

Economic Development and Maine's Sustainability Solutions Initiative

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The authors discuss how Maine's Sustainability Solutions Initiative (SSI) can contribute to economic development in the state. SSI research is covering five of the seven targeted technology areas identified in recent reports as being important for economic development in the state (forestry and agriculture, environmental, information, composites, marine and aquaculture). The authors note how the broad scope of research carried out through SSI provides opportunities to catalyze new commercial opportunities. As important, SSI is providing many students with a unique learning environment that will prepare them for the new knowledge-based economy. 

INTRODUCTION

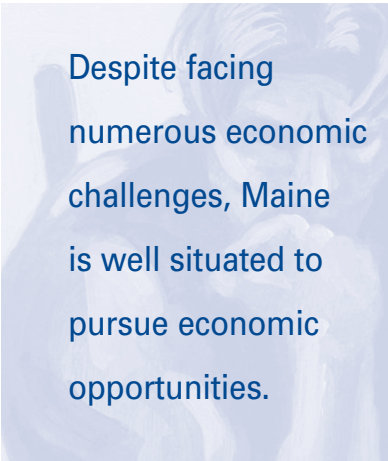
It is easy to be negative about Maine's economy. For example, *Forbes Magazine* recently rated Maine as the worst state for businesses and careers (Forbes 2011a). The *Forbes* ranking seems to be primarily driven by relatively high business costs (particularly energy costs) in Maine relative to the rest of the country (although similar to other New England states) (Forbes 2011b). These high energy costs may not be surprising in a state with a small population dispersed over a large area, given that 40 percent of these costs are related to distribution and transmission (EIA 2012). The low density of Maine's population may also explain some higher taxes, as the costs of providing public infrastructure are higher on a per person basis. For example, Mainers support about three times more road miles per person relative to our neighbors in Connecticut, Massachusetts, and Rhode Island.

Yet on several other economic measures Maine does relatively well. For example, Maine's December 2011 unemployment rate was 7.0 percent, about one percent better than the national average and in the middle of the pack relative to other New England states (Bureau of Labor Statistics 2012). Further, Maine's economy could be seen as more stable. Since 1976 Maine's unemployment rate has been, on average, lower and it fluctuates less than the nation as a whole; since 2000, Maine's unemployment rate has been below the national average seven out of 11 years. This may lead some, such as Laurie Lachance, president of the Maine Development Foundation, to adopt a more positive tone, as she highlights Maine's creative and practical people, innovative and resourceful companies, and resilient culture (Lachance 2011). Arguably, a productive approach to evaluating Maine's economy is to acknowledge Maine's economic challenges and strive to identify and seize opportunities for improving Maine's long-term economic future.

Despite facing numerous economic challenges, Maine is well situated to pursue economic opportunities. Various institutions in the state are advancing strategies to seize these opportunities, ranging from new education and training programs to meet short-term business needs, to innovative regional initiatives focused around themes such as renewable energy, local

food, knowledge generation, or the creative class, to long-term strategic investments in research and development (R&D) to promote an innovation-focused economy. Maine's Sustainability Solutions Initiative (SSI), which, among other things, regularly brings together economists from across the University of Maine System, represents a unique opportunity to align academic research and training for the betterment of Maine's economy.

SSI is responsive to the key objectives of the "2010 Science and Technology Action Plan for Maine" (Maine Innovation Economy Advisory Board 2010) and supports Maine's cluster-based economic development strategies (Maine Center for Business and Economic Research 2008). The 2010 plan, which sets forth a program to foster an innovation-focused economy, advances goals to stimulate a robust R&D enterprise, increase employment in seven targeted technology sectors, and increase per capita income via improved worker skills. Strategies advocated to achieve these goals include continued growth in R&D funding; attraction and support of innovation-focused businesses, workers, and investments to Maine; improved alignment of private and nonprivate sector networks; nourishment of knowledge entrepreneurs; and attraction and support of science, technology, engineering, and math (STEM) faculty and graduate students. The 2008 cluster report (Maine Center for Business and Economic Research 2008), which offers an assessment of existing and emerging clusters, made parallel recommendations stressing increased R&D, targeted investments in cluster-enhancement activities, such as technology, infrastructure, and networks, and improved workforce development. SSI research activities are supporting at least five of the seven targeted technology areas by improving scientific knowledge, supporting interactions across areas, and facilitating technology transfer. SSI research advances are inspiring new and creative applications of technologies to monitor and model systems (e.g., sensors) and communicate knowledge of these systems (e.g., new media and geospatial).



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The 2010 science and technology report, and the 2008 cluster report emphasize the need to support and develop the “supply side” of innovation through investments in Maine’s workforce, infrastructure, and entrepreneurs. SSI is clearly working hard to help in this regard. However, developing a new innovation economy can also require changes to state and local government policies and operations, increased public support for the development and siting of new industries, and market- (demand side) development assistance. SSI economists and other social-science researchers help support Maine’s move to an innovation economy by helping stakeholders (public institutions, businesses and the general citizenry) to understand the range of potential benefits and risks of these economic changes, who is affected by these changes, the strategies available to manage these changes, and better ways to work together to efficiently meet these changes.

The broad scope of research underway within SSI provides numerous ways to catalyze new commercial opportunities that could contribute to Maine’s economic development.

SUPPORT FOR INFORMATION GENERATION AND TRANSFER

SSI provides a unique opportunity not only to improve the understanding of how ecological and socioeconomic systems interact with one another, but also to provide information to decision makers more effectively through new models of interaction between scientists, citizens, and policymakers. New ideas, development, and regulations often are met with social push back. We too frequently see circumstances where there is a lack of awareness about the presence of an issue until significant investments have been made. Maine is now positioned to have stronger interactions where

new scientific knowledge can be delivered to its citizens, and in turn, citizen knowledge/values can be returned to researchers and decision makers, thereby improving opportunities for innovation and/or advanced planning horizons. SSI projects exemplify this new way of integrating science and research with decision making. For example, one research team seeks to interact with Maine landowners and municipal officials regarding vernal pools on private properties. The team is able to share knowledge with landowners about the benefits associated with having a vernal pool located on private land, along with the drawbacks. In turn, researchers are able to learn from landowners about desired information, changes, and potential options for their land. The team is able to simulate the impact of alternative policy arrangements on development options for landowners and levels of protection for vernal pools. Together, researchers and citizens aim to use this information to guide management policies that consider socioeconomic needs while conserving a valuable part of Maine’s landscape.

The other way SSI generates new ideas and better decision making is through the development of regional research and policy networks. One may question the value of region-specific information in an age filled with the World Wide Web and Google. However, just as industrial clusters can develop and succeed because of information sharing (e.g., the financial-services industry in New York or London), regional information networks can have potential value. In his study of the sources of regional advantage, Porter (1998) demonstrates how regions that are effective at tackling complex problems to meet local needs create real advantages for firms that can then use that knowledge to both reduce relative costs of production and create new products and services for global markets. This is echoed in the report by Maine Center for Business and Economic Research (2008: 5):

The principal sources of regional competitive advantage are the unique knowledge bases of the region and the continual expansion and improvement of those knowledge bases.... The effective translation of regional knowledge bases into commercial success requires effective networks among organizations from the public, private, academic and nonprofit sectors.

STRENGTHENING THE R&D ENTERPRISE

By galvanizing the extensive network of faculty and students in sustainability science fields, SSI is effectively strengthening Maine's R&D enterprise by creating a hub for entrepreneurial activity; increasing academic R&D capacity; bolstering alliances and collaborations among Maine's universities, research institutions, non-government organizations, and private companies; and enhancing Maine's workforce through increased STEM training in a novel interdisciplinary environment.

A key part of linking the efforts of SSI researchers to the R&D efforts in the public and private sector is currently under development for implementation. The broad scope of research underway within SSI provides numerous ways to catalyze new commercial opportunities that could contribute to Maine's economic development, but that very scope presents some real challenges. Unlike many EPSCoR projects, including those previously awarded to Maine for research into composites and forest biofuels, SSI research has no specific technological area as a focus.

Indeed, most SSI research is not devoted to technology development in the usual sense of the term. Much of the knowledge acquired during the research process in SSI is in the form of information about the interactions among social and ecological systems and about how to translate that information into decisions that contribute to greater sustainability. Such information may translate into technologies such as environmental sensors and monitoring systems (including software and computers), or technologies for the visualization of the interactions among systems. But the information gathered by researchers may also be valuable to those in the environmental services industry, one of the emerging clusters identified in the 2008 cluster report. The idea of R&D fostering innovation in service industries is a boundary-spanning concept that has been significantly under-explored in both the research and practice of fostering innovation-led economic development.

Because SSI research is not oriented directly to the development of commercially viable technologies but may still produce commercially useful products, links must be forged from SSI and its research partners with

the business community, similar to those that exist in all successful innovation-fostering clusters. These links must be across a much broader spectrum of industries and firms than in previous EPSCoR grants. To do this, SSI has initiated a process that will establish and foster these links over the next several years.

Maine is fortunate to have a number of organizations that bring together firms in a variety of industries related to SSI research. These include E2 Tech (www.e2tech.org), which is the largest organization of firms in the environmental services, technologies, and renewable-energy fields in Maine (Noblet and Gabe 2007). E2Tech is also spearheading, in cooperation with similar organizations in New England the establishment of a region-wide Clean Tech Collaborative. Maine Business for Sustainability (formerly Maine Businesses for Social Responsibility) is the oldest organization in Maine concerned with sustainability issues. It comprises many of the same firms as E2 Tech, but there are additional firms in a variety of industries such as hotels, banking, communications, legal services, and others that are concerned with increasing the sustainability of their own operations. (www.mainebusinessesforsustainability.org). Maine's regional economic development organizations, acting under the banner of Mobilize Maine, have joined together to foster cluster-based growth throughout Maine.

Another important partner is the Maine Technology Institute (www.mainetechnology.org), the lead state agency fostering innovation-related activity among Maine businesses. MTI, through its seed grants, development awards, and cluster grants has provided direct assistance to businesses in Maine seeking to transform research into commercial products, and adds the key ingredient of resources that can be used to catalyze real economic development from the links crafted between SSI research and the business community.

SSI is partnering with these organizations to establish links between researchers and businesses. This partnership will begin with a series of workshops to be held in 2012 that will bring researchers and businesses together to identify areas of mutual interest. These workshops will not only provide opportunities for the results of SSI research to be shared, but will provide businesses the opportunity to advise researchers on where commercial opportunities may

lie; this information will help shape the research in the last two years of the EPSCoR grant and guide efforts to secure funding for the post-grant period.

TARGETED SUPPORT FOR MAINE'S ECONOMY

SSI research activities are currently supporting at least five (forestry and agriculture, environmental, information, composites, marine and aquaculture) of the seven targeted technology areas through research on changing forest conditions; local food systems; vulnerability of specific crops to climate change; social, economic, and environmental feasibility of multiple renewable energy initiatives; and applications of geospatial technologies to sustainability problems.

Energy Initiatives

SSI researchers have been working with regulatory, industry, environmental and local area groups to assess the social, economic, and ecological feasibility of Maine's renewable-energy options. Researchers have been examining the production costs of off-shore wind power and comparing it to the long-term pricing of natural-gas-based electricity. In addition, researchers are examining the factors that explain Mainers' reactions to off-shore wind investments, whether people will buy Maine-based wind power, and how people evaluate different marketing messages related to Maine wind. SSI researchers have also been examining the potential impacts of tidal-energy projects on fisheries, coastal industries, and coastal communities (see Johnson and Zydlewski, this issue). Working closely with private businesses, community members, and relevant community organizations, researchers are exploring community reactions to tidal-energy projects and assessing the feasibility of alternative designs and improved understanding of permitting processes.

Regional and Local Systems

SSI researchers recognize the importance of regional and local information in sustainability research. SSI researchers have been working closely with municipal officials across the state to identify key areas of concern to the local citizens. In addition to individual projects aimed at providing university expertise to help these officials with specific problems

(e.g., waterfront development, rising energy costs), the project will help foster connections across municipalities that have similar problems. These connections should lead to more efficient policy and management outcomes. SSI research teams are also making use of geospatial data and analysis tools to address regional and local systems. Researchers have been adding value to geospatial data by creating data-based tools that are responsive to the needs of decision makers and communities. Researchers are exploring ways to improve access to geospatial data and testing reactions to visualization and modeling tools. For example, one team is creating regional geospatial databases to explore and communicate economic and social changes in the Bangor and Portland metropolitan areas (see Waring, this issue). Another team developed a geospatial tool to organize and display images to help municipal officials to track development around lakes in the Belgrade region. A third team is employing geospatial data to help regional stakeholders to consider alternative social, economic, and environmental futures.

SSI researchers are also enhancing Maine's capacity to manage and withstand future economic, social, and ecological shocks. For example, multiple teams of researchers have been examining the likely impacts of invasive forest pests (emerald ash-borer, hemlock woolly adelgid, and spruce budworm) on Maine's forest resources (see Ranco et al. this issue). By working collaboratively with stakeholders, these researchers are striving to reduce the negative impacts of these pests and to foster proactive state, regional, and local forest-management responses. Similarly, another group of researchers is helping coastal communities to improve their understanding of future flooding risks to support infrastructure planning and avoid costly surprises. Researchers are responding to regional concerns expressed by citizens. The impact of wild turkeys is a multifaceted problem, which may crosscut agricultural, economic, and health realms, requiring a novel interdisciplinary approach (see sidebar). In another project, a unique partnership between wildlife ecologists and engineers resulted in the development of a cutting-edge sensor technology that is helping obtain information on the vulnerability of Maine species and has numerous other applications currently being explored.

Striking a Balance: Wild Turkeys and Maine Agriculture

By Kim Ridley

Once on the brink of extinction, wild turkeys are now thriving in Maine, thanks to reintroduction efforts started in the 1970s. Today, more than 50,000 turkeys roam the state, and the population is growing. The success of this important game species, however, may come at a price: concern is rising among some Maine farmers that wild turkeys can damage crops and spread disease.

Christopher Lage, assistant professor of biology at the University of Maine at Augusta, is leading an SSI project to address this concern. Lage and his colleagues are surveying Maine farmers and growers and studying the biology, genetics, and distribution of wild turkeys throughout the state to get a clearer picture of the birds' actual and potential effects on Maine agriculture.

Two recent studies have shown that wild turkeys damage blueberry crops in Maine and growers have raised concerns about economic losses. In response, lawmakers introduced a bill into the state legislature in 2010 to direct the Maine Department of Inland Fisheries and Wildlife to explore options for controlling nuisance turkeys in agricultural areas, including expanding hunting opportunities.

Another issue is the potential for wild turkeys to spread disease, particularly on farms, where they often feed on waste grain and seeds in manure in the winter. Wild turkeys can carry bacteria, viruses, and other disease-causing agents that could be transmitted to domestic poultry, livestock, and humans. Little is known, however,

about which pathogens Maine wild turkeys may carry or whether or not they are actual vectors of disease.

Lage and his colleagues are analyzing survey results from more than 320 agricultural interests around the state, and working with hunters and farmers to screen wild turkeys for pathogens. They also are collecting data on Maine the genetics of wild turkeys to answer questions including whether some populations are genetically distinct. In addition, the researchers are preparing methods to track wild turkey populations and habitat use in Maine.

Lage's project is a prime example of SSI's collaborative approach to research, which begins with stakeholders' needs and gathers interdisciplinary teams of researchers to address them. He first learned of growers' concerns from Univerisyt of Maine Cooperative Extension educator Caragh Fitzgerald, who's now a collaborator on his team. Findings from this project will address key issues for growers and wildlife managers alike, and inform public policy decisions to support a healthy and sustainable population of wild turkeys in Maine. In the end, everyone stands to benefit.

Team Members: Christopher Lage (team leader), Peter Milligan, and Joseph Szakas, University of Maine, Augusta.

Team Collaborators: Irv Kornfield, Caragh Fitzgerald, and Ann Lichtenwalner, University of Maine; Kelsey Sullivan and Brad Allen, Maine Department of Inland Fisheries and Wildlife; Kirk Shively, U.S. Department of Agriculture.

These are examples of SSI's engagement in identifying potential (or missing) markets for information, knowledge, and new technology; complementing engineering and science research to document social reactions to new innovations; and documenting emerging trends relevant to entities from all sectors (e.g., private, government, and nongovernmental organizations).

Workforce Development

A crucial component of translating the information economy into success clearly lies in preparation of

our workforce (see Renault, Silka and Ward, this issue). Workers in today's economy are being asked to understand scientific, economic and political ramifications of decisions and it is imperative that SSI contribute to the development of a prepared workforce. SSI is enhancing Maine's workforce through increased training in a novel interdisciplinary environment leading to proficiency in sustainability science, modeling, statistics, and communication. The SSI research initiative yields an opportunity for Maine's future workforce to focus on conducting real-world, problem-focused research and

Top 10

Ways We Are Measuring the Impacts of SSI

- By the number of “problems” we have solved
- By successfully training and mentoring innovative researchers at graduate, undergraduate, and high-school levels
- By measuring effective partnerships, through iterative assessments of the research and collaboration process
- By evaluating how our research assists with the legislative process
- By communicating with and hearing testimonies from stakeholders who see research outcomes
- By decreasing the amount of time it takes for research to reach stakeholders
- By connecting Maine residents and researchers for greater collaborative potential
- By providing opportunities for Maine policymakers to access and leverage research capacity
- By the degree to which SSI is a fundamental voice in sustainability science
- By the extent to which SSI findings are applied to other states, regions, and countries

“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.

engaging with state, regional and local decision makers. This type of workforce development helps stimulate these students to continue their education, particularly in STEM fields while also providing a long-term increase in Maine’s technological workforce. The undergraduate and graduate students engaged with SSI have the unique opportunity to flex their analytical skills in a collaborative environment addressing Maine-based problems. This learning environment yields precisely the type of multi-skilled individuals that employers seek to fill knowledge-economy positions (Renault, Silka and Ward, this issue). In addition, students are exposed to boundary-spanning training focused on the generation and transfer of scientific knowledge outside academic settings, and the conduct of research through community-university partnerships centered on the challenges of sustainable development. SSI continues to reconsider what workforce development means in

order to aptly prepare innovators for Maine’s growing knowledge economy.

CONCLUSIONS

Sustainable economic development requires innovative processes capable of taking bold steps to enhance resilience and bolster full consideration of various tradeoffs. SSI’s contributions to Maine’s economy are occurring within a sustainability-based framework that stresses interactions across economic, social, and ecological systems. By adopting this framework, SSI is looking at Maine’s economic future from an inclusive vantage point. SSI researchers recognize the crucial role of economic implications in sustainability development, and have submitted new grant proposals focused on further study of the intersection of SSI’s work and economic development. We believe SSI is implementing research and training activities that not only complement traditional economic development goals, but also enhance Maine’s communities and natural resources.

Clusters and innovation: SSI activities are bolstering efforts to fortify innovation-based clusters by enhancing skills, networks, and entrepreneurship; boosting R&D investments to targeted clusters; and expanding desired “two-way” knowledge and skills development between research institutions and private businesses (Colgan, Merrill and Rubin 2008; Colgan and Baker 2003).

Networks and improved alignment of research with societal needs: SSI can be a force that acts to bring together researchers, businesses, and citizens for opportunities in research innovation, public-sector innovation, and business innovation. SSI’s commitment to engaged research is fostering innovative delivery of new scientific knowledge to stakeholders, novel uptake of stakeholder knowledge by researchers, and collaborative processes for problem-focused research. Further, sharing strategies and results across institutions facing similar problems should lead to more cost-effective management strategies and the development of better, less-disruptive policies.

Forward-thinking: Sustainability assumes growth and change that makes sense at the triple-bottom line: economically feasible, socially acceptable,

and environmentally safe. Mainers know that *any* change requires making tradeoffs. Consider Maine's plentiful forest resource: are we better served by engaging in harvesting for paper production, or by attracting eco-tourism? Is there an opportunity to pursue both options? Improved information about the values associated with different choices can offer important insights for decision making. SSI researchers are working diligently with local and state stakeholder groups to find a path that improves Maine's economic prospects while protecting Maine's quality of place.

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