

Fort Fairfield Landowner Survey: Perspectives on Grass Biomass

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Photo credits: We thank Paul Cyr for providing aerial photographs of Fort Fairfield fallow and hay fields, as well as a sunset scene from Presque Isle. See www.paulcyrphotography.com to see more of Paul's stunning landscape, wildlife and other photos.

For more information about this survey or the overall research being conducted at the University of Maine at Presque Isle, please contact David Vail (dvail@bowdoin.edu), Jason Johnston (Jason.johnston@umpi.edu), or visit our website: <http://www.umpi.edu/academics/environmental-studies/epscor>



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Summary

Fort Fairfield landowners were asked to complete a brief survey as part of the University of Maine Presque Isle's EPSCoR study of grass biomass' potential as a renewable energy source in Aroostook County. Sixty-one landowners with holdings of ten acres or more, one third of Fort Fairfield's total, submitted the survey in the fall of 2012. The survey covered basic demographic information, farm assets, and commercial farming activities and posed numerous questions about the prospects for producing grass biomass as a renewable energy feedstock in Aroostook County.

Salient features of the respondent sample:

The respondent pool is older and better educated than Maine's overall population – and probably Aroostook County's population as well.

Just one-third of respondents are currently engaged in commercial farming. Most non-farmers, however, rent out some land and have hay harvested from their land. Many also have their fallow land bush-hogged. Fort Fairfield's non-farming landowners thus play an important role in keeping arable land available for commercial agriculture, present and future.

Salient findings regarding grass biomass:

Most respondents consider their current knowledge about grass biomass production and research to be poor; nonetheless, a majority is either somewhat optimistic or very optimistic about the prospects for grass biomass development in Aroostook County.

This general optimism is also reflected in responses regarding the likely seriousness of seven potential obstacles to profitable grass biomass production. (Response options range from “not an obstacle” to “very serious obstacle.”) Two market-related problems, a low price for grass and unreliable buyers, are viewed as most serious, with average ratings between “moderately” and “fairly” serious. Transportation and harvesting costs are rated between “minor” and “moderate” obstacles, while land conversion, harvest labor shortage, and production risks (e.g. drought, pests) are viewed as closer to “minor” obstacles. These response patterns convey an idea of the incentives and assurances landowners would require to dedicate land to grass biomass crops.

Roughly one-third of respondents indicate a moderate or strong interest in participating in grass biomass field trials. This group ranges widely across age cohorts, education levels, land holdings, and involvement in farming. Not surprisingly, the interested group perceives all seven obstacles to be less serious and they tend to be more optimistic about the potential of grass biomass.

These findings and others detailed in the report will guide future project activities, such as focus group discussions, key informant interviews, and the design of field trials.

Research Objectives

The overarching goal of UM Presque Isle's EPSCoR project is to assess the potential of grass biomass as a commercial crop and as sustainable renewable energy feedstock in Aroostook County. A preliminary task is to inventory the human, land, and capital resources that, with appropriate incentives, might be allocated to grass biomass production. Another important task is to catalogue the viewpoints of local landowners – the prospective participants in a commercial grass biomass initiative – regarding their knowledge about perennial grass production, their sense of the major obstacles to successful diffusion of grass biomass, their overall optimism or pessimism about its prospects, and their willingness to participate in field trials. This report summarizes findings from a survey of Fort Fairfield landowners. Insights from the survey will guide the design of follow-up activities such as key informant interviews, focus group discussions, and survey revision for distribution across Aroostook County.

Principal Findings

Fifty-nine Fort Fairfield (FF) landowners, roughly one-third of the town's 182 landowners, submitted valid surveys. Because of the fairly low response rate, and our lack of demographic and farm data on the full population of FF landowners, we cannot say how representative the sample is. Nonetheless, we believe the findings reported here offer useful insights about the potential of grass biomass, even if they are not scientifically rigorous.

Demographics

The respondent pool is fairly old and well educated. Sixty-three percent are at least 55 years old, with a median age of roughly 58 years. Forty-three percent have earned at least a bachelor's degree, compared to 27% of Maine's adult population. More than one-third have had agricultural education or training. These generalizations are tempered by the presence of five Amish farmers (7% of the sample) who are younger and have agricultural training, despite low levels of formal education.

Farm Assets

Most respondents own less than 100 acres of open farmland, however 20% own 500 acres or more. Nearly all also own some fallow or scrub land.

One-fourth of respondents own some hay making equipment, which could be used for perennial grass production. Few, however, own a full inventory of implements, including mower, bailer, and hay wagons.

2011 Farming Activity

Two-thirds of respondents were not engaged in commercial farming activity in 2011. However, most of the non-farmers rented land to active farmers or had hay harvested from their land. Many also had fallow land bush-hogged. In other words, most non-farm-

ers take actions that help keep arable land in production or prevent it from reverting to forest.

Sixteen of the twenty active farmers report that farming was their principal occupation in 2011. As a group, the farmers are significantly younger and own significantly more land than the sample as a whole (median age 49, median holding over 500 acres). Nearly half have at least a bachelor's degree, although a large number - including several Amish - have no more than a high school diploma.

Aroostook County's familiar potato-small grains rotation appears to predominate: seven farmers report over 250 acres of row crops and over 250 acres of small grains. (We did not get a breakdown of row crop acreage into potatoes and other crops, such as broccoli.) In addition, a majority of all land owners had hay or silage harvested on their land - including several who contracted with a custom harvester.

Grass Biomass

Most respondents (59%) consider their current knowledge about grass biomass research and production to be poor. Just one-in five consider their knowledge good or excellent, with active farmers and older respondents over-represented in this group.

Respondents were asked to assess the seriousness of seven obstacles to successful development of biomass grass production, with response options ranging from "not an obstacle" to "very serious obstacle." Two market-related problems - low prices and unreliable buyers - are deemed most serious, with average ratings between "moderately serious" and "fairly serious." Transportation and harvesting costs have average scores slightly below "moderately serious," while land conversion, harvest labor shortages, and production risks (e.g. drought and pests) receive still lower average scores, closer to "minor obstacle." We note that, although the average rating for harvest labor shortage is low, several of the row crop farmers view it as a potentially serious obstacle.

After assessing potential obstacles, respondents were asked about their overall level of pessimism or optimism regarding the economic potential of grass biomass in Aroostook County. About one-third do not feel well enough informed to offer an opinion, but among the rest, eighty-five percent describe themselves as either somewhat or very optimistic. Notably, active farmers tend to be more optimistic than others, while respondents older than 65 years tend to be less optimistic.

Potential Field Trial Participants

At the end of the survey, respondents were asked about their willingness to include some of their land in a grass biomass field trial. Not surprisingly, many (21%) indicate that they need more information before deciding. However, one-third of respondents are moderately or very interested in participating. The interested group is somewhat younger than the full sample and includes proportionally fewer who own very little land (less than 20 acres). Otherwise, the most interested group does not differ significantly from the full sample in age, land ownership or the extent of farming activity.

The Survey Instrument and the Respondent Pool

The survey was designed by UMPI/EPSCoR project leader Jason Johnston and project advisor David Vail. It was reviewed by the full project team and pre-tested by seven UMPI EPSCoR faculty and students.

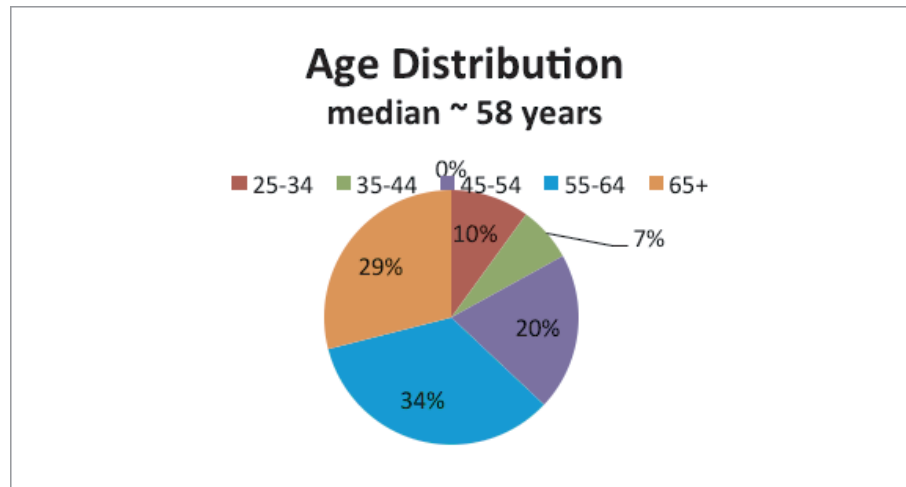
We identified 182 Fort Fairfield landowners with holdings of ten acres or more. Several methods - Internet, email, traditional mail, and in-person visits - were used to contact them and encourage their participation in the survey. Follow-up requests were sent to non-respondents several times between late-August and the end of November. Sixty-one landowners, roughly one-third of the sample population, returned surveys (21 online and 40 via hard copy). Two seriously incomplete surveys were removed, leaving the fifty-nine responses used in the following analysis.

The relatively low response rate raises the possibility of sample biases. Since we lack background information about the entire population of Fort Fairfield landowners, we cannot test how accurately the survey data map their characteristics or their viewpoints. The very high proportion of respondents at least 65 years of age and the high percentage with college and graduate education are two indications of bias. Twenty-nine percent of survey respondents are at least 65, compared with 16.3% of Maine's total population. Forty-three percent report at least a bachelor's degree, compared to just 27.1% of Maine's adult population (<http://quickfacts.census.gov/qfd/states/23000.html>). We also recognize that survey questions dealing with land holdings and farming activities do not fully capture the complexities of family and corporate ownerships and operations. Nonetheless, we are convinced that the survey responses and our interpretation of them offer valuable insights about the potential and the pitfalls of grass biomass production in central Aroostook County.

Demographic Characteristics

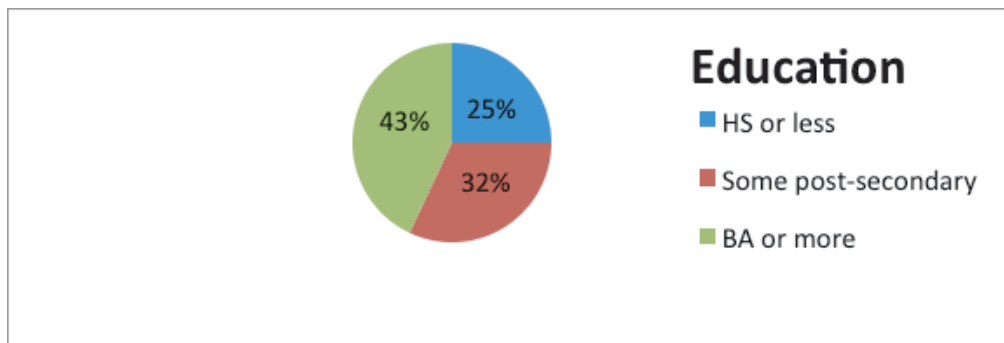
The median respondent age, roughly 58 years, reflects Aroostook County's aging population of land owners, several of whom were once farmers. It may also reflect a tendency of younger residents to opt for more densely settled areas and not to acquire sizable undeveloped land parcels. Conspicuously just ten of 59 respondents (17%) are younger than 45 years of age and four of them are recent Amish in-migrants to Fort Fairfield. Seven respondents (12%) are women.

Figure 1



As mentioned, the respondent pool is on the whole considerably better educated than a cross-section of Maine adults. 76% have some post-secondary education and 43% at least a bachelor's degree. Five of those with less formal education are Amish farmers. Fully 37% have had formal agricultural training or education, more than the 34% currently involved in commercial farming. This includes numerous older respondents who farmed in the past but do not at present.

Figure 2



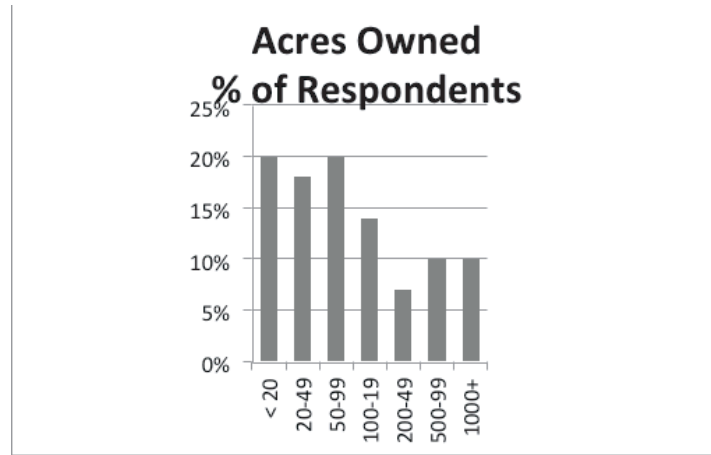
In general, educational attainment is spread across age cohorts roughly in proportion to their share of the sample population. An interesting exception is very young respondents who are over-represented among the less educated: twenty-seven percent of the full sample has a high school diploma or less, but the figure is 43% (or 3 of 7 respondents) for those under 35 years. Two of the three are Amish farmers who have had agricultural training, although they have not completed high school.

Farm Assets

Acres of Open farm Land Figure 3 shows a wide dispersion in the scale of land ownerships. However, nearly 60% (35 of 59 respondents) own fewer than 100 acres of open land and just six

of these smaller owners produce farm products for the market (three are full-time Amish farmers).

Figure 3



Respondents younger than 55 years are over-represented among the large landowners and, as discussed below, the full-time farmers. They comprise 46% of the full sample, but 57% of those with 500 acres or more of land and 67% of those with 1000 acres or more.

Twenty-eight non-farmers – nearly half of the entire sample – rent or lease some of their land to farmers. This widespread practice is important for sustaining Ft. Fairfield’s productive land base. It is also an informal mechanism for inter-generational transfer of land use, as nearly two-thirds of those who rent out land are at least 55 years old. Nearly the same proportion of the rent-out group own 100 acres or more of open land.

Ownership of Fallow or Scrub Land Nearly ninety percent of all respondents own fallow or scrub land. Most (58%) have less than 50 acres of fallow and scrub, but 8% own 50-99 acres and 22% own 100 acres or more. In 2011, thirty-six respondents (61%) had land bush-hogged. For sixteen of them, the area bush-hogged was very small: less than five acres. However, nine had 6-50 acres, six 51-250 acres, four 250-499 acres and one more than 500 acres bush hogged. In aggregate, this is a substantial acreage which, with appropriate incentives, could be an important resource for biomass production.

Inventory of Hay Making Equipment Haying equipment would be important for harvesting perennial biomass grasses. As recent Vermont field trials showed, “hay crops and dedicated energy grasses can be successfully grown and harvested using conventional methods and existing farm equipment (VGEP 2011: 5). Fourteen respondents (24%) own mowing equipment, six own balers (including two with round balers), four own silage choppers, and seven own hay wagons. Anticipating the discussion of 2011 farming activities, below, three of the equipment owners did custom haying for others (two custom harvested more than 200 acres) and twelve landowners had custom haying done on their land.

2011 Farming Activities

Who are the farmers? Just over one-third of respondent households were engaged in commercial farming. Thirty-four percent (20 in all) were personally engaged in commercial farming: 16 full-time, three part-time and one unclear. A slightly larger proportion (37%) report that other household members such as spouse, siblings, and children participated in commercial farming tasks. And twenty report that farming contributed to household income: at least 75% of income for 13 respondents and less than 25% of income for seven. (None reported a farm income share between 25% and 75%.) Thirteen of twenty commercial farmers rented-in some land to supplement their own acreage.

Table 1 summarizes characteristics of the sixteen self-described full-time farmers. As a group, they are younger and own more land than the full sample. By interpolation, their median age is roughly 49 years compared to 58 for the full sample. Forty-four percent are below the age of 45, compared to just 17% of the full sample. Median land ownership is over 500 acres, compared to less than 100 acres for all respondents.¹ Full-time farmers' educational attainment is bimodally distributed, with roughly equal numbers having at least a bachelor's degree or no more than a high school diploma. However, fifteen of sixteen have had specialized agricultural training. The age and education distributions are influenced by four full-time Amish farmers, three of whom are younger than 45 years. None has had post-secondary education; all have had specialized agricultural training; and none owns more than 199 acres.²

Table 1 Characteristics of Sixteen Full-time Farmers

<u>Age</u>	25-34	25%
	35-44	19%
	45-54	19%
	55-64	19%
	65+	19%
<u>Education</u>	HS or less	44%
	Some post-secondary	19%
	At least bachelor's degree	47%

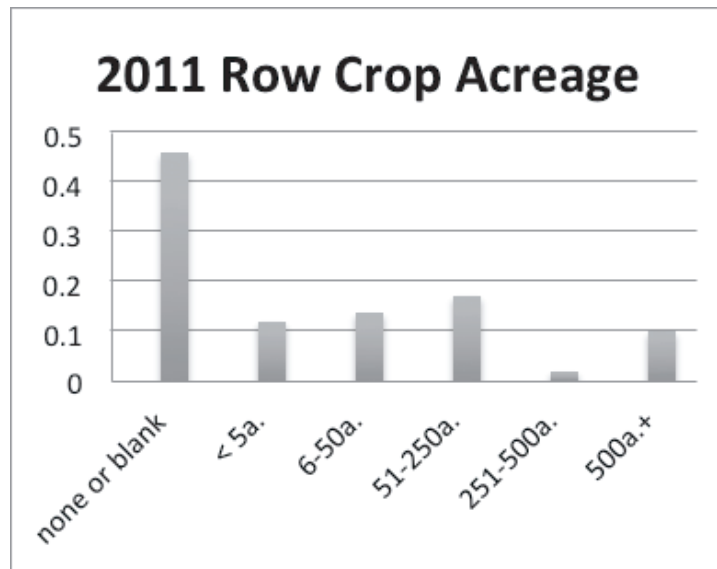
¹ These differences are statistically significant, based on the Mann-Whitney U test: age differences are significant at the 95% confidence level and land ownership differences with 99% confidence. Educational attainment is not significantly different from the rest of the sample.

² Two Amish farmers did not indicate their formal educational level. We infer that they did not go beyond high school, although they have had specialized agricultural training.

<u>Land holding</u>	< 50 acres	0
	50-99	19%
	100-199	19%
	200-499	0
	500-999	25%
	1000+	37%

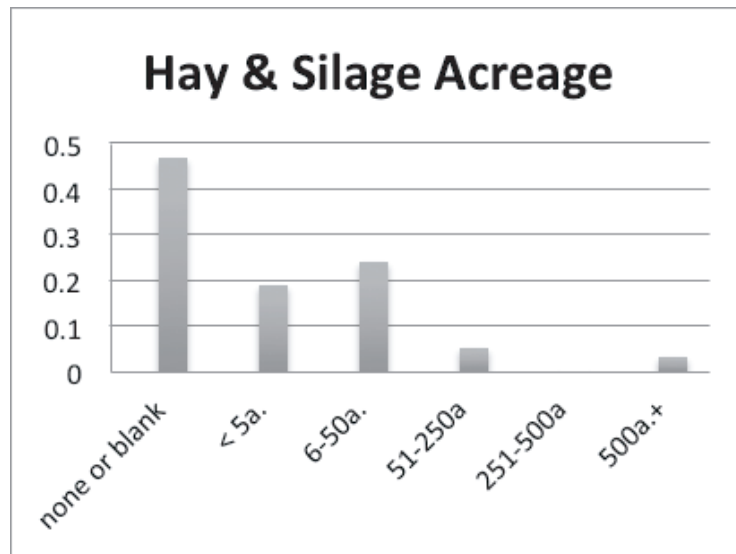
2011 Crop Production Over half of all respondents (54%) report row crop production and 44% small grains on their land in 2011. As noted, for many the production was on land rented to another person. For about half of respondents, plantings were in the 1-to-50 acre range, however the aggregate acreage is dominated by seven farmers who had more than 250 acres of row crops and six who had over 250 acres of small grains. Respondents were not asked their acreage of specific crops, but presumably much of the cultivated land was in Aroostook County’s familiar potato – small grain rotation. Some growers probably also produced broccoli.

Figure 4.



A similar small majority (52%) had hay or silage harvested from their land, including 20% who contracted with a custom harvest operator. The prevalence of very small acreages is even more pronounced with hay than with row crops: four-fifths of hay producers harvested 50 acres or less. Just eight respondents (14%) actually marketed hay from their land (in addition to those who dealt with custom operators). Seven (12%) fed hay to their commercial livestock. And, as mentioned, three respondents ran custom haying operations.

Figure 5.



Perspectives on Grass Biomass

A primary goal of the survey, beyond gathering basic information about Fort Fairfield landowners, was to assess their knowledge of grass biomass, perceived obstacles to its introduction, overall optimism, and interest in field trial participation.

Self-Assessed Knowledge: Respondents were asked to rate their knowledge about grass biomass and their understanding of the biomass research currently underway in Aroostook County. Just one-in-five consider their knowledge to be excellent (5%) or good (14%), while four-of-five rate their knowledge as poor (59%) or only fair (21%). Clearly, a central task in the EPSCoR project's "knowledge to action" mission is educating stakeholders about grass biomass cultivation, harvesting, costs, yields, and potential profitability.

There is no clear correlation between respondents' educational attainment and their self-assessed knowledge about grass biomass. Respondents who list farming as their principal occupation disproportionately view their knowledge as good or excellent: they represent 34% of all respondents but half of those with excellent or good knowledge. Demographically, the older age groups stand out for their self-assessed knowledge: They represent 54% of the sample population but 70% of those who view their biomass knowledge as excellent or good. (Since we were unable to compare respondents' actual knowledge with their self-assessed knowledge, no great significance should be attached to these patterns.)

Perceived Obstacles: Respondents were asked to assess the seriousness of seven potential obstacles to profitable grass biomass production. Considering that a majority rate their current knowledge as poor, it is not surprising that more than one-quarter recorded blanks for each obstacle listed in Table 2.

Table 2 Obstacles to Biomass Development

Production	Risks	Land Conversion		Harvest		Labor	Harvest	Cost Transport	Cost
		Low Price	Unreliable	Buyers					
Not obstacle	(0)	10	7	3	4	6	1	2	
Minor	(1)	12	14	11	10	17	4	8	
Moderate	(2)	12	7	20	18	12	11	11	
Fairly serious	(3)	6	11	3	3	4	15	12	
Very serious	(4)	3	3	4	6	2	10	8	
Blank	16	17	18	18	18	18	18		
% fairly or very serious ¹		20%	33%	17%	22%	15%	61%	49%	
Sample mean ¹		1.57	1.74	1.85	1.93	1.49	2.71	2.39	

1 – blank responses are omitted from these calculations.

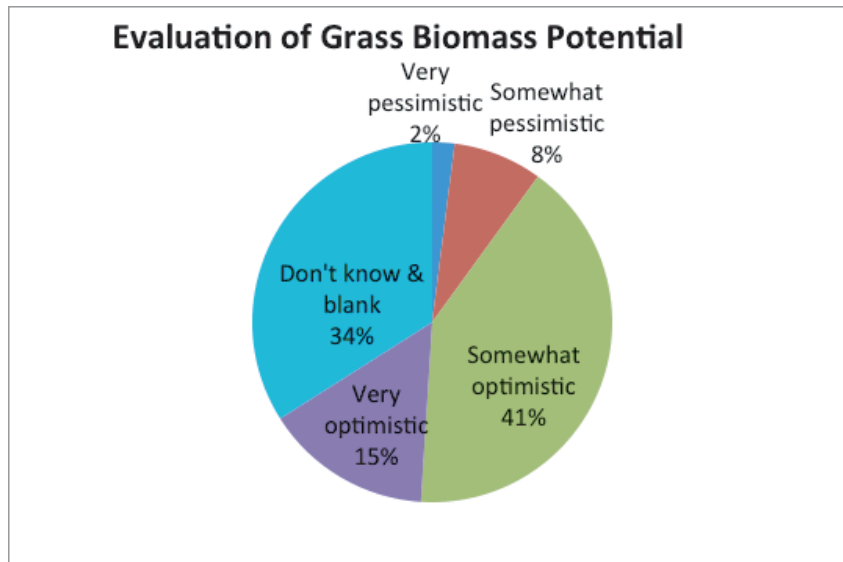
A glance at Table 2 reveals that two marketing-related problems – low price and unreliable buyers — are viewed as most serious. Giving responses numerical values, ranging from zero for “not an obstacle” to four for a “very serious obstacle,” these two obstacles rate between moderately serious and fairly serious. Mean values for the other five obstacles lie between “minor” and “moderate.” Land conversion and production risks (such as pests and inadequate rainfall) are thought to be the least serious.

Two obstacles with low mean values warrant closer inspection. First, although harvest labor shortage has a fairly low mean score, one third of respondents rate it fairly or very serious. These are predominantly active farmers with substantial row crop acreage. Four of the six respondents who own at least 1000 acres believe labor shortage would be a fairly or very serious obstacle. Their fall crop harvest could conflict with the grass biomass harvest. In addition, six landowners anticipate that the cost of transporting grass to a processing facility would be a very serious obstacle.

Eighteen respondents contributed open-ended comments about obstacles. Ten comments centered on production-related problems, most commonly lack of equipment and the cost of grass seed. Six comments focused on market-related problems, notably skepticism about the reliability of contracts. One person, without elaboration, mentioned “politics” as an obstacle.

Overall Optimism: One-in-three respondents (19) do not feel well enough informed to evaluate the economic potential of grass biomass in Aroostook County. Nonetheless, a majority of all respondents – and 85% of those who express an opinion - are somewhat optimistic or very optimistic, in spite of the potential obstacles discussed above.

Figure 6

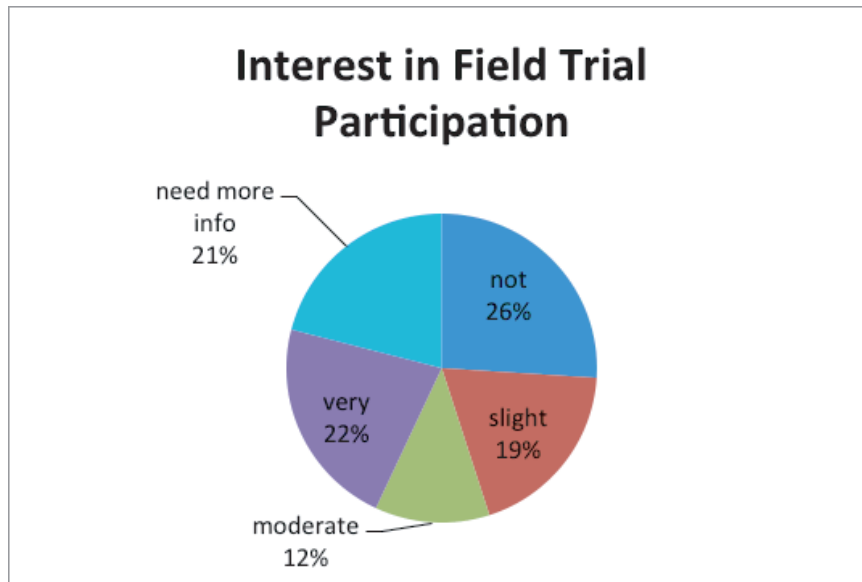


Groups with notably high levels of optimism include the 45-54 year age cohort (83% optimistic), respondents with post-secondary education but less than a bachelor's degree (67% optimistic), and those who list farming as their main occupation (63% optimistic). Young and old respondents are at the low end: 35-44 years of age - 25% optimistic; 65-plus - 44% optimistic. We find it encouraging that active farmers are comparatively optimistic, but we are not able to offer a compelling explanation of these particular response patterns.

Interest in Field Trial Participation: It is encouraging that over half of respondents indicate some interest in joining a grass biomass field trial and that one-fifth are very interested (see Figure 7). Not surprisingly, another fifth feel that they are not well-enough informed to make a decision.

In addition, respondents were asked about their interest having fallow and scrub land commercially bush-hogged to supply biomass feedstock. Of the 46 respondents who own such land, 85% express some interest and one-third are very interested.

Figure 7



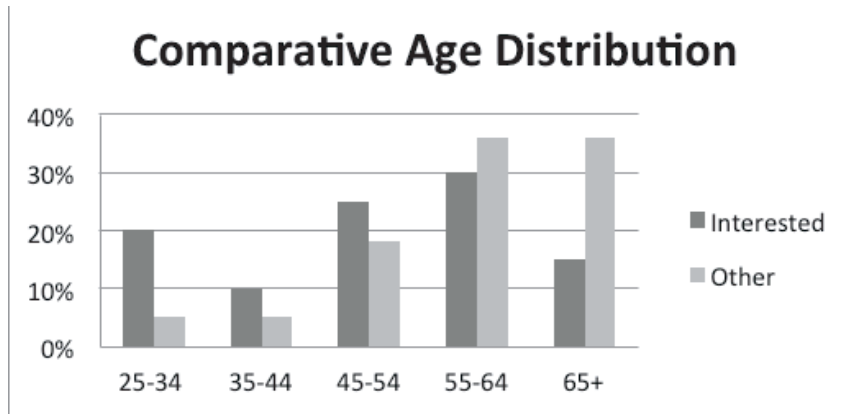
As the EPSCoR grass biomass investigation progresses, it will be important to study the agronomy and the economics of perennial grass production under realistic field conditions. It is thus helpful to know more about the subset of landowners who would be moderately or very interested in field trial participation. The following section characterizes that group of twenty landowners — roughly one-third of all survey respondents — and compares them with the rest of the sample.

Landowners Interested in Field Trial Participation

Demographics: The most conspicuous demographic difference between the most interested group and other respondents is in age distribution. As one might expect, a substantially larger proportion of interested respondents are younger than 45 years (30% of the interested group compared with 10% of the full sample) and a substantially smaller proportion are 65 or over (15% of the interested vs. 36% of the sample). The median age of the interested group is roughly 54 years, compared to 61 years for the others.³

³ The age differences are statistically significant, with 95% confidence, based on a Mann-Whitney U test.

Figure 8



Differences in educational attainment are less pronounced, although a somewhat larger proportion of the interested group has completed college (50% vs. 38%) and a slightly larger proportion has had formal agricultural training (40% vs. 36%). We note in passing that two of the interested landowners are 25-34 year old Amish farmers with agricultural training but no post-secondary education.

Farm assets and activities: The interested group is quite similar to the rest of the sample in terms of land ownership and involvement in commercial farming. As Figure 9 shows, the interested group includes proportionally fewer with extremely small acreage; however, above 50 acres the distributions are very similar — as is the median acreage. Twenty-five percent of the interested group (vs. 28% of the rest) describe themselves as full-time farmers and 10% (vs. 2%) as part-time farmers; 35% (vs. 38%) indicate that other family members are engaged in commercial farming activities.

Figure 9



Ownership of haying equipment is also similar: 20% of the interested group and 26% of others. However, proportionally more respondents interested in field trial participation are also interested in performing custom haying: 20% vs. 10%.

Combining all these factors, the composite portrait of the interested group reveals them to be somewhat younger and better educated, but otherwise very similar to the other respondents.

Perspectives on grass biomass: Like the sample as a whole, the great majority of the interested group (75%) consider their current knowledge about grass biomass to be poor or fair. Their interest does not appear to be grounded in a more sophisticated understanding. Their interest is, however, linked to greater optimism about the potential of grass biomass as reflected in two types of data. First, they view all seven potential obstacles as less serious than do the other respondents, although low price and unreliable buyers are also their greatest sources of concern (See Table 3). In fact, these are the only obstacles that any member of the interested group views as *very* serious. The only statistically significant difference between the two groups relates to transportation cost, which the interested group views as a minor obstacle and other respondents view as a moderate obstacle.⁴

Table 3: Perceived Obstacles to Grass Biomass: Mean Values

Key: Not an obstacle = 0, minor = 1, moderate = 2, fairly serious = 3, very serious = 4.

<u>Interested Group</u>		<u>Other Respondents</u>
Land Conversion	1.12	1.57
Harvest Labor Shortage	1.25	1.74
Harvest Cost	1.60	1.85
Transportation Cost	1.27	1.93
Production Risks	1.27	1.49
Unprofitable Price	2.50	2.71
Unreliable Buyers	2.19	2.39

Second, as seen in Table 4, those who are most interested in field trial participation are more optimistic about the future of grass biomass than the rest of the sample. None of the interested group express pessimism and three-fourths express optimism.

⁴ For six of seven obstacles, the Mann-Whitney U-test did not identify statistically significant differences between the responses of the interested group and the other respondents, at the 95% confidence level. The only statistically significant difference at 95% confidence is with transportation cost.

Table 4. General Optimism About Grass Biomass Potential

<u>Interested Group</u>		<u>Other Respondents</u>
Don't Know or Blank	25%	38%
Very Pessimistic	0	3%
Somewhat Pessimistic	0	13%
Somewhat Optimistic	55%	33%
Very Optimistic	20%	13%

References

VGEP (Vermont Grass Energy Partnership). 2011. Technical Assessment of Grass Pellets as Boiler Fuel in Vermont. Montpelier.

