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Place-based Approaches to Alternative Energy:

The Potential for Forest and Grass Biomass for Aroostook County

by Jason Johnston

Soraya Cardenas

Teams at the University of Maine Presque Isle and the University of Maine at Forth Kent are engaged in evaluating the potential for forest and grass biomass energy in Aroostook County, funded through Maine's Sustainability Solutions Initiative. Jason Johnson and Soraya Cardenas discuss how this potential is being evaluated and the possible ways in which expanding grass and wood biomass might benefit farmers and residents of The County. They suggest that using some of Maine's farmland for fuel might be sustainable with appropriate management and with consideration for potential environmental and socioeconomic drawbacks.

Using biomass as a heating source in Aroostook County is not new. Families in northern Maine used wood to heat their homes long before the current heavy reliance on oil. According to Dan Vaillancourt (personal communication, December 28, 2011), CEO of Daigle Oil, the average Aroostook County consumer uses about 600 to 650 gallons of oil, which at current prices is $2,000 to $2,500 dollars of a family's annual budget. Vaillancourt contends that the impact of high oil prices has been kept partially in check because of new, more efficient furnace and boiler technologies and conservation efforts by consumers who have lowered their thermostats and increased home insulation to keep costs in check. Despite these efforts, oil prices remain uncertain and their impact on family budgets a continuing concern. In 2008, the annual average cost of a barrel of oil surged to $91.48, its highest level since the energy price spike of 1980 (Inflation Data 2012). Though prices then declined, they have begun to climb anew. This high cost of oil is especially burdensome to the residents of Aroostook County, one of the poorest in Maine, with an average household income of $34,868, which is $10,000 below the state average and $15,000 below the national average (U.S. Census 2010).

But now the potential for biomass to help reduce The County's dependence on high-priced foreign oil, while boosting the local economy, is a major emphasis of community and regional economic-development efforts. In 2010, the Northern Maine Development Commission (NMDC) and Aroostook Partnership for Progress commissioned an analysis of potential energy alternatives for northern Maine and concluded that biomass offered greater economic opportunities than wind power (ViTAL Economy Alliance 2010). According to Michael Eisensmith (2011) of the NMDC, a 2010 survey found that 5.9 million gallons of fuel oil are consumed each year in Aroostook County, at an annual cost to consumers of $18.8 million dollars, only $4.2 million dollars of which was retained in the region. In comparison, using the 45,000-ton regional capacity for pellets would result in more than $11 million dollars of retained wealth.

With the incentives of high energy costs and a biomass resource base unrivaled in the eastern U.S., Aroostook County planners, businesses, communities, and public institutions are pursuing local biomass as a way to reduce energy costs and develop the predominantly natural resource-based economy. With the aid of the American Recovery and Reinvestment Act (ARRA) of 2009, 22 public institutions in Maine have converted oil boilers to wood pellet or biomass boilers with grants from the U.S. Forest Service, with several of these in Aroostook County. Under ARRA, new heating systems have been installed in Fort Fairfield, Madawaska, Limestone, and Houlton public schools. The Northern Maine Medical Center also received a grant to install a 10-million-BTU biomass heating system. Three of the areas institutions of higher education, Northern Maine Community College, University of Maine at Fort Kent (UMFK), and University of Maine at Presque Isle (UMPI), also updated boilers to either biomass or pellets. All told the biomass-boiler projects completed or under construction in Aroostook County are projected to save roughly $2.1 million annually.

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In addition to these savings, which will benefit local taxpayers, the local economy will also benefit. Any loss of oil revenue will be offset because 78 percent of money spent on pellets and wood chips remains in the local economy versus only 22 percent for oil (NMDC, personal communication, 2012). According to an article by Jen Lynds in the November 14, 2011, *Bangor Daily News*, the biomass heating system at Northern Maine Community College is expected to provide heat for nearly 70 percent of the total square footage of campus buildings. The new heating system at UMPI will heat the campus's two main teaching buildings, by burning approximately 100 tons of pellets per year, with an estimated cost saving to the university of $37,500. This project combines with new solar panels on the roof, a variety of energy efficiencies, and

previously installed heat pumps—systems that complement each other to add further energy savings. Projects like these that reduce both costs and carbon footprint are intended to serve as demonstrations of comprehensive energy systems for other public and private facilities.

Significant resources are being directed at these conversion efforts, going beyond one or two buildings. An article by Julie Daigle in the *Fiddlehead Focus* on November 7, 2011, states that UMFK and Maine School Administrative District (MSAD) 27 secured two grants totaling more than three million dollars under the leadership of UMFK's Center for Rural Sustainable Development, headed by Brian Kermath. The Maine Department of Conservation and federal stimulus funds grant totaling $500,000 will help convert UMFK's two largest facilities to a single biomass heating system, and the U.S. Department of Agriculture High Energy Cost Grant for $2.6 million will allow for the construction of a biomass heating system with a single boiler for nine buildings on the UMFK and Fort Kent Community High School campuses. According to the May 24, 2011, *Fiddlehead Focus* article by Andrew Birden, Kermath states "the projects will be good for the local economy, the environment, and the University's bottom line, if managed sustainably and they will help educate the larger community on critical energy issues."

> ...energy [is] clearly the most pressing concern to the Aroostook River watershed in terms of ecological, sociological, and economic importance.

What remains to be seen is if conversion to local biomass for heating can be sustained without federal stimulus money. For example, Caribou is also assessing the feasibility of a city-wide district heating system that would use biomass as an energy source. It is seeking funds for an engineering analysis to determine the mechanical feasibility of connecting several buildings to the network (NMDC 2004). In a conversation with Caribou town manager, Steven Buck, he points out that Caribou High School's conversion to wood chips was done on cost-savings alone, with no tax increase. With $242,000 in savings per year, the $2.7 million project will be paid for within 11 years.

Interest in using woody and perhaps grass biomass for local heat, electricity production, and industrial use is apparent in the minutes at meetings of the Biomass Working Group, which has been convened by the NMDC. This collection of industry, policy, municipal, academic, and government representatives has been exploring options for economic development through local biomass use and production for more than two years. As the development of a local biomass economic sector has proceeded, many new questions have emerged. Is there enough wood to supply a growing industry? Is it feasible to use agricultural land to grow biomass, and are farmers interested? Does support for crop conversion exist in the farm community? Are furnaces and boilers limited to certain kinds of biomass? How much agricultural and forest land is potentially available for biomass production? How do we educate community members about the many questions and issues raised by biomass energy?

Finding answers to these and other questions is the impetus for two research projects that are part of Maine's Sustainability Solutions Initiative (SSI). Through a National Science Foundation grant to Maine EPSCoR, UMPI and UMFK have begun to conduct research directly linked to their local communities. By engaging a variety of stakeholders from the inception of their research, the institutions are planning to accomplish one of the central goals of this SSI project—to help bring "knowledge to action." Both the UMPI and UMFK projects address biomass as a potential source of local energy and economic development for Aroostook County. UMPI focuses on the potential for production of grass biomass on currently underused land, within the Aroostook River watershed. UMFK's work, though in some ways parallel to UMPI's, specifically focuses on Fort Kent, a St. John Valley community, in an effort to implement economic and life-style changes. The idea is that insights from these changes will be shared with other Aroostook communities. Ultimately, both projects will contribute to assessing the feasibility, scale, and extent of Aroostook County's

developing biomass initiatives. It is hoped that this work will benefit residents through cost savings and stimulation of local economies, while addressing potential negative impacts of shifting land-use practices.

UNIVERSITY OF MAINE-PRESQUE ISLE AND GRASS BIOMASS

When the research team at UMPI began to consider options for an SSI project, energy was clearly the most pressing concern to the Aroostook River watershed in terms of ecological, sociological, and economic importance. The interest among UMPI researchers linked nicely to a project already underway through the leadership of University of Maine Cooperative Extension's (UMCE) Andrew Plant that involved the exploration of grass biomass for energy. The UMPI team began to focus on research collaboration with UMCE to evaluate the feasibility of grass biomass for the region. As this article lays out, this project typifies both the challenges and opportunities that SSI is attempting to address. The challenges concern how to collect and create knowledge that will be useful to local stakeholders. We have embraced the opportunity to transform academic research from its typical outlet in peer-reviewed journals to "boots on the ground" research, stakeholder engagement, and recommendations that actually are implemented.

The UMPI team's research approach involves identifying potential land and landowners, assessing likely ecological impacts, connecting interested stakeholders, conducting economic assessments, and examining how knowledge of the past can be a tool in leading discussions of future land use change. Chunzeng Wang (earth and environmental sciences) is using a combination of satellite imagery, aerial photos, ground-truthing, and tax maps to determine potential land area for grass biomass production. While some of these lands may currently be in row-crop production, the primary focus is on hay, fallow, or old field habitat. Although Aroostook still has the most agricultural land of any county in Maine, its cultivated acreage has declined by roughly 200,000 acres (about 50 percent) since the 1940s, when potato production peaked at 219,000 acres (Robin Helrich, personal communication, January 13, 2012). There are currently 205,000 acres of total farmland, with 126,000 acres currently planted in potatoes, grains, or broccoli. While 28,000 acres are enrolled in the Conservation Reserve Program, another 67,000 acres remain idle (ViTAL Economy Alliance 2010). A considerable portion of underused land is mowed biannually to prevent forest succession. To obtain an accurate assessment of these lands, the final GIS database will identify suitable plots, current land use, ownership, and landowner interest in providing fiber for biomass.

The grass biomass project captivated the UMPI group's attention because of its potential to benefit from currently underused land, but also because there was the potential for ecological benefit. Often "development" and "ecological sustainability" are seen as antithetical, but converting crop or old field habitat into grasslands harvested late in the season may provide some benefit to grassland birds—among the most threatened species of birds in the Northeast and U.S. (Vickery and Herkert 2001). For this reason, Johnston (wildlife ecology) has been leading research into the habitat potential of grasslands for common and threatened grassland birds. By measuring food availability, physiological condition, and bird abundance of 14 grassland bird species in five different grassland habitat types, Johnston will be able to evaluate the amount and quality of current and potential habitat for these birds. State-threatened species such as the upland sandpiper are only encountered in large, open agricultural areas, such as those in Aroostook, the blueberry barrens of Washington County, or preserves and airfields. Even if biomass grass fields are not equivalent to preserves, they may still offer habitat that is not currently afforded by row-crop farming. While a variety of native and non-native grasses are being explored for production, some concern remains over the invasiveness of reed canary grass, especially if planting expands to thousands of acres. Thus, by monitoring current and past reed canary grass plantings, Johnston and his student researchers will investigate its ability to disperse into and dominate adjacent habitats.

There are several challenges in exploring this potential energy source. Are landowners interested? Is there a market for the product? Are new commercial enterprises needed for getting product to market? How do all the potential stakeholders connect with one another?

University researchers are playing a critical role in addressing these questions and coordinating to help to evaluate potential economic development opportunities that might otherwise not get off the ground. For example, many small non-farmer landowners may have an interest in growing grass for biomass but do not possess the necessary equipment or expertise. There may be interested farmers, but they may not have the ability to harvest the biomass if the timing conflicts with the potato harvest. Municipalities may have interest in encouraging this development in their town, but lack the GIS capability to compile a township-scale map and a plan that would assist in this effort. Therefore, to bring together diverse stakeholders interested in grass biomass, our university research team is using meetings, outreach, and survey instruments to evaluate interest, feasibility, and logistical concerns. By providing information to landowners, potential custom operators, municipalities, and others, we can provide a clearer path for them to evaluate their potential involvement in grass biomass production. This outreach is being conducted by David Putnam of UMPI and David Vail of Bowdoin College.

A final component of feasibility analysis is assessment of economic feasibility. Plant has already created a farm enterprise budget, and Vail will expand on this work to evaluate costs, revenues and risks to additional types of stakeholders, such as non-farm landowners, custom haying operators, and bulk transport businesses. He will also evaluate impacts on local employment and economic activity, building on ViTAL Economy's previous modeling.

Whether or not grass biomass ever reaches a scale of thousands of acres in Aroostook County depends largely on potential economic gain to three types of stakeholders: landowners, pellet fuel manufacturers/distributors, and end users. How people view the land and what it should be used for, however, plays a part in their willingness to convert to a new land use. One way we plan to engage stakeholders in discussions of whether to grow grass for biomass is to have them consider the history of land use in our region. As the foundation for this dialogue, Kimberly Sebold (history) is conducting historical analyses based on agricultural censuses, population censuses, and other historical records. She is developing a comprehensive database of past agricultural land uses in the town of Fort Fairfield. We will use these histories to engage people in imagining the future landscape of our region. We will combine current and historical data to create a variety of alternative future scenarios (e.g., McCloskey, Lilieholm and Cronan in review), to inform a participatory land-use planning process.

We anticipate many useful outcomes from this SSI research project. They include (1) a map and analysis of potential areas for grass biomass development along with identification of interested landowners; (2) an assessment of ecological risks and opportunities of conversion to grass biomass; (3) management guidelines and plans for non-farmer landowners, farmers, and municipalities; (4) an economic analysis and feasibility study; and (5) an overall analysis of past, present and potential future land uses for the agricultural portion of the Aroostook River watershed. By providing comprehensive place-based knowledge, we hope to arm stakeholders with the capacity to decide whether grass biomass fits within their own management plans. Regardless of whether this leads to thousands of acres of grass for biomass, the research and participatory activities will provide local stakeholders with both the knowledge and perspective to decide the most appropriate and sustainable uses for their land.

The fact that UMPI and UMFK independently selected renewable energy production for their SSI work underscores how prominent this topic is from both academic and societal perspectives. The teams are using an interdisciplinary approach that considers both scientific and socioeconomic factors. While UMPI is considering primarily grass biomass, UMFK is considering a range of renewable local sources.

UNIVERSITY OF MAINE-FORT KENT AND LOCAL BIOMASS

The focus of UMFK's research is geographically narrower and more applied, looking specifically at the impact on the Fort Kent community of implementing both wood and grass biomass as a supplementary heating source. UMFK's research team is in its second year of the SSI project. The team is made up of an interdisciplinary group of researchers, which includes biologist Kim Borges, forestry professor Dave

Hobbins, psychologist Kurt Holzhausen, and environmental sociologist Soraya Cardenas. The team is investigating whether biomass production can help to reduce heating costs and stimulate the economy in Fort Kent, through the development of a place-based research model. Can land owners produce enough biomass to fuel a community and could any additional product be sold elsewhere? Are farmers and woodlot owners interested in producing biomass? What are the risks for farmers and woodlot owners? Are residents and businesses alike interested in supplementing or replacing their primary heating source with biomass? Are there retailers of biomass equipment and how accessible is it to residents and businesses?

Before these questions can be addressed Borges and Hobbins must first determine the availability of land for biomass conversion. Through a GIS analysis, Hobbins has begun to outline the potential boundaries for woodlot and agricultural production for biomass products. Borges has begun to assess actual land use through ground-truthing methodologies. She also will determine the most appropriate biomass crops, looking at potential risks such as crops that may be invasive species and may have sensitivity to low temperatures and high moisture. Once Borges and Hobbins have determined the availability of biomass, they will provide a calculation of the land area available for production and the potential maximum biomass yield for the Fort Kent area.

Though a maximum calculation for grass biomass may be determined, there are economic and social factors that may affect feasibility of growing biomass use for heating. According to Plant, some biomass furnaces and boilers are restricted to wood pellets, relegating grass biomass primarily to commercial or industrial use, or as part of a manufactured product that is predominantly wood. Farmers also may be slow to transition from potato to grass biomass crops because of lower revenue compared to potatoes. According to Plant, despite lower annual input costs to farmers to grow grass crops, farmers may still be slow to transition because of cultural ties and familial traditions. Many farmers from The County have a long history of growing potatoes and other traditional crops such as buckwheat. Potato harvest is so ingrained in the community culture that festivals such as Fort Kent's Scarecrow Festival and Fort Fairfield's Potato Blossom Festival highlights the region's annual cultural events. Throughout Aroostook County many elementary and high schools still close for two to three weeks to provide workers for the potato harvest. Further limiting the economic feasibility of grass biomass are the transportation costs associated with moving the crops to the pellet plants. Thus, Plant has explored the possibility of a mobile pellet plant and shared operating costs between farmers, which may provide incentives to tap into a potential growing market as technology begins to adapt to the availability of renewable resources.

The fact that UMPI and UMFK independently selected renewable energy production for their SSI work underscores how prominent this topic is from both academic and societal perspectives.

To fully capture the complex social and economic consequences of converting a community to biomass from oil, Cardenas and Holzhausen have begun to interview focus groups in the Fort Kent area. These focus groups consist of business owners, retailers of biomass equipment, biomass distributors, and producers. In addition, residential occupants were interviewed during the 2010-2011 academic year with the assistance of undergraduate students in Cardenas's "Rural Societies" class, and four UMFK interns, Travis Nadeau, Sandy Mosquera, Shannon Berube, and Amber Garrison.

Cardenas and the students found that socio-demographic factors along with cultural influences affected homeowners' decisions to use alternative heating sources. A total of 20 women homeowners who are current residents of Fort Kent were interviewed, with ten being not originally from Maine (and not previously living in an urban or suburban area) and ten being originally from the St. John Valley or with close family ties to the community.

Among the findings were that many of the women who were not originally from the Valley came from higher income and educational categories and these demographic factors appeared to have affected some of their choices for heating. Some of them reported preferring oil to wood because it was not messy and they didn't have to think about it. As one respondent put it: "Yeah, I do not want to do wood, it's messy…."

Some suggested that as long as they could pay for the oil, they preferred not to invest in alternative sources. On the other hand, others with lower economic means reported that they would consider alternative sources, but needed some economic assistance.

> *Well, using pellets is an alternative source, if doing something else that was… less costly, and…good for the environment. I would and …where retrofitting the house would not be a costly thing, or where there was some kind of grant program, absolutely.*

Using a portion of Maine's forest and farmland resources for fuel for biomass may be sustainable if resources are managed appropriately and with consideration for potential environmental and socioeconomic pitfalls.

Of the ten women interviewed from the Valley, six already supplemented their homes with wood biomass; of the ten not from the Valley, only four did. The women from the Valley reported using wood as a way of life and a way to reduce the expense of oil, and they were not averse to using alternative sources. One woman said, "This year … we purchased ten cords of wood… the wood heat is wonderful… because I think that the oil is really expensive right now."

Their behavior appears not to be a consequence of their education levels, but rather to be economically driven and influenced by culture. Income considerations are further exemplified by the women who were not from Maine; those who did use wood were at lower income and educational levels. According to a study by Tanner (1999), education level appears to affect people's attitudes and beliefs, but it does not correlate with changing behaviors. In another study by Verhallen and Van Raaij (1981), individual attitudes did not affect decisions about choosing more environmentally friendly measures to heat homes. The more important determinants of environmental choices were socio-demographic characteristics of respondents. The researchers hypothesized that price tags attached to behaviors may have a greater influence on consumers to invest in energy-saving practices when cost of energy exceeded their financial means.

Based on our findings, women with higher incomes, who could afford oil, were more inclined to pay for oil because it was less messy and more convenient. Meanwhile, lower income residents in Fort Kent tended to adopt more affordable sources. Though further investigation is warranted, socio-demographic characteristics appear to be the driving force, but cultural experiences should also be considered. Women originally from the Valley grew up burning wood, while women not originally from Maine did not.

Cardenas and Holzhausen plan to further investigate the role of the biomass producers, distributors, retailers and local businesses owners through opened-ended interviews. This information will be used to provide a descriptive analysis of the current stakeholders in Fort Kent. Upon completing this analysis, this information will be analyzed by economist Brad Ritz. The data produced will then be used to inform stakeholders, community members, town offices and non-profit organizations, such as the NMDC, so that they can make better-informed decisions, build stronger partnerships, and create sound policy decisions.

POLICY CONSIDERATIONS OF PLACE-BASED APPROACHES TO BIOMASS IN AROOSTOOK COUNTY

It is somewhat ironic that local energy sources, i.e., wood and grass, that were the primary feedstocks of agricultural and home energy more than a century

ago, are now being re-considered as "alternatives." Our research is premised on the assumption that biomass feedstocks can be produced sustainably and that the potential economic benefits are significant. The main thrusts of these projects are to evaluate these assumptions and help implement practices that optimize socioeconomic benefits while minimizing negative land-use impacts.

It may or may not turn out that biomass is more affordable than current energy sources. However, even if biomass fuels are ultimately more expensive than oil, their development may be justified by the economic multiplier effect of locally generated income recirculating in the local economy through purchase of products and services (ViTAL Economy Alliance 2010). At the same time, producing biomass for fuel could place additional stresses on forest and farmland habitat, which may include invasive species or habitat loss for non-game wildlife and deer. Using a portion of Maine's forest and farmland resources for fuel for biomass may be sustainable if resources are managed appropriately and with consideration for potential environmental and socioeconomic pitfalls. An additional advantage to using tillable land (especially underused land) is that this may conserve farmland for additional future expansion. With food demand increasing globally, and with a growing demand for local food in the region, northern Maine is in a position to greatly increase the production of food crops, especially through diversified or organic farms (Beach 2011; Beal and Jemison 2011). Having 10,000 acres of extensively managed grassland that could easily be re-converted to higher-value food crops might be a smart hedging strategy.

Whereas forest biomass has already proven to be economically viable, grass biomass remains unproven. At present, there is no good consumer outlet due to the difficulty of producing a household-scale boiler that can withstand the corrosion from burning grass. Thus, the market for the product is uncertain and may be limited to commercial or industrial users. Furthermore, the claim that biomass is a renewable and carbon neutral energy source has also been questioned (Manomet 2010). A life-cycle carbon analysis for Aroostook County may be needed to determine if the fuel demands of cultivation and harvesting make grass biomass a sustainable alternative. Life-cycle carbon analyses of corn and switchgrass used in ethanol production, with associated worldwide forest clearing to meet increasing demand for food, suggest that greenhouse-gas emissions will actually increase by 20 percent and 50 percent, respectively, in warmer U.S. regions (Searchinger et al. 2008). Thus, claims that

STUDENT SPOTLIGHT

Gary Parent

SSI Undergraduate Researcher;
Environmental Studies major, University of Maine at Presque Isle

Gary Parent was in his forties when he decided to pursue his undergraduate degree at the University of Maine at Presque Isle in order to get a good job. A native of Aroostook County who lives in Fort Fairfield, Parent says he has long been concerned about the region's sustainability. "I would like to remain here and help provide a future for my children so The County's rich history can be preserved," he says.

Now in his junior year, Parent is contributing to the region's future—and gaining marketable skills—as an SSI undergraduate researcher. He is one of several UMPI students helping rural communities in Aroostook County to transfer paper tax maps into a digital format, which will enable them to more easily and efficiently manage their data with free Google Earth software.

"Many of these smaller communities don't have the fiscal ability to purchase software or pay a salary for someone to complete a project like this," says Parent, who has worked on maps of five towns in Aroostook County including Easton, Mapleton, Chapman, Castle Hill, and New Sweden. "This project will allow towns to enter the digital age and go from using 18th century technology to using 21st century technology."

Parent and his fellow students are working with Chunzeng Wang, associate professor of earth and environmental science at UMPI, who is overseeing mapping of land ownership in the Aroostook River watershed and creating a GIS database that links land use to land ownership. Wang's work is part of an SSI research project on sustainable development of the Aroostook River watershed led by Jason Johnston, assistant professor of wildlife ecology at UMPI.

The SSI researchers are studying various aspects of sustainable development including historical and current land use and its impacts, promoting the region's unmotorized trails, and identifying the best land for producing biofuels in ways that minimize potential effects on grassland birds and other wildlife. They are working with more than a dozen stakeholders as part of the study.

Students working on the project have the rare opportunity to gain hands-on experience in helping to solve real-world problems. For Parent, who also has done GIS mapping for Fort Fairfield, this has made all the difference. "As a 45-year-old, it has taken me a long time to find my niche," he says. "Using the skills I have learned at UMPI and through some connections I have made through this work, I hope to start a career in a field that focuses on sustainability. This project has definitely given me a head start on that."

—Kim Ridley

renewable fuel is carbon neutral (Adler, Del Grosso and Parton 2007) may not be valid for our region, when the fossil-fuel inputs and loss of sequestration capacity are considered.

Maine has experienced a variety of land-use pressures over the last two decades, e.g., a loss of farmland to development and conversion of working forest ownership from large industrial owners to various investment entities. However, in The County the land-use concerns differ from statewide patterns. Forestland is still largely owned or managed by industrial, sustainably certified forest products companies such as Irving Timberlands and Seven Islands Land Company. Urban sprawl and consequent loss of potential agricultural land can be detected in bedroom communities surrounding a few small cities such as Presque Isle. However, the loss of agricultural land to forest succession is the dominant land-use change over recent decades. Regardless of whether the UMFK and UMPI research efforts spur increased forest or grass biomass development, a discussion will be opened with the community about the best use for these lands—forests, farms, conservation lands, or more housing subdivisions. By engaging stakeholders at all levels without a prescriptive message of what should be done, we hope to avoid the mistakes of others who have recommended large-scale land-use changes for The County. The memory of one such environmental and economic disaster—Fred Vahlsing's encouragement of sugar beets (Beem 2008)—is still part of the local culture. By engaging citizens, municipal officials, policymakers, businesses, farmers, and foresters we hope to do the kind of work a university should be well positioned to perform. Through our analysis of economic, ecological, and societal costs and benefits of energy alternatives, we hope to spur planning not just about local energy strategies, but about optimal land-use practices.

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Jason Johnston is assistant professor of wildlife ecology at the University of Maine at Presque Isle. His research on birds includes studies of forest ecology and management, physiological condition, effects of wind turbines, and agricultural grasslands as habitat for birds.

Soraya Cardenas is an associate professor of environmental studies and behavioral sciences at the University of Maine at Fort Kent. She conducts research on renewable energy, natural resources, and sustainability. She is UMFK's 2010 researcher of the year, 2009 recipient of the Trustee Professorship, and a Garcia-Robles Fulbright Scholar. She currently co-chairs UMFK's Scholar Symposium and is the principal investigator for their EPSCoR/NSF grant on biomass.