their awareness and knowledge. Least gains were noted in the areas of *groundwater, mathematical, thermal stratification* and *evapotranspiration modeling*.	**Yes**

Goal Area	Key Findings	Goal Met?
Goal 3 - Interdisciplinary teams	IDM course contributed to participants' improvements in skills and confidence in working in interdisciplinary teams to address complex issues. Females scored slightly higher than males on the pre- and the post-survey for skills and confidence in working in Interdisciplinary teams. Between 87% to 92% of participants indicated they experienced *good* or *great* gains in this area. Participant comments indicated feelings of increased ability to collaborate with various professionals across multiple disciplines and found such collaborations beneficial to their own work and research.	**Yes**
Goal 4 – Confidence	IDM course contributed to participants' increased confidence in doing interdisciplinary modeling. Males scored considerably higher than females on the pre-survey and slightly higher than females on the post-survey. Females experienced more gains in confidence than males. Over 79% of participants indicated they experienced *good* to *great* gains in this area. Participants commented that they felt as though they could better understand interdisciplinary modeling projects and their importance. Some participants came away with more ideas of how to incorporate modeling in their own projects while others wanted to learn more about interdisciplinary modeling.	**Yes**
Goal 5: Enthusiasm	IDM course did not increase participants' enthusiasm for working with interdisciplinary modeling approaches. However a lack of statistically significant increase may be because the participants were already enthusiastic about the topic before the course began. Participant comments indicated that the material covered in the IDM course prompted them to think differently about the ways in which interdisciplinary modeling could fit within their own scope of work.	**Yes**
Goal 6: Interest in modeling	Overall, participants' interest in doing interdisciplinary modeling increased significantly; however, when disaggregated by gender only females had statistically significant increases from pre- to post-surveys. Between 54% and 80% of participants indicated that they experienced *good* or *great* gains in this area. Responses indicated that many participants and former participants were interested and engaged in interdisciplinary modeling in their academic and/or career pursuits.	**Yes**

Three of the 25 participants (12%) are underrepresented minorities and eight (32%) are female. Advertise this class more widely and personally invite underrepresented minorities and females. Considerable gains were made in all goal areas except participants' enthusiasm, which was already very high at the start of the class. Females benefited more than males in increased confidence in doing interdisciplinary modeling. The IDM course is an excellent example of how various aspects of the EPSCoR project can be integrated to utilize many different specialists' skills and to increase overall understanding of extremely useful concepts and skills. Consider offering this class more than every 1-2 years. Possibly offer 1-day follow-up seminars to expand on and cover topics requested by participants. Participants may also benefit from increased application activities, such as labs which they can incorporate techniques and concepts they have learned to their own research.

3.2 Sustainability of project components

Track 2 funding allowed for the expansion of existing activities and the development of new programs and components relevant to its goal of knowledge transfer by enhancing state cyberinfrastructure. As shown in Figure 50, most activities will continue with alternate funding.

Figure 50. Sustainability of project components

Project component	Existed prior to Track 2 funding?	Will continue?	How will component be able continue?
Data Portals – Idaho, Nevada, New Mexico	No	Yes	Continued data portal development will be sustained by each state and was included in each state's Track 1 EPSCoR proposal.
Idaho McCall Outdoor Science school (MOSS) summer institute	Yes	Yes	MOSS will continue using Idaho Track 1 monies. MOSS also received a grant for 5 more years of funding from the USDA.
Nevada Summer Science Institute (SSI) for Teachers	No	Yes	SSIs are a part of the Workforce Development Plan included in the Nevada Track 1 proposal building on collaborations established with Track 2 and previous Track 1 funding.
New Mexico CI for Industry	No	Yes	This program has support from CenturyLink and has trained 400 people already this year in 6 additional communities.
New Mexico SCC/GUTS summer teacher institute and student programs	Yes	Yes	Project GUTS will continue in a modified and refocused form called GUTC or Growing Up Thinking Computationally with greater emphasis on computational thinking and computer programming skills development. The program was included in NM's Track 1 EPSCoR proposal. SCC will continue through funding from a myriad of sources including Los Alamos National Laboratory / Los Alamos National Security, Sandia National Laboratory, industry partners and private donors.
Tri- state Consortium annual meeting and workshops	No	Not at this time	
Tri-state cyberinfrastructure (CI) training opportunities	No	Yes, in a different form	The tri-state group plans a Postdoctoral Fellowship Leadership Workshop and continued work by the CI group to identify and promote interoperability, visualization, provenance and other standards.
Tri-state Cyberlearning Summit	No	Not at this time	
Tri-state educational materials development	No	Yes	Educational materials development will continue at individual institutions using Track 1 and/or institutional funds.
Tri-state Interdisciplinary Modeling Course	No*	Undecided*	If funding is available. *Responses are specifically in relation to the Tri-State offering of the course.

3.3 Summative impacts of the Tri-state EPSCoR project

Background

As stated in the introduction of this summative report, the primary goal and three objectives of the Tri-state EPSCoR project are:

Project Goal - Knowledge transfer

The Track 2 project will promote knowledge transfer to scientists, educators, students, and citizens within and beyond the Consortium by enhancing state CI, and to enable the community science that is required to address regional to global scientific and societal challenges.

Objective 1 - Connectivity

Significant effort will focus on promoting communication and collaboration by improving connectivity infrastructure within the Consortium. Proposed and future Consortium efforts related to improving research competitiveness, STEM education, and economic development rely on this basic infrastructure.

Objective 2 - Interoperability

The Consortium will promote discovery by supporting community-based climate change science through enhanced interoperability between models and other software components, improved access to and usability of Consortium data products through the adoption of standards-based data management and access models, and new data assimilation, analysis, and visualization capabilities.

Objective 3 - Cyberlearning

The Consortium will enhance learning by focusing particularly on graduate student and postdoctoral researcher development; extending cyberenabled science education into middle and high schools and extracurricular programs; and improving outreach to business and industry.

Background of the evaluation

To assess achievement of the project goals and objectives and impact of this project on the three states, SmartStart developed a survey to measure perceived impacts as a result of participating in the Track 2 project. Only two questions were asked in the survey. Participants first indicated their current academic or professional position and then complete an open-ended response answering the following question:

*Reflect back over the past three years of the Tri-state EPSCoR project. What do you believe is the **greatest impact** your participation in this project has had on you, your research, your teaching, or your community?*

Evaluation participants

The email invitation and several reminders were sent to 265 EPSCoR participants across the three states. Although only 15% (40 people) completed the survey, many of the survey recipients were involved with the EPSCoR project in a minor or peripheral manner. Most of the core project participants completed the survey. As shown in Figure 51, most respondents (n=26) indicated they were higher education faculty and with the next largest proportion (n=8) indicating they were graduate students.

Figure 51. Demographic description of impact survey participants

Position	# (n=40)	%
Higher Education Faculty/Administrator	26	65%
K-12 Educator/Administrator	1	2.5%
Postdoc	1	2.5%
Graduate student	8	20%
Undergraduate student	--	--
Community-based participant	--	--
Industrial affiliate	--	--
Higher Education IT Department	1	2.5%
Researcher at Harry Reid Center for Environmental Studies	1	2.5%
NSHE Staff	1	2.5%
Research associate	1	2.5%

Data analyses

The Impacts Survey was administered online via www.zoomerang.com. The link to the evaluation form was sent to participants' email addresses. Once collected, responses were downloaded into an Excel file. Participant responses were analyzed, qualitatively, in Excel employing the following steps:

1. A first pass reading of comments was completed to identify common themes in accordance with the three main project objectives: *connectivity, interoperability*, and *cyberlearning*.

2. Next, a word-frequency query using the 50 most frequent words of three letters of more was conducted in Wordle. To assist in visualizing the data, the word frequency data was also used to produce a word cloud with www.Wordle.net. The word cloud relates the frequency of word use to the font size of each word.

3. Comments were then re-examined and coded for instances of each of the identified themes. The text from the comments where participants discussed a theme was entered into a spreadsheet and assigned the appropriate code.

4. Frequencies were calculated indicating the proportion of participants who referred to each theme. When appropriate, the content of the comments was analyzed to identify commonalities or differences between comments made by participants on each theme.

Summary of evaluation findings
Word frequency Word Cloud
The word cloud was created from participants' comments about impacts of the Track 2 project. Because the words *EPSCoR* (n=56) and *projects* (n=25) were used very frequently, they were removed from the word cloud so details of perceived impacts would not be obscured. Additionally, non-pertinent words were removed (e.g., First, also, but). As shown in Figure 52, common themes observed from the word frequency analysis focused on increased research developments and new opportunities and experiences.

Figure 52. Word cloud of impacts of the Track 2 EPSCoR project

Next, the evaluator categorized each response by the project-wide goal of knowledge transfer or project objective (connectivity, interoperability, and cyberlearning). The majority of comments addressed the project-wide goal. This indicates a considerable integration of cyberinfrastructure throughout the project therefore facilitating community-focused science. Figure 53 illustrates the percentage of comments that align the closest with the project-wide goal or each objective. Comments pertaining to the project-wide goal demonstrated sub-categorical themes that included collaborations, research development, and knowledge attainment. More than a third of comments pertained to the importance of collaborations participants have developed. Participants also noted considerable progress made in their research and knowledge they have gained as significant impacts. The Cyberlearning comments demonstrated sub-categorical themes that included science education and professional practices. This reinforces the word cloud findings indicating considerable strides in scientific research and opportunities that have resulted from Track 2 funding.

Figure 53. Impacts of the Track 2 EPSCoR project by project objective[8]

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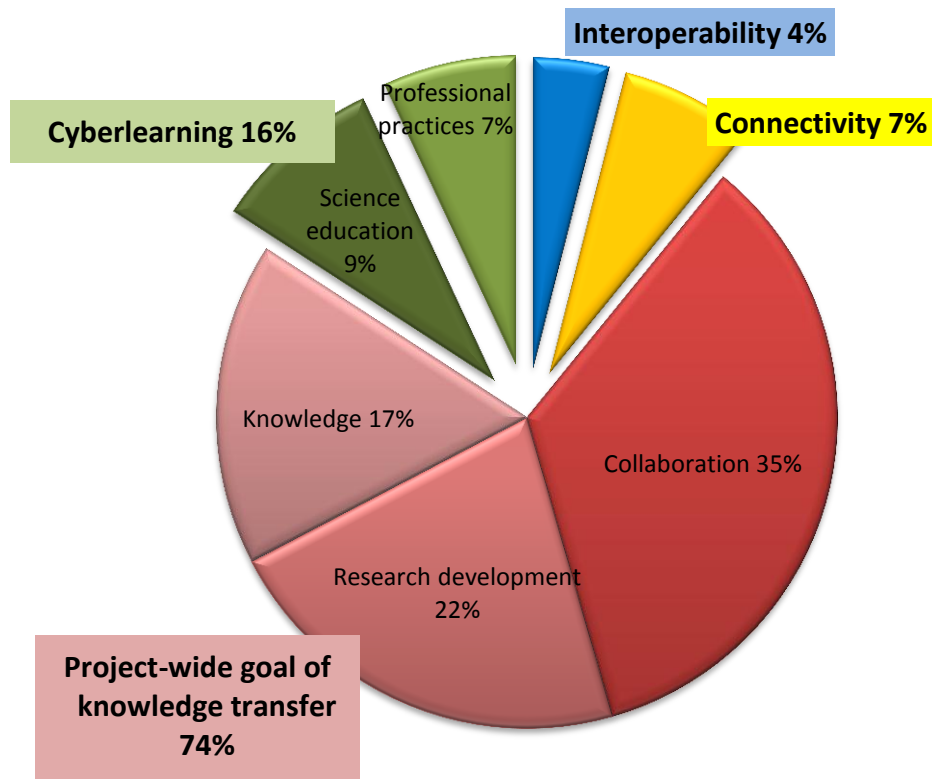
[8] Percent doesn't equal 100 due to rounding.

Figure 54 presents key participant responses divided by project goal and objectives. The complete list of responses can be found in Appendix G. Comments demonstrate the consistent finding that the Track 2 project had the greatest impact on the overall goal of knowledge transfer.

Figure 54. Key participant comments of impacts by project goal and objectives

Key participant comments
Project goal: Knowledge transfer
• *This project enabled significant progress in the development of a much needed and purposeful hydro-economic model of the Rio Grande watershed system… this will enhance future research efforts considerably and enable improved policy assessment regarding agricultural irrigation efficiency and water use conservationI have built a solid computer programming skill foundation. I have improved my public speaking and presentation skills. I have learned a significant amount regarding the theory and practice of academic research. I have improved my teaching skills via a course funded by EPSCoR that I acted as a TA for. EPSCoR has made me a better citizen of the both the general and academic communities.*   • *This EPSCoR project has brought my environmental research together with a new paradigm of data transport and systems management using cyberinfrastructure which will ultimately result in better quality data, wider data distribution, and long term data accountability.*   • *Expanded my understanding of climate range research and in particular how it relates to local and regional scale hydrologic impacts*   • *I have been able to hire exceptional graduate students to conduct cutting edge research. I have engaged over 20 students in undergraduate research-because of this, many of these students have gone on to graduate school. My research program has grown substantially.*   • *Shown me the potential we can achieve by creating relationships and dialog across a wide group of diverse individuals.*
Objective 1: Connectivity
• *We have been able to bring high speed Internet bandwidth and connectivity to several key research facilities that are vital to our mission while being challenged by their remote location. We have also been able to create, in South Central Idaho, infrastructure that will continue to be built on in future projects. We are in the process of connecting another site and are performing design work on yet another.*   • *The support through Track 2 has enormously help implement some of the high-end computational needs. For example, we were able to develop codes at our local server and implement the code at the INL cluster for which a high bandwidth data transfer capabilities were made available through this support. Students were able to get trained in these data transfer, coding, compiling and simulation exercises very effectively. Without this support, we would not have developed the computational capabilities of my research group. Certainly, it has helped me advance my research plan and growth and abilities to submit proposals to perform high-spatial resolution land surface hydrological process modeling. Our ability to integrate state of the art science in our modeling framework and that attracted quite a bit of interest from outside Idaho as well. That would not have been possible without this project.*
Objective 2: Interoperability
• *The EPSCoR Track 2 project has enabled me to begin integrating my research in environmental sciences with Cyberinfrastructure personnel and tools. This will ultimately result in more consistent science and leveraging of research data for multiple projects into the future. The advances that we have made under the EPSCoR Track 2 have set the foundation for scientific uniformity in data collection, transport, archival, and distribution. This allows researchers to readily analyze larger, more complete datasets from multiple sources, an opportunity that has been historically difficult at the State institution scale and typical budgeting levels.*   • *I think the most significant EPSCoR impact was to create pooled physical resources (equipment and field sites) for collaborative use by New Mexico universities.*
Objective 3: Cyberlearning
• *We have been able to influence more than 1,000 high school students and their learning of climate change science.*   • *The most important difference this project has made has been the impact to a wide range of K12 students and the public through a variety of outreach and curriculum development and dissemination efforts.*

Section 4. Key Findings and Recommendations

Key findings and recommendations address the achievement of project objectives.

Objective	Key Findings and Recommendations	Objective met?
Objective 1 – Connectivity Promoting communication and collaboration by improving connectivity infrastructure	**Findings**: Seven percent of impact responses focused specifically on how improved connectivity has impacted research and ability to communicate with other scientists and an additional 35% focused on collaborations that have been developed. **Recommendations**: Assess connectivity needs throughout the tri-states to identify areas that are still in need of additional cyberinfrastructure.	**Yes**
Objective 2 – Interoperability Promote discovery through enhanced interoperability between models and other software components, improved access to and usability of Consortium data products	**Findings**: Interoperability is being developed through the tri-state data portals. This objective is still in its beginning stage. As the portals develop, the utility of their content will become apparent to tri-state educators, scientists, and students. Four percent of impact responses focused specifically on how improved interoperability has impacted research and communications. **Recommendations**: • Data portal developers should develop best practices and learn from each other's challenges. • Place a feedback form on each portal website. • Developers should work with educators and curriculum developers to present data in a manner that is useful to teachers and students.	**In progress**
Objective 3 – Cyberlearning Enhance learning through graduate student and postdoc development; extending cyberenabled science education into schools; and improving outreach to business and industry.	**Findings**: Numerous cyberenabled institutes, trainings, programs, workshops, courses, and seminars have been conducted throughout the tri-states. All received extremely high ratings for usefulness and goal achievement by participants. Programs have reached out K-12 educators and students, undergrads, grads, postdocs, and faculty as well as the general public and Native American populations. Almost all programs will be sustained after the grant period ends. Greatest impacts were noted in increased collaborations, research development, and knowledge. **Recommendations**: • Best practices should continue to be shared across states and programs. Programs that are offered in one state should be offered in the other states. • Develop a tri-state searchable database of STEM educational materials. • Conduct a curriculum development training that identifies a research-based process. • Align curriculum with state standards • Develop curriculum that utilizes data sets contained in the state data portals. • Assess quality, usefulness, and impact of the educational materials.	**Yes**

General recommendations

It is clear that this project has made tremendous progress and has had significant impacts on Idaho, Nevada, and New Mexico's cyberinfrastructure and Cyberlearning capabilities. Baseline data, benchmarks, annual milestones, and evaluations of individual project activities were developed and collected by the previous evaluator in year 1 and can be found in the year 1 evaluation report. However, it was a challenge for the new evaluator to assess the extent of progress made on this Track 2 project because the change in the evaluation plan in year 2 of the project, due to the change in the evaluator and the focus of the evaluation, made integration of year 1 with years 2 and 3 data difficult. The evaluator makes the following recommendations for future projects:

1. Component leads should develop project benchmark and annual milestone expectations for each project goal and objective.
2. The evaluator will use the benchmarks and milestones to develop metrics that will be used to assess achievement of all project benchmarks.
3. The evaluator will work with component leads to establish baseline data for all metrics.
4. Component leads should update benchmark and milestone tables as the project progresses and submit annual reports of progress made on benchmarks.
5. The evaluator will track progress made on benchmarks based on project leads' reports.
6. The component leads and evaluator should develop a project logic model as a snapshot of their progress. The logic model should be based on project benchmarks.
7. All project activities should be assigned under the supervision of a component lead and component leads should monitor implementation and outcomes of project activities that are assigned to their component.
8. The evaluator will meet quarterly with project leads to assess progress, provide feedback from evaluation results and plan implementation of recommended changes.

Western Consortium of Idaho, Nevada, and New Mexico

Idaho, Nevada and New Mexico EPSCoR - CI Training Evaluation

Please answer the following questions about the CI Training workshop you attended. **Double click the box to make your selection.**

1. What is your name?

2. What is the name of the training you attended?

3. What is the date(s) of the training you attended the training

4. With which gender do you identify?
   ☐ Male
   ☐ Female

5. With which ethnicity do you most closely identify?
   ☐ African American (Black)
   ☐ Asian (Chinese, Filipino, Japanese, Vietnamese, etc.)
   ☐ Caucasian (White)
   ☐ East Indian (from India)
   ☐ Hispanic (Latino/a, Mexican, Chicano/a, Brazilian)
   ☐ Middle Eastern
   ☐ Native American (American Indian)
   ☐ Pacific Islander / Hawaiian
   ☐ Other, please specify:

6. What is your position?
   ☐ Faculty
   ☐ Research faculty
   ☐ Post-doc
   ☐ Graduate student – Masters
   ☐ Graduate student – Ph.D.
   ☐ Undergraduate student
   ☐ Other, please specify:

7. With which institution with which you are affiliated?
   ☐ Desert Research Institute
   ☐ Idaho State University
   ☐ New Mexico State University
   ☐ New Mexico Tech
   ☐ University of Idaho
   ☐ University of Nevada, Las Vegas
   ☐ University of Nevada, Reno
   ☐ University New Mexico
   ☐ Other, please specify:

Please rate the training you attended in the following areas. Put an X in the box.

	Did not meet my expectations	Met my expectations	Exceeded my expectations	Far exceeded my expectations	N/A
8. To what degree did this training meet your expectations for increasing your **scientific capabilities**?					
9. To what degree did this training meet your expectations for increasing your **CI-literacy**?					

10. Will this training enhance your ability to conduct research in your scientific field?
☐ Yes   ☐ No

Please explain.

11. Has this training increased your awareness, skills and knowledge in the area of climate change or other scientific disciplines?
☐ Yes   ☐ No

Please explain.

12. Has this training increased your awareness, skills and knowledge in the area of cyberlearning and/or cyberinfrastructure literacy?
☐ Yes   ☐ No

Please explain.

13. Will you be able to apply what you have learned to your studies, research and/or career?
☐ Yes   ☐ No

If yes, please explain how you will apply what you have learned.

14. Was the application review and award process timely?

15. Is there anything else you would like to share with the EPSCoR project leads or directors?

Thank you for completing this evaluation form. Please email this form back to the person who sent it to you or to the project evaluator: Lisa Kohne at lkohne@smartstartecs.com

Appendix B: IDM Faculty course evaluation

What are the initials of your First, Middle, and Last name, in that order? For example: LMK.
This information will only be used to track survey completion and to send reminders to non-completers. It will be removed during data analysis.

PLEASE TELL US ABOUT YOURSELF

Are you a:

Co-instructor
Guest lecturer

How many times they have participated in this interdisciplinary modeling course including this summer 2012?

1 time
2 times
3 times
4 times

With which gender do you identify?

Male
Female
Prefer not to respond

With which ethnicity or racial background do you most closely identify?

African American or Black
Asian
Caucasian or White
Hispanic or Latino

American Indian or Alaska Native
Native Hawaiian or other Pacific Islander
Prefer not to respond
Other, please specify

With which institution are you most closely affiliated? (Choose one)

Boise State University
Desert Research Institute
Idaho State University
Nevada State College
New Mexico State University
New Mexico Tech
University of Idaho

University of Nevada, Las Vegas
University of Nevada, Reno
University of New Mexico
Other, please specify:

Page 2 - Heading

FORMAT OF THE INTERDISCIPLINARY MODELING COURSE
Please give us your feedback on this year's course format.
If you did not present or participate in the summer 2012 course please skip the questions that apply to summer 2012.

Page 2 - Heading

This year, the 2-day conference/workshop was conducted in the middle of the course to provide more overlap of instructors during the course. This required us to separate lectures from labs (i.e., they were mostly not held on the same day as was done in the past).

Page 2 - Question 7 - Yes or No

Did you find this year's format effective to bring together more faculty at the same time and therefore inspire more collaboration between faculty?

    Yes
    No
    Please explain.

Page 2 - Question 8 - Yes or No

Did you find this year's format effective to provide good examples of applying interdisciplinary modeling?

    Yes
    No
    Please explain.

Page 2 - Question 9 - Yes or No

Did you find this format an effective way of delivering the material?

    Yes
    No
    Please explain

Page 2 - Question 10 - Open Ended - Comments Box

How did this format affect your level and type of involvement in the course?

Page 2 - Question 11 - Choice - One Answer (Bullets)   [Mandatory]

Would you prefer to have the course over two weeks (like this year) or three weeks (as in previous years)?

    Two weeks
    Three weeks

Page 2 - Question 12 - Choice - One Answer (Bullets)

| Would you like to see this course be offered online? |

    No, all face to face.
    Yes, partial online, partially face to face.
    Yes, all online.

Page 2 - Question 13 - Choice - One Answer (Bullets)   [Mandatory]

| Would you continue to participate in this interdisciplinary modeling course if your travel was not covered? |

    No
    Yes

Page 2 - Question 14 - Choice - One Answer (Bullets)   [Mandatory]

| Would you continue to participate in this interdisciplinary modeling course if you did not receive compensation (i.e., a stipend)? |

    No
    Yes

Page 2 - Question 15 - Open Ended - Comments Box

| Please explain how you believe any aspect of this course could be improved. |

Page 2 - Question 16 - Rating Scale - Matrix

| Please indicate the number that most closely matches your satisfaction with the following aspects of the summer 2012 course. |

	Low	2	3	4	High
Pre-course information	○ 1	○ 2	○ 3	○ 4	○ 5
Travel arrangements (well-planned, organized)	○ 1	○ 2	○ 3	○ 4	○ 5
Food (quality, dietary needs, preferences, freshness)	○ 1	○ 2	○ 3	○ 4	○ 5
Accommodations (physical comforts: beds, bathroom facilities, safety, location)	○ 1	○ 2	○ 3	○ 4	○ 5
Course schedule (comprehensive, sequential order)	○ 1	○ 2	○ 3	○ 4	○ 5
Course management (well-prepared, organized, equipment was ready)	○ 1	○ 2	○ 3	○ 4	○ 5

Classroom (good set-up for this type of class, functional equipment)	◯	1	◯	2	◯	3	◯	4	◯	5
Technology (availability, quality of projectors/sound, internet connection)	◯	1	◯	2	◯	3	◯	4	◯	5
Atmosphere (friendly, supportive, promoted teamwork)	◯	1	◯	2	◯	3	◯	4	◯	5

Page 3 - Heading

COURSE IMPACT

Page 3 - Question 17 - Open Ended - One or More Lines with Prompt

Did participating in this interdisciplinary modeling course help you strengthen or initiate a collaborative relationship within the tri-state (NM, NV, ID) region? (Comment on all that apply)

Yes, strengthened one or more collaborations. How many? ....

Yes, new collaborations were initiated. How many? ....

N   o ....

Page 3 - Question 18 - Choice - Multiple Answers (Bullets)   [Mandatory]

Please indicate whether any of the following have resulted from (or you anticipate resulting from) your participation in this course. (Mark all that apply)

Ideas generated improved (or will improve) my research
I collaborated (or will collaborate) on a project with another researcher
I collaborated (or will collaborate) to develop a proposal with another researcher
I collaborated (or will collaborate) to develop a paper with another researcher
I collaborated (or will collaborate) to develop a new course with another researcher
Other, please specify

....

Page 3 - Question 19 - Open Ended - Comments Box

In what other ways has participation in this course impacted or benefited you professionally?

....

....

Thank You Page

Thank you for completing this evaluation form!

THANK YOU

Appendix C: IDM Student Pre/Post Survey

What are the initials of your First, Middle, and Last name, in that order?
For example: LMK.
This information will only be used to compare your pre-survey responses to your post-survey responses.
It will be removed during data analysis.

PLEASE TELL US ABOUT YOURSELF

With which gender do you identify?

- Male
- Female
- Prefer not to answer

With which ethnicity or racial background do you most closely identify?

- African American or Black
- Asian
- Caucasian or White
- Hispanic or Latino
- American Indian or Alaska Native
- Native Hawaiian or other Pacific Islander
- Prefer not to answer
- Other, please specify

What is your primary area of study/major at your home university?

- Atmospheric Science/Physics
- Biology/Ecology/Wildlife
- Computer science
- Economics
- Engineering (including Civil Engineering)
- Environmental Science
- Geography
- Geosciences
- Hydrology/Water Resources
- Range Science
- Other, please specify

ACHIEVEMENT OF PROJECT GOALS

Page 2 - Question 5 - Rating Scale - Matrix

Goal 1: - Increase awareness of models used in different disciplines to model water-related issues and climate change
Please indicate your level of familiarity with the following concepts.
Presently I am familiar with

	Not at all	A little	Somewhat	A lot	A great deal
Uncertainty issues associated with modeling.	◗ 1	○ 2	○ 3	○ 4	○ 5
Scale issues associated with interdisciplinary modeling.	○ 1	○ 2	○ 3	○ 4	○ 5
Assumptions and limitations of modeling.	○ 1	○ 2	○ 3	○ 4	○ 5
Models in disciplines besides my own that are used to model water-related issues and changing climate.	○ 1	○ 2	○ 3	○ 4	○ 5

Page 2 - Question 6 - Rating Scale - Matrix

Goal 2 : Increase knowledge of the challenges of applying models in an interdisciplinary context
Please indicate your level of understanding of the following concepts.
Presently I understand

	Not at all	A little	Somewhat	A lot	A great deal
The challenges of applying models in an interdisciplinary context	◗ 1	○ 2	○ 3	○ 4	○ 5
The challenges of applying interdisciplinary modeling to address climate-related issues	○ 1	○ 2	○ 3	○ 4	○ 5
The challenges of applying interdisciplinary modeling to address water-related issues	○ 1	○ 2	○ 3	○ 4	○ 5
The challenges involved in linking models from different disciplines in modeling water-related issues and changing climate.	○ 1	○ 2	○ 3	○ 4	○ 5

Goal 3: Improve skills and confidence in working in interdisciplinary teams to address complex issues
Please indicate your level of skills in the following areas.
Presently I can

	Not at all	A little	Somewhat	A lot	A great deal
Work effectively in teams with people from other disciplines to apply models.	○ 1	○ 2	○ 3	○ 4	○ 5
Work effectively in teams with people from other disciplines to do interdisciplinary projects	○ 1	○ 2	○ 3	○ 4	○ 5
Work effectively in teams with people from other disciplines to prepare interdisciplinary reports	○ 1	○ 2	○ 3	○ 4	○ 5
Work effectively in teams with people from other disciplines to prepare interdisciplinary presentations	○ 1	○ 2	○ 3	○ 4	○ 5

Goal 4: Increase confidence in doing interdisciplinary modeling
Please indicate your level of confidence in the following areas.
Presently I am

	Not at all	A little	Somewhat	A lot	A great deal
Confident about my ability to do interdisciplinary modeling of water related issues and changing climate.	○ 1	○ 2	○ 3	○ 4	○ 5
Comfortable working with complex issues related to climate change.	○ 1	○ 2	○ 3	○ 4	○ 5
Comfortable working with complex issues related to water	○ 1	○ 2	○ 3	○ 4	○ 5

Goal 5: Increase enthusiasm for working with interdisciplinary modeling approaches for addressing water-related issues and climate change
Please indicate your level of enthusiasm in the following areas.
Presently I am

Not at all	A little	Somewhat	A lot	A great deal

Excited about interdisciplinary modeling of water-related issues and changing climate.	◑	1	○	2	○	3	○	4	○	5
Interested in using interdisciplinary modeling to address water-related issues and changing climate.	○	1	○	2	○	3	○	4	○	5
Interested in working in interdisciplinary teams	○	1	○	2	○	3	○	4	○	5

Page 2 - Question 10 - Rating Scale - Matrix

Goal 6: Increase interest in interdisciplinary modeling
Please indicate your level of interest in the following areas.
Presently I am

	Not at all		A little		Somewhat		A lot		A great deal
Interested in taking additional classes (besides this one) in water-related issues and changing climate.	◑	1	○	2	○	3	○	4	○	5
Interested in conducting research in an area related to changing climate.	○	1	○	2	○	3	○	4	○	5
Interested in conducting research in an area of water-related issues.	○	1	○	2	○	3	○	4	○	5
Interested in pursuing higher education/doctoral degree in an area related to changing climate.	○	1	○	2	○	3	○	4	○	5
Interested in pursuing higher education/doctoral degree in an area of water-related issues.	○	1	○	2	○	3	○	4	○	5
Interested in pursuing a career in changing climate.	○	1	○	2	○	3	○	4	○	5
Interested in pursuing a career in an area of water-related issues.	○	1	○	2	○	3	○	4	○	5
Interested in teaching a course in changing climate.	○	1	○	2	○	3	○	4	○	5
Interested in teaching a course in water-related issues.	○	1	○	2	○	3	○	4	○	5
Interested in teaching a course interdisciplinary modeling.	○	1	○	2	○	3	○	4	○	5

Page 2 - Question 11 - Choice - One Answer (Bullets)   [Mandatory]

Are you completing this as a pre-survey (before participating in the class) or as a post-survey (after participating in the class)?

Pre-survey [Skip to End]
Post-survey

COMPONENTS OF THE INTERDISCIPLINARY MODELING COURSE

How much did the following aspects of the class help your learning?

Page 3 - Question 12 - Rating Scale - Matrix

Structure of the class

	No Help	A little help	Moderate Help	Much help	Great help
The instructional approach taken in this class	○ 1	○ 2	○ 3	○ 4	○ 5
How the class topics, activities, reading and assignments fit together	○ 1	○ 2	○ 3	○ 4	○ 5
The pace of the class	○ 1	○ 2	○ 3	○ 4	○ 5

Page 3 - Question 13 - Rating Scale - Matrix

Class Components

	No help	A little help	Moderate help	Much help	Great help
The lectures	○ 1	○ 2	○ 3	○ 4	○ 5
Participating in class discussions	○ 1	○ 2	○ 3	○ 4	○ 5
Laboratory exercises	○ 1	○ 2	○ 3	○ 4	○ 5
The case studies	○ 1	○ 2	○ 3	○ 4	○ 5

Page 3 - Question 14 - Rating Scale - Matrix

Assignments and Feedback

	No help	A little help	Moderate help	Much help	Great help
Graded assignments	○ 1	○ 2	○ 3	○ 4	○ 5
Interdisciplinary modeling project	○ 1	○ 2	○ 3	○ 4	○ 5
Feedback received on my work	○ 1	○ 2	○ 3	○ 4	○ 5

Class resources

	No help	A little help	Moderate help	Much help	Great help
The virtual textbook (wiki)	● 1	○ 2	○ 3	○ 4	○ 5
Online notes or presentations posted by instructor	○ 1	○ 2	○ 3	○ 4	○ 5
Class binder of materials	○ 1	○ 2	○ 3	○ 4	○ 5

The information given

	No help	A little help	Moderate help	Much help	Great help
Pre-course information about course content (i.e., schedule, syllabus, location, etc.)	● 1	○ 2	○ 3	○ 4	○ 5
Information about course assignments	○ 1	○ 2	○ 3	○ 4	○ 5
Information about course expectations	○ 1	○ 2	○ 3	○ 4	○ 5

Support for you as an individual learner

	No help	A little help	Moderate help	Much help	Great help
Interacting with the instructors during and outside of class	● 1	○ 2	○ 3	○ 4	○ 5
Working with peers as part of the class	○ 1	○ 2	○ 3	○ 4	○ 5

Specific Class Activities

	No help	A little help	Moderate help	Much help	Great help
Conceptual modeling exercise (Saito/Koracin/Steele)	● 1	○ 2	○ 3	○ 4	○ 5
Stella training session (Ahmad)	○ 1	○ 2	○ 3	○ 4	○ 5
Climate modeling lab (Mejia)	○ 1	○ 2	○ 3	○ 4	○ 5

Hydrologic/watershed modeling lab (Saito)	❍ 1	❍ 2	❍ 3	❍ 4	❍ 5
Vadose zone/groundwater modeling lab (TBD/King)	❍ 1	❍ 2	❍ 3	❍ 4	❍ 5
Canopy interception/evapotranspiration modeling lab (Link/Sridhar)	❍ 1	❍ 2	❍ 3	❍ 4	❍ 5
Economics modeling lab (Cobourn)	❍ 1	❍ 2	❍ 3	❍ 4	❍ 5
GIS/remote sensing lab (Steele)	❍ 1	❍ 2	❍ 3	❍ 4	❍ 5
Systems dynamics modeling lab (Tidwell)	❍ 1	❍ 2	❍ 3	❍ 4	❍ 5
Statistical modeling lecture/lab (Panorska)	❍ 1	❍ 2	❍ 3	❍ 4	❍ 5
Working on class projects	❍ 1	❍ 2	❍ 3	❍ 4	❍ 5
Doing evaluations of lectures	❍ 1	❍ 2	❍ 3	❍ 4	❍ 5

Page 3 - Question 19 - Open Ended - Comments Box

Are there any additional topics that should be covered in this class? If so, please explain what topic and why.

Page 3 - Question 20 - Open Ended - Comments Box

Were there any topics that were covered in this class that were not necessary?   If so, please explain what topics and why.

Page 3 - Question 21 - Open Ended - Comments Box

What teaching approaches do you believe are most effective for this type of class?

Page 4 - Heading

FORMAT OF THE INTERDISCIPLINARY MODELING COURSE

How did you find out about this class? (Mark all that apply)

Received an email announcement
From one of the instructors/ presenters of this course
From my advisor
Other, please specify

This year the lectures were primarily conducted during the first week and labs were primarily conducted during the second week.   Did you find this format an effective way of delivering the material?

Yes
No
Please explain

Would you prefer to have the course over two weeks (as is this year) or three weeks?
The three week model has four hours of lecture in the morning, followed by 4 hours of lab in the afternoon. The labs cover the same topics that were presented in the morning. There is no class on Saturday or Sunday.
Please explain your selection.

Two weeks _____
Three weeks _____

Would you like this course to be offered online? Please explain.

No, all face to face
Yes, partially online, partially face to face.
Yes, all online.

Did you pay the tuition for this course yourself (e.g., you were not on a grant, fellowship, or scholarship that paid the tuition)?

Yes
No
If no, Would you have enrolled in this course if you had to pay the tuition yourself?

Would you have enrolled I this course if you had to pay for travel and lodging?

Yes
No

Page 4 - Question 28 - Rating Scale - Matrix

Please rate the following aspects of participation in this class.

	Poor	Fair	Average	Good	Excellent
Pre-course information	◑ 1	○ 2	○ 3	○ 4	○ 5
Registration process	○ 1	○ 2	○ 3	○ 4	○ 5
Transportation (pickup/dropoff, around town, weekend activities)	○ 1	○ 2	○ 3	○ 4	○ 5
Lunches during class	○ 1	○ 2	○ 3	○ 4	○ 5
Provision of other meals outside of class	○ 1	○ 2	○ 3	○ 4	○ 5
Lodging accommodations (physical comforts: beds, bathroom facilities, safety, location)	○ 1	○ 2	○ 3	○ 4	○ 5
Course schedule (comprehensive, sequential order)	○ 1	○ 2	○ 3	○ 4	○ 5
Course management (well-prepared, organized, equipment was ready)	○ 1	○ 2	○ 3	○ 4	○ 5
Classroom for course (good set-up for this type of class, functional equipment, comfortable environment)	○ 1	○ 2	○ 3	○ 4	○ 5
Technology (availability, quality of projectors/sound, internet connection)	○ 1	○ 2	○ 3	○ 4	○ 5
Atmosphere (friendly, supportive, promoted teamwork)	○ 1	○ 2	○ 3	○ 4	○ 5
Hours for the class (e.g., 13 days, 8-5, M-F with lunch)	○ 1	○ 2	○ 3	○ 4	○ 5

Page 4 - Question 29 - Open Ended - Comments Box

Do you have any other suggestions or comments about this course or how it could be improved?

Page 5 - Heading

PERCEIVED GAINS IN GOAL ACHIEVEMENT

Page 5 - Question 30 - Rating Scale - Matrix

Goal 1: Increase awareness of models used in different disciplines to model water-related issues and climate change.
Goal 2 : Increase knowledge of the challenges of applying models in an interdisciplinary context
As a result of your work in this class, what gains did you make in your understanding of each of the following?

	No gain	A little gain	Moderate gain	Good gain	Great gain
Ethics of modeling and why model	○ 1	○ 2	○ 3	○ 4	○ 5

Model concepts and issues	○	1	○	2	○	3	○	4	○ 5
Weather and climate modeling	○	1	○	2	○	3	○	4	○ 5
GIS, remote sensing, and snow hydrology modeling	○	1	○	2	○	3	○	4	○ 5
Systems dynamics modeling	○	1	○	2	○	3	○	4	○ 5
Vadose zone modeling	○	1	○	2	○	3	○	4	○ 5
Groundwater modeling	○	1	○	2	○	3	○	4	○ 5
Adding people to the equation	○	1	○	2	○	3	○	4	○ 5
Mathematical modeling	○	1	○	2	○	3	○	4	○ 5
Hydrologic/watershed modeling	○	1	○	2	○	3	○	4	○ 5
Vegetation-atmosphere,canopy interception modeling	○	1	○	2	○	3	○	4	○ 5
Economics modeling	○	1	○	2	○	3	○	4	○ 5
Ecological modeling	○	1	○	2	○	3	○	4	○ 5
Thermal stratification modeling	○	1	○	2	○	3	○	4	○ 5
Evapotranspiration modeling	○	1	○	2	○	3	○	4	○ 5
Why the past matters	○	1	○	2	○	3	○	4	○ 5
Issues of scale	○	1	○	2	○	3	○	4	○ 5
The use and misuse of models	○	1	○	2	○	3	○	4	○ 5
Uncertainty and calibration	○	1	○	2	○	3	○	4	○ 5
Linked modeling approaches such as CSDMS	○	1	○	2	○	3	○	4	○ 5
Understanding the challenges of applying models in an interdisciplinary context	○	1	○	2	○	3	○	4	○ 5

Goal 3: Improve skills and confidence in working in interdisciplinary teams to address complex issues
As a result of your work in this class, what gains did you make in the following skill areas?

	No gain	A little gain	Moderate gain	Good gain	Great gain
Linking models from different disciplines to solve problems	○ 1	○ 2	○ 3	○ 4	○ 5
Working effectively with scientists from other disciplines	○ 1	○ 2	○ 3	○ 4	○ 5

Please comment on what skills you have gained.

Goal 4: Increase confidence in doing interdisciplinary modeling
As a result of your work in this class, what gains did you make in the following?

	No gain	A little gain	Moderate gain	Good gain	Great gain
Confidence in your ability to do interdisciplinary modeling of water-related issues and changing climate	○ 1	○ 2	○ 3	○ 4	○ 5
Your comfort level in working with complex ideas	○ 1	○ 2	○ 3	○ 4	○ 5

Please comment on how this class has changed your confidence in doing interdisciplinary modeling.

Goal 5 Increase enthusiasm for working with interdisciplinary modeling approaches for addressing water-related issues and climate change
As a result of your work in this class, what gains did you make in the following?

	No gain	A little gain	Moderate gain	Good gain	Great gain
Enthusiasm about interdisciplinary modeling of water-related issues and changing climate	○ 1	○ 2	○ 3	○ 4	○ 5
Interest in using interdisciplinary modeling to address water-related issues and changing climate	○ 1	○ 2	○ 3	○ 4	○ 5

Please comment on how this class has changed your interest in interdisciplinary modeling.

Goal 6: Increase interest in interdisciplinary modeling
As a result of your work in this class, what gains did you make in the following?

	No gain	A little gain	Moderate gain	Good gain	Great gain
My interest in taking more classes in interdisciplinary modeling	○ 1	○ 2	○ 3	○ 4	○ 5
My interest in conducting research in interdisciplinary modeling	○ 1	○ 2	○ 3	○ 4	○ 5
My interest in pursuing a degree that incorporates interdisciplinary modeling	○ 1	○ 2	○ 3	○ 4	○ 5
My interest in pursuing a career that uses interdisciplinary modeling	○ 1	○ 2	○ 3	○ 4	○ 5
My interest in teaching a course in interdisciplinary modeling	○ 1	○ 2	○ 3	○ 4	○ 5

Please comment on how this class has changed your interest in pursuing more education and or a career that uses interdisciplinary modeling.

How will you use or apply what you have learned in this class in your classes, research, and/or career?

Thank You Page

Thank you for completing this survey!

Appendix D: IDM Student Follow-Up Survey

What are the initials of your First, Middle, and Last name, in that order? For example: LMK.
This information will only be used to track survey completion and to send reminders to non-completers. It will be removed during data analysis.

What year did you participate in the interdisciplinary modeling course:

2005
2008
2010
2012

Have you been able to use of the knowledge or skills you learned in the interdisciplinary modeling course in your academic or professional life? Please explain.

Has participation in the interdisciplinary modeling course interested or inspired you in any way? Please explain.

Has participation in the interdisciplinary modeling course influenced your academic and/or career path in any way? Please explain.

Have any of the following resulted from your participation in this interdisciplinary modeling course?

I participated in scientific research
I took additional water/climate related courses
I pursued an advanced degree in science-related field
My interest in teaching a course related to interdisciplinary modeling increased
I submitted grant proposals
I made presentations
I prepared paper for publications
I decided to pursue a career in science
Other, please specify

What are you currently doing academically and/or professionally?

Pursuing a degree. Please
    explain where, what
    degree, in what subject
    area.
Working. Please explain
    where, what kind of job?
Other, please explain.

Do you currently work in any interdisciplinary teams? If yes, please explain.

Yes
No
Please explain

Do you currently work in any interdisciplinary teams that address water related issues or changing climate? If yes, please explain.

Yes
No
Please explain

Now that you have had time to reflect on this course, do you have any suggestions to improve it?

Thank you for completing this survey!

Appendix E: IDM Day 1-9 Evaluation Forms

IDM Day 1 Monday June 4

Page 1 - Question 1 - Open Ended - One Line

What are the initials of your First, Middle, and Last name, in that order? For example: LMK.
This information will only be used to track completion of evaluation forms. It will be reported separately from responses.

Page 1 - Heading

8:15-9:15 Ethics of modeling and why model (Saito)

Page 1 - Question 2 - Rating Scale - Matrix

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this presentation?

	Extremely Low	L o w	M e d i u m	H i g h	Extremely High
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	○ 1	○ 2	○ 3	○ 4	5
Knowledge you gained about this topic.	○ 1	○ 2	○ 3	○ 4	5
How beneficial is what you have learned to you professionally and/or personally?	○ 1	○ 2	○ 3	○ 4	5
Effectiveness in increasing your understanding of the applications of this type of modeling.	○ 1	○ 2	○ 3	○ 4	5

Page 1 - Question 3 - Yes or No

Are there any additional concepts that you would have liked the presenter to cover?

    Yes
    No
    If yes, please explain

Page 1 - Question 4 - Open Ended - Comments Box

Do you have any suggestions to improve this presentation?

Page 1 - Question 5 - Open Ended - Comments Box

Explain how you will use or benefit from the knowledge you gained in this presentation.

9:15-9:55 Model concepts and issues (Koracin)

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this presentation?

	Extremely Low		Low		Medium		High		Extremely High
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	◐	1	○	2	○	3	○	4	○	5
Knowledge you gained about this topic.	○	1	○	2	○	3	○	4	○	5
How beneficial is what you have learned to you professionally and/or personally?	○	1	○	2	○	3	○	4	○	5
Effectiveness in increasing your understanding of the applications of this type of modeling.	○	1	○	2	○	3	○	4	○	5

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Do you have any suggestions to improve this presentation?

Explain how you will use or benefit from the knowledge you gained in this presentation.

10:05-12:00 Conceptual modeling exercise

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this activity?

	Extremely Low	Low	Medium	High	Extremely High
Quality of the activity (easy to understand and follow, sequential, good instructional aids)	◉ 1	○ 2	○ 3	○ 4	○ 5
Knowledge you gained about this topic.	○ 1	○ 2	○ 3	○ 4	○ 5
How beneficial is what you have learned to you professionally and/or personally?	○ 1	○ 2	○ 3	○ 4	○ 5
Skills gained in conducting this type of analysis or model.	○ 1	○ 2	○ 3	○ 4	○ 5
Effectiveness in increasing your understanding of the applications of this type of modeling.	○ 1	○ 2	○ 3	○ 4	○ 5

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Do you have any suggestions to improve this activity?

Explain how you will use or benefit from the knowledge you gained in this activity.

1:00-2:55 Weather and climate modeling (Koracin)

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this presentation?

	Extremely Low	Low	Medium	High	Extremely High
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	○ 1	○ 2	○ 3	○ 4	○ 5
Knowledge you gained about this topic.	○ 1	○ 2	○ 3	○ 4	○ 5
How beneficial is what you have learned to you professionally and/or personally?	○ 1	○ 2	○ 3	○ 4	○ 5
Effectiveness in increasing your understanding of the applications of this type of modeling.	○ 1	○ 2	○ 3	○ 4	○ 5

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Do you have any suggestions to improve this presentation?

Explain how you will use or benefit from the knowledge you gained in this presentation.

3:05-5:00 GIS, remote sensing and snow hydrology modeling (Steele)

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this presentation?

	Extremely Low	Low	Medium	High	Extremely High
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	○ 1	○ 2	○ 3	○ 4	○ 5

Knowledge you gained about this topic.

○   1   ○   2   ○   3   ○   4   ○   5

How beneficial is what you have learned to you professionally and/or personally?

○   1   ○   2   ○   3   ○   4   ○   5

Effectiveness in increasing your understanding of the applications of this type of modeling.

○   1   ○   2   ○   3   ○   4   ○   5

Page 5 - Question 19 - Yes or No

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Page 5 - Question 20 - Open Ended - Comments Box

Do you have any suggestions to improve this presentation?

Page 5 - Question 21 - Open Ended - Comments Box

Explain how you will use or benefit from the knowledge you gained in this presentation.

IDM Day 2 Tuesday June 5

What are the initials of your First, Middle, and Last name, in that order? For example: LMK.
This information will only be used to track completion of evaluation forms. It will be reported separately from responses.

8:00-9:55 Systems dynamics modeling (Ahmad)

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this presentation?

	Extremely Low		L o w		M e d i u m		H i g h		Extremely High
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	●	1	❍	2	❍	3	❍	4	❍	5
Knowledge you gained about this topic.	❍	1	❍	2	❍	3	❍	4	❍	5
How beneficial is what you have learned to you professionally and/or personally?	❍	1	❍	2	❍	3	❍	4	❍	5
Effectiveness in increasing your understanding of the applications of this type of modeling.	❍	1	❍	2	❍	3	❍	4	❍	5

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Do you have any suggestions to improve this presentation?

Explain how you will use or benefit from the knowledge you gained in this presentation.

10:05-12:00 Introduction to Stella lab (Ahmad)

Page 2 - Question 6 - Rating Scale - Matrix

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this activity?

	Extremely Low	L o w	M e d i u m	H i g h	Extremely High
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	○ 1	○ 2	○ 3	○ 4	○ 5
Knowledge you gained about this topic.	○ 1	○ 2	○ 3	○ 4	○ 5
How beneficial is what you have learned to you professionally and/or personally?	○ 1	○ 2	○ 3	○ 4	○ 5
Effectiveness in increasing your understanding of the applications of this type of modeling.	○ 1	○ 2	○ 3	○ 4	○ 5

Page 2 - Question 7 - Yes or No

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Page 2 - Question 8 - Open Ended - Comments Box

Do you have any suggestions to improve this presentation?

Page 2 - Question 9 - Open Ended - Comments Box

Explain how you will use or benefit from the knowledge you gained in this presentation.

Page 3 - Heading

1:00-2:55 Vadose zone modeling (Heinse)

Page 3 - Question 10 - Rating Scale - Matrix

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this presentation?

	Extremely Low	L o w	M e d i u m	H i g h	Extremely High

Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	○	1	○	2	○	3	○	4	○	5
Knowledge you gained about this topic.	○	1	○	2	○	3	○	4	○	5
How beneficial is what you have learned to you professionally and/or personally?	○	1	○	2	○	3	○	4	○	5
Effectiveness in increasing your understanding of the applications of this type of modeling.	○	1	○	2	○	3	○	4	○	5

Page 3 - Question 11 - Yes or No

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Page 3 - Question 12 - Open Ended - Comments Box

Do you have any suggestions to improve this presentation?

Page 3 - Question 13 - Open Ended - Comments Box

Explain how you will use or benefit from the knowledge you gained in this presentation.

Page 4 - Heading

3:05-5:00 Groundwater modeling (King)

Page 4 - Question 14 - Rating Scale - Matrix

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this presentation?

	Extremely Low		Low		Medium		High		Extremely High
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	○	1	○	2	○	3	○	4	○	5
Knowledge you gained about this topic.	○	1	○	2	○	3	○	4	○	5
How beneficial is what you have learned to you professionally and/or personally?	○	1	○	2	○	3	○	4	○	5

Effectiveness in increasing your understanding of the applications of this type of modeling. ◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5

Page 4 - Question 15 - Yes or No

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Page 4 - Question 16 - Open Ended - Comments Box

Do you have any suggestions to improve this presentation?

Page 4 - Question 17 - Open Ended - Comments Box

Explain how you will use or benefit from the knowledge you gained in this presentation.

IDM Day 3 Wednesday June 6

Page 1 - Question 1 - Open Ended - One Line

What are the initials of your First, Middle, and Last name, in that order? For example: LMK.
This information will only be used to track completion of evaluation forms. It will be reported separately from responses.

Page 1 - Heading

8:00 - 9:55 Adding people to the equation (Wulfhorst)

Page 1 - Question 2 - Rating Scale - Matrix

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this presentation?

	Extremely Low	Low	Medium	High	Extremely High
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	◯ 1	◯ 2	◯ 3	◯ 4	◯ 5
Knowledge you gained about this topic.	◯ 1	◯ 2	◯ 3	◯ 4	◯ 5
How beneficial is what you have learned to you professionally and/or personally?	◯ 1	◯ 2	◯ 3	◯ 4	◯ 5

Effectiveness in increasing your understanding of the applications of this type of modeling.　　○　　1　○　　2　○　　3　○　　4　○　　5

Page 1 - Question 3 - Yes or No

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Page 1 - Question 4 - Open Ended - Comments Box

Do you have any suggestions to improve this presentation?

Page 1 - Question 5 - Open Ended - Comments Box

Explain how you will use or benefit from the knowledge you gained in this presentation.

Page 2 - Heading

10:05-12:00 Mathematical modeling (Telyakovskiy)

Page 2 - Question 6 - Rating Scale - Matrix

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this presentation?

	Extremely Low	L o w	M e d i u m	H i g h	Extremely High
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	○ 1	○ 2	○ 3	○ 4	○ 5
Knowledge you gained about this topic.	○ 1	○ 2	○ 3	○ 4	○ 5
How beneficial is what you have learned to you professionally and/or personally?	○ 1	○ 2	○ 3	○ 4	○ 5
Effectiveness in increasing your understanding of the applications of this type of modeling.	○ 1	○ 2	○ 3	○ 4	○ 5

Page 2 - Question 7 - Yes or No

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Do you have any suggestions to improve this presentation?

Explain how you will use or benefit from the knowledge you gained in this presentation.

1:00-2:55 Hydrologic/watershed modeling (Stone)

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this presentation?

	Extremely Low	L o w	M e d i u m	H i g h	Extremely High
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	◑ 1	○ 2	○ 3	○ 4	○ 5
Knowledge you gained about this topic.	○ 1	○ 2	○ 3	○ 4	○ 5
How beneficial is what you have learned to you professionally and/or personally?	○ 1	○ 2	○ 3	○ 4	○ 5
Effectiveness in increasing your understanding of the applications of this type of modeling.	○ 1	○ 2	○ 3	○ 4	○ 5

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Do you have any suggestions to improve this presentation?

Page 3 - Question 13 - Open Ended - Comments Box

Explain how you will use or benefit from the knowledge you gained in this presentation.

Page 4 - Heading

3:05-5:00 Vegetation-atmosphere, canopy interception modeling (Link)

Page 4 - Question 14 - Rating Scale - Matrix

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this presentation?

	Extremely Low	L o w	M e d i u m	H i g h	Extremely High
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	● 1	○ 2	○ 3	○ 4	○ 5
Knowledge you gained about this topic.	○ 1	○ 2	○ 3	○ 4	○ 5
How beneficial is what you have learned to you professionally and/or personally?	○ 1	○ 2	○ 3	○ 4	○ 5
Effectiveness in increasing your understanding of the applications of this type of modeling.	○ 1	○ 2	○ 3	○ 4	○ 5

Page 4 - Question 15 - Yes or No

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Page 4 - Question 16 - Open Ended - Comments Box

Do you have any suggestions to improve this presentation?

Page 4 - Question 17 - Open Ended - Comments Box

Explain how you will use or benefit from the knowledge you gained in this presentation.

IDM Day 4 Thursday June 7

Page 1 - Question 1 - Open Ended - One Line

What are the initials of your First, Middle, and Last name, in that order? For example: LMK.
This information will only be used to track completion of evaluation forms. It will be reported separately from responses.

8:00-9:55 Economics modeling (Elbakidze)

Page 1 - Question 2 - Rating Scale - Matrix

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this presentation?

	Extremely Low	L o w	M e d i u m	H i g h	Extremely High
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	● 1	○ 2	○ 3	○ 4	○ 5
Knowledge you gained about this topic.	○ 1	○ 2	○ 3	○ 4	○ 5
How beneficial is what you have learned to you professionally and/or personally?	○ 1	○ 2	○ 3	○ 4	○ 5
Effectiveness in increasing your understanding of the applications of this type of modeling.	○ 1	○ 2	○ 3	○ 4	○ 5

Page 1 - Question 3 - Yes or No

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Page 1 - Question 4 - Open Ended - Comments Box

Do you have any suggestions to improve this presentation?

Page 1 - Question 5 - Open Ended - Comments Box

Explain how you will use or benefit from the knowledge you gained in this presentation.

Page 2 - Heading

10:05-12:00 Ecological modeling (Boykin)

Page 2 - Question 6 - Rating Scale - Matrix

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this presentation?

	Extremely Low	L o w	M e d i u m	H i g h	Extremely High

Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	◑ 1	○ 2	○ 3	○ 4	○ 5
Knowledge you gained about this topic.	○ 1	○ 2	○ 3	○ 4	○ 5
How beneficial is what you have learned to you professionally and/or personally?	○ 1	○ 2	○ 3	○ 4	○ 5
Effectiveness in increasing your understanding of the applications of this type of modeling.	○ 1	○ 2	○ 3	○ 4	○ 5

Page 2 - Question 7 - Yes or No

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Page 2 - Question 8 - Open Ended - Comments Box

Do you have any suggestions to improve this presentation?

Page 2 - Question 9 - Open Ended - Comments Box

Explain how you will use or benefit from the knowledge you gained in this presentation.

Page 3 - Heading

1:00-2:55 Thermal stratification modeling (Kreamer)

Page 3 - Question 10 - Rating Scale - Matrix

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this presentation?

	Extremely Low	Low	Medium	High	Extremely High
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	◑ 1	○ 2	○ 3	○ 4	○ 5
Knowledge you gained about this topic.	○ 1	○ 2	○ 3	○ 4	○ 5
How beneficial is what you have learned to you professionally and/or personally?	○ 1	○ 2	○ 3	○ 4	○ 5

Effectiveness in increasing your understanding of the applications of this type of modeling.   ○   1   ○   2   ○   3   ○   4   ○   5

Page 3 - Question 11 - Yes or No

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Page 3 - Question 12 - Open Ended - Comments Box

Do you have any suggestions to improve this presentation?

Page 3 - Question 13 - Open Ended - Comments Box

Explain how you will use or benefit from the knowledge you gained in this presentation.

Page 4 - Heading

3:05-5:00 Evapotranspiration modeling (Sridhar)

Page 4 - Question 14 - Rating Scale - Matrix

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this presentation?

	Extremely Low	Low	Medium	High	Extremely High
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	◑ 1	○ 2	○ 3	○ 4	○ 5
Knowledge you gained about this topic.	○ 1	○ 2	○ 3	○ 4	○ 5
How beneficial is what you have learned to you professionally and/or personally?	○ 1	○ 2	○ 3	○ 4	○ 5
Effectiveness in increasing your understanding of the applications of this type of modeling.	○ 1	○ 2	○ 3	○ 4	○ 5

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Do you have any suggestions to improve this presentation?

Explain how you will use or benefit from the knowledge you gained in this presentation.

IDM Day 5 Friday June 8

What are the initials of your First, Middle, and Last name, in that order? For example: LMK.
This information will only be used to track completion of evaluation forms. It will be reported separately from responses.

8:15 - 9:00 Why the past matters (Biondi)

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this presentation?

	Extremely Low	Low	Medium	High	Extremely High
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	● 1	○ 2	○ 3	○ 4	○ 5
Knowledge you gained about this topic.	○ 1	○ 2	○ 3	○ 4	○ 5
How beneficial is what you have learned to you professionally and/or personally?	○ 1	○ 2	○ 3	○ 4	○ 5
Effectiveness in increasing your understanding of the applications of this type of modeling.	○ 1	○ 2	○ 3	○ 4	○ 5

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Do you have any suggestions to improve this presentation?

Explain how you will use or benefit from the knowledge you gained in this presentation.

9:00 - 9:45 Use and misuse of models (Wilson)

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this presentation?

	Extremely Low	L o w	M e d i u m	H i g h	Extremely High
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	○ 1	○ 2	○ 3	○ 4	○ 5
Knowledge you gained about this topic.	○ 1	○ 2	○ 3	○ 4	○ 5
How beneficial is what you have learned to you professionally and/or personally?	○ 1	○ 2	○ 3	○ 4	○ 5
Effectiveness in increasing your understanding of the applications of this type of modeling.	○ 1	○ 2	○ 3	○ 4	○ 5

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Page 2 - Question 8 - Open Ended - Comments Box

Do you have any suggestions to improve this presentation?

Page 2 - Question 9 - Open Ended - Comments Box

Explain how you will use or benefit from the knowledge you gained in this presentation.

Page 3 - Heading

10:00 - 10:45 Issues of scale (Saito/Mejia)

Page 3 - Question 10 - Rating Scale - Matrix

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this presentation?

	Extremely Low		L o w		M e d i u m		H i g h		Extremely High
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	○	1	○	2	○	3	○	4	○	5
Knowledge you gained about this topic.	○	1	○	2	○	3	○	4	○	5
How beneficial is what you have learned to you professionally and/or personally?	○	1	○	2	○	3	○	4	○	5
Effectiveness in increasing your understanding of the applications of this type of modeling.	○	1	○	2	○	3	○	4	○	5

Page 3 - Question 11 - Yes or No

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Page 3 - Question 12 - Open Ended - Comments Box

Do you have any suggestions to improve this presentation?

Page 3 - Question 13 - Open Ended - Comments Box

Explain how you will use or benefit from the knowledge you gained in this presentation.

10:45-11:30 Uncertainty and calibration (Saito/Tracy)

Page 4 - Question 14 - Rating Scale - Matrix

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this presentation?

	Extremely Low	L o w	M e d i u m	H i g h	Extremely High
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	○ 1	○ 2	○ 3	○ 4	○ 5
Knowledge you gained about this topic.	○ 1	○ 2	○ 3	○ 4	○ 5
How beneficial is what you have learned to you professionally and/or personally?	○ 1	○ 2	○ 3	○ 4	○ 5
Effectiveness in increasing your understanding of the applications of this type of modeling.	○ 1	○ 2	○ 3	○ 4	○ 5

Page 4 - Question 15 - Yes or No

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Page 4 - Question 16 - Open Ended - Comments Box

Do you have any suggestions to improve this presentation?

Page 4 - Question 17 - Open Ended - Comments Box

Explain how you will use or benefit from the knowledge you gained in this presentation.

IDM Day 6 Saturday June 9

Modeling - Day 6 - Saturday, June 9

Page 1 - Question 1 - Open Ended - One Line

What are the initials of your First, Middle, and Last name, in that order? For example: LMK.
This information will only be used to track completion of evaluation forms. It will be reported separately
from responses.

Page 1 - Heading

9:00 - 9:45   CSDMS Modeling (Peckham)

Page 1 - Question 2 - Rating Scale - Matrix

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this
presentation?

	Extremely Low	L o w	M e d i u m	H i g h	Extremely High
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	❍ 1	❍ 2	❍ 3	❍ 4	❍ 5
Knowledge you gained about this topic.	❍ 1	❍ 2	❍ 3	❍ 4	❍ 5
How beneficial is what you have learned to you professionally and/or personally?	❍ 1	❍ 2	❍ 3	❍ 4	❍ 5
Effectiveness in increasing your understanding of the applications of this type of modeling.	❍ 1	❍ 2	❍ 3	❍ 4	❍ 5

Page 1 - Question 3 - Yes or No

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Page 1 - Question 4 - Open Ended - Comments Box

Do you have any suggestions to improve this presentation?

Page 1 - Question 5 - Open Ended - Comments Box

Explain how you will use or benefit from the knowledge you gained in this presentation.

IDM Day 7 Sunday June 10

What are the initials of your First, Middle, and Last name, in that order? For example: LMK.
This information will only be used to track completion of evaluation forms. It will be reported separately from responses.

8:00-9:55 Lab: Climate modeling (Mejia)

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this activity?

	Extremely Low	Low	Medium	High	Extremely High
Quality of the activity (easy to understand and follow, sequential, good instructional aids)	◖ 1	◯ 2	◯ 3	◯ 4	◯ 5
Knowledge you gained about this topic.	◯ 1	◯ 2	◯ 3	◯ 4	◯ 5
How beneficial is what you have learned to you professionally and/or personally?	◯ 1	◯ 2	◯ 3	◯ 4	◯ 5
Effectiveness in increasing your understanding of the applications of this type of modeling.	◯ 1	◯ 2	◯ 3	◯ 4	◯ 5

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Do you have any suggestions to improve this activity?

Explain how you will use or benefit from the knowledge you gained in this activity.

10:05-12:00 Lab: Hydrologic/watershed modeling (Saito)

Page 2 - Question 6 - Rating Scale - Matrix

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this activity?

	Extremely Low		Low		Medium		High		Extremely High
Quality of the activity (easy to understand and follow, sequential, good instructional aids)	◑	1	○	2	○	3	○	4	○	5
Knowledge you gained about this topic.	○	1	○	2	○	3	○	4	○	5
How beneficial is what you have learned to you professionally and/or personally?	○	1	○	2	○	3	○	4	○	5
Effectiveness in increasing your understanding of the applications of this type of modeling.	○	1	○	2	○	3	○	4	○	5

Page 2 - Question 7 - Yes or No

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Page 2 - Question 8 - Open Ended - Comments Box

Do you have any suggestions to improve this activity?

Page 2 - Question 9 - Open Ended - Comments Box

Explain how you will use or benefit from the knowledge you gained in this activity.

Page 3 - Heading

1:00-2:55 Vadose zone/groundwater modeling lab (TBD/King)

Page 3 - Question 10 - Rating Scale - Matrix

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this activity?

	Extremely Low	Low	Medium	High	Extremely High

Quality of the activity (easy to understand and follow, sequential, good instructional aids)	●	1	○	2	○	3	○	4	○	5
Knowledge you gained about this topic.	○	1	○	2	○	3	○	4	○	5
How beneficial is what you have learned to you professionally and/or personally?	○	1	○	2	○	3	○	4	○	5
Effectiveness in increasing your understanding of the applications of this type of modeling.	○	1	○	2	○	3	○	4	○	5

Page 3 - Question 11 - Yes or No

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Page 3 - Question 12 - Open Ended - Comments Box

Do you have any suggestions to improve this activity?

Page 3 - Question 13 - Open Ended - Comments Box

Explain how you will use or benefit from the knowledge you gained in this activity.

Page 4 - Heading

3:05 - 5:00   Lab: Canopy interception/evapotranspiration modeling (Link/Sridhar)

Page 4 - Question 14 - Rating Scale - Matrix

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this activity?

	Extremely Low		Low		Medium		High		Extremely High
Quality of the activity (easy to understand and follow, sequential, good instructional aids)	●	1	○	2	○	3	○	4	○	5
Knowledge you gained about this topic.	○	1	○	2	○	3	○	4	○	5
How beneficial is what you have learned to you professionally and/or personally?	○	1	○	2	○	3	○	4	○	5
Effectiveness in increasing your understanding of the applications of this type of modeling.	○	1	○	2	○	3	○	4	○	5

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Do you have any suggestions to improve this activity?

Explain how you will use or benefit from the knowledge you gained in this activity.

IDM Day 8 Monday June 11

What are the initials of your First, Middle, and Last name, in that order? For example: LMK.
This information will only be used to track completion of evaluation forms. It will be reported separately from responses.

8:00-9:55 Lab: Economics modeling (Cobourn)

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this activity?

	Extremely Low	Low	Medium	High	Extremely High
Quality of the activity (easy to understand and follow, sequential, good instructional aids)	⬤ 1	◯ 2	◯ 3	◯ 4	◯ 5
Knowledge you gained about this topic.	◯ 1	◯ 2	◯ 3	◯ 4	◯ 5
How beneficial is what you have learned to you professionally and/or personally?	◯ 1	◯ 2	◯ 3	◯ 4	◯ 5
Effectiveness in increasing your understanding of the applications of this type of modeling.	◯ 1	◯ 2	◯ 3	◯ 4	◯ 5

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Page 1 - Question 4 - Open Ended - Comments Box

Do you have any suggestions to improve this activity?

Page 1 - Question 5 - Open Ended - Comments Box

Explain how you will use or benefit from the knowledge you gained in this activity.

Page 2 - Heading

10:05-12:00 Lab: GIS/remote sensing (Steele)

Page 2 - Question 6 - Rating Scale - Matrix

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this activity?

	Extremely Low	Low	Medium	High	Extremely High
Quality of the activity (easy to understand and follow, sequential, good instructional aids)	❍ 1	❍ 2	❍ 3	❍ 4	❍ 5
Knowledge you gained about this topic.	❍ 1	❍ 2	❍ 3	❍ 4	❍ 5
How beneficial is what you have learned to you professionally and/or personally?	❍ 1	❍ 2	❍ 3	❍ 4	❍ 5
Effectiveness in increasing your understanding of the applications of this type of modeling.	❍ 1	❍ 2	❍ 3	❍ 4	❍ 5

Page 2 - Question 7 - Yes or No

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Page 2 - Question 8 - Open Ended - Comments Box

Do you have any suggestions to improve this activity?

Page 2 - Question 9 - Open Ended - Comments Box

Explain how you will use or benefit from the knowledge you gained in this activity.

Page 3 - Heading

1:00-2:55 Lab: Systems dynamics modeling (Tidwell)

Page 3 - Question 10 - Rating Scale - Matrix

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this activity?

	Extremely Low	L o w	M e d i u m	H i g h	Extremely High
Quality of the activity (easy to understand and follow, sequential, good instructional aids)	⬤ 1	◯ 2	◯ 3	◯ 4	◯ 5
Knowledge you gained about this topic.	◯ 1	◯ 2	◯ 3	◯ 4	◯ 5
How beneficial is what you have learned to you professionally and/or personally?	◯ 1	◯ 2	◯ 3	◯ 4	◯ 5
Effectiveness in increasing your understanding of the applications of this type of modeling.	◯ 1	◯ 2	◯ 3	◯ 4	◯ 5

Page 3 - Question 11 - Yes or No

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Page 3 - Question 12 - Open Ended - Comments Box

Do you have any suggestions to improve this activity?

Page 3 - Question 13 - Open Ended - Comments Box

Explain how you will use or benefit from the knowledge you gained in this activity.

3:05-5:00 Statistical modeling (Panorska)

Page 4 - Question 14 - Rating Scale - Matrix

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this presentation?

	Extremely Low	Low	Medium	High	Extremely High
Quality of the presentation (easy to understand and follow, sequential, good instructional aids)	○ 1	○ 2	○ 3	○ 4	○ 5
Knowledge you gained about this topic.	○ 1	○ 2	○ 3	○ 4	○ 5
How beneficial is what you have learned to you professionally and/or personally?	○ 1	○ 2	○ 3	○ 4	○ 5
Effectiveness in increasing your understanding of the applications of this type of modeling.	○ 1	○ 2	○ 3	○ 4	○ 5

Page 4 - Question 15 - Yes or No

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Page 4 - Question 16 - Open Ended - Comments Box

Do you have any suggestions to improve this presentation?

Page 4 - Question 17 - Open Ended - Comments Box

Explain how you will use or benefit from the knowledge you gained in this presentation.

IDM Day 9 Tuesday June 12

Page 1 - Question 1 - Open Ended - One Line

What are the initials of your First, Middle, and Last name, in that order? For example: LMK.
This information will only be used to track completion of evaluation forms. It will be reported separately from responses.

Page 1 - Heading

8:00 - 9:55   Lab: Ecological modeling (Boykin)

Page 1 - Question 2 - Rating Scale - Matrix

On a scale of 1-5; 1= extremely low to 5= extremely high, how would you rate the following aspects of this activity?

	Extremely Low	Low	Medium	High	Extremely High
Quality of the activity (easy to understand and follow, sequential, good instructional aids)	● 1	○ 2	○ 3	○ 4	○ 5
Knowledge you gained about this topic.	○ 1	○ 2	○ 3	○ 4	○ 5
How beneficial is what you have learned to you professionally and/or personally?	○ 1	○ 2	○ 3	○ 4	○ 5
Effectiveness in increasing your understanding of the applications of this type of modeling.	○ 1	○ 2	○ 3	○ 4	○ 5

Page 1 - Question 3 - Yes or No

Are there any additional concepts that you would have liked the presenter to cover?

Yes
No
If yes, please explain

Page 1 - Question 4 - Open Ended - Comments Box

Do you have any suggestions to improve this activity?

Page 1 - Question 5 - Open Ended - Comments Box

Explain how you will use or benefit from the knowledge you gained in this activity.

APPENDIX F: NSF EPSCoR Track 2 Impacts Survey

As the Track 2 (Nevada, New Mexico, Idaho) EPSCoR project is coming to a close it is important to identify significant impacts that have occurred as a result of this program. This two-question survey will ask you to explain the most significant impact that has occurred in your professional life as a result of your participation in this Track 2 project. Thank you for taking a few moments out of your busy day to tell us about the difference this project has made.

All responses will be compiled anonymously and reported back to the project leadership team and to the National Science Foundation.

*1. What best describes your position? (Choose one)

◯ Higher Ed Faculty/Administrator

◯ K-12 Educator/Administrator

◯ Post doc

◯ Graduate student

◯ Undergraduate student

◯ Community-based participant

◯ Industrial affiliate

◯ Other, please specify

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[                              ]
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This is the last question - please take your time reflecting and responding to it.

*2.

Reflect back over the past three years of the Tri-state EPSCoR project. What do you believe is the greatest impact your participation in this project has had on you, your research, your teaching, or your community?

For example:
What have you been able to achieve?
What can you do now that you couldn't do before because of the Tri-state project?
How has your research area changed and grown?
How has your teaching improved?
How have the Track 2 EPSCoR-funded programs affected the schools and community?
What is the most important difference that you believe this EPSCoR project has made?

Please be very specific with your answer.

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[                              ]
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APPENDIX G: Impacts Survey Participant Responses[9]

Impacts on overall goal of Knowledge Transfer
Knowledge and awareness
• The EPSCoR Water Quality team was able to test high quality instrumentation in situ to observe dynamic biogeochemical cycles at multiple time scales. As a result, I acquired skills related to data management and instrumentation troubleshooting. This project has supported my graduate research.
• The Tri-State project (specifically the meetings) helped me become aware of both the techniques and the research objectives of other scientists working in my field. These meetings were an improvement over large annual society meetings because we had lots of time to talk and network. Though I have not become a part of join proposals yet, I am inspired to work with folks in the future.
• Expanded my understanding of climate range research and in particular how it relates to local and regional scale hydrologic impacts.
• My opportunity to actively participate and be embraced by EPSCoR totally changed my approach to teaching and interacting with the community science. The key difference EPSCoR has made is in my comprehension of the complete enterprise of science - from grade school student to researcher and beyond (policy maker) – from local to National to global. My involvement with Tri-State EPSCoR over the last 3 years has given me a chance to become involved at a National level. This has been valuable because it allows me to see, and participate in, a common thread connecting primary research with "local" Jurisdiction economy across the USA. This link to the local economy is huge as it literally connects and affects everyone – students, parents, workers, businesses. I can now involve everyone regarding the impact of science on the entire community and help the entire community to explore the relevance of science as it impacts lives – across the entire spectrum of life. The specifics of the RII allow me to share my understanding of this community and then allows my students to make it "real" because we (they) can now go there – actually obtaining background info from primary sources and engaging and being able to reflect with those doing the research and/or those impacted by the research. These are truly transformations that are transformative – engagement in real time that allows students of all ages to write, discuss, visualize and organize, in their own terms, what they know, have learned, and are learning. Doing science IS exciting – providing opportunities for others to get involved IS education! Creating new knowledge IS science. This IS sustainable.
• I believe the greatest impact has been the learning achieved through collaboration with faculty from other states.
• I have a much better understanding of research projects and research themes in the three states that allows the planning of collaborative workshops and future potential joint projects.
• I have built a solid computer programming skill foundation. I have improved my public speaking and presentation skills. I have learned a significant amount regarding the theory and practice of academic research. I have improved my teaching skills via a course funded by EPSCoR that I acted as a TA for. EPSCoR has made me a better citizen of the both the general and academic communities.
• I have been to the Tri-State EPSCoR meeting at Albuquerque, which was a very good learning experience for me. I would like to get more involved in some funding proposal in the future
Research Development
• I have been able to hire exceptional graduate students to conduct cutting edge research. I have engaged over 20 students in undergraduate research-because of this, many of these students have gone on to graduate school. My research program has grown substantially.
• Gave me the opportunity to pursue interesting research into dust records.
• This project provided initial funding to support me through the first year of graduate school, after which I was able to secure an NSF Fellowship to fund the rest. EPSCoR funded the critical physical and human infrastructure I needed to complete my research, uniting my colleagues and I in a single project. The details of each individual project varied, but we shared field sites and facilities funded by EPSCoR.

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[9] Some participants' responses were divided if different sections of the response fit under more than one objective. Therefore there are more than 40 responses even though there were only 40 respondents.

Research Development (continued)

- *It has aided my ability to research various components (data literacy, water resources, educational access) allowing that to influence design decisions. Presenting projects that can be sustainably achieved. Landscape architecture.*

- *This EPSCoR project has brought my environmental research together with a new paradigm of data transport and systems management using cyberinfrastructure which will ultimately result in better quality data, wider data distribution, and long term data accountability.*

- *My thanks and appreciation to the NSF and to the New Mexico EPSCoR team for their support and encouragement. This project has enabled significant progress in the development of a much needed and purposeful hydro-economic model of the Rio Grande watershed system. By promoting student development and research the project contributed significantly to the success and accomplishment of my graduate research assistant. As a result of the research and support, he has found placement into one of the country's best water research PhD programs at the University of Illinois. His research at NMSU and in the EPSCoR program specifically contributed to the enhanced capacity to examine agricultural effects and irrigation technologies and management. This will enhance future research efforts considerably and enable improved policy assessment regarding agricultural irrigation efficiency and water-use conservation.*

- *As a result of a working group grant, I was able to meet with my research team and local caving groups to identify promising areas for work. We have completed a pilot project working on the paleoclimate of the Great Basin over the past 100,000 years based on this working group meeting. One master's thesis is in progress on this project (Paul Pribyl), and several publications are in progress. I anticipate that this pilot project will lead to an NSF proposal in the next 1-2 years to complete a more detailed study.*

- *The most important thing that the EPSCoR project gave me was the opportunity to complete my Masters in Hydrology. I received funding from the project for the three years my degree program required and otherwise, it would have been much more difficult to afford to go to grad school. Because of this Master's degree, I was able to get a job in the field of hydrologic consulting, which not have been open to me otherwise. Much of my geochemical data that I analyzed in my Master's thesis came from a partnership with EPSCoR researchers at UNM and a IWG workshop that I organized on DTS technology was possible through a partnership with EPSCoR researchers at UNR. The UROP program through EPSCoR gave the opportunity to mentor minority students during their summer internships. This gave me leadership experience as well as exposure to underserved communities in New Mexico.*

- *EPSCoR funded most of my master's degree and allowed me to focus on classes and my thesis project while in graduate school. Without EPSCoR funding, I would have needed to work part time during graduate school, and as a result I wouldn't have had as much time to devote to my thesis project. I feel my thesis project was a great success; it has resulted in two peer-reviewed publications, which will be important to my career if I choose to pursue a PhD. These publications have also helped me get a job interview.*

- *The Tri-state EPSCoR project has provided two scholarships to my graduate student. In addition to financing her PhD research and allowing her to graduate in the Fall of 2011, it allowed her to peruse ground-breaking research on cirrus cloud measurements and the representation of clouds in global climate models (GCMs). Specifically, the mass-weighted ice particle fall speed, Vm, strongly affects cirrus cloud lifetime and coverage, optical depth and the cirrus cloud radioactive forcing in GCMs. Our research used new, more reliable field observations to accurately predict Vm from the effective diameter, De, of the ice particle size distribution or PSD. This relates the cloud microphysical properties through De to the cirrus cloud radioactive forcing in a more physically realistic way, making the cloud forcing more sensitive to De through Vm. This approach motivated NCAR and NASA scientists to improve NCAR's Community Atmosphere Model version 5 (CAM5) to achieve physical consistency so the prediction of De and Vm are physically consistent. This work has just begun as collaboration between me and NCAR/NASA scientists. The exploration of new cirrus cloud aircraft measurements led to a new discovery that homogeneous freezing nucleation has a large impact on cloud microphysics. Ice crystals are produced through two general modes of nucleation processes; homogeneous and heterogeneous. Our research may be the first strong evidence that the homogeneous process strongly affects the cloud microphysics based on aircraft measurements. This research formed a large part of a recent proposal submitted to the Dept. of Energy, Atmospheric Systems Research (ASR), which was recently funded for ~ $700,000 over 3 years. This new project allows us to further explore the impact of homogeneous nucleation on cirrus cloud microphysics, and to improve the radar remote sensing of ice clouds. Finally, our analysis of cirrus cloud field measurements has provided a means for estimating the maximum planetary cooling that could result if relatively cold cirrus clouds were "seeded" with an efficient ice nucleant such as silver iodide. Cooling in the multitudes and Polar regions was very modest in CAM5 (~ 0.5 W/m2) but was substantial in the German GCM named ECHAM5 (~ 2 W/M2), based on these field measurements. This is relevant to a new research area known as climate engineering, where scientists are exploring actions that could possibly slow the rate of global warming to buy time for increased mitigation of greenhouse gas emissions to take effect.*

Collaboration
• *Shown me the potential we can achieve by creating relationships and dialog across a wide group of diverse individuals.*
• *The EPSCoR program also offered opportunities for me to chances to work with other universities that would have been difficult to coordinate on my own.*
• *The funding for infrastructure purchases was also very helpful. I gained valuable experience with distributed temperature sensing equipment that will help me in my new job.*
• *The collaboration with researchers in other states that would not have been possible otherwise.*
• *Track II efforts have given me the unique opportunity to collaborate with technical individuals and large state agencies to start developing the policies, organization, and structure to create very large-scale data and metadata exchange systems for state institutions. Ultimately, this poises those institutions to leverage significantly greater masses of information in their research efforts and proposals. The inclusion of such large-scale problems within the scope of my institution and general industry exposes many opportunities to leverage cutting-edge technologies to solve these challenges and create entirely new research and funding opportunities that would have been impossible otherwise.*
• *EPSCoR project was a great gateway for networking regional collaborators. Through networking, EPSCoR activities promote multidisciplinary research beyond campus settings, especially to deal with climate change issues at regional and/or national levels.*
• *I have begun collaborating with scientists at other institutions, which has led to an expanded research scope for my dissertation and to new side projects that I hope to turn into a postdoctoral position.*
• *Collaborative efforts between the tri-state institutions which enriches my experience as a communications expert.*
• *Interactions between researchers and students.*
• *Enabled collaboration with other EPSCoR jurisdictions and formed partnerships that will be sustained long after the award ends.*
• *I have 7 publications in the works, 1 already published. I formed networks with a well known difficult group to connect with, Native American tribes, and much new knowledge will come of this. I hope this will help the tribes, but I am not sure it will, since new instruments were not placed on tribal lands and they received no funding i.e. for training or infrastructure. We have some of the best social science of climate change work performed on a state, and this will reflect well in the publications which will come out over the next couple years. My students had great professional presentation opportunities and our lab had a strong bond before the UNLV budget and administrative woes made it difficult to want to continue. In a normal situation this would have led to at least 1 new lab and a train of students that would have lasted a long time and resulted in great research and our grads taking excellent jobs. Case in point, one of my students took at Post-Doc at a very strong school, while the other got an IGERT full ride to do a Ph.D. at another strong school. So, by investing in people rather than just infrastructure, we made serious traction fast. Into the future I believe we will continue to work together on grants and papers.*
• *The project has been instrumental in setting up new collaborations with other researchers that have shared interests but bring complementary skills to the table. The project has resulted in a draft review paper on the impacts of climate change on C and N dynamics in arid lands that will be submitted this Fall. Also, this project resulted in a large collaborative proposal submitted to NSF. The project helped focus my own research interests as well as identified new areas that can be explored. Since I am primarily a research faculty and don't teach, the project has not affected my teaching. In addition, we have not engaged the schools and community at this time but this is an important aspect of the proposal that has been submitted.*
• *I have been involved with creating CI that supports this EPSCoR project. The CI needed to support collaborative research across research institutions in the US is staggering. We were able to scratch the surface with this proposal and ideally need to continue the work we started. In particular, the collaboration between the Universities in Idaho with the UNM and University of Nevada has been outstanding and hopefully we can find a way to continue the work.*
• *I have been able to develop collaborations with institutions in my state and outside of my state that have really furthered the work that our organization has been able to do. For example, through Tri-State meetings MOSS was able to form a partnership with the Geospatial Software Lab at ISU that has allowed us to develop a really powerful tool for collecting and sharing citizen science data with students. This has been integrated into a newly funded NSF project and has really added a lot of value to it.*
• *Being just administrative staff, the benefit of the Tri-State project has been networking, meeting new people, including administrative staff of the other EPSCoR offices. I feel like I have made some great contacts and met wonderful people.*

Collaboration (continued)

- *The impact has been relatively small. The post-doc I undertook was a great experience but ultimately did little for my career prospects (it had zero bearing on my obtaining my current job). I did get to meet a good number of folks through EPSCoR and the Leadership workshop I was able to participate in was excellent (I would recommend this for everyone). In terms of meeting people I met a fellow at AGU (meeting costs supported by EPSCoR) whom I have been collaborating with recently leading to a publication. In terms of involvement in the wider community I feel that I accomplished very little during my time as post-doc. It was not encouraged (neither were teaching opportunities) but I did make endeavors on my own time to get involved in science education at middle and high-school level through the NM MESA program. Ultimately I enjoyed my 2 years of EPSCoR research but I feel that I could have used the time available to greater effect.*

Impacts on Connectivity

- *We have been able to bring high speed Internet bandwidth and connectivity to several key research facilities that are vital to our mission while being challenged by their remote location. We have also been able to create, in South Central Idaho, infrastructure that will continue to be built on in future projects. We are in the process of connecting another site and are performing design work on yet another.*

- *The support through Track 2 has enormously help implement some of the high-end computational needs. For example, we were able to develop codes at our local server and implement the code at the INL cluster for which a high bandwidth data transfer capabilities were made available through this support. Students were able to get trained in these data transfer, coding, compiling and simulation exercises very effectively. Without this support, we would not have developed the computational capabilities of my research group. Certainly, it has helped me advance my research plan and growth and abilities to submit proposals to perform high-spatial resolution land surface hydrological process modeling. Our ability to integrate state of the art science in our modeling framework and that attracted quite a bit of interest from outside Idaho as well. That would not have been possible without this project.*

- *Very good platform for communications*

Impacts on Interoperability

- *It has enabled me to integrate my research in environmental sciences with Cyberinfrastructure personnel and tools. This ultimately results in more consistent science and leveraging of research data for multiple projects into the future. Advances we have made under Track 2 have set the foundation for scientific uniformity in data collection, transport, archival, and distribution. This allows researchers to readily analyze larger, more complete datasets from multiple sources, an opportunity that has been historically difficult at the State institution scale and typical budgeting levels.*

- *I think the most significant EPSCoR impact was to create pooled physical resources (equipment and field sites) for collaborative use by New Mexico universities.*

Impacts on Cyberlearning

Professional practice

- *My teaching has improved because I am more connected and interested in projects that are happening in my area. I have a greater knowledge of research being done and in turn can share that information with my students.*

- *I published a manuscript in Water Resources Research with a graduate student and others. This publication was based on a large and complicated hydro-economic model. This model is the basis of out ongoing work with another graduate student. This published and ongoing work is now also a part of my graduate and undergraduate class materials in Production Economics and Natural Resource and Environmental Economics.*

- *EPSCoR project has enabled me to hire/work with a postdoc RA-- whois able to focus entirely on the project. This has enabled my research to be much more productive than it would have been otherwise w/out the postdoctoral researcher.*

Secondary science education

- *We have been able to influence more than 1,000 high school students and their learning of science as it relates to climate change and to research and improve our materials through the project funding. It has allowed us to fund teacher PD as well as the creation of student materials. Their use in classrooms has been effective and we have seen great gains, particularly with students with IEPs, largely due to the fact that C4D materials provide and scaffold opportunities for independent learning and self-regulated behavior (respectively).*

- *Purchase of advanced multiparameter probes aided my own field measurements and gave me the opportunity to work with elementary students in my community to perform water quality monitoring for their class project.*

- *19 K-12 teachers with whom I work regularly incorporate GCC science into their classes, both science and ELA.*

- *The most important difference this project has made has been the impact to a wide range of K12 students and the public through a variety of outreach and curriculum development and dissemination efforts.*