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Advancing Science and Improving Quality of Place: Linking Knowledge with Action in Maine's Sustainability Solutions Initiative

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Advancing Science and Improving Quality of Place:

Linking Knowledge with Action in Maine's Sustainability Solutions Initiative

by Damon M. Hall

Linda Silka

Laura Lindenfeld

Damon Hall, Linda Silka and Laura Lindenfeld give an overview of how research carried out through Maine's Sustainabilty Solutions Initiative (SSI) improves traditional models of science by providing a fuller picture of the interaction between social and ecological systems. They provide examples of university-community research partnerships, where there is a continuous communication and feedback process that identifies problems and develops projects with a solutions-oriented focus. SSI projects, they argue, "focus on issues that may make lasting improvements to Maine's quality of place." ❧

Like a hand-crank ice-cream machine lying on its side underwater, the paddles of the new tidal energy technology slowly spin as the tidewaters pass through. Dependable and cyclical tidal currents push the paddles generating plug-in-ready electricity. Ocean Renewable Power and the University of Maine are working together to understand how this technology interacts with marine conditions. In addition to field-testing, university faculty also are investigating impacts on the biological systems. To understand the local and regional social, cultural, and economic systems, researchers are visiting with people in Maine's coastal towns to hear their concerns, ideas, and thoughts about this technology. The information mutually benefits the team's need to develop a comprehensive picture of tidal power's long-term suitability for Maine. The aim is to integrate the management of economic, ecological, and social sectors so that research moves sustainability into reality.

Finding practical pathways to integrate knowledge of social, economic, and environmental systems and then presenting that information in ways that are useful to business and civic decision makers is a principal aim of sustainability science. This case of tidal energy testing and development is one experiment in learning how to improve the linkages between research-based knowledge and action. This article will highlight ways that researchers are learning to position university knowledge to help Maine citizens and community leaders to make decisions and implement research-based changes for the good of their communities.

When researchers consider the applicability of our research, it encourages us to think differently about many aspects of our work. Within the Sustainability Solutions Initiative (SSI), our group of researchers studies the linkages between knowledge and action. We term this concept K⟷A to emphasize the reciprocal, dynamic relationship between knowledge production and action. Sustainability science pushes us to rethink many of the ways in which we work in academic institutions. It requires that we listen to community members. It asks us to consider how we can best balance the production of science with the need for scientific information and how we match those pressing needs with the research and information resources at the university.

Through SSI, our research aims to create useful knowledge by working with Maine communities. The goal is to create feasible, healthy, and long-term solutions that enhance the overall quality of life in Maine. SSI strives to improve traditional models of science by carrying out research that provides a more complete picture of how social and ecological systems mutually influence one another. Researchers working within diverse fields and with diverse backgrounds and perspectives share their knowledge to identify key decision points and practices that foster improvements in the system. This research cycles back and forth between knowledge production and application to ensure that research, produced collaboratively with stakeholders and communities, leads to meaningful, practical, and innovative outcomes. This ongoing process of linking knowledge with decision making and useful action depends on university and community relationships.

SSI asks how it can ensure that scientific knowledge is useful *and* gets used. That people use research is particularly challenging for academics because academics are trained to value peer-reviewed publications and to speak with each other in specialized language that is difficult for those outside a particular discipline to understand. Yet, many academics have become increasingly concerned that their work will go unused. Harvard researcher David Cash (Cash et al. 2006) refers to this as the "loading-dock problem," where scientists write the results of their research and publish them in documents that then are left on a loading dock, waiting to be picked up and used by practitioners. An antidote to this problem is increased engagement with decision makers and communities who will use that science. With support from the National Science Foundation, SSI is working to change how universities design research so the knowledge

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Karen Hutchins

**Graduate Research Assistant,
Sustainability Solutions Initiative IPh.D. candidate,
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An avid fly-fisherwoman with deep family roots in Bethel, Karen Hutchins decided to pursue her Ph.D. through SSI because she wanted to conduct research that would help Maine communities. As a member of SSI's Knowledge-to-Action Collaborative, she is leading a statewide survey of municipal officials to identify the most urgent problems Maine communities face—and find more effective ways to solve them.

What problem are you working to solve?

The key problem our team is addressing is the disconnect between knowledge production and "real-world" action. University researchers produce knowledge, but often it is not used in decision making; the suggested solutions do not match the needs of communities; or researchers are not studying the issues communities need us to investigate. To help address this mismatch, my research focuses on contributing to models of stakeholder-university collaborations by identifying and exploring the factors that influence the likelihood and style of those partnerships. The belief is that improving researchers' working relationships with stakeholders will make research and solutions more relevant and useful to stakeholders, and better aligned with community needs.

What progress are you making toward solutions?

Our research is contributing to solutions by helping to understand, analyze, and inform the development of community-university partnerships. We believe these partnerships are critical for developing sustainable solutions. My primary research involves a statewide survey sent to more than 2,500 municipal officials in every community in Maine.

Through this survey, we identified current problems facing municipalities and assessed factors that influenced the likelihood of officials' interest in developing a community-university partnership, as well as their preferred partnership structure, in terms of the level of involvement in problem identification, research, solution development, and implementation.

Thus far, our analyses show that municipal officials' belief that university researchers can assist them with solving problems in their communities is the strongest predictor of their interest in a partnership. We are continuing our analyses and our outreach to municipalities, and we will be conducting additional surveys to expand and improve our model.

How could your findings contribute to a more sustainable future in Maine and beyond?

I believe that improving connections between university and college researchers and stakeholders in Maine will contribute to a more sustainable future. This research will help us to find more effective ways for universities and communities to work together by identifying stakeholders' partnership preferences prior to collaboration. Findings also will determine key factors that may help to improve collaboration between researchers and stakeholders to better identify solutions to some of the state's most pressing sustainability challenges.

— Kim Ridley

produced promotes strong economies, vibrant communities, and healthy ecosystems upon which Maine depends. Our K↔A research focuses on the challenges and opportunities for this different type of science. The theme of understanding the connections between knowledge and action cuts across all SSI projects and infuses our work with an ethos of responsibility and responsiveness to Maine's needs.

The following sections share a few examples of what SSI is doing and learning in the field. Each section intends to give a flavor of the work while identifying the most striking ways it is moving research towards a solutions-focused applied science.

RETHINKING TEAMS AS LEARNING ORGANIZATIONS

Rethinking research teams stands at the center of the effort to improve linkages between knowledge and action. Sustainability problems, such as gradually declining water quality and fish stocks, are more complex than any one individual or discipline can address alone. The SSI views its research teams as *learning organizations*. Groups of decision makers and researchers create shared understandings of a problem and identify pathways for designing and implementing solutions. Being a learning organization also means that the group collectively reflects on its efforts to ensure it is developing effective strategies for working with all its members and community partners. Furthermore, as part of a learning organization, the work will change through engagement with relevant information and new voices. Thus, SSI is open to adapting its vision of the problem.

The emerald ash borer (EAB) project, described in another article in this special issue (Arnett et al. this issue), provides an example of how a learning-organization-approach enables the K↔A process. Originally, SSI researchers approached Maine's Wabanaki (Maliseet, Micmac, Passamaquoddy, and Penobscot) tribes about assisting with their forest-management planning needs. After a series of conversations, the communities expressed little interest in general planning, but they were concerned about the potential impacts of the EAB, an exotic insect species that kills ash trees. The insect is expected to arrive in Maine in

2015 and may cost the state millions of dollars in tree removal (Quimby 2011). Even more important, this infestation poses a risk to basket making in the Wabanaki communities.

In response, SSI researchers altered their plans and objectives. Though the researchers were not experts on this pest, they brought in new expertise to learn about the insect. They traveled to Michigan with four representatives from the Maine Indian Basketmakers Alliance to see the damages from the EAB infestation first hand. Together the group learned about the insect's biology and brought this knowledge back to Maine. The team hosted a workshop to discuss research objectives, information needs, and steps necessary to develop an emergency management plan should the insect arrive in Maine.

Viable sustainability solutions are those that citizens are willing, able, and committed to implement. University research can match practitioners' needs, provided the researchers take the time to listen, learn, and adapt. When the research team is viewed as a learning organization, learning as the priority has an equilibrating effect on the diverse problem-solving team. Here, voice is given to good ideas regardless of who the speaker is. Integrating these voices is one way SSI is advancing science.

RETHINKING EXPERTISE

The integration of knowledge and action demands that researchers remain open to multiple ways of understanding social and ecological systems. The social theorist and literary critic, Kenneth Burke notes that the universe "would appear to be something like a cheese; it can be sliced in an infinite number of ways— and when one has found his pattern of slicing, he finds that other men's slices fall in the wrong places" (1984: 103). Expert training offers distinct ways of slicing the world for its examination and action. Many of the problems plaguing ecological and social systems are best grasped by gathering, integrating, and synthesizing many lenses of expertise.

SSI works in teams of diverse specializations that include economics, biology, psychology, ecology, communication, education, history, forestry, anthropology, chemistry, and engineering. To change from

STUDENT SPOTLIGHT ▶ **Colleen Budzinski**

MA student in Communication and Journalism, University of Maine

Colleen Budzinski is working with research teams at SSI partner institutions that are helping to advance one of SSI's central goals: building a statewide network of coordinated research to address sustainability challenges in Maine. Budzinski's communication research focuses on facilitating the development of this network, which currently includes 10 Maine colleges and universities where SSI teams are working on issues ranging from lake-water quality to renewable-energy development. A new mother, she says her son and husband inspire her to contribute to a more sustainable future.

What problem are you working to solve?

My research focuses on working with teams at SSI partner institutions to better understand their needs within the larger SSI project. I examine team dynamics, communication, and stakeholder engagement. My research analyzes communication practices and how they support or undermine interdisciplinary collaboration. I also assess SSI's current communication modes, including the web site and all-team meetings, to understand how SSI researchers at partner institutions perceive these communication platforms. The goal is to provide a critical analysis of their attitudes toward their own projects, SSI in general, and the project's communication outlets, while observing and better understanding the cultural dynamics of each team.

What progress are you making toward solutions?

We distributed a statewide survey to research teams at SSI partner institutions to better understand team development and engagement while identifying communication barriers. Based on survey results, SSI developed workshops to help these teams to meet EPSCoR grant requirements,

conducted site visits, and redesigned its web site to provide more resources and to help these teams to stay current with SSI information, people, and projects. In the future, we will interview teams to better understand the barriers that each group faces when communicating with one another on an interdisciplinary level and with stakeholders through knowledge-to-action research. Findings from these interviews will help streamline communication for teams at SSI partner institutions.

How could your findings contribute to a more sustainable future in Maine and beyond?

Partner institutions are important to SSI's overall success in developing a statewide pipeline for sustainability science research in Maine. By serving as a liaison between SSI management teams at the University of Maine campus and research teams across the state, the partner institutions program will help to build and strengthen SSI's statewide network. Our research will yield new insights into improving communication to facilitate the development of statewide research networks in Maine and elsewhere.

— Kim Ridley

what philosopher Nicholas Butler (1934) says about the expert "who knows more and more about less and less," an essential first step is spending time understanding how one's specially trained ways of slicing up

Top 10 Ways SSI Will Make a Difference for Maine in the Policy Arena

By identifying research needs of Maine's policy community

By aligning higher education research efforts with Maine's local and state needs

By improving research-informed policy

By ensuring that the higher education institutions in Maine have the resources and infrastructure to be responsive to communities

By improving the likelihood, efficiency, and speed of knowledge transfer between researchers, community stakeholders, and decision makers

By serving as a link between research and policy

By providing opportunities for students to address policy issues through their research and training

By finding new ways that academic researchers can help communities, towns, and industries to build a better future for Maine

By providing Maine citizens with research-based evidence that accounts for and informs complex decision making in the face of uncertainty

By training Maine's future leaders to understand links between policy and research and extending workforce development into policy arenas

"Top 10" lists provide a synthesis of common themes, methods, strategies and outcomes within SSI and reflect the collective input of more than 30 SSI faculty and students.

One example of this cross-discipline, cross-sector research is in an SSI project focused on helping lakeshore landowners improve the water quality of their common resource, the Belgrade and Rangeley lakes, a collaboration between Colby and University Maine-Farmington biologists, social scientists, and chemists, and the Belgrade Lakes Association. One aspect of the project involves working with citizens to provide monitoring resources and data for identifying best lawn-management practices to preserve and improve the lake's water quality. This approach exemplifies a common effort among all SSI research teams of learning how to integrate the outsider's general knowledge about watersheds and the lakeshore resident's insider knowledge *of* a specific place.

The success of research partnerships such as the Belgrade and Rangeley lakes projects depends upon the involvement of the year-round and summer residents. Because residents share a shoreline, they know how to talk to their neighbors about related problems they share. They have the credibility as stakeholders—people who have a stake in the local quality of place.

SSI projects focus on issues that may make lasting improvements to Maine's quality of place, such as invasive species, private forest decision making, regional economic development, renewable-energy electricity production, and water quality and management. Long-term problems require long-term relationships with the people who live and lead in Maine's communities. Because university researchers often do not live near the places they study, they need to rely on others more familiar with that place. These local residents will remain the "experts" left on the scene after the research is completed.

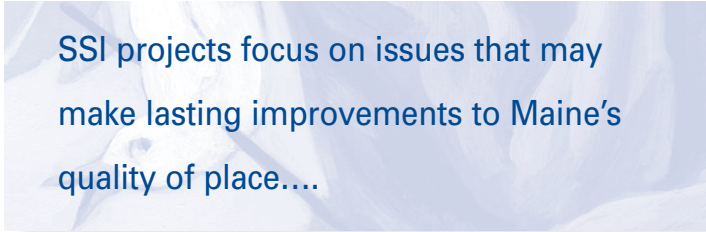### RETHINKING HOW KNOWLEDGE IS PRIORITIZED

Post-industrialism changed work from manufacturing goods to providing specialized services. This led to increased efficiency in how those original goods were produced. A similar change is happening in universities. Knowledge production is giving way to knowledge services. The role of the university is becoming that of a hub that brings together science and education and policymakers and citizens.

the world can be integrated to tell a more complete story of a particular problem. Expertise, however, comes in many forms, and specialized training is merely one form. In fact, "the whole of science" according Albert Einstein, "is nothing more than a refinement of everyday thinking" (1954: 290). Expertise also comes from familiarity with one's place. Residents of an area can teach research teams about relevant lessons from the past. They can provide insider information about interpersonal and inter-organizational relationships that should be considered and respected if a policy or business solution is to be enacted. Good science goes nowhere without an understanding of the social landscape.

One example comes from this information age: people already have access to an abundance of information. Yet when it comes to making decisions within a complex setting, few Mainers need *more* information. Rather, they need to find the best information to address their decision-making needs and a means of seeing through complex human-environment relationships to understand the issue as a coherent story. The SSI has several projects that are exploring the specific information needs of Maine communities. One such project is the Maine municipal survey (see Hutchins and Conrad, this issue).

A questionnaire was sent to key officials in Maine's 499 communities asking local leaders about the problems they face now and those they anticipate in the future. Officials from 86 percent of these communities completed and returned the survey. What SSI is learning about the needs, concerns, and visions of Maine's communities has been instrumental in shaping the research it conducts and delivers to its partners. The interdisciplinary survey-analysis team is bringing relevant information to other SSI teams about the places and problems they are researching. The opinions of community leaders are shaping the design and approach of some teams' research. For example, teams are evaluating their approach based on how communities have expressed they wish to collaborate with researchers. Further, several respondents expressed the importance of academic institutions working with regional groups of communities across Maine. They expressed the need for a study on the feasibility of regional efforts across municipalities, which would require us to understand the complexities across individual communities. SSI is actively participating in and seeking out partnerships with organizations such as the Bangor Area Stormwater Group and the Maine Municipal Association, which deal with pressing issues regionally. The importance of partnerships with organizations such as these was a significant insight gained through this survey.

A project led by SSI, Maine Sea Grant, and Cooperative Extension has adapted its approach based on community feedback. The team spoke with municipal officials in several coastal Maine towns about long-term changes and anticipated town liabilities related to climate change's erratic weather patterns. Scholarly journals and popular media often emphasize the threats

of sea-level rise as the main concern, but when the team met with municipal decision makers, they heard a different story. In the near-term, planners are particularly concerned with large precipitation events that exceed drainage systems, holding ponds, culverts, and other town infrastructure. Sharing these findings across teams led to research examining culvert sizes around the state to ensure that they are appropriate for the rain events of the next 20 years, which are likely to be markedly different from rain events when the drainage structures were originally installed. It has also led to investigating the process towns use when deciding what diameter of culvert to install. Thinking in terms of systems and longer-time frames reveals how a decision to save $50 on a smaller metal part may lead to a flood that causes millions of dollars in damages.

> SSI projects focus on issues that may make lasting improvements to Maine's quality of place….

RETHINKING ACTION AND SOLUTIONS

SSI is finding that linking knowledge to sustainable solutions requires a big-picture understanding of the interactions between social, political, economic, cultural, and ecological systems. Working closely with local resident experts moves teams closer to revising everyday practices towards solutions.

For some projects, starting discussions with the desired endpoint and working backwards makes it easier to see the means needed to get there. One project attempting this approach involves a partnership between SSI, Cooperative Extension, and the Maine Business School. This group traveled throughout the state speaking with 200 of Maine's agricultural producers who intended to be farming in 2025 to ask them what they think Maine agriculture will be like in 2025. By starting with a desired vision of the future, the team is working backwards to address likely barriers to the flourishing of Maine's agriculture.

Maine's farmers are teaching SSI about solutions in unexpected ways. Agricultural producers in Maine are an intelligent and self-sufficient community of growers, business owners, and marketers. Individual farmers, who are effectively competitors over the same slice of market, share trade secrets to help one another increase productivity. They collectively organize what they grow to find new ways of expanding market share. This culture of common-pool problem solving is evident in off-season conferences, face-to-face meetings, and general camaraderie. Sustainable solutions are not limited to sweeping policy changes; often solutions are changes in habit and practice that fit the places where people live. Linking knowledge with action does not assume that defining the problem is as important as focusing on ways to adapt practices towards a desired endpoint. An emphasis on ends or a shared vision of the future moves researchers away from knowledge *about* (for academic audiences) to knowledge *how*, the latter phrase emphasizing action.

> Sustainable solutions are not limited to sweeping policy changes; often solutions are changes in habit and practice that fit the places where people live.

A glance across SSI's projects reveals that when academic teams define a problem, they should consider addressing a set of interrelated problems. Reducing problems to a single culprit may be comforting in the face of difficulty, but such a convenience risks overlooking important details. Worse yet, poorly designed "solutions" can turn into new problems, more unwieldy than the original.

Feasible solutions depend upon knowing the interconnections within human and natural systems and not upon the empirical findings alone. SSI teams seek to build solutions by leveraging scientific knowledge that makes transparent the links between data, the assumptions that shape our understandings of the social and ecological world, the judgments involved in data collection, the particular circumstances of the context, and the specific conclusions made (Fischer 2000). Crafting sustainability solutions is a matter of aligning and coordinating the people, capacities, resources, experts, and political will to reach a desired vision for the long-term quality of a place. Successful solutions are built upon a foundation of mutual learning relationships with the resident leaders of Maine. This is not science as usual.

CONCLUSION: RETHINKING RELATIONSHIPS

Sustainability science at its heart is about putting knowledge into the hands of those who are best able to use it. The aim of sustainability science is not only to produce smart technologies, practices, tools, and policies to sustain the natural world and our communities, it also aims for sharpened and heightened attention to the important relationships between human beings and the natural world. What good is ocean energy if it damages fish resources? What good is a lakefront vacation rental or camp if the waters are too polluted for swimming? Sustaining shared natural resources requires that people also sustain social and cultural resources because they are fundamentally linked.

SSI is a pioneering force within sustainability science worldwide, even though it is working in and focusing solely on Maine. As a team, SSI is aware that the nation and other states are watching to see if this experimental program of universities working with each other and with the public to solve long-term sustainability problems is a worthy investment. In every case, SSI teams are finding that understanding key relations between society and nature depends upon the relationships researchers build and sustain with Maine's resident experts. Making science more meaningful for Maine begins with rethinking these fundamental relationships. ✎

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Damon M. Hall is a Postdoctoral Sustainability Science Fellow with the Sustainability Solutions Initiative at the University of Maine. His research examines where culture, science, and environmental policy meet and particularly how communication practices shape social relationships with the natural world.