Water for Agriculture Webinar Series

Evaluating the Effectiveness of Collaborative Modeling Methodologies to Address Climate Change in Mountain Regions: A Case Study from the Sierra Nevada in the Western United States

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The Water for Agriculture Webinar Series welcomed Dr. Loretta Singletary, who shared lessons learned from collaborative modeling (CM) methods employed in Water for the Seasons (WftS), a collaborative effort between the University of Nevada, Reno, the Desert Research Institute, the U.S. Geologic Survey, and Ohio University. WftS was a four-year study funded by the National Science Foundation and the U.S. Department of Agriculture Water Sustainability and Climate program that applied a collaborative modeling framework in the Truckee-Carson River System as a case study to assess and enhance the climate resiliency of snow-fed arid lands river systems. In this talk, Dr. Singletary describes the origins and main components of the project, reviews the formative and summative evaluation results, highlights stakeholders' perceived outcomes of the project, and concludes by sharing retrospective challenges and ideas for improvement of future collaborative and participatory research endeavors.

Dr. Singletary began by defining climate resiliency and exploring its relationship to the Great Basin region of the western U.S. Climate resiliency refers to how humans and natural systems interact to continue functioning in the face of climatic change. Several different factors – cultural, institutional, economic, historical, and environmental – influence how a community will react to change in the environment. What is particularly challenging about the concept of climate resiliency in the high desert Great Basin region, Dr. Singletary explained, is that most communities depend on winter snowpack and spring snowmelt or runoff for their water supply. "Precipitation still arrives in the winter as it always has, but due to warming temperatures, it doesn't always arrive as snow," she explained. Also, snowmelt occurs earlier in the spring now. As water quantity becomes scarcer, competition among entities demanding water for irrigated agriculture, municipalities and industry, and environmental flows manifests or increases. "From that competition often emerges conflict," Singletary explained.

Water is a critical source in the Great Basin region, and with estimates projecting decreased quality and quantity in the coming years, communities will need to adapt. “What we see through climate adaptation is the opportunity to look at resiliency puzzles in the communities,” Dr. Singletary explained. “How are [community reactions] different? How are the water management institutions performing? It seemed like an ideal opportunity to employ a participatory research design.”

Collaborative modeling is one example of a participatory research method that seeks to perform academic research *with* and *for* rather than *on* their communities of study. Dr. Singletary and her collaborators designed a collaborative modeling project whose goals were to “assess community resiliency, climate resiliency, and in doing that, provide information to the communities to build their capacity to adapt to changing water supply.” Emphasizing the action-oriented element of the project’s design, Singletary stressed: “We wanted to make sure that, from the get-go, the information we were generating throughout the research process was useful.”

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First, Dr. Singletary and her team conducted face-to-face interviews with 66 organizations that are charged with water management decision-making in the river system. “Partly,” she described, “this was to assess their perception of the existing resiliency of the system to climate change and to identify tipping points; to begin picking out and teasing out how organizations respond and react to climate models.” Data from these interviews informed the first set of climate scenarios, which were subsequently presented in five face-to-face workshops with a carefully selected volunteer Stakeholder Advisory Group (SAG).

The SAG was comprised of 12 individuals representing municipal, industrial, environmental, agricultural, and regulatory agencies and tribal communities. “We wanted to make sure the stakeholders had expertise around the functionality of the river system, so these are individuals working for the entities in the river systems which have some decision-making responsibility,” Dr. Singletary described. “We wanted them to be able to inform what kinds of climate scenarios we could create that would purposely stress the system that would inform these decision-making bodies and promote resiliency thinking. [We wanted to challenge them to] consider what you might need in advance of that climate scenario becoming a reality.” Ultimately, “there was nothing magical about the number 12 in terms of water management entities selected. But we wanted a workable number and based on the results of our 66 interviews, these 12 water management organizations effectively represented water management issues from the headwaters of the river system to its natural and manmade terminus. Also, by the time you get to 12 entities and the two dozen researchers in the room for workshops, it can turn into quite the event. So, 12 was as large as we had.” In addition to the SAG, Dr. Singletary’s project brought together members of the University of Nevada, Reno’s Cooperative Extension network, and an interdisciplinary research team of socio-behavioral and bio-physical scientists.

Following the 66 face-to-face interviews, the Stakeholder Advisory Group met via in-person workshops. Dr. Singletary described how Mike Dettinger, a now-retired USGS climate scientist, developed hypothetical climate scenarios that would convey precipitation and temperature data that would be fed through a suite of hydrological and operational models tailored to the river system. During in-person workshops, researchers presented the climate, hydrologic, and operational scenarios to the SAG, and the stakeholders would suggest ideas for adaptation geared to water supply based on a particular hypothetical climate scenario. These workshops were action-oriented, encouraging stakeholder participants to communicate their respective organization’s and water use community’s information needs. After each meeting, stakeholders were provided with outreach publications and materials that summarized research results so

that they could share research progress and findings, report back, and get input to help guide future research needs from their respective water use communities. “And then they would bring that input back to us,” Dr. Singletary explained, “so there was somewhat of a snowball effect in terms of distributing research information and facilitating participatory input into the research.” In addition to the in-person workshops, Dr. Singletary and her team conducted annual phone interviews with SAG participants. “We wanted to make sure that our stakeholder guided research was still on target to meet their information needs. It was a way to keep our fingers on the pulse of the water use community, so to speak, and to keep their fingers on our pulse,” she explained.

Ultimately, the project produced three sets of hypothetical climate scenarios, requested by the SAG, that explored warmer temperature and precipitation changes across the Great Basin region. “Researchers fed into their suite of hydrologic models temperature and precipitation information, which allowed them to simulate potential flows or water availability. Researchers were able to reflect the impact of water management operations of the existing institutional arrangements, which determined basically where water flow may cease to exist in the river system under these hypothetical climate scenarios. You can see how existing institutional arrangements and water management practices might respond under these climate scenarios,” Dr. Singletary explained. Though these models were tailored to the Truckee-Carson River System, they can be tailored with localized data for other snow-fed river systems. In addition, the project produced more than 60 professional conference paper and poster presentations, 15 presentations at local conferences and meetings, 12 peer-reviewed journal articles, two peer-reviewed book chapters, and 12 peer-reviewed extension publications. Dr. Singletary reflected: “I think we were fairly productive given the intensive and iterative interaction that we committed ourselves to with stakeholders.”

Dr. Singletary next described the formative and summative evaluation results of the project. From follow-up interviews with SAG participants, the researchers found that the project allowed stakeholders to consistently acquire information to improve their organization’s resilience operations, acquired knowledge to improve their organization’s resilience planning, and generated and obtained information about potential adaption strategies to climate resiliency. Dr. Singletary reflected, “I think there was an ah-ha moment across the system and all of the stakeholder bodies that this is a very fragile river system and we need to be prepared for the future.” The project’s summative evaluation results from a USDA-appointed external party identified findings through interviews with SAG participants, project researchers, and content analyses of project reports. These findings showed that the project consistently engaged key stakeholders in collaborative research that facilitated learning, cooperation, and communication. In addition, the project provided iterative, structured interaction between stakeholders and interdisciplinary researchers, and effectively utilized extension as a boundary organization to conceptualize, implement, and formatively evaluate the efficacy of collaborative research design.

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Concluding the webinar, Dr. Singletary shared retrospective challenges and ideas for improving collaborative research projects. She first explained how there was insufficient funding to implement, test, and revise adaptation strategies and take part in more educational outreach with the stakeholders. From an interdisciplinary project perspective, a few challenges impeded collaborative research. These include expectations for generalizable and publishable research, research timelines, standardized metrics to identify knowledge co-production progress, varied expectations concerning goals and deliverables, local climate information needs, and group and interpersonal conflict. Dr. Singletary reflected: “If I had to do it over again, I would have probably started much earlier with a professional facilitator, external to the research team, to establish

ground rules and intercede to handle conflict that bubbled up at times." Despite these challenges, Dr. Singletary concluded with suggestions for making collaborative research projects work. "I cannot say enough about an objective stakeholder analysis at the very beginning of any collaborative/participatory research project," she explained. Dr. Singletary also suggests ensuring early and consistent iterative interaction between stakeholders and researchers, co-developing a project charter, assessing stakeholder and researcher expectations for project outcomes, tracking progress and results and responding accordingly through formative and summative evaluations, and conducting retrospective evaluations to inform future endeavors.

To view the full webinar, click here.

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