



Evaluation of the WC-WAVE Track 2 EPSCoR Project

Trimester 1 Evaluation Report

August 1, 2014 – November 30, 2014

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Section 1. Executive Summary

1.1 Overview of the project

On August 1, 2013, the Idaho, Nevada, and New Mexico NSF EPSCoR projects were awarded a Track 2 EPSCoR (Experimental Program to Stimulate Competitive Research) grant for their “Western Consortium for Watershed Analysis, Visualization, and Exploration” (WC-WAVE) project. There are four components of this EPSCoR project:

Component 1 – Watershed Sciences

Component 2 – Cyberinfrastructure (CI) - Visualization

Component 3 – Cyberinfrastructure - Data

Component 4 – Workforce Development

The following EPSCoR activities were conducted between August, and November, 2014. Evaluation results of these project components are included in this report:

- Program Sustainability Assessment Tool (PSAT)
- Baseline survey

1.2 Summary of findings

Key findings and recommendations for project activities are listed in Figure 1. A complete description of key findings and recommendations for each project activity can be found at the end of each project activity section of this report. Overall project findings and recommendations are listed in Section 4 of this report.

Key findings and recommendations for baseline results are shown in Figure 1.

Figure 1. Summary of findings of evaluation activities

Evaluation Activity	Strengths	Areas of Growth
Program Sustainability Assessment Tool		
Program Sustainability Assessment Tool (PSAT)	<ul style="list-style-type: none">• Among the eight domains of project sustainability, four domains were rated above the midpoint (Program Adaptation, Organizational Capacity, Program Evaluation, and Environmental Support) and four were rated below the midpoint (Strategic Planning, Communications, Partnerships, and Funding Stability).¹	<ul style="list-style-type: none">• The areas of <i>funding stability</i> and <i>partnerships</i> require the most attention.• Incorporate discussions of sustainability at all meetings from component to larger groups. Utilize the results from the PSAT to guide these discussions and planning for project sustainability.

¹ The initial PSAT is a baseline to analyze project leadership’s views of the project’s overall sustainability.

Evaluation Activity	Strengths	Areas of Growth
Baseline Survey		
Demographics	<ul style="list-style-type: none"> African-Americans, and Hispanic/Latinos are well-represented. The focus on increasing diversity is evident in the composition of new participants. The response rate for the new participants was 67%. 	<ul style="list-style-type: none"> Continue focused outreach and recruitment to women and underrepresented minority groups.
Component 1: Watershed Science	<ul style="list-style-type: none"> Out of the three objectives, <i>Objective 2: Develop CSDMS (Community Surface Dynamics Modeling System) adapters for models</i> had the highest level of mean new participant knowledge at <i>somewhat knowledgeable</i>. New participants are showing increasing levels of watershed content knowledge. 	<ul style="list-style-type: none"> <i>Objective 3: Test VW applications and answer research questions using the VW platforms to investigate watershed ecosystem services</i> had the lowest mean new participant knowledge at <i>not knowledgeable at all</i>. Promote WC-WAVE activities that will increase new participant content knowledge of Objective 3. Continue to involve students in faculty mentoring and research opportunities to increase their watershed science knowledge and abilities.
Component 2: Cyber-infrastructure-Visualization	<ul style="list-style-type: none"> Overall, new participants rated themselves as <i>somewhat knowledgeable</i> in the CI - visualization component. The highest-rated items for new project participants were <i>how interfaces for the visualization environments</i> and <i>how data required by models and visualization tools are defined</i>. For each component objective, new project participants generally rated their knowledge as higher than current project participants. 	<ul style="list-style-type: none"> One area of growth for current project participants were <i>how interfaces for the visualization environments are developed</i>. For new project participants, <i>the model and visualization tool data format requirements</i> is an area for growth. For both groups, <i>how visualization environments interface with virtual watershed platform adapters</i> remains an area for growth.
Component 3: Cyber-infrastructure-Data	<ul style="list-style-type: none"> The mean ratings from new participants showed themselves as <i>somewhat knowledgeable</i> in the CI -data component. The highest rated item was <i>how data are integrated within and into larger networks</i>. 100% of new participants rated this objective as <i>somewhat knowledgeable</i> to <i>very knowledgeable</i>. New participants generally rated their knowledge as higher than current participants in each component objective. 	<ul style="list-style-type: none"> Areas of growth for current project participants include <i>understanding of opportunities for streamlining data intensive research through improvement of data management skills</i>. For new project participants, areas of growth include <i>strategies for the acceleration of integrated watershed scale modeling</i>.

Evaluation Activity	Strengths	Areas of Growth
Component 4: Workforce Development/ Education	<ul style="list-style-type: none"> • New project participants reported less participation overall in Workforce Development activities. • While the participation in these activities varied among current project participants, new project participants' reported their involvement mostly in attending collaborative fieldwork activities. 	<ul style="list-style-type: none"> • Apprise new participants of what involvement in these activities entails and be invited to participate, support, and/or attend. • Ensure that new and current project participants have access to upcoming Workforce Development activities and know how to get involved.

General Project Recommendations:

- (1) New project participants are showing relatively higher levels of watershed content knowledge on the baseline survey than current participants; continue to recruit students and participants who have experience and interest in the project's activities and areas of research.
- (2) While progress has been made to recruit more Hispanics and African Americans to the project, continue to focus on increasing the participation of females. The focus on increasing diversity is evident in the composition of new participants. Work collaboratively across components to generate strategies for increasing female representation on the project.
- (3) Continue to involve students in faculty mentoring and research opportunities to increase their watershed science knowledge and abilities. Encourage cross-component attendance at activities to build new content knowledge in a different disciplines and increase student contact with project faculty.
- (4) Incorporate discussions of sustainability at all meetings from component to larger groups. Utilize the results from the PSAT to guide these discussions and planning for project sustainability.
- (5) Encourage new project participants to take part in project outreach and training activities in addition to research.

Section 2. Introduction

2.1 Background of the project

On August 1, 2013, Idaho, Nevada and New Mexico NSF EPSCoR projects were awarded funding for a Track 2 EPSCoR (Experimental Program to Stimulate Competitive Research) project, named the Western Consortium for Watershed Analysis, Visualization, and Exploration (WC-WAVE). The consortium model significantly increases opportunities for scientific collaboration and enhances each state's ability to secure competitive funding and tackle complex watershed science research agendas. The mission of the NSF EPSCoR program is to assist the Foundation 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."² The NSF EPSCoR components aim to:

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

The objectives of the NSF EPSCoR program include:

- Catalyzing key research themes and related activities within and among EPSCoR jurisdictions that empower knowledge generation, dissemination and application;
- Activating effective jurisdictional and regional collaborations among academic, government and private sector stakeholders that advance scientific research, promote innovation and provide multiple societal benefits;
- Broadening participation in science and engineering by institutions, organizations and people within and among EPSCoR jurisdictions;
- Using EPSCoR for development, implementation and evaluation of future programmatic experiments that motivate positive change and progression.

The three-year award funds watershed science research, CI-enabled discovery and innovation, and workforce development and education, which are part of each state's Science and Technology Plan. The project is creating a new immersive virtual reality environment that fosters "interdisciplinary discussion and creative insight into complex scientific questions" and enables "innovations that result in groundbreaking discoveries"³ about watershed science.

Project components and objectives

The WC-WAVE project is organized around four major components. Each component has its own set of objectives. An overview of the project's components and objectives is found in Figure 2.

² <http://www.nsf.gov/od/oia/programs/epscor/about.jsp>

³ http://www.nsf.gov/awardsearch/showAward?AWD_ID=1329469&HistoricalAwards

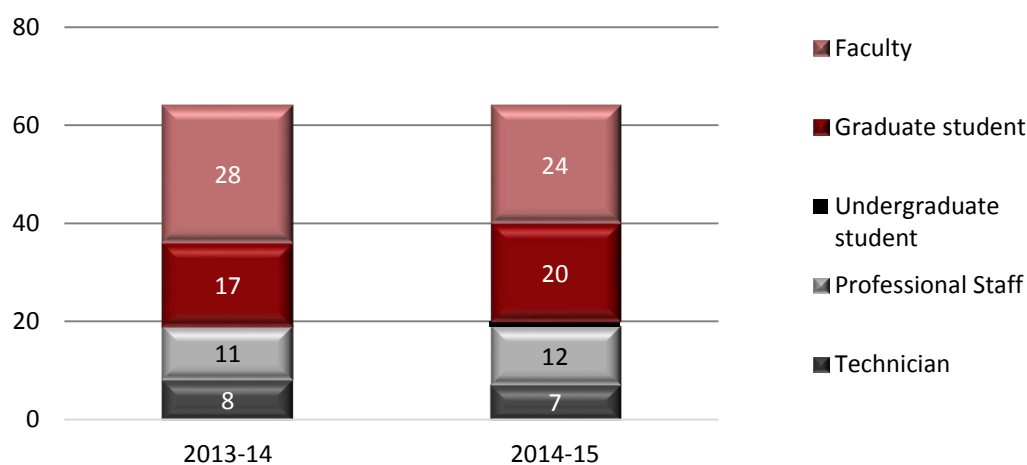
Figure 2. Project components and objectives

WC-WAVE Project Overview	
Component 1: Watershed Sciences - Advance understanding of hydrologic interactions and their impact on ecosystem services using a virtual watershed (VW) framework.	
Objective 1	Parameterize and validate watershed models
Objective 2	Develop CSDMS adapters for models
Objective 3	Test VW applications and answer research questions using the VW platforms to investigate watershed ecosystem services
Objective 4	Snow camp & summer institutes
Component 2: Cyberinfrastructure-Visualization - Accelerate collaborative, interdisciplinary watershed research and discovery by creating innovative visualization environments.	
Objective 1	Develop and deploy Visualization Environment \leftrightarrow Virtual Watershed Platform adapters
Objective 2	Develop user interfaces (“front end interfaces”) for the visualization environments
Objective 3	Train users on how to use the visualization environments
Objective 4	Educate graduate students on CI for watershed research
Objective 5	Disseminate results
Component 3: Cyberinfrastructure-Data	
Objective 1	Accelerate integrated watershed scale modeling through streamlined data access, transfer of outputs and associated metadata to data management systems, visualization, model configuration
1a	Define data required by models and visualization tools
1b	Define model and visualization tool data format requirements
1c	Define model configuration options to be exposed through the virtual watershed and visualization tool
2	Define model integration workflow
3	Deploy virtual watershed data and service platform
4	Deploy data source to Virtual Watershed adapters
5	Deploy virtual watershed model adapters
6	Deploy virtual watershed to Visualization Environment adapter
Objective 2	Enable accelerated and broad access to research products, data and metadata through integration with national networks through interoperable data services
1	Integrate data management system with CUAHSI HIS WaterOneFlow service network
2	Integrate data management system with DataOne network as Tier 4 member nodes
Objective 3	Streamline data intensive research through improved data management skills
1	Provide annual data management workshops for EPSCoR researchers and their students
Component 4: Workforce Development and Education	
	Engage university faculty and graduate students in interdisciplinary team-based watershed research, and broaden undergraduate student participation in STEM through modeling and visualization.
Objective 1	Develop a Graduate Interdisciplinary Training (GIT) Program
Objective 2	Develop an Undergraduate Visualization and Modeling Network (UVMN)
Sustainability Activities	
*Sustainability Activities will be noted and discussed after the WC WAVE Annual Meeting in January 2015.	

Project participants

Sixty four faculty, students, professional staff, and technicians participated in the 2013-14 WC-WAVE EPSCoR project and six additional participants joined the project in 2014-15: three graduate students, two professional staff, and one undergraduate student. The breakdown of project participants' roles by year are found in Figure 3. The majority of the project is comprised of faculty. It is expected that the number of undergraduates, graduate students, and external partners, such as educational, industry and governmental personnel will grow as this project develops.

Figure 3. Project participants' roles



Project components

Figure 4 shows all of the components and activities that are part of the WC-WAVE project.

Figure 4. WC-WAVE project components

Watershed Science Research	Visualization and Data Cyberinfrastructure	Workforce Development/Education
<ul style="list-style-type: none"> Hypothesis driven collaborative research activities Model runs with students Experiential field teaching and learning for students and faculty (Snow Camp, Summer Institutes) Dissemination of findings and products Planning and discussion about sustainability of research activities 	<ul style="list-style-type: none"> Ongoing gathering of data and model requirements and user expectations Analysis of data and feedback to cyberinfrastructure leads on end users' needs Workshops for faculty and students on effective use of the visualization environment and data management Planning and discussion about sustainability of CI that is being developed 	<ul style="list-style-type: none"> Interdisciplinary training of graduate students (GIT) UVMN cohort 1 and 2 UVMN capstone event Undergraduate modules Diversity of participation Planning and discussion about sustainability of activities

2.2 Background of the evaluation

Three types of evaluation are conducted for this WC-WAVE project: a front-end evaluation to assess program needs and assist with organization and planning, a formative evaluation to monitor implementation of the project components and provide feedback, and a summative evaluation to assess achievement of project components and broader impacts. All three types of evaluation use a combination of qualitative and quantitative indicators.

The front end evaluation organizes the project and assesses needs. The evaluator works with the leadership team to refine the logic model, collect baseline information, conduct a needs assessment, refine outputs and outcomes, and develop evaluation instruments and data collection procedures. The evaluator(s) attend planning meetings virtually and/or in-person and works with the leadership team to align the evaluation to project components and activities as they develop.

The formative evaluation assesses the implementation and quality of project components. All participants who attend meetings, field experiences, and workshops, and take part in research exchanges complete post-evaluations to assess the usefulness of activities and to identify strengths and areas of improvement. The formative evaluation is used to identify potential problems and seek solutions early during the implementation.

The summative evaluation examines the project's overall success and benefit to participating students, faculty, researchers, and universities. Summative procedures include conducting a project baseline and post-survey of all project participants when they begin working with the WC-WAVE project and at the end of each project year. The evaluation measures participants' gains in new knowledge, research collaboration, and establishment of collaborative relationships across components and teams. The summative evaluation also assesses growth in institutions' capacity to develop networks and engage in research and education collaborations. The summative evaluation examines the project's overall success and benefit to participating students, faculty, researchers, and universities.

Guiding evaluation questions

The following guiding evaluation questions are based on the WC-WAVE project components.

Advanced understanding of hydrologic interactions and their impact on ecosystem services using a virtual watershed framework

- What progress has been made in achieving the project's scientific benchmarks and milestones?
- How have the watershed models and adapters provided by the EPSCoR project enabled scientists to advance their understanding of hydrologic interactions and their impact on ecosystem services?
- In what way have the addition of watershed models and adapters increased the WC-WAVEs' competitiveness in this scientific field?
- How have these watershed models and adapters influenced scientists' ability to serve as experts in their fields?

Develop a comprehensive approach that leads to an increase in the number of underrepresented students who graduate from STEM degree-granting programs

- What value-added effect has this project provided for underrepresented students?

Accelerated collaborative, interdisciplinary watershed research and discovery through innovative visualization environments and through streamlined data management, discovery and access?

- What progress has been made in achieving the project's CI Visualization and Data benchmarks and milestones?
- What visualization resources have been accessed and how have they been used by researchers, faculty, and students?
- How have the visualization environments and streamlined data management, discovery and access affected the pace at which scientists can conduct hydrologic and ecosystem research?
- What long-term impacts will development of this visualization environment have on ecosystem research and discoveries?

Engaged university faculty and graduate students in interdisciplinary team-based watershed research, and broaden undergraduate student participation in STEM through modeling and visualization?

- What progress has been made in achieving the project's workforce development benchmarks and milestones?
- In what ways has participation in the EPSCoR programs increased participants' understanding of issues related to hydrology and ecosystems?
- 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 did participants' take the knowledge they acquired in EPSCoR programs and transfer it back into the classroom, university, and workplace in a meaningful, productive way?
- What value-added effect has this project provided for students and participants who are traditionally underrepresented in STEM?

Evaluation Development

SmartStart has developed the following assessment instruments for the Tri-State WC-WAVE project:

- Evaluation forms for all project activities seminars, workshops, and meetings
- Project baseline/post-survey
- Pre-/Post- content test development with program coordinators for specific activities
- Program Sustainability Assessment Tool (PSAT)⁴
- Focus group and interview question and protocol development

In addition to these assessment instruments, SmartStart will also assist with parts of submitted Institutional Review Board (IRB) applications for specific activities. Evaluation forms are based on workshop and meeting agendas. Forms include rating scales of usefulness of agenda items as well as open-ended questions so participants can comment on agenda items and the overall

⁴ Developed by researchers at Washington University. Retrieved from <http://www.sustaintool.org>.

training. Baseline/post surveys' Likert scale, open-ended, and perceived gains questions are adapted from six validated surveys.⁵ Instrument development is guided by a systematic, iterative process of construct identification, creation, and instrument review or validation (Wilson, 2005). To develop the surveys, the evaluator discussed the project components and the impact principal investigators would like participation in the project to have on participants. Next, the evaluator generated questions that address key constructs identified in the components. Survey drafts were sent to principal investigators and program coordinators. Feedback and suggestions were incorporated into the surveys and the surveys were finalized. Questions are repeated on baseline and post-surveys to measure changes in outcome areas. Focus group and interview protocol questions are based on assessment of project component achievement. Principal investigators provide feedback to improve all protocols.

Data collection methods and analyses

Participants complete paper or online workshop and meeting evaluation forms at the end of each workshop or meeting. Project baseline and post-surveys are posted on www.surveymizmo.com and a link is sent to project participants' email addresses. Quantitative results are analyzed using SPSS software. Results of workshop and meeting evaluations and the baseline survey are analyzed using means and response frequencies. Likert scale results of project baseline/post surveys and the research abroad experience post-survey are analyzed using paired t-tests and ANOVAs to measure gains that can be attributed to participation. All responses to open-ended questions are included in reports. Qualitative results, such as focus group and interview responses are analyzed using NVivo software to identify themes.

Evaluation activities conducted during Trimester 1

The following evaluation activities were conducted during Trimester 1 of this project:

- Program Sustainability Assessment Tool (PSAT)
- Baseline survey

⁵ List of surveys is in the References section.

Section 3. Evaluation Findings

3.1 Evaluation of project components

Education, outreach, and training activities were not conducted this trimester. These project activities have been planned and will be conducted during Trimesters 2 and 3.

3.2 Achievement of project goals

A. Program Sustainability Assessment Tool (PSAT)

As part of the evaluation activities, project team members participated in taking the Program Sustainability Assessment Tool (PSAT) that assesses project sustainability and demonstrates to the project which areas may need more assistance around sustainability as well as those that are on track to expand existing activities and develop new programs and components.

Background of the assessment tool

Eleven project leaders, including the project director and four component leads, completed the online Program Sustainability Assessment Tool (PSAT) (Appendix A). The PSAT (<https://sustaintool.org>) assesses the extent to which a project has processes and structures in place that will increase the likelihood of sustainability. The PSAT defines capacity for sustainability as the ability to maintain programming and its benefits over time. According to the researchers at the University of Washington, St Louis, who developed the PSAT Framework, eight key domains are believed to influence a program's capacity for sustainability.

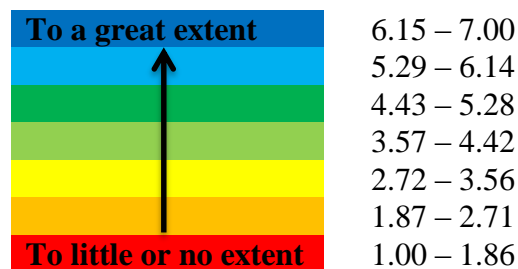


- **Environmental Support:** Having a supportive internal and external climate for your program
- **Funding Stability:** Establishing a consistent financial base for your program
- **Partnerships:** Cultivating connections between your program and its stakeholders.
- **Organizational Capacity:** Having the internal support and resources needed to effectively manage your program
- **Program Evaluation:** Assessing your program to inform planning and document results
- **Program Adaptation:** Taking actions that adapt your program to ensure its ongoing effectiveness.
- **Communications:** Strategic communication with stakeholders and the public about your program.
- **Strategic Planning:** Using processes that guide your program's directions, components, and strategies.

Building program sustainability capacity requires assessment and planning. The PSAT was designed to identify a program's areas of sustainability strength and challenge. Program staff and stakeholders can then use results from this assessment to inform sustainability planning.

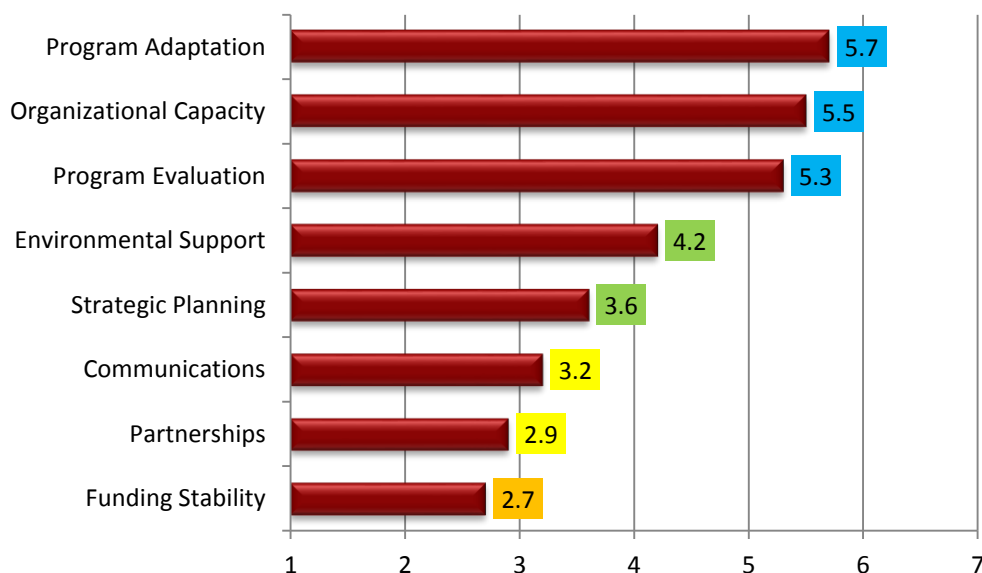
Overall project sustainability

Project leaders rated the WC-WAVE project's capacity for sustainability (downloaded PSAT report is in Appendix B) across the eight domains on a scale of 1-7, 1=*to little or no extent*, 7=*to great extent*. Ratings can be considered to trend towards positive or negative based on the following scale:



The full list of domains with their respective average scores can be found in Figure 5. Domains with the highest ratings were *program adaption*, *organizational capacity*, *program evaluation*, and *environmental support*. Lowest scores were assigned to *strategic planning*, *communications*, *partnerships*, and *funding stability*. The overall mean for Capacity for Sustainability was 4.10.

Figure 5. Respondents' ratings of sustainability capacity by domain



Next the individual aspects of each domain was analyzed individually to determine areas of strength and weakness within each domain. Each of the eight domains are presented in order from highest to lowest overall mean rating.

Program adaptation

Program adaptation is defined as taking actions that adapt your program to ensure its ongoing effectiveness. Indicators of program adaptation are displayed in Figure 6. *The program adapts*

strategies as needed received the highest score. *Decisions about which components are ineffective and should not continue* received the lowest rating.

Figure 6. Respondents' ratings of program adaptation domain

Program Adaptation	Average
The program adapts strategies as needed	6.1
The program adapts to new science	5.8
The program proactively adapts to changes in the environment	5.7
The program periodically reviews the evidence base	5.5
The program makes decisions about which components are ineffective and should not continue	5.3
Mean	5.7

Organizational capacity

Organizational capacity is defined as having the internal support and resources needed to effectively manage your program. Indicators of organizational capacity are displayed in Figure 7. *Leadership efficiently manages staff and program is well integrated into the operations of the organization* received the highest ratings. *Leadership effectively articulates the vision of the program to external partners* received the lowest rating.

Figure 7. Respondents' ratings of organizational capacity domain

Organizational Capacity	Average
Leadership efficiently manages staff and other resources	6.0
The program is well integrated into the operations of the organization	5.9
Organizational systems are in place to support the various program needs	5.6
The program has adequate staff to complete the program's components	5.5
Leadership effectively articulates the vision of the program to external partners	4.6
Mean	5.5

Program evaluation

Program evaluation is defined by PSAT researchers as assessing your program to inform planning and document results. Indicators of program evaluation are displayed in Figure 8. *The program reports short term and intermediate outcomes* received the highest score. *Program provides strong evidence to the public that the program works* received the lowest rating.

Figure 8. Respondents' ratings of program evaluation domain

Program Evaluation	Average
The program reports short term and intermediate outcomes	6.5
Evaluation results inform program planning and implementation	5.9
The program has the capacity for quality program evaluation	5.7
Program evaluation results are used to demonstrate successes to funders and other key stakeholders	4.5
The program provides strong evidence to the public that the program works	4.1
Mean	5.3

Environmental Support

Environmental support is defined as having a supportive internal and external climate for your program. Indicators of environmental support are displayed in Figure 9. Respondents assigned the highest rating to *the program has leadership support from within the larger organization* and the lowest rating to *the program has strong public support*.

Figure 9. Respondents' ratings of environmental support domain

Environmental Support	Average
The program has leadership support from within the larger organization	5.4
Champions exist who strongly support the program	4.6
The program has strong champions with the ability to garner resources	4.3
The program has leadership support from outside of the organization	3.7
The program has strong public support	2.8
Mean	4.2

Strategic planning

Strategic planning is defined as using processes that guide your program's directions, components, and strategies. Indicators of strategic planning are displayed in Figure 10. *Planning for future resource needs* was the highest rated indicator. *The program has a long-term financial plan* was the lowest rated indicator.

Figure 10. Respondents' ratings of strategic planning domain

Strategic Planning	Average
The program plans for future resource needs	4.5
The program clearly outlines roles and responsibilities for all stakeholders	3.8
The program's components are understood by all stakeholders	3.7
The program has a sustainability plan	3.4
The program has a long-term financial plan	2.7
Mean	3.6

Communications

Communications is defined as strategic communication with stakeholders and the public about your program. Indicators of communications are displayed in Figure 11. *The program is marketed in a way that generates interest* received the highest rating. *Program staff communicate the need for the program to the public* and *the program demonstrates its value to the public* received the lowest ratings.

Figure 11. Respondents' ratings of communication domain

Communications	Average
The program is marketed in a way that generates interest	3.5
The program has communication strategies to secure and maintain public support	3.3
The program increases community awareness of the issue	3.2
Program staff communicate the need for the program to the public	3.0
The program demonstrates its value to the public	2.9
Mean	3.2

Partnerships

Partnerships are defined as cultivating connections between your program and its stakeholders. Results are displayed in Figure 12. The highest rating was assigned to *the program communicates with community leaders*. *The community is engaged in the development of program components* received the lowest rating.

Figure 12. Respondents' ratings of partnerships domain

Partnerships	Average
The program communicates with community leaders	3.2
Diverse community organizations are invested in the success of the program	3.1
Community leaders are involved with the program	3.0
Community members are passionately committed to the program	2.7
The community is engaged in the development of program components	2.5
Mean	2.9

Funding Stability

Funding stability is defined as establishing a consistent financial base for your program. Indicators of funding stability are displayed in Figure 13. Respondents assigned the highest ratings to *the program exists in a supportive state economic climate* and the lowest ratings to *the program has sustained funding*.

Figure 13. Respondents' ratings of funding stability domain

Funding Stability	Average
The program exists in a supportive state economic climate	4.0
The program implements policies to help ensure sustained funding	3.5
The program is funded through a variety of sources	2.4
The program has a combination of stable and flexible funding	1.9
The program has sustained funding	1.7
Mean	2.7

Key findings and recommendations for project sustainability

Among the eight domains of project sustainability, four domains were rated above the midpoint (Program Adaptation, Organizational Capacity, Program Evaluation, and Environmental Support) and four were rated below the midpoint (Strategic Planning, Communications, Partnerships, and Funding Stability). The evaluator also ranked all of the indicators from the highest to lowest ratings to assist program leaders identify areas that require the most growth. Results are shown in Figure 14. The domain in which the indicator falls is shown in the first column. From this ranking it is clear that indicators that involve funding stability and partnerships require the most attention. Most Communications items also fall below the midpoint.

The PSAT researchers recommend an eight-step approach to planning for sustainability:

1. Assemble the planning team.
2. Envision your program's future.
3. Review your Program Sustainability Assessment Tool results.
4. Decide which program elements must be continued and which might be scaled down or eliminated.
5. Prioritize the areas of sustainability capacity to address first.
6. Develop an Action Plan with specific action steps to strengthen and build your program's sustainability capacity.
7. Implement the Action Plan
8. Reassess your sustainability capacity each year

The evaluator will meet with project leaders in upcoming months to review PSAT results and develop a plan for sustainability that meets the needs of stakeholders maximizes project components that will provide the greatest future benefits for Tri-State researchers and the scientific community.

Figure 14. Ranking of respondents' ratings of sustainability

Domain	Indicator	Average
E	The program reports short term and intermediate outcomes	6.5
PA	The program adapts strategies as needed	6.1
OC	Leadership efficiently manages staff and other resources	6.0
E	Evaluation results inform program planning and implementation	5.9
OC	The program is well integrated into the operations of the organization	5.9
PA	The program adapts to new science	5.8
PA	The program proactively adapts to changes in the environment	5.7
E	The program has the capacity for quality program evaluation	5.7
OC	Organizational systems are in place to support the various program needs	5.6
OC	The program has adequate staff to complete the program's components	5.5
PA	The program periodically reviews the evidence base	5.5
ES	The program has leadership support from within the larger organization	5.4
PA	The program makes decisions about which components are ineffective and should not continue	5.3
OC	Leadership effectively articulates the vision of the program to external partners	4.6
ES	Champions exist who strongly support the program	4.6
SP	The program plans for future resource needs	4.5
E	Program evaluation results are used to demonstrate successes to funders and other key stakeholders	4.5
ES	The program has strong champions with the ability to garner resources	4.3
E	The program provides strong evidence to the public that the program works	4.1
FS	The program exists in a supportive state economic climate	4.0
SP	The program clearly outlines roles and responsibilities for all stakeholders	3.8
SP	The program's components are understood by all stakeholders	3.7
ES	The program has leadership support from outside of the organization	3.7
FS	The program implements policies to help ensure sustained funding	3.5
C	The program is marketed in a way that generates interest	3.5
SP	The program has a sustainability plan	3.4

Domain	Indicator	Average
C	The program has communication strategies to secure and maintain public support	3.3
C	The program increases community awareness of the issue	3.2
P	The program communicates with community leaders	3.2
P	Diverse community organizations are invested in the success of the program	3.1
C	Program staff communicate the need for the program to the public	3.0
P	Community leaders are involved with the program	3.0
C	The program demonstrates its value to the public	2.9
ES	The program has strong public support	2.8
SP	The program has a long-term financial plan	2.7
P	Community members are passionately committed to the program	2.7
P	The community is engaged in the development of program components	2.5
FS	The program is funded through a variety of sources	2.4
FS	The program has a combination of stable and flexible funding	1.9
FS	The program has sustained funding	1.7

B. Baseline survey results

The baseline survey is based on the WC-WAVE project goals and objectives. To develop the survey, the evaluator discussed the project components and the impact principal investigators would like participation in the project to have on participants. Questions are repeated on baseline and post-surveys to measure changes in outcome areas. The survey was developed over many iterations and adapted from a review of the literature and other validated surveys that measure similar constructs. Survey drafts were sent to principal investigators. Feedback and suggestions were incorporated into the surveys and the surveys were finalized. As part of this group process, the project leaders determined the baseline survey should assess:

- Demographics
- Implementation of project
- Progress made towards achievement of project goals

The purpose of reporting baseline levels is to inform project leaders of areas of strength and weakness of new people who enter the project. This enables leaders to focus on developing areas of weakness and align project activities with participants' needs.

Baseline survey response rate

The baseline survey link for 2014-15 was emailed to the 6 new project participants on October 16, 2014 and 4 participants had completed it by December 8, 2014. The response rates was 67% and is shown in Figure 15. Four reminders were sent to project participants and an additional notification was sent to project leads with a list of participants still needing to complete the baseline survey.

Figure 15. Baseline survey completion rate

Year	Number Requested	Number Completed	Return Rate (%)
2013-14	64	59	92%
2014-15	6	4	67%

Demographic description of baseline survey respondents

Three quarters (75%) of new project respondents are male and are evenly divided between graduate students and professional staff as shown in Figure 16. They attend the University of Nevada, Reno and the University of New Mexico. The evaluator notes the following differences between the demographics of new project participants and the tri-state comparison population in regard to underrepresented groups:

- Hispanic/Latinos and African Americans are well -represented
- American Indians and females are underrepresented with respect to the comparison population

Figure 16. Demographic description of Baseline Survey participants⁶

	2013-14 Baseline Participants (n=59)		2014-15 Baseline participants (n=4)		ID, NM, NV Comparison Population (n=140,181) ⁷
	#	%	#	%	%
Gender					
Male	33	56%	3	75%	48%
Female	26	44%	1	25%	52%
Race					
White (non-Hispanic)	41	69%	1	25%	62%
Asian	9	15%	-	-	6%
Other ⁸	4	7%	-	-	-
Hispanic	3	5%	2	50%	22%
American Indian or Alaska Native	2	3%	-	-	3%
Black or African American	-	-	1	25%	3%
Multi-racial	-	-	-	-	2%
Pacific Islander or Native Hawaiian	-	-	-	-	<1%
Role					WC-WAVE project (n=64)
Faculty/University academic researcher	27	46%	-	-	Faculty 44%
Graduate student	13	22%	2	50%	Graduate Students 26%
Professional Staff	15	25%	2	50%	Administration 17%
Undergraduate student	3	5%	-	-	Technical 13%
Ambassador	1	2%	-	-	
Institution					
Idaho					
Boise State University	5	8%	-	-	
College of Southern Idaho	2	3%	-	-	
Idaho State University	5	8%	-	-	
University of Idaho	14	24%	-	-	
Idaho Total	26	43%	-	-	44% (28 members)

⁶ Percentages may not add up to 100% due to rounding.

⁷ Faculty, undergraduate, and graduate students from the following institutions are included in these calculations: Idaho: Boise State University, College of Southern Idaho, Idaho State University, University of Idaho; Nevada: University of Nevada, Las Vegas, University of Nevada, Reno, Desert Research Institute; New Mexico: New Mexico State University, New Mexico Institute of Mining and Technology, University of New Mexico

⁸ "Other" for 2013-14 Baseline participants includes 1 Jewish and 3 who did not wish to specify

	2013-14 Baseline Participants (n=59)		2014-15 Baseline participants (n=4)		ID, NM, NV Comparison Population (n=140,181) ⁷
	#	%	#	%	%
Nevada					
Desert Research Institute	3	5%	-	-	
Nevada System of Higher Education	2	3%	-	-	
University of Nevada, Las Vegas	3	5%	-	-	
University of Nevada, Reno	7	12%	2	50%	
Nevada Total	15	25%	2	50%	28% (18 members)
New Mexico					
New Mexico Institute of Mining and Technology	4	7%	-	-	
New Mexico State University	1	2%	-	-	
University of New Mexico	13	22%	2	50%	
New Mexico Total	18	31%	2	50%	28% (18 members)
Year of Entry into Project					
2013-14	47	80%	1	25%	
2014-15	11	19%	3	75%	
2015-16	1	2%	-	-	

Baseline level of achievement of project components

Respondents' baseline levels of component achievement are listed below by project component. Each component has measureable objectives and it is the overall achievement of each that is measured.

For Components 1-3, participants rated their knowledge on a scale of 1-5, 1=*not knowledgeable at all* to 5=*extremely knowledgeable*. Ratings can be considered to trend towards positive or negative based on the following scale:

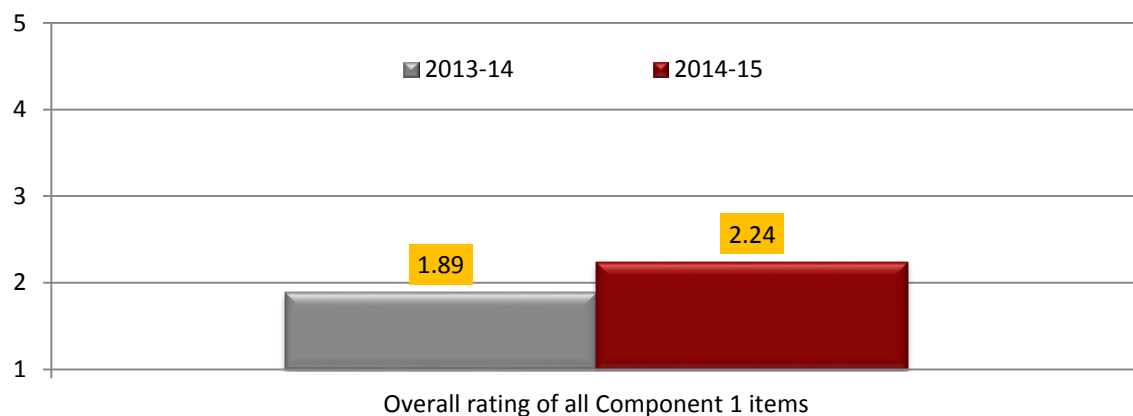
Extremely knowledgeable	4.21 – 5.00
Very knowledgeable	3.41 – 4.20
Somewhat knowledgeable	2.61 – 3.40
Slightly knowledgeable	1.81 – 2.60
Not knowledgeable at all	1.00 – 1.80

Component 1: Watershed Science

Component 1: Advance understanding of hydrologic interactions and their impact on ecosystem services using a virtual watershed (VW) framework.⁹

Results for objectives within this component are presented as a composite and individually to present the knowledge and skills pertinent to each objective. As shown in Figure 17, the overall mean ratings for Component 1 show new project participants still feel *slightly knowledgeable* similar to the initial 2013-14 project participants.

Figure 17. Overall baseline ratings for Component 1



Next, results were further broken down to show participants' ratings of each objective within Component 1. The objectives include:

1. Parameterize and validate watershed models
2. Develop CSDMS adapter for models
3. Test VW applications and answer research questions using the VW platforms to investigate watershed ecosystem services
4. Snow camp and summer institutes¹⁰
5. Sustainability Activities

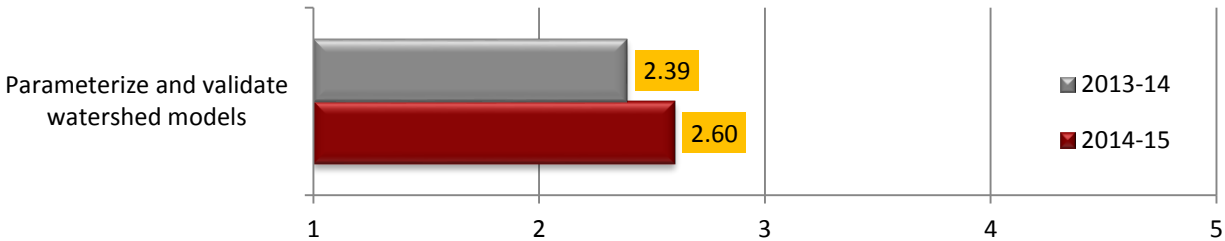
⁹ <http://westernconsortium.org/uploads/20%20Page%20Proposal%20-%20WC-WAVE.pdf>

¹⁰ Baseline survey questions regarding snow camp and summer institutes are reported in the Workforce Development component, which coordinates the field experience activities.

Objective 1: Parameterize and validate watershed models

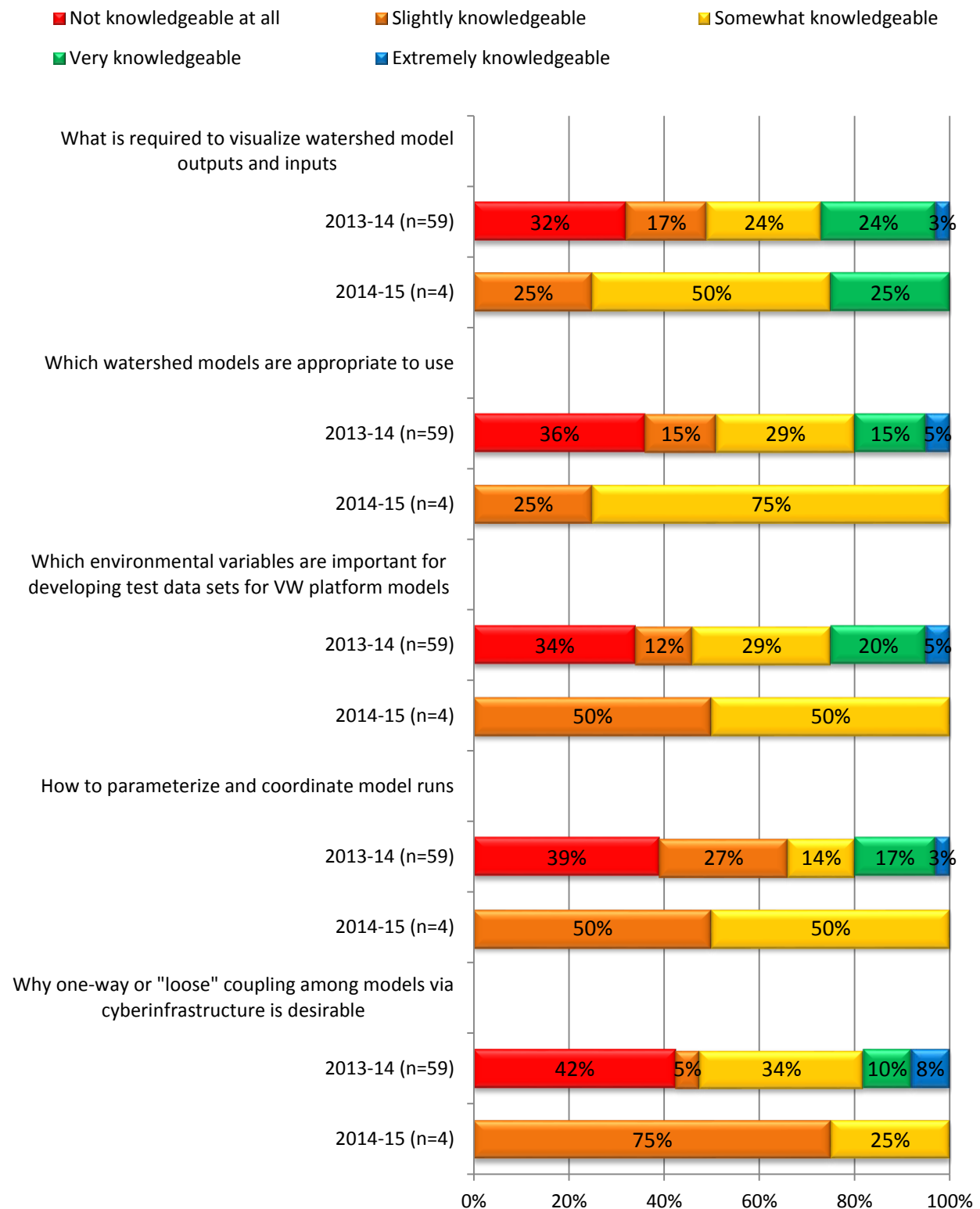
Results of participants' overall knowledge of watershed models are found in Figure 18. Currently, project participants are *slightly knowledgeable* about this objective.

Figure 18. Participants' mean ratings of Objective 1: Parameterize and validate watershed models



Next, results were further broken down to show project participants' ratings of items within each objective to identify specific strengths and weaknesses so project leaders can design assistance to help project participants improve in weaker areas. As shown in Figure 19, while all areas have room for growth, the one with most potential for growth is *why one-way or "loose" coupling among models via cyberinfrastructure is desirable*, as participants went from mostly "not knowledgeable at all" last year to "slightly knowledgeable" for new participants. Generally, the new project participants report having more knowledge than current project participants initially did at the beginning of the project for *Objective 1: Parameterizing and validating watershed models*.

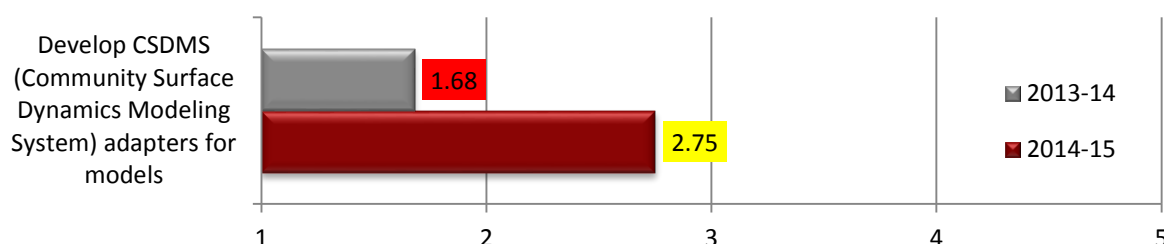
Figure 19. Mean ratings of knowledge of Objective 1 statements, by rating category



Objective 2: Develop CSDMS (Community Surface Dynamics Modeling System) adapters for models

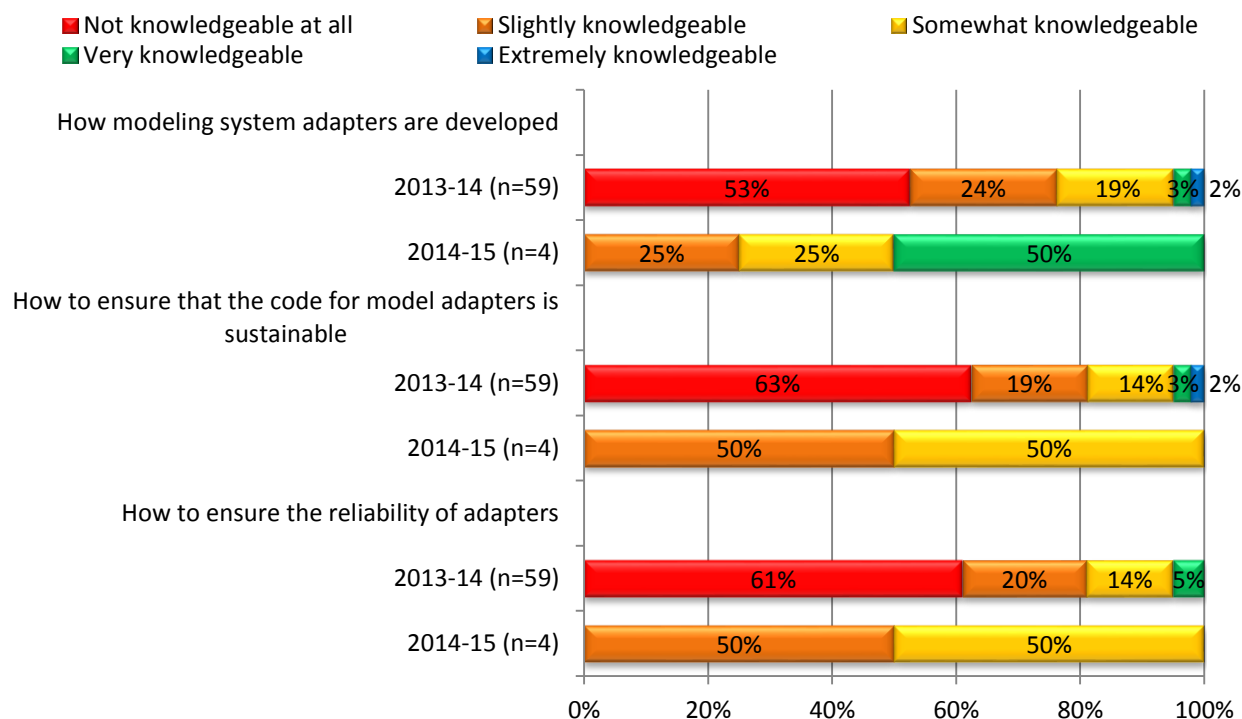
Results of participants' overall knowledge of CSDMS adapters are found in Figure 20. The mean average for the objective as a whole will be compared to post-survey results in subsequent years to assess growth. New project participants are *somewhat knowledgeable* about this objective, which is higher than the current project participants.

Figure 20. Participants' mean ratings of Objective 2: Develop CSDMS (Community Surface Dynamics Modeling System) adapters for models



Next, results were further broken down to show students' ratings of items within each objective to identify specific strengths and weaknesses so project leaders can design assistance to help students improve in weaker areas. Responses for Objective are shown in Figure 21. The areas with the most potential for growth continue to be *how to ensure that the code for model adapters is sustainable* and *how to ensure the reliability of adapters*.

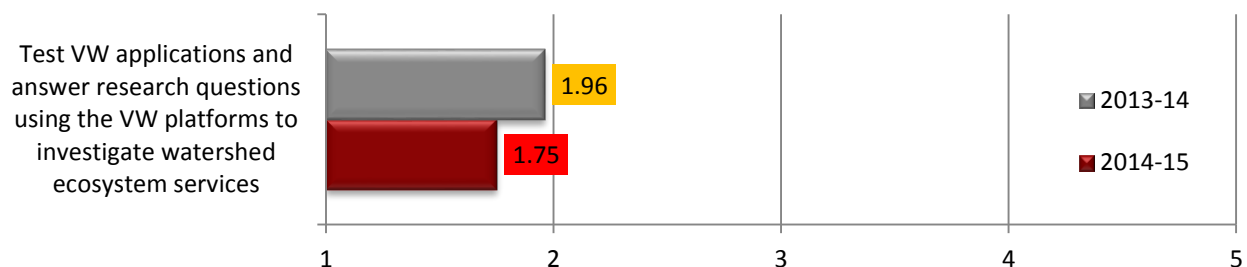
Figure 21. Mean ratings of knowledge of Objective 2 statements, by rating category



Objective 3: Test VW applications and answer research questions using the VW platforms to investigate watershed ecosystem services

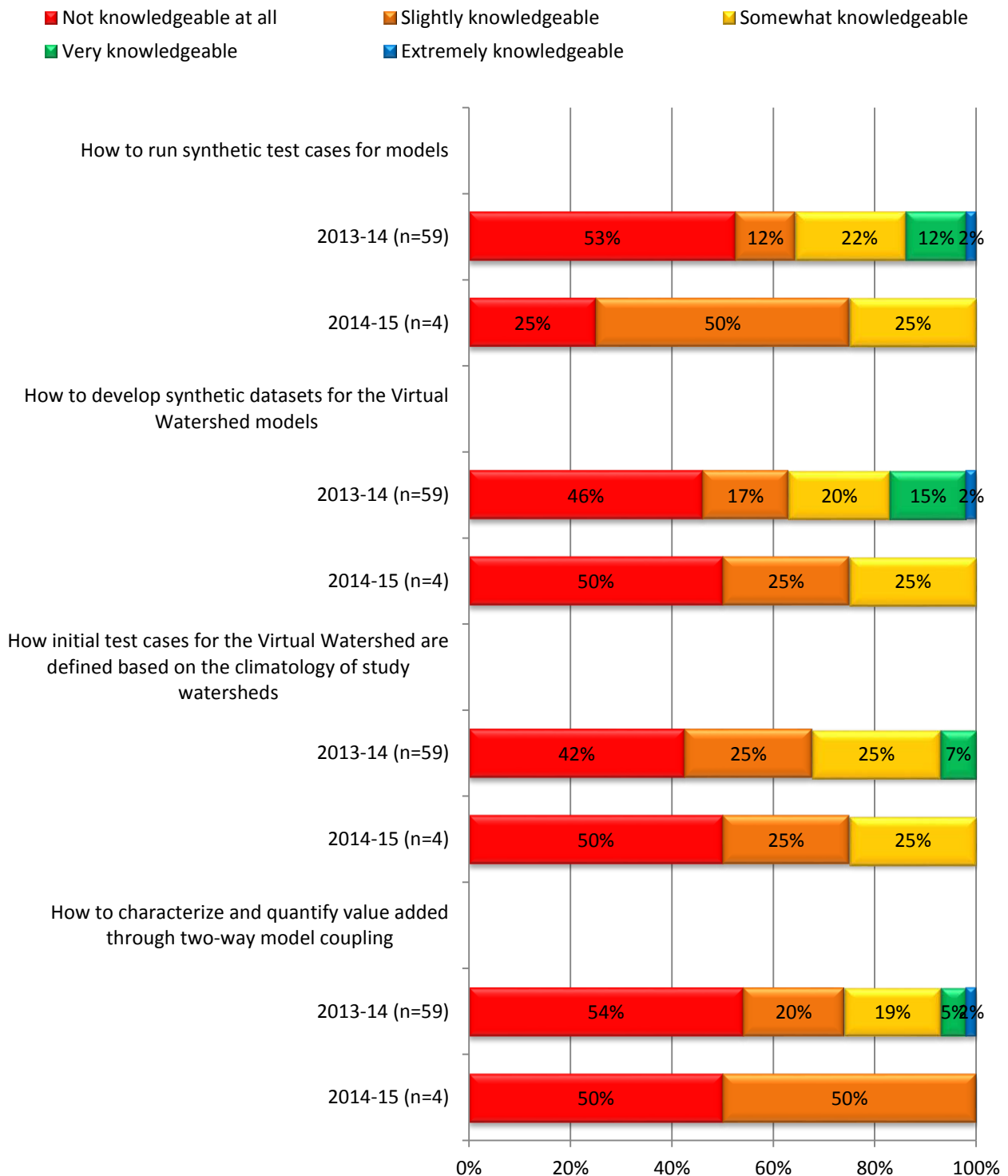
Results of participants' overall knowledge of VW applications and platforms are found in Figure 22. The mean average for the objective as a whole will be compared to post-survey results in subsequent years to assess growth. New project participants are *not knowledgeable at all* about this objective, which is slightly lower than the current project participants.

Figure 22. Participants' mean ratings of Objective 3: Test VW applications and answer research questions using the VW platforms to investigate watershed ecosystem services



Next, results were further broken down to show students' ratings of items within each objective to identify specific strengths and weaknesses so project leaders can design assistance to help students improve in weaker areas. Responses for Objective 3 were analyzed by category as shown in Figure 23. The area with the most room for growth is *how to characterize and quantify value added through two-way model coupling*.

Figure 23. Mean ratings of knowledge of Objective 3 statements, by rating category

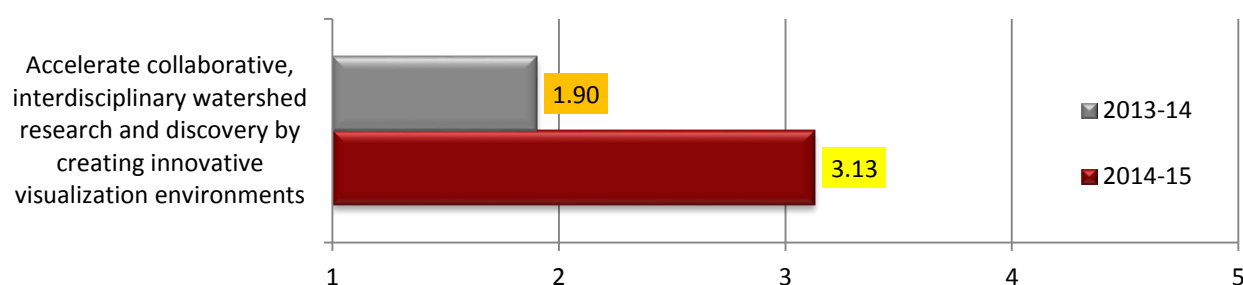


Component 2: Cyberinfrastructure-Visualization

Component 2: Accelerate collaborative, interdisciplinary watershed research and discovery by creating innovative visualization environments.¹¹

Results of participants' overall knowledge of visualization environments are found in Figure 24. The mean average for the objective as a whole will be compared to post-survey results in subsequent years to assess growth. New project participants are *somewhat knowledgeable* about this objective, which is higher than current project participants.

Figure 24. Participants' mean ratings of Component 2



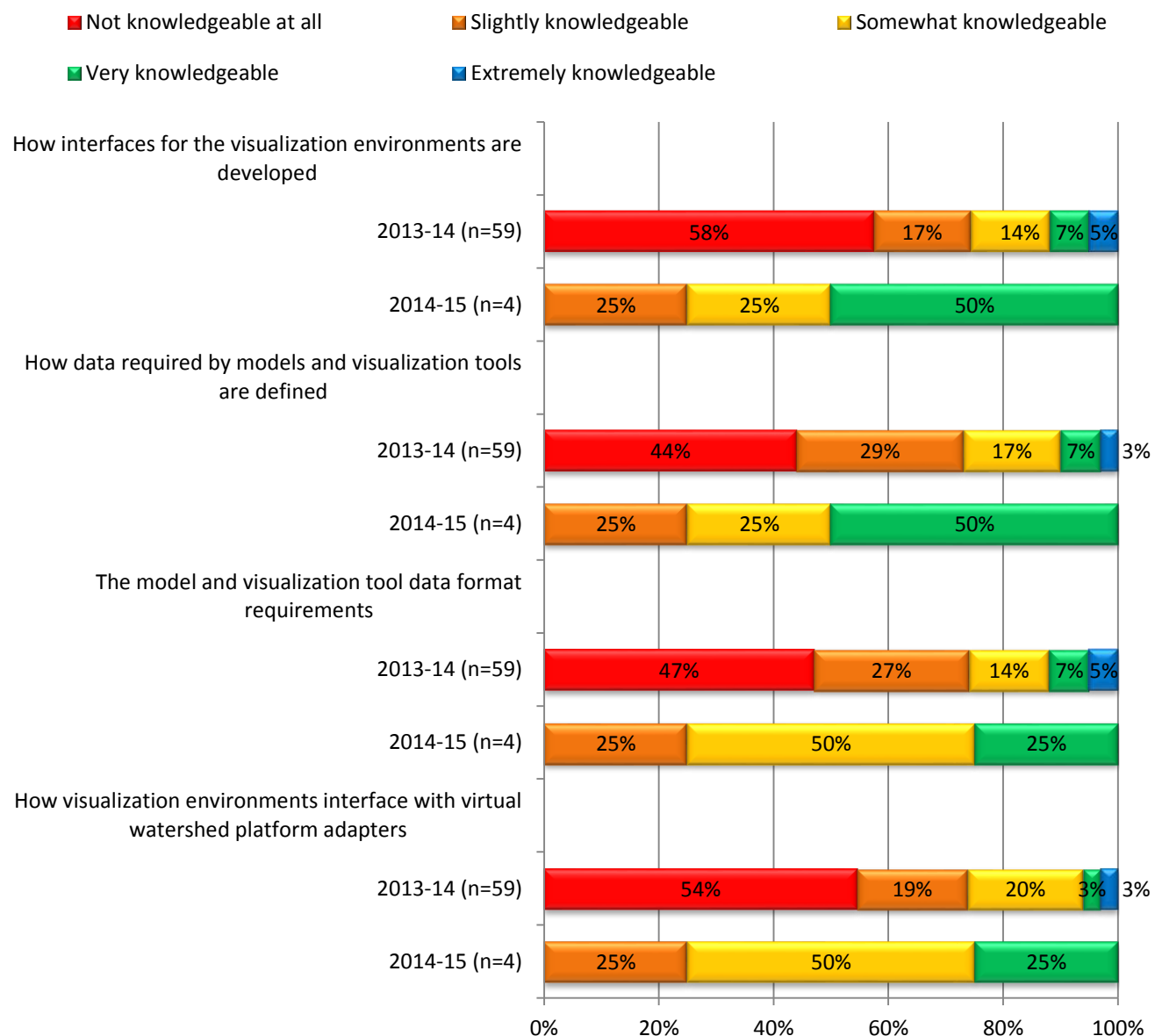
Next, results were further broken down to show participants' ratings of each objective within Component 2. The component's objectives are to:

1. Develop and deploy visualization environment
2. Develop user interfaces
3. Train users on how to use the visualization environment
4. Educate graduate students on CI for watershed research
5. Disseminate results

The results were broken down to show project participants' ratings of items within each objective to identify specific strengths and weaknesses so project leaders can design assistance to help project participants improve in weaker areas. Results are shown in Figure 25. Participants showed the greatest knowledge for *how interfaces for the visualization environments are developed* and *how data required by models and visualization tools are defined*. The areas with the highest potential for growth include the following: *the model and visualization tool data format requirements* and *how visualization environments interface with virtual watershed platform adapters*.

¹¹ <http://westernconsortium.org/uploads/20%20Page%20Proposal%20-%20WC-WAVE.pdf>

Figure 25. Mean ratings of knowledge of Cyberinfrastructure Visualization Component statements, by rating category

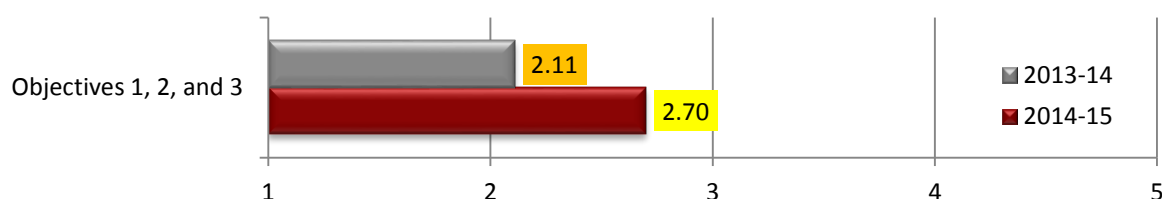


Component 3: Cyberinfrastructure-Data

Component 3: Cyberinfrastructure-Data has 3 distinct objectives that all contribute to the component. These are each described below.

Results of participants' overall knowledge of cyberinfrastructure data are found in Figure 26. The mean average for the objective as a whole will be compared to post-survey results in subsequent years to assess growth. New project participants are *somewhat knowledgeable* about this objective.

Figure 26. Participants' mean ratings of Objectives 1, 2, and 3



Next, results were further broken down to show participants' ratings of each objective within Component 3. These include the following:

Objective 1: Accelerate integrate watershed scale modeling through streamlined data access, transfer of outputs, and associated metadata to data management systems, visualization, model configuration.¹²

- 1a. Define data required by models and visualization tools
- 1b. Define model and visualization tool data format requirements
- 1c. Define model configuration options to be exposed through the VW and visualization tool
2. Define model integration workflow
3. Deploy virtual watershed data and service platform
4. Deploy data source to Virtual Watershed Platform adapters
5. Deploy virtual watershed model adapters
6. Deploy virtual watershed to Visualization Environment adapter

Objective 2: Enable accelerated and broad access to research products, data, and metadata through integration with national networks through interoperable data services.

These include the following:

1. Integrate data management system with CUAHSI HIS WaterOneFlow service network
2. Integrate data management system with DataOne network as Tier 4 member nodes

Objective 3: Streamline data intensive research through improved data management skills.

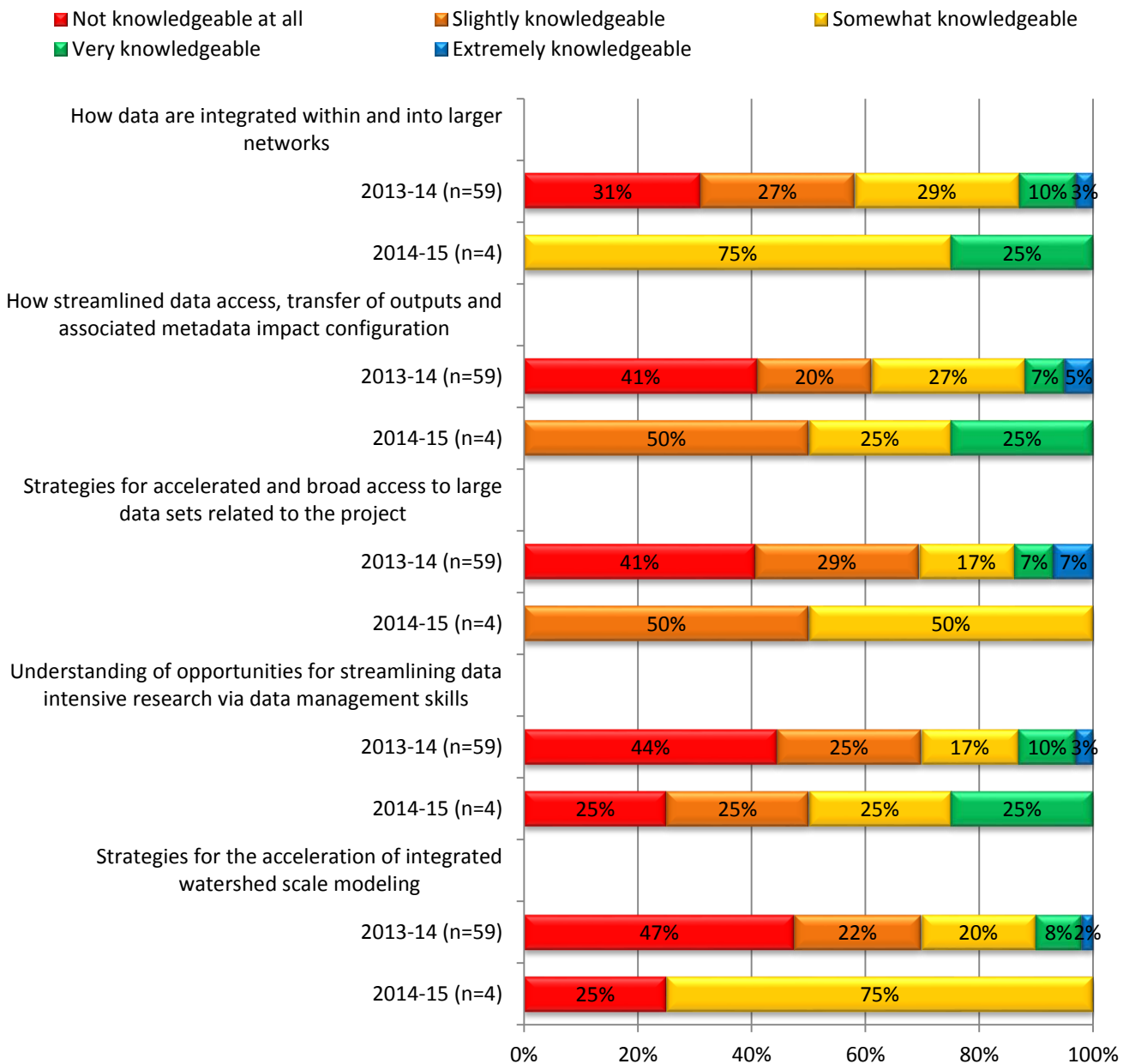
This includes:

1. Provide annual data management workshops for EPSCoR researchers and their students

¹² <http://westernconsortium.org/uploads/20%20Page%20Proposal%20-%20WC-WAVE.pdf>

The results were broken down to show students' ratings of items within each objective to identify specific strengths and weaknesses so project leaders can design assistance to help students improve in weaker areas. The individual items were analyzed by category in Figure 27. The item that participants felt they had the greatest knowledge of was *how data are integrated within and into larger networks*. The item with the most growth potential was: *strategies for the acceleration of integrated watershed modeling*.

Figure 27. Mean ratings of knowledge of Components 1, 2, and 3 statements, by rating category



Component 4: Workforce Development

Component 4: Engage university faculty and graduate students in interdisciplinary team-based watershed research, and broaden undergraduate student participation in STEM through modeling and visualization.¹³

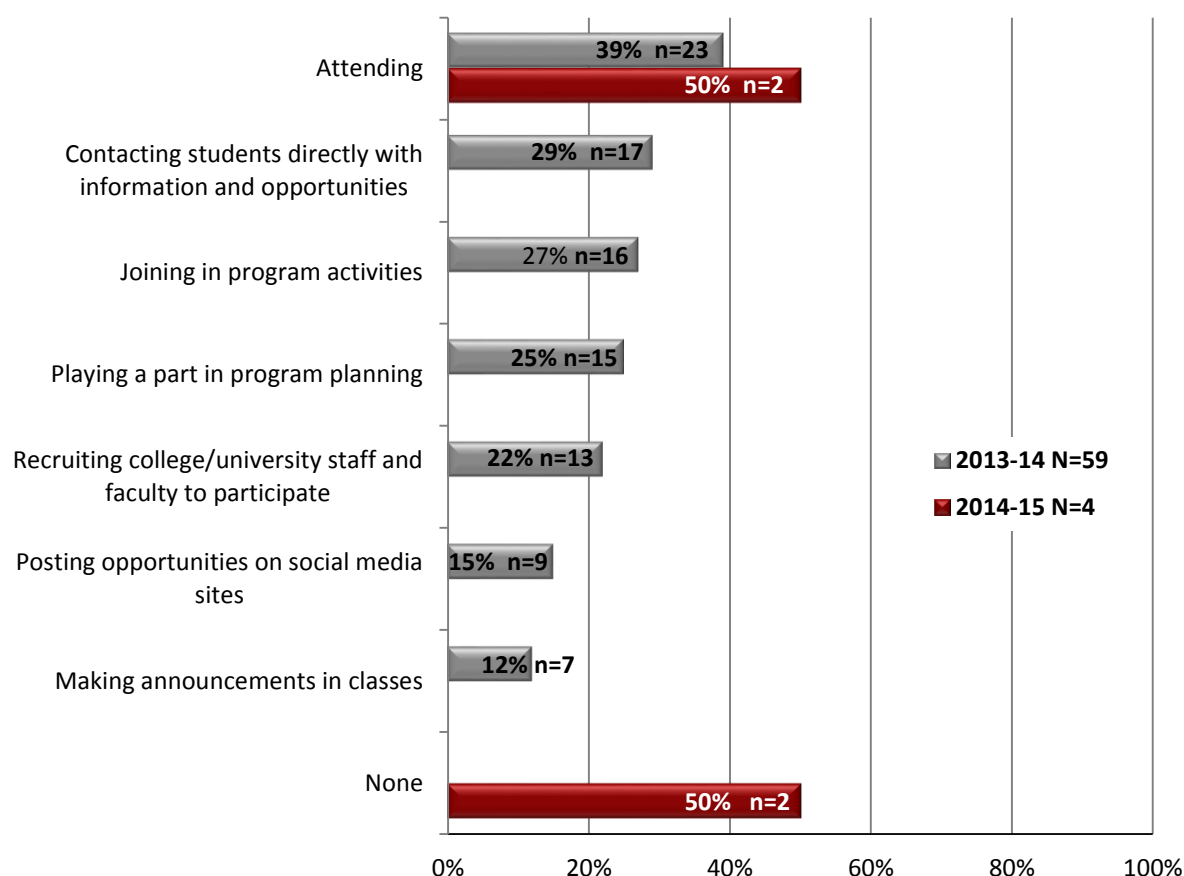
Its objectives include:

1. Develop a Graduate Interdisciplinary Training (GIT) Program
2. Develop an Undergraduate Visualization and Modeling Network (UVMN)

Participants' involvement in collaborative fieldwork activities

As shown in Figure 28, participants noted how they were involved in collaborative fieldwork activities. The largest percentages of participants in the 2014-2015 year said they *attend* (50%) activities. Fifty percent (50%) also said that they did not attend any activities, which is an area for improvement.

Figure 28. Participants' involvement in collaborative fieldwork activities

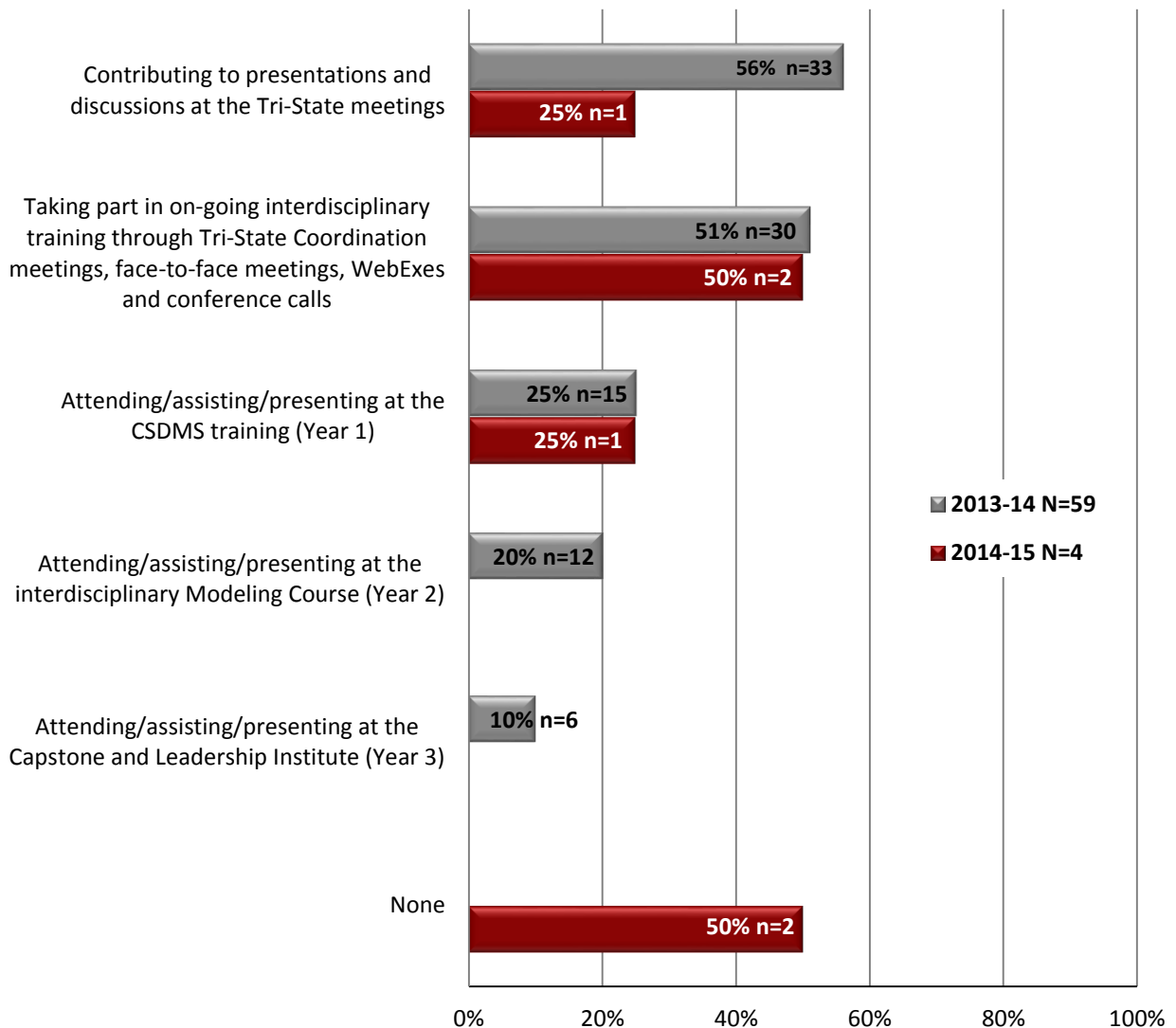


¹³ <http://westernconsortium.org/uploads/2020Page%20Proposal%20-%20WC-WAVE.pdf>

Graduate Interdisciplinary Training participation

Participants explained how they were involved in the Graduate Interdisciplinary Training program. As shown in Figure 29, the largest group of participants (n=2) contributed *in on-going interdisciplinary training through Tri-State Coordination meetings*.

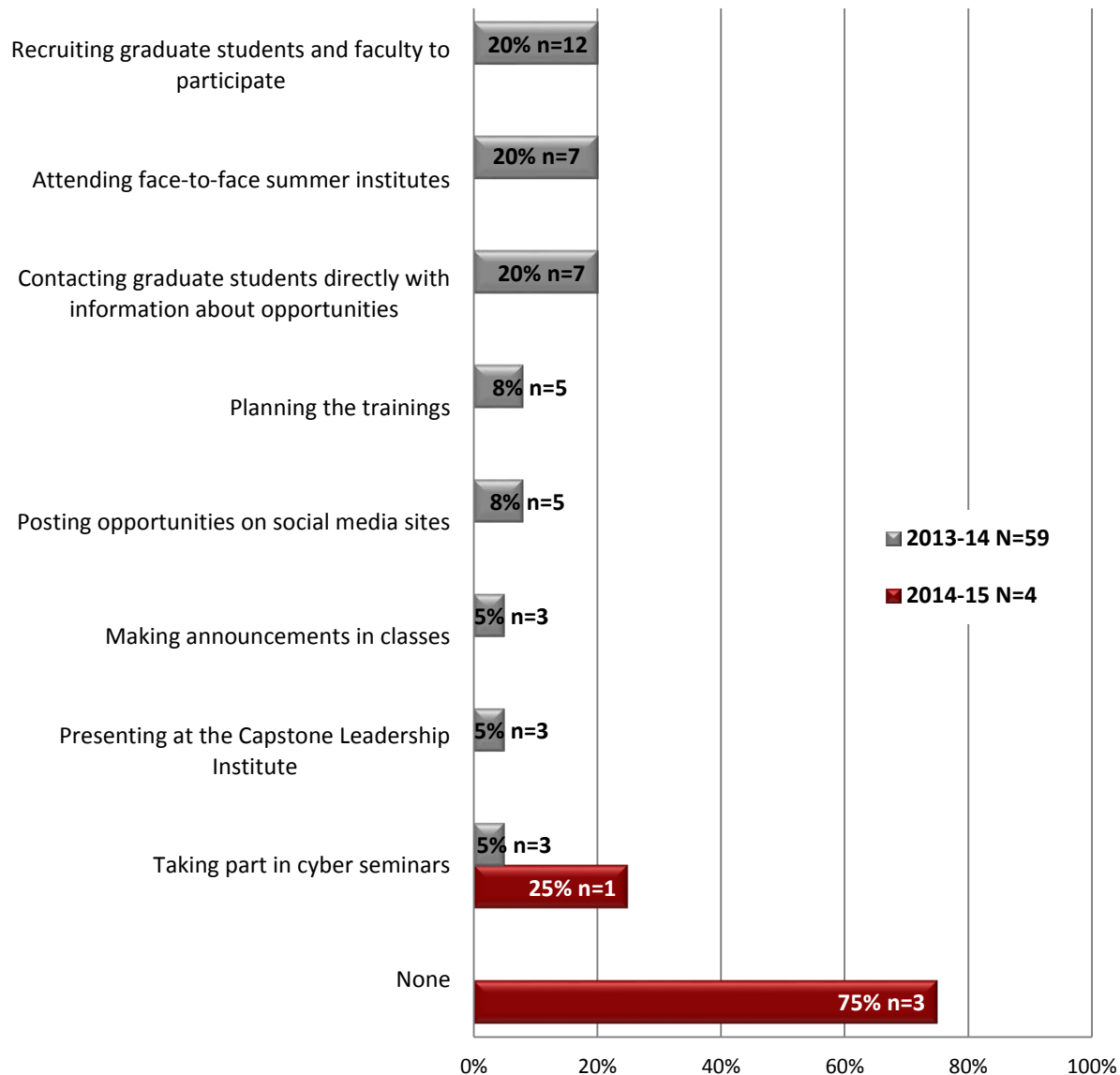
Figure 29. Participants' involvement in the Graduate Interdisciplinary Training



Capstone and Leadership Institute Participation

Survey participants noted how they participated in the Capstone and Leadership Institute. One participant took part in the *cyber seminars*. The other 75% did not attend any leadership activities, suggesting an area for improvement. Results are shown in Figure 30.

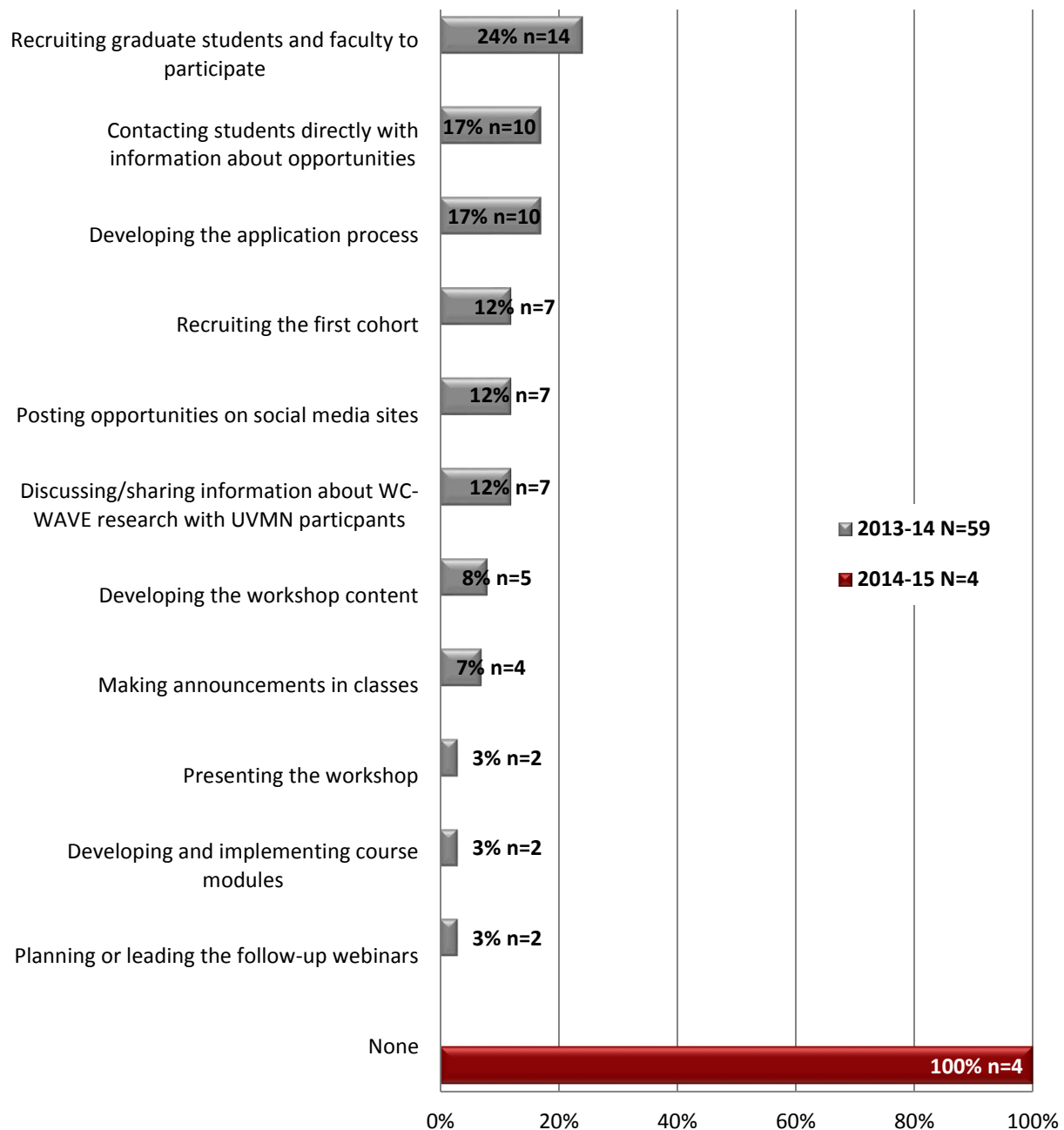
Figure 30. Participants' involvement in the Capstone and Leadership Institute



Undergraduate Visualization and Modeling Network participation

As shown in Figure 31, participants explained their involvement with the Undergraduate Visualization and Modeling Network (UVMN). None of the new baseline survey participants took part in UVMN.

Figure 31. Participants' involvement in the Undergraduate Visualization and Modeling Network (UVMN)



Section 4. Key Findings and Recommendations

- (1) *New project participants are showing increasing levels of watershed content knowledge; continue to recruit students and participants who have experience and interest in the project's activities and areas of research.*

The overall Component 1 (Watershed Sciences) composite ratings showed that although new project participants rated their knowledge slightly higher, they still felt *slightly knowledgeable* like the initial 2013-14 baseline participants. For Component 2 (Cyberinfrastructure-Visualization), new baseline participants rated themselves much higher than the initial baseline survey participants, at *somewhat knowledgeable* compared to the previous *slightly knowledgeable*.

- (2) *While progress has been made to recruit more Hispanics and African Americans to the project, continue to focus on increasing the participation of females. The focus on increasing diversity is evident in the composition of new participants. Work collaboratively across components to generate strategies for increasing female representation on the project.*

The new participants are more ethnically diverse as 50% are Hispanic and 25% are African American. However, American Indian/Alaskan Natives were not represented among new participants compared to 3% in the institution-based population. In addition, there were fewer female participants, just 25% compared with 44% of the initial baseline participants and 52% of the comparison population.

- (3) *Continue to involve students in faculty mentoring and research opportunities to increase their watershed science knowledge and abilities. Encourage cross-component attendance at activities to build new content knowledge in a different disciplines and increase student contact with project faculty.*

For Component 4 (Workforce Development), a larger percentage of new baseline participants are attending collaborative fieldwork activities, with 50% attending compared to the initial baseline participant attendance rate of 39%. However, half of new participants do not participate in Graduate Interdisciplinary Training, a large percentage do not participate in the Capstone and Leadership Institute, and none are participating in UVMN.

- (4) *Incorporate discussions of sustainability at all meetings from component to larger groups. Utilize the results from the PSAT to guide these discussions and planning for project sustainability.*

While the PSAT results demonstrate that *funding* and *partnerships* should be priority for sustainability, other areas of focus include: *strategic planning* and *communication*. An in-depth discussion about sustainability should be scheduled for the next WC-WAVE Annual meeting. Sustainability should also be added as an agenda item for each meeting and a sustainability sub-committee should be formed.

- (5) *Encourage new project participants to take part in project activities in addition to research.*

Inform each new participant of the opportunities and activities available to them through WC-WAVE. Ensure that new and current project participants have access to upcoming Workforce Development activities and know how to get involved.

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Appendix A: Program Sustainability and Assessment Tool (PSAT)

The name of the program or set of activities I am assessing is:

In the following questions, you will rate your program across a range of specific factors that affect sustainability. Please respond to as many items as possible. If you truly feel you are not able to answer an item, you may select “NA.” **For each statement, circle the number that best indicates the extent to which your program has or does the following things.**

Environmental Support: Having a supportive internal and external climate for your program

	To little or no extent							To a very great extent	Not able to answer
1. Champions exist who strongly support the program.	1	2	3	4	5	6	7	NA	
2. The program has strong champions with the ability to garner resources.	1	2	3	4	5	6	7	NA	
3. The program has leadership support from within the larger organization.	1	2	3	4	5	6	7	NA	
4. The program has leadership support from outside of the organization.	1	2	3	4	5	6	7	NA	
5. The program has strong public support.	1	2	3	4	5	6	7	NA	

Funding Stability: Establishing a consistent financial base for your program

	To little or no extent							To a very great extent	Not able to answer
1. The program exists in a supportive state economic climate.	1	2	3	4	5	6	7	NA	
2. The program implements policies to help ensure sustained funding.	1	2	3	4	5	6	7	NA	
3. The program is funded through a variety of sources.	1	2	3	4	5	6	7	NA	
4. The program has a combination of stable and flexible funding.	1	2	3	4	5	6	7	NA	
5. The program has sustained funding.	1	2	3	4	5	6	7	NA	

For each statement, circle the number that best indicates the extent to which your program has or does the following things.

Partnerships: Cultivating connections between your program and its stakeholders

	To little or no extent							To a very great extent	Not able to answer
1. Diverse community organizations are invested in the success of the program.	1	2	3	4	5	6	7		NA
2. The program communicates with community leaders.	1	2	3	4	5	6	7		NA
3. Community leaders are involved with the program.	1	2	3	4	5	6	7		NA
4. Community members are passionately committed to the program.	1	2	3	4	5	6	7		NA
5. The community is engaged in the development of program goals.	1	2	3	4	5	6	7		NA

Organizational Capacity: Having the internal support and resources needed to effectively manage your program and its activities

	To little or no extent							To a very great extent	Not able to answer
1. The program is well integrated into the operations of the organization.	1	2	3	4	5	6	7		NA
2. Organizational systems are in place to support the various program needs.	1	2	3	4	5	6	7		NA
3. Leadership effectively articulates the vision of the program to external partners.	1	2	3	4	5	6	7		NA
4. Leadership efficiently manages staff and other resources.	1	2	3	4	5	6	7		NA
5. The program has adequate staff to complete program's goals.	1	2	3	4	5	6	7		NA

For each statement, circle the number that best indicates the extent to which your program has or does the following things.

Program Evaluation: Assessing your program to inform planning and document results

	To little or no extent							To a very great extent	Not able to answer
1. The program has the capacity for quality program evaluation.	1	2	3	4	5	6	7	NA	
2. The program reports short term and intermediate outcomes.	1	2	3	4	5	6	7	NA	
3. Evaluation results inform program planning and implementation.	1	2	3	4	5	6	7	NA	
4. Program evaluation results are used to demonstrate successes to funders and other key stakeholders.	1	2	3	4	5	6	7	NA	
5. The program provides strong evidence to the public that the program works.	1	2	3	4	5	6	7	NA	

Program Adaption: Taking actions that adapt your program to ensure its ongoing effectiveness

	To little or no extent							To a very great extent	Not able to answer
1. The program periodically reviews the evidence base.	1	2	3	4	5	6	7	NA	
2. The program adapts strategies as needed.	1	2	3	4	5	6	7	NA	
3. The program adapts to new science.	1	2	3	4	5	6	7	NA	
4. The program proactively adapts to changes in the environment.	1	2	3	4	5	6	7	NA	
5. The program makes decisions about which components are ineffective and should not continue.	1	2	3	4	5	6	7	NA	

For each statement, circle the number that best indicates the extent to which your program has or does the following things.

Communications: Strategic communication with stakeholders and the public about your program

	To little or no extent							To a very great extent	Not able to answer
1. The program has communication strategies to secure and maintain public support.	1	2	3	4	5	6	7	NA	
2. Program staff communicate the need for the program to the public.	1	2	3	4	5	6	7	NA	
3. The program is marketed in a way that generates interest.	1	2	3	4	5	6	7	NA	
4. The program increases community awareness of the issue.	1	2	3	4	5	6	7	NA	
5. The program demonstrates its value to the public.	1	2	3	4	5	6	7	NA	

Strategic Planning: Using processes that guide your program's direction, goals, and strategies

	To little or no extent							To a very great extent	Not able to answer
1. The program plans for future resource needs.	1	2	3	4	5	6	7	NA	
2. The program has a long-term financial plan.	1	2	3	4	5	6	7	NA	
3. The program has a sustainability plan.	1	2	3	4	5	6	7	NA	
4. The program’s goals are understood by all stakeholders.	1	2	3	4	5	6	7	NA	
5. The program clearly outlines roles and responsibilities for all stakeholders.	1	2	3	4	5	6	7	NA	

Appendix B: Program Sustainability Report

WC-WAVE Sustainability Report

11/24/2014

[>Go to Next Steps](#)

Many factors can affect sustainability, such as financial and political climates, organizational characteristics, and elements of evaluation and communication. The Program Sustainability Assessment Tool allows stakeholders to rate their programs on the extent to which they have processes and structures in place that will increase the likelihood of sustainability. Assessment results can then be used to identify next steps in building program *capacity* for sustainability in order to position efforts for long term success.

Interpreting the Results:

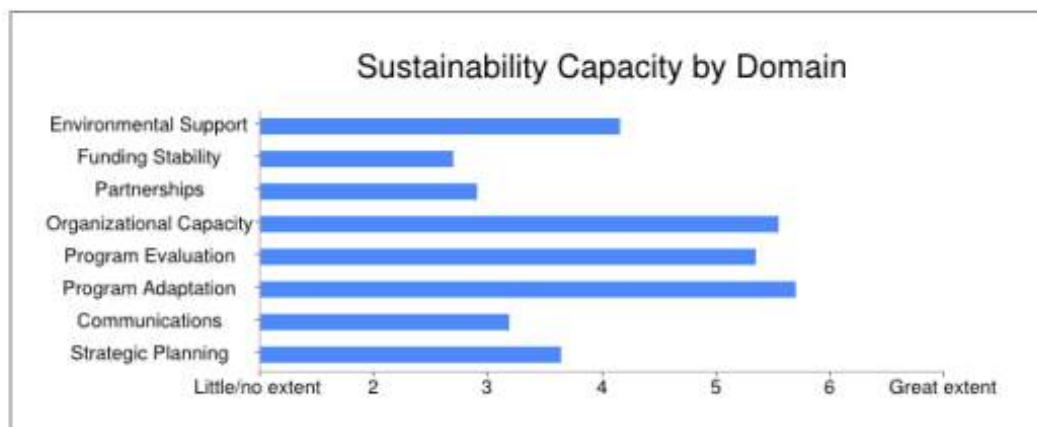
The table presents the average rating for each sustainability domain based on the responses provided by 11 participants. The remainder of the document presents the average ratings for indicators within each domain. There is no minimum rating that guarantees the sustainability of your program. However, lower ratings do indicate opportunities for improvement that you may want to focus on when developing a plan for sustainability.

Next Steps:

- These results can be used to guide sustainability planning for your efforts.
- Areas with lower ratings indicate that there is room for improvement.
- Address domains that are most modifiable, quicker to change, and have data available to support the needed changes.
- Develop strategies to tackle the domains that may be more difficult to modify.
- Make plans to assess the sustainability of your efforts on an ongoing basis to monitor changes as you strive for an ongoing impact.

Overall Capacity for Sustainability	4.1
Environmental Support	4.2
Funding Stability	2.7
Partnerships	2.9
Organizational Capacity	5.5
Program Evaluation	5.3
Program Adaptation	5.7
Communications	3.2
Strategic Planning	3.6

1 = to little or no extent / 7 = to a great extent



For more information about the Program Sustainability Assessment Tool and sustainability planning, visit <http://www.sustaintool.org>

Environmental Support	Average
1. Champions exist who strongly support the program.	4.6
2. The program has strong champions with the ability to garner resources.	4.3
3. The program has leadership support from within the larger organization.	5.4
4. The program has leadership support from outside of the organization.	3.7
5. The program has strong public support.	2.8

1 = to little or no extent / 7 = to a great extent

Funding Stability	Average
1. The program exists in a supportive state economic climate.	4.0
2. The program implements policies to help ensure sustained funding.	3.5
3. The program is funded through a variety of sources.	2.4
4. The program has a combination of stable and flexible funding.	1.9
5. The program has sustained funding.	1.7

Partnerships	Average
1. Diverse community organizations are invested in the success of the program.	3.1
2. The program communicates with community leaders.	3.2
3. Community leaders are involved with the program.	3.0
4. Community members are passionately committed to the program.	2.7
5. The community is engaged in the development of program goals.	2.5

Organizational Capacity	Average
1. The program is well integrated into the operations of the organization.	5.9
2. Organizational systems are in place to support the various program needs.	5.6
3. Leadership effectively articulates the vision of the program to external partners.	4.6
4. Leadership efficiently manages staff and other resources.	6.0
5. The program has adequate staff to complete the program's goals.	5.5

For more information about the Program Sustainability Assessment Tool and sustainability planning, visit <http://www.sustaintool.org>

Program Evaluation	Average
1. The program has the capacity for quality program evaluation.	5.7
2. The program reports short term and intermediate outcomes.	6.5
3. Evaluation results inform program planning and implementation.	5.9
4. Program evaluation results are used to demonstrate successes to funders and other key stakeholders.	4.5
5. The program provides strong evidence to the public that the program works.	4.1
1 = to little or no extent / 7 = to a great extent	

Program Adaptation	Average
1. The program periodically reviews the evidence base.	5.5
2. The program adapts strategies as needed.	6.1
3. The program adapts to new science.	5.8
4. The program proactively adapts to changes in the environment.	5.7
5. The program makes decisions about which components are ineffective and should not continue.	5.3

Communications	Average
1. The program has communication strategies to secure and maintain public support.	3.3
2. Program staff communicate the need for the program to the public.	3.0
3. The program is marketed in a way that generates interest.	3.5
4. The program increases community awareness of the issue.	3.2
5. The program demonstrates its value to the public.	2.9

Strategic Planning	Average
1. The program plans for future resource needs.	4.5
2. The program has a long-term financial plan.	2.7
3. The program has a sustainability plan.	3.4
4. The program's goals are understood by all stakeholders.	3.7
5. The program clearly outlines roles and responsibilities for all stakeholders.	3.8

Results based on responses to the Program Sustainability Assessment Tool v2, ©2013, Washington University in St Louis.

For more information about the Program Sustainability Assessment Tool and sustainability planning, visit <http://www.sustaintool.org>

Appendix C: WC-WAVE Baseline Survey

Thank you for participating in the evaluation of the WC-WAVE Track 2 Tri-State EPSCoR project. Your responses are very important. The information you provide will help improve this project and make it more valuable for participants and will help assess the impact this project has on participants and institutions and the broader impacts it may have on the scientific community and the states of Idaho, New Mexico, and Nevada.

As you're completing the survey, reflect back on when you joined this project and answer questions from that perspective. The baseline information resulting from the survey will be used to determine our progress on project components and objectives, which is required by NSF and reported annually. Please answer each question honestly and thoroughly. All responses are confidential.

If you have questions about this survey please contact:

Sara Newkirk, Project Evaluator

Smart Start Educational Consulting Services

About You: Completion of this section provides basic information to capture the demographics of NSF EPSCoR participants. This information strengthens future applications for funding, ultimately providing research program sustainability and growth.

1) What role do you play in the NSF Track 2 EPSCoR WC-WAVE project?*

☐ Faculty/University academic researcher

☐ Governmental agency employee

☐ Graduate student

☐ Industry researcher

☐ Policy maker/politician

☐ Postdoctoral fellow

☐ Professional Staff

☐ Technician

☐ Teacher - elementary

☐ Teacher - secondary

☐ Undergraduate student

☐ Other: _____

2) With which gender do you identify?*

☐ Male

☐ Female

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

☐ Hispanic or Latino

☐ Not Hispanic or Latino

☐ Other

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

☐ Black or African American

☐ Asian

☐ White (non-Hispanic)

☐ Hispanic

☐ American Indian or Alaska Native

☐ Pacific Islander or Native Hawaiian

☐ Other: _____

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

☐ Boise State University

☐ College of Southern Idaho

- ☐ Desert Research Institute
- ☐ Idaho State University
- ☐ Nevada System of Higher Education
- ☐ New Mexico State University
- ☐ New Mexico Tech
- ☐ University of Idaho
- ☐ University of Nevada, Las Vegas
- ☐ University of Nevada, Reno
- ☐ University of New Mexico
- ☐ Other: _____

6) What year did you begin participating in the WC-WAVE project?*

- ☐ 2013-14
- ☐ 2014-15
- ☐ 2015-16

COMPONENT 1: WATERSHED SCIENCES

Component 1 - Advance understanding of hydrologic interactions and their impact on ecosystem services using a virtual watershed (VW) framework.

Please rate your knowledge about the following topics. Select the response that corresponds to your level of familiarity on a scale of "not knowledgeable at all" to "extremely knowledgeable." These knowledge-based questions are based on benchmark activities identified by project leaders as areas in which knowledge is expected to grow during the 3 years of the project. There is no expectation that everyone possesses all this knowledge. Please answer honestly. Participants' baseline survey responses will be compared with annual post-survey responses to measure overall participant growth over the course of the project.

7) Objective 1. Parameterize and validate watershed models*

	Not knowledgeable at all	Slightly knowledgeable	Somewhat knowledgeable	Very knowledgeable	Extremely knowledgeable
Which watershed models are appropriate to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
What is required to visualize watershed model outputs and inputs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Which environmental variables are important for developing test data sets for models in the VW platform.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
How to parameterize and coordinate model runs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Why one-way or "loose" coupling among models via cyberinfrastructure is desirable.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8) Objective 2. Develop CSDMS (Community Surface Dynamics Modeling System) adapters for models*

	Not knowledgeable at all	Slightly knowledgeable	Somewhat knowledgeable	Very knowledgeable	Extremely knowledgeable
How modeling system adapters are developed	()	()	()	()	()
How to ensure the reliability of adapters	()	()	()	()	()
How to ensure that the code for model adapters is sustainable	()	()	()	()	()

9) Objective 3. Test VW applications and answer research questions using the VW platforms to investigate watershed ecosystem services*

	Not knowledgeable at all	Slightly knowledgeable	Somewhat knowledgeable	Very knowledgeable	Extremely knowledgeable
How initial test cases for the Virtual Watershed are defined based on the climatology of study watersheds.	()	()	()	()	()
How to develop synthetic datasets for the Virtual Watershed models.	()	()	()	()	()
How to run synthetic test cases for models.	()	()	()	()	()
How to characterize and quantify value added through two-way model coupling.	()	()	()	()	()

COMPONENT 2: CI-VISUALIZATION**Component 1 - Accelerate collaborative, interdisciplinary watershed research and discovery by creating innovative visualization environments****10) Please rate your knowledge about the following areas below.***

	Not knowledgeable at all	Slightly knowledgeable	Somewhat knowledgeable	Very knowledgeable	Extremely knowledgeable
How Visualization Environments interface with Virtual Watershed Platform adapters	()	()	()	()	()
How interfaces for the visualization	()	()	()	()	()

environments are developed					
How data required by models and visualization tools are defined	()	()	()	()	()
The model and visualization tool data format requirements	()	()	()	()	()

COMPONENT 3: CI-DATA

Component 1: Accelerate integrated watershed scale modeling through streamlined data access, transfer of outputs and associated metadata to data management systems, visualization, model configuration.

Component 2: Enable accelerated and broad access to research products, data and metadata through integration with national networks through interoperable data services

Component 3: Streamline data intensive research through improved data management skills

11) Please rate your knowledge about the following areas below.*

	Not knowledgeable at all	Slightly knowledgeable	Somewhat knowledgeable	Very knowledgeable	Extremely knowledgeable
How data are integrated within and into larger networks	()	()	()	()	()
Strategies for the acceleration of integrated watershed scale modeling	()	()	()	()	()
How streamlined data access, transfer of outputs and associated metadata impact visualization and model configuration.	()	()	()	()	()
Strategies for accelerated and broad access to large data sets related to the project	()	()	()	()	()
Understanding of opportunities for streamlining data intensive research through improved data management skills	()	()	()	()	()

COMPONENT 4: WORKFORCE DEVELOPMENT

Component 1- Engage university faculty and graduate students in interdisciplinary team-based watershed research, and broaden undergraduate student participation in STEM through modeling and visualization.

What strategies do you use to participate in and/or support the activities of the Workforce Development component? Please place a check only by the activities and strategies in which you are currently involved.

12) I participate in collaborative fieldwork activities involving students and faculty such as pre-meeting camps by:*

- ☐ Attending
- ☐ Contacting students directly with information and opportunities
- ☐ Recruiting college/university staff and faculty to participate
- ☐ Posting opportunities on social media sites
- ☐ Making announcements in classes
- ☐ Playing a part in program planning
- ☐ Joining in program activities
- ☐ Other: _____
- ☐ None

13) I participate in ongoing Graduate Inter-disciplinary Training by*

- ☐ Contributing to presentations and discussions at the Tri-State meetings
- ☐ Taking part in on-going interdisciplinary training through Tri-State Coordination meetings, face-to-face meetings, WebExes and conference calls
- ☐ Attending/assisting/presenting at the CSDMS training (Year 1)
- ☐ Attending/assisting/presenting at the Interdisciplinary Modeling Course (Year 2)
- ☐ Attending/assisting/presenting at the Capstone and Leadership Institute (Year 3)
- ☐ Other: _____
- ☐ None

14) I participate in the Capstone and Leadership Institute by:*

- ☐ Taking part in cyber seminars
- ☐ Attending face-to-face summer institutes
- ☐ Presenting at the Capstone Leadership Institute
- ☐ Contacting graduate students directly with information about opportunities
- ☐ Recruiting graduate students and faculty to participate
- ☐ Posting opportunities on social media sites
- ☐ Making announcements in classes
- ☐ Planning the trainings
- ☐ Other: _____
- ☐ None

15) I participate in the Undergraduate Visualization and Modeling Network (UVMN) by:*

- ☐ Developing the workshop content
- ☐ Developing the application process
- ☐ Recruiting the first cohort
- ☐ Presenting the workshop
- ☐ Developing and implementing course modules
- ☐ Contacting students directly with information about opportunities
- ☐ Recruiting students and faculty to participate
- ☐ Posting opportunities on social media sites
- ☐ Making announcements in classes
- ☐ Planning or leading the follow-up webinars
- ☐ Discussing/sharing information about WC-WAVE research with UVMN participants
- ☐ Other: _____
- ☐ None

Thank You!