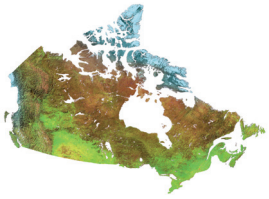
Natural Resources Canada
Ressources naturelles Canada



Issues related to the development and implementation of afforestation and agroforestry technologies for energy biomass production: results of focus group sessions in Quebec and the Prairie provinces

Pierre P. Marchand and Sylvain Masse

Information Report LAU-X-135E

2008

Natural Resources Canada, Canadian Forest Service

Laurentian Forestry Centre

Canada

Issues related to the development and implementation of afforestation and agroforestry technologies for energy biomass production: results of focus group sessions in Quebec and the Prairie provinces

Pierre P. Marchand and Sylvain Masse

Information Report LAU-X-135E

2008

Natural Resources Canada, Canadian Forest Service

Laurentian Forestry Centre

LIBRARY AND ARCHIVES CANADA CATALOGUING IN PUBLICATION

Marchand, Pierre P.
Issues related to the development and implementation of afforestation and agroforestry technologies for energy biomass production [electronic resource]: results of focus group sessions in Quebec and the Prairie provinces / Pierre P. Marchand and Sylvain Masse

(Information report; LAU-X-135E)
Electronic monograph in PDF format.
Issued also in French under title: Enjeux reliés au développement et à l'application de technologies de boisement et d'agroforesterie pour la production de biomasse énergétique.
Includes abstract in French.
Issued also in printed form.
Includes bibliographical references.
ISBN 978-1-100-11720-1
Cat. no.: Fo113-3/135E-PDF

1. Agroforestry – Prairie Provinces.
2. Agroforestry – Québec (Province).
3. Afforestation – Prairie Provinces.
4. Afforestation – Québec (Province).
5. Farmers – Prairie Provinces – Attitudes.
6. Farmers – Québec (Province) – Attitudes.
7. Landowners – Prairie Provinces – Attitudes.
8. Landowners – Québec (Province) – Attitudes.
9. Afforestation – Environmental aspects – Canada.

I. Masse, Sylvain, 1956-
II. Laurentian Forestry Centre.
III. Title.
IV. Series: Information report (Laurentian Forestry Centre: Online) LAU-X-135E.

SD409 M36 2008 634.9'909712 C2009-980007-1

Catalogue No. Fo113-3/135E-PDF
ISBN: 978-1-100-11720-1

This publication is available at no charge in PDF format at the Web site of the Canadian Forest Service Bookstore: http://bookstore.cfs.nrcan.gc.ca

TTY: 613-996-4397 (teletype for the hearing impaired).

Cette publication est également disponible en français sous le titre « Enjeux reliés au développement et à l'application de technologies de boisement et d'agroforesterie pour la production de biomasse énergétique » (Numéro de catalogue Fo113-3/135F-PDF).

TABLE OF CONTENTS

LIST OF TABLES

ABSTRACT

This study identifies issues in the area of the development and implementation of four short-rotation afforestation and agroforestry technologies, mainly for energy biomass production, as perceived by landowners in Quebec and the three Prairie provinces. The technologies are short-rotation intensive culture of willow or hybrid poplar, block plantation of hybrid poplar, willow-based riparian buffer systems and willow or hybrid poplar-based alley cropping.

Twenty-three focus groups (fourteen in Quebec and nine in the Prairie provinces) were formed, thanks to the participation of 81 landowners with early adopter profiles. Each focus group session began with a non-specialist presentation on the technology in question, followed by a thematic discussion. In addition to discussions among participants, which were noted and recorded, a questionnaire was used to gather qualitative information.

The exploratory approach adopted proved to be effective and efficient. The perceived benefits and drawbacks associated with the technologies were identified. Regardless of their initial knowledge and experience with respect to a particular technology, over 90% of the participants considered that they had learned something about that technology. Participants' levels of interest rose significantly for two of the four technologies. The intention to implement a technology in the short term proved to be very good for three of the four technologies. However, the low anticipated implementation rates obtained for alley cropping reflect the early stage of development of that technology.

The results obtained from participants' perceptions enabled us to prepare a list of technical, financial, legal, environmental and other issues relating to R&D and adoption. Since these issues are based on landowners' perceptions, their definition and relevance must be specified and validated with research scientists and other stakeholders.

RÉSUMÉ

Cette étude identifie chez des propriétaires terriens du Québec et des trois provinces des Prairies des enjeux de développement et d'application perçus à l'égard de quatre technologies de boisement et d'agroforesterie en courtes rotations visant notamment la production de biomasse à des fins énergétiques. Il s'agit de la culture intensive en courtes rotations du saule ou du peuplier hybride, de la plantation en blocs du peuplier hybride, de systèmes de bandes de protection riveraines avec saule et de la culture intercalaire avec saule ou peuplier hybride.

Vingt-trois groupes de consultation (*focus groups*) (quatorze au Québec, neuf dans les Prairies) ont été formés grâce à la participation de 81 propriétaires terriens ayant un profil d'adoptants initiaux. Chaque séance de consultation débutait par une présentation vulgarisée sur la technologie discutée, suivie d'une discussion thématique. En plus des échanges entre participants qui ont été notés et enregistrés, un questionnaire a permis de recueillir des renseignements de type qualitatif.

L'approche exploratoire utilisée s'est avérée efficace et efficiente. On a identifié les avantages et désavantages perçus dans les technologies. Sans égard pour le niveau initial de connaissance et d'expérience envers une technologie donnée, plus de 90 % des participants estiment avoir appris sur celle-ci. Le niveau d'intérêt des participants a augmenté de façon notable pour deux des quatre technologies. L'intention d'appliquer une technologie à court terme s'est avérée être très bonne pour trois des quatre technologies. Toutefois, les faibles prévisions d'application obtenues pour la culture intercalaire reflètent l'état encore préliminaire de développement de cette technologie.

Les résultats obtenus à partir des perceptions des participants ont permis de dresser une liste de plusieurs enjeux de recherche-développement et d'application de natures technique, financière, légale, environnementale et autre. Comme ces enjeux reposent sur les perceptions des propriétaires terriens, leur nature et leur importance doivent être précisées et validées auprès de chercheurs et d'autres intervenants.

1. INTRODUCTION

1.1 Context

The Canadian Forest Service's Laurentian Forestry Centre is co-ordinating a 2½-year (2005-2008) research and development project on the development of short-rotation afforestation and agroforestry systems for energy production and greenhouse gas emissions reduction. This project is being implemented under the Technology and Innovation Initiative of Natural Resources Canada's Canadian Biomass Innovation Network.

The project, which is being conducted at the national level, covers four technologies: (1) short-rotation intensive culture[1] of willow or hybrid poplar, (2) block plantation of hybrid poplar, (3) willow-based riparian buffer systems, and (4) willow or hybrid poplar-based alley cropping.

Short-rotation intensive culture (SRIC) is a relatively recent form of silviculture that uses fast-growing species such as willow or hybrid poplar. It is characterized by high planting density (approximately 18,000 cuttings/ha), a very short harvesting cycle (3-4 years) and high post-harvest stump sprout density (50,000-80,000/ha). Various clones can be used, depending on the desired characteristics and culture conditions. Periodic harvesting can continue over a period of approximately 25 years, after which the stumps must be removed. Mean yields range between 10 and 20 dry tonnes/ha/year. This type of culture has been described by Keoleian and Volk (2005) and Labrecque and Teodorescu (2006).

Block plantation of hybrid poplar (BPHP) is a technology that uses various clones planted at densities of the order of 800 outplants/ha. Here again, clones are selected depending on the desired characteristics and culture conditions. Final harvesting takes place after a period of 15-20 years, and yields may be as high as 240-400 m^3/ha. In Quebec, this culture has been developed for over three decades by the Research Branch of the ministère des Ressources naturelles et de la Faune du Québec. It has been described by various authors, including Ménétrier et al. (2005) and van Oosten (2006) in particular.

Willow-based riparian buffer systems typically include herbaceous species. They are established along streams to intercept non-point-source pollution (such as fertilizers and pesticides) in shallow groundwater and surface runoff while also reducing streambank erosion. These systems are usually adjacent to fields of agricultural crops. As with short-rotation intensive culture of willow, the harvesting cycle can be as short as 3-4 years. In this way, both streambank protection and biomass production can be achieved. In Canada, willow-based riparian buffer systems have been developed over approximately the past 5 years. Schultz et al. (2004) have described various riparian buffer systems using tree and/or shrub species.

In willow or hybrid poplar-based alley cropping systems, herbaceous crops (annual or perennial) are planted between rows of trees or shrubs. This approach seeks to take advantage of the positive ecological interactions between woody and herbaceous species, especially in terms of soil and light. In Canada, R&D on willow or hybrid poplar-based alley cropping systems began about 5 years ago. Culture systems of this type as applied in North America have been described by Garrett and McGraw (2000) and by Williams et al. (1997).

[1] Concentrated biomass for energy plantation is also used to describe short-rotation intensive culture.

The research project explores primarily the aspects listed below:

- genetic selection for clones of native willows;
- crop yields;
- biomass harvesting mechanization and biomass transportation;
- potential for energy production and GHG reduction;
- economic viability of the technologies;
- political and social factors associated with the development and adoption of these technologies.

These various aspects are addressed through subprojects that are juxtaposed to form an integrated whole.

Ten Canadian research centres are participating in the project, including four forestry research centres and the CANMET Energy Technology Centre of Natural Resources Canada, two Agriculture and Agri-Food Canada research centres, and the Institut de recherche en biologie végétale (IRBV). Various provincial government departments and agencies, universities, and other partners, such as industry and landowners, are also contributing significantly to the project.

1.2 Study on policies, legislation, programs and social factors

In the framework of the national project, this subproject explores the specific area of the dynamics of the policies, laws, regulations and programs, along with social factors, that may affect the implementation and development of one or another of the four technologies under study.

Work under this subproject includes:

1. a study of the legislative context and incentive programs in place in Quebec relating to the four technologies (Marchand and Masse 2007);

2. a study with focus groups, described in this report, addressing the issues of R&D and implementation of the four technologies;

3. a study featuring a survey of specialists in the development and implementation of the four technologies (scheduled for 2008 and 2009).

The results of the present study will serve as a basis for the content of the survey to be conducted in the third study.

1.3 Bibliographic analysis

To date, very few investigators have used the focus group approach or related research techniques (such as in-depth interviews) to identify issues related to the development or implementation of afforestation and agroforestry technologies in the Canadian context.

Copestake (2003) explored incentives and constraints affecting afforestation in Ontario through three “focus sessions”, a modified version of the conventional focus group,

accompanied by discovery sessions. The sessions began with standard PowerPoint presentations, followed by a group discussion of various aspects of afforestation.

The results demonstrate the importance of the following factors: ensuring the availability of stable long-term incentive programs, with delivery officers linked to reliable local agencies or organizations; respecting the property rights of landowners; providing financial support covering up to 90% of establishment costs; ensuring land use for afforestation purposes that is competitive with other uses; and resolving tax-related issues relating to land use (farming *vs* forestry).

Smith et al. (2005), whose team included two scientists from the Canadian Forest Service, set up seven focus groups with landowners in the three Prairie provinces with a view to identifying factors that should be taken into consideration in the establishment of a prospective afforestation program featuring fast-growing, high-yield species such as hybrid poplar. The study highlighted various benefits and drawbacks, together with a number of barriers and challenges that may hamper or facilitate, as the case may be, this type of afforestation.

Among the benefits identified were environmental benefits, such as wildlife habitat creation and increased biodiversity, diversification of income, and intergenerational benefits. Drawbacks and barriers found by the study included opportunity costs, uncertain return on investment after 15-20 years, the time required for the establishment and maintenance of trees, and the lack of technical knowledge.

More recently, an exploratory study by Martineau and Bouthillier (2007) looked at the social acceptability of block plantation of hybrid poplar to various target publics in the Eastern Townships of Quebec. This afforestation technology is growing in importance in Quebec, owing primarily to its use by the forestry industry. The study, which consisted of semi-directed interviews with 17 persons on an individual basis, did not provide a very clear picture of the concept of social acceptability. However, it did identify a number of issues that should be taken into consideration in cases where plans for large-scale plantings on privately-owned land are being contemplated.

The study found, for example, that social concerns, especially among environmentalists, usually focus on environmental impacts (e.g., hydrological) rather than economic or aesthetic impacts, although landscape is a concept that remains an important consideration. The matter of land use and forestry or agricultural practices is another issue. To illustrate: persons who value conventional agriculture consider it unacceptable to convert old fields to hybrid poplar plantations.

Our survey of these studies does not constitute an exhaustive review of published research on the use of focus-group techniques or related approaches to identify issues in the area of the development and implementation of afforestation and agroforestry technologies. We may, however, note the following points:

- None of the studies reviewed deals with short-rotation intensive culture of willow or hybrid poplar, riparian buffer systems, or alley cropping.

- Studies that have addressed the cultivation of fast-growing trees have tended to focus on the application of systems; they have not attempted to identify issues related to development of the systems in question.

- The contexts in which afforestation technologies featuring fast-growing species have been applied are highly specific, such as a prospective incentive program or large-scale plantation of hybrid poplar by the forestry industry in a given region.

Clearly, there is a large knowledge gap that needs to be filled on issues related to development and application of the four technologies in question. This is due in part to the relative novelty of SRIC and the two agroforestry technologies based on the use of willow or hybrid poplar. These systems have not yet been applied on a large scale in Canada. The same is true of block plantation of hybrid poplar, with the notable exception of its implementation by forestry companies. Consequently, few data are available on landowners' perceptions of these new technologies. Yet these are the persons who will ultimately decide to what extent they will be adopted.

1.4 Objectives

Based on a series of focus groups of landowners in Quebec and the three Prairie provinces on the four technologies in question, the study has three main objectives:

1. to identify issues in the area of the development and implementation of these technologies as perceived by participants;

2. to evaluate the potential for implementation of these technologies, generally within a 5-year horizon; and

3. to compare the results obtained for the various technologies in different geographic regions (i.e., Quebec and the Prairie provinces).

It should be noted that the focus groups in the Prairie provinces did not discuss block plantation of hybrid poplar, since Smith et al. (2005) published focus group findings on that particular technology which answer a number of the questions addressed in this study.

The methodology selected to achieve these objectives and the reasons why that methodology was chosen are outlined in the next chapter. Results obtained for each technology are presented and subjected to comparative analysis in subsequent chapters. The report ends with our conclusions and an overview of further research needs in this area.

2. METHODOLOGY

2.1. The focus group method

The focus group is an exploratory, qualitative, applied research method. It is an inductive method (in contrast to the hypothetical-deductive approach) that makes extensive use of open questions on a particular subject, which are considered by the members of a small group consisting of between 7 and 12 persons. It does therefore not include verification of previously formulated research hypotheses. This method was developed by Merton and his collaborators (Merton, 1987; Merton and Kendall, 1946; Merton, Fiske and Maddi, 1956, 1990), and its components have been described in greater detail by Morgan and Krueger (1998) and Krueger and Casey (2000). Nor is a focus group a form of survey. Accordingly, the concepts of sampling and representativeness are not of primary importance, and there is little room for inferential statistics, such as are commonly used to generalize results to a defined population.

According to Krueger and Casey (2000), focus groups have five characteristics. “They involve (1) people who (2) possess certain characteristics and (3) provide qualitative data (4) in a focused discussion (5) to help understand the topic of interest.” (Kruger and Casey, 2000, p. 10). They enable a group to exchange views and discuss a particular subject, and to identify issues, perceptions, questions, attitudes and opinions on that subject. They are led by a facilitator who asks open questions on various aspects of the selected subject and facilitates the discussion and interaction process among the participants. An assistant facilitator takes notes and makes a sound recording of the discussion. The data obtained in a focus group setting are usually descriptive or nominal in nature. The report that is subsequently produced is ordinarily narrative and descriptive, containing no quantitative or statistical measures.

Smith et al. (2005) noted that focus groups have both advantages and drawbacks, as previously identified by Babie (2001). The main advantages include:

1. a flexible method that can be adapted or altered according to circumstances. For example, the size of the group may be reduced, supporting materials may be presented, various scenarios may be discussed, and questionnaires or scripts may be used;
2. high face validity;
3. achievement of speedy results.

The main drawbacks are as follows:

1. this formula is very time-consuming (preparation of tools, recruiting, management of the groups);
2. analysis and synthesis of the qualitative content may prove to be time-consuming;
3. it is more difficult to assemble a group than to conduct individual interviews (substantial requirements in terms of logistics);
4. success depends largely on the skills of the facilitator.

2.2. Selected approach

The approach selected for the purpose of this study incorporates the characteristics of the conventional focus group, but also includes other distinctive features. This approach was selected mainly because of the exploratory nature of the study. Emphasis was therefore placed

on the use of open questions, with no prior or restrictive assumptions about specific answers. As we shall see, this did not preclude the use of a number of closed questions aimed at estimating participants' knowledge and interest levels vis-à-vis the technologies under discussion.

To develop this approach, a 10-member pilot focus group was established to address two of the technologies under study, namely block plantation of hybrid poplar and short-rotation intensive culture of willow. For each of these technologies, the group discussion was preceded by a non-specialist PowerPoint presentation lasting approximately 15 minutes. Each participant was given a printed copy of the presentation on which to note his or her comments and questions. A comment form with multiple-choice questions was also used and tested.

The pilot focus group confirmed the feasibility of having one group discuss two technologies in two successive sessions lasting approximately 90 to 120 minutes. This approach is advantageous from a budgetary perspective and promotes effective discussion. Moreover, it facilitates the selection of participants with various levels of knowledge about the technologies under review, since the participants in a particular group are identified on the basis of their interest in one of the two technologies.

Furthermore, experience with the pilot focus group prompted adjustments to the wording of some questions in the comment form and the addition of some questions. In the end, four analogous comment forms were produced, one for each of the four technologies under study.

2.2.1 Groups of participants

For the purposes of this study, the word "participant" denotes a landowner or landowner's representative who took part in the focus groups. Landowners' representatives were for the most part employees of municipalities or commercial firms that owned land.

In Quebec, two afforestation or agroforestry technologies were discussed by one group each in the course of a single day, i.e. there were two focus groups per day. In the Prairie provinces, each of the three technologies was discussed by one group in the course of a single day, i.e. there were three focus groups. As noted earlier, the technology consisting of block plantation of hybrid poplar was not discussed by focus groups in the Prairie provinces.

Seven meetings were organized in Quebec and three in the Prairie provinces. In all, fourteen focus groups met in Quebec and nine in the Prairie provinces.

The distribution of subjects addressed and number of participants in the 23 focus groups that took part in the study are shown in Tables 1 and 2 for Quebec and the Prairie provinces respectively.

Table 1. Locations, dates and number of participants for focus groups in Quebec

	Technologies discussed[1] and number of participants			
Place and date of focus group	**Short-rotation intensive culture of willow**	**Block plantation of hybrid poplar**	**Willow-based riparian buffer systems**	**Willow or hybrid poplar-based alley cropping systems**
Quebec City 2006-07-13	B[2] (n = 10)	A[2] (n = 10)		
La Pocatière 2006-09-20	B (n = 8)	A (n = 7)		
Saint-Hyacinthe 2006-10-04	B (n = 7)	A (n = 7)		
Boisbriand 2006-10-25	A (n = 7)	B (n = 7)		
Quebec City 2006-12-11	B (n = 6)	A (n = 6)		
La Pocatière 2006-12-13			A (n = 6)	B (n = 6)
Saint-Hyacinthe 2007-01-16			A (n = 8)	B (n = 8)
Total	N = 38	N = 37	N = 14	N = 14

[1] For the sake of conciseness, the following acronyms and abbreviations will also be used to designate the four technologies: SRICW (or SRIC), BPHP, RBS and alley cropping.

[2] The letters A and B are used to indicate the order in which the technologies were discussed by the group in the course of the day.

Data from the pilot focus group of July 13, 2006 were kept and analyzed for the purposes of the study.

The groups that met on October 25 and December 11, 2006, were made up of large landowners (or their representatives) who were interested in SRIC or BPHP respectively. In that case, the selection criteria specified a managed land area greater than 4 ha.

Table 2. Locations, dates and number of participants for focus groups in the Prairie provinces

	Technologies discussed and number of participants		
Place and date of focus group	**Short-rotation intensive culture of willow or hybrid poplar**	**Willow-based riparian buffer systems**	**Willow or hybrid poplar-based alley cropping**
Edmonton, Alberta 2006-11-20	B (n = 9)	A (n = 9)	C (n = 9)
Saskatoon, Saskatchewan 2006-11-22	B (n = 8)	A (n = 8)	C (n = 8)
Winnipeg, Manitoba 2006-11-24	B (n = 11)	A (n = 11)	C (n = 11)
Total	N = 28	N = 28	N = 28

Note: The letters A, B and C are used to indicate the order in which the technologies were discussed by the group in the course of the day.

For the two regions, the focus groups comprised a total of 66 participants for short-rotation intensive culture of willow or hybrid poplar, 37 participants (Quebec only) for block plantation of hybrid poplar, and 42 participants for willow-based riparian buffer systems and willow or hybrid poplar-based alley cropping. In all, 81 individuals took part in the focus groups.

2.2.2. Selection of participants

A set of criteria was developed to guide the selection of participants for each of the four technologies that were to be discussed. These criteria included primarily the prospective participant's interest in discussing a technology, his/her status as a farmer, the presence of a stream adjacent to his/her land, or his/her prior practical experience with one of the technologies examined in this study. Selection criteria for Quebec participants are found in Appendix 1, and those for participants from the Prairie provinces in Appendix 2. Generally speaking, both in Quebec and in the Prairie provinces, the objective of the exercise was to secure the participation of early or potential adopters[2] of the technologies under study.

Prospective participants were identified by various agencies, government departments or other bodies that had dealings with landowners. For the Quebec focus groups, the ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec (MAPAQ), the La Pocatière campus of the Institut de technologie agroalimentaire (ITA), the Institut de recherche en biologie végétale (IRBV) at l'Université de Montréal, the Department of Phytology at Université Laval, and private forest development agencies were useful in this connection.

For the focus groups in the three Prairie provinces, participants were selected from a list of landowners with previous experience in afforestation projects conducted by the Canadian Forest Service's Northern Forestry Centre. The participants had taken part in other focus groups organized by the CFS in collaboration with provincial forestry associations.

Prospective participants were contacted by telephone, and a standard recruitment presentation (see Appendix 3) was used to introduce the study and determine whether the

[2] The concept of "early adopter" has been developed and studied by Rogers (2003) in his work on the diffusion of innovations.

person met the selection criteria. For the Prairie provinces, potential participants were contacted by Derek Sidders, of the CFS's Northern Forestry Centre in Edmonton, Alberta. For Quebec, this work was done by the principal author.

The recruitment presentation outlined the purpose of the study, explained how a focus group works, and stated that if the person agreed to participate, he/she would be paid $100. If the person concerned agreed verbally to participate in one of the focus groups, a formal letter of invitation was sent to him/her, with an accompanying summary of the study and instructions (map, address and telephone number) on how to get to the location of the meeting. A follow-up telephone call was made two days before the focus group was scheduled to meet to ensure that the participant had received the formal letter of invitation, confirm that he/she would be participating, and remind him/her where the meeting was to be held.

The composition of the focus groups is shown in Tables 3 and 4.

Table 3. Distribution of categories of participants by region for short-rotation intensive culture and block plantation of hybrid poplar

Category	Quebec (n = 39)	Prairie provinces[3] (n = 28)	Total (N = 67)
Landowners	54%	75%	63%
• Active	(46%)	(75%)	(58%)
• Retired	(8%)	(0 %)	(5 %)
Owners' spouse or family members	2%	14%	7%
Industry personnel, consultants	23%	4%	15%
Municipalities	10%	4%	7%
Others (NGOs, not-for-profit organizations, universities)	10%	4%	7%
Total	100%	100%	100%

For the afforestation systems (see Table 3), just under two thirds of the participants were landowners. This category was less heavily represented in Quebec, with participants from industry, NGOs and municipalities accounting for a substantial fraction of the total (43%). The groups in the two regions were therefore characterized by differences in composition.

[3] The focus groups held in the Prairie provinces did not discuss block plantation of hybrid poplar.

Table 4. Distribution of categories of participants by region for riparian buffers and alley cropping

Category	Quebec (n = 14)	Prairie provinces (n = 28)	Total (N = 42)
Landowners	93%	75%	81%
• Active	(93%)	(75%)	(81%)
• Retired	(0%)	(0%)	(0%)
Owners' spouse or family members	0%	14%	9%
Industry personnel, consultants	0%	4%	2%
Municipalities	0%	4%	2%
Others (NGOs, not-for-profit organizations, universities)	7%	4%	5%
Total	100%	100%	100%

For the two agroforestry systems, more than four out of five participants were landowners. In Quebec, the figure was over 90%. The lower percentage for the Prairie provinces is attributable in part to the presence of members of landowners' families.

2.2.3 Structure of focus groups and operating procedure

Two professionals from the Canadian Forest Service acted as facilitators for the various meetings. In Quebec, the subproject director was responsible for the non-specialist presentations on the two technologies discussed by the groups and also served as assistant facilitator. A research officer acted as facilitator.

For the Prairie provinces, the same research officer who participated in the Quebec focus groups was responsible for the presentations on the three technologies discussed and also acted as facilitator. A Northern Forestry Centre professional served as assistant facilitator.

Each focus group discussing a particular technology followed a standardized script, an example of which is provided in Appendix 4.

The format of the focus group meetings was as follows:

- Introduction of the facilitator and assistant facilitator. Rules of procedure and signing of the participation consent form (see Appendix 5).

- Participants were given a comment sheet (see Appendix 6), introduced themselves and indicated both orally and in writing their level of knowledge of and experience with the technology in a round-table format.

- A non-specialist on-screen presentation lasting 15-20 minutes was given on the technology to be discussed (see Appendix 7). Participants were given a hard copy of the presentation, which in most cases was structured as follows: definition; technical characteristics; costs, yields and markets; development status; statutory and regulatory framework; main incentive programs. Presentations on the various

technologies were slightly different in the two regions (Quebec and Prairie provinces), reflecting their respective programs, regulations and yield data.

- Participants were invited to address the points below, both in writing on their comment sheets and orally in a round-table format:
    - any aspects of the presentation that required clarification or were missing;
    - the benefits of the technology;
    - the drawbacks of the technology;
    - whether they intended to apply the technology during the next 5 years, assuming they would be eligible for a financial and technical support program. If a participant answered yes, he/she was asked to indicate the size of the area on which the technology would be applied;[4]
    - whether they intended to apply the technology during the next 5 years, assuming they would not be eligible for a financial and technical support program. If a participant answered yes, he/she was asked to indicate the size of the area on which the technology would be applied.
- Next, the participants were asked to answer the questions below in writing, without discussing them:
    - subjective level of learning during the focus group session;
    - which of the subjects discussed was deemed the most useful;
    - change in his/her level of interest in the technology during the focus group session;
    - additional comments.

2.2.4 Data collection and processing

The techniques listed below were used to collect basic focus group data:

- tape recordings of exchanges among the participants;
- participants' comment sheets;
- contents of flip charts used by the facilitator;
- handwritten notes taken by the assistant facilitator (Quebec);
- salient points jotted down during the meeting by the assistant facilitator based on oral remarks made during exchanges among the participants (Prairie provinces).

On this basis, detailed salient points were produced for each focus group. For individual data that were classificatory (e.g. a participant's intention to plant or not to plant), ordinal (e.g. level of knowledge of and experience with a particular technology) or quantitative (e.g. number

[4] Financial support would be on the order of 75% of establishment costs. For alley cropping, participants were asked to indicate to what extent they would consider the possibility of applying the technology if it became operational in the medium term, with no reference to eligibility for any support program. There was a choice of three answers: very much, perhaps, not at all. Participants were also invited to write in their reasons for their choices.

of hectares that would be planted) in nature, a database was set up as an Excel file for subsequent statistical processing.

2.2.5 Data analysis

Starting from these salient points, it was possible to construct, for each of the four technologies and each of the two regions, a summary table presenting aggregated data, such as (1) number of times mentioned, (2) answers to multiple-choice questions, (3) areas, etc.

For qualitative data on perceived benefits and drawbacks, five classes were available at the outset: technical, financial, legal, environmental, and other aspects. Following examination of the participants' answers, the "technical" and "financial" categories were subdivided. Technical aspects were broken down into (1) equipment/methods/risks, (2) site-specific, (3) comparison with other crops, and (4) yields. Financial aspects were broken down into (1) general, (2) costs, and (3) markets.

The same categories were used to classify answers about aspects of the presentation that were deemed missing or unclear, as well as for answers relating to the question about which of the subjects discussed were deemed the most useful.

In view of the exploratory nature of the study and the fact that the subgroups were not established by random sampling, descriptive statistics were used.

2.2.6 Specificity of the selected approach

The approach used for this study differs from the conventional focus group as follows:

- Inclusion of a two-scenario question (eligibility or ineligibility for a financial and technical support program) in order to measure, in accordance with each scenario, participants' intention to apply or not to apply the technology, and the corresponding area.

- Use of questions on participants' comment sheets, the answers to which were noted without having been discussed during the session.

- Each group was required to participate in two (in the case of Quebec) or three (in the case of the Prairie provinces) focus groups in the context of a session held during a single day.

- Gathering of quantitative data (e.g. on areas) and use of multiple-choice answers in the case of three questions (four in the case of alley cropping).

3. RESULTS FOR EACH TECHNOLOGY

In this section, the focus group results for each of the four technologies under study will be described. The results are first presented in accordance with the eight themes addressed in the focus groups:

1. initial level of knowledge and experience;
2. perceived benefits;
3. perceived drawbacks;
4. anticipated implementation;
5. information learned in the focus group;
6. change in interest level during the exercise;
7. missing or unclear aspects in the presentation;
8. additional comments.

Examination of these results, particularly with respect to the benefits and drawbacks perceived by participants and the reasons stated in explanation of changes in interest level during the focus group session, enabled us to identify R&D and application issues for each of the technologies. These issues are presented in the form of actions following the results for the eight themes addressed by the focus groups.

With the exception of block plantation of hybrid poplar, the results are presented for both regions.

3.1 Short-rotation intensive culture

3.1.1 Initial knowledge and experience level

Overall, 44% of the participants rated their level of knowledge of and experience with SRIC as low or very low (see Table 5). The figure was 62% in Quebec, whereas it was only 25% in the Prairie provinces. The disparity is more pronounced if we consider that 48% of Quebec participants rated their level as very low, while not one of the Prairie province participants rated himself/herself as very low. In the Prairie provinces, 36% of the participants rated their knowledge and experience level high or very high, compared with 17% in Quebec. Overall, participants from the Prairie provinces described themselves as more familiar with that technology than their Quebec counterparts.

Table 5. Distribution of participants' initial knowledge and experience levels with respect to short-rotation intensive culture, by region

Level	Quebec (n = 29)[1,2]	Prairie provinces (n = 28)	Total (N = 57)
Very low	48%	0%	25%
Low	14%	25%	19%
Average	21%	39%	30%
High	14%	25%	19%
Very high	3%	11%	7%
Total[3]	100%	100%	100%

[1] n indicates the number of participants.

[2] In the case of the 10 participants in the pilot focus group of July 13, 2006, this variable was not measured. The data thus concern 29 participants.

[3] The reported percentages have been rounded off to the nearest whole number. They may add up to slightly less or more than 100%.

3.1.2 Perceived benefits

The distribution of perceived benefits, broken down into categories, for each region and for all participants is shown in Table 6.

Table 6. Categories of perceived benefits associated with short-rotation intensive culture, by region

Perceived benefit category	Quebec (n = 124)	Prairie provinces (n = 126)	Total (N = 250)
Technical	44%	29%	36%
• Equipment/Methods/Risks	(33%)	(26%)	(30%)
• Site-specific	(0%)	(0%)	(0%)
• Comparison with other crops	(1%)	(0%)	(0%)
• Yields	(10%)	(3%)	(6%)
Financial	31%	23%	27%
• General	(2%)	(7%)	(5%)
• Costs	(10%)	(3%)	(6%)
• Markets	(18%)	(13%)	(16%)
Legal	2%	1%	2%
Environmental	18%	42%	30%
Other	5%	4%	4%
Total	100%	100%	100%

Overall, the results indicate that close to four out of ten (36%) identified benefits were technical benefits, followed by environmental benefits (30%) and financial benefits (27%). These three categories represent 93% of all benefits identified by the participants.

Main technical benefits:

- Comparatively simple technology, user-friendly (Quebec, Prairie provinces)
- Uses available existing machinery (Quebec, Prairie provinces)
- High growth and high yields (Quebec, Prairie provinces)
- Short production cycles (Quebec)
- Stump sprouting following harvesting of stems (Quebec)
- Possibility of fertilizing with liquid manure (Quebec)
- Use of abandoned farm land (Quebec)
- Crop diversification (Prairie provinces)

Main financial benefits:

- Relatively low production costs, particularly maintenance costs (Quebec, Prairie provinces)
- Reasonable initial investment considering a production period of approximately 25 years (Quebec, Prairie provinces)
- Potential for reducing production costs in an operational context (Quebec)
- Short-term income (Prairie provinces)
- Proximity to markets (Quebec)
- Availability of markets (Quebec, Prairie provinces)
- Alternative to crops that are not economically viable (Quebec)
- Income diversification (Prairie provinces)
- Maintenance or increase in the value of farmland (Quebec, Prairie provinces)
- Potential for job creation (Quebec, Prairie provinces)
- Approach to environmental problem-solving that is less costly than heavy technologies (Quebec)

Main legal benefits:

- Possibility of recognition as an agricultural crop (Quebec)
- Crop that could handle future environmental constraints (reductions in non-point-source pollution, combatting climate change) (Prairie provinces)

Main environmental benefits:

- Carbon sequestration (Quebec, Prairie provinces)
- Creation of wildlife habitats (Prairie provinces)
- Fertilizer capture and filtering (Prairie provinces)
- Possible use for water purification and bioremediation purposes (Quebec)
- Biofuel production (Prairie provinces)
- Numerous environmental benefits not specified by participants (Quebec)

Most frequently mentioned other benefits:

- Landscape enhancement (Quebec, Prairie provinces)
- Improvement of the image of agriculture (Quebec)
- Agricultural crisis conducive to the introduction of new technologies (Quebec)
- Possibility of using hybrid poplar instead of willow (Prairie provinces)

3.1.3 Perceived drawbacks

The distribution of perceived drawbacks, broken down into categories, for each region and for all participants is shown in Table 7. Technical and financial drawbacks account for over 80% of the perceived drawbacks both in Quebec and in the Prairie provinces.

Table 7. Categories of perceived drawbacks associated with short-rotation intensive culture, by region

Perceived drawback category	Quebec (n = 92)	Prairie provinces (n = 138)	Total (N = 230)
Technical	38%	43%	41%
• Equipment/Methods/Risks	(35%)	(43%)	(40%)
• Site-specific	(0%)	(0%)	(0%)
• Comparison with other crops	(3%)	(0%)	(1%)
• Yields	(0%)	(0%)	(0%)
Financial	45%	42%	43%
• General	(15%)	(4%)	(9%)
• Costs	(9%)	(25%)	(19%)
• Markets	(21%)	(12%)	(16%)
Legal	13%	2%	6%
Environmental	3%	12%	8%
Other	1%	1%	1%
Total	100%	100%	100%

Main technical drawbacks:

- New equipment or specialized equipment required (Quebec, Prairie provinces)
- Crop design a constraint for equipment (Prairie provinces)
- Lack of availability of cuttings (clones) to establish plantations (Quebec, Prairie provinces)
- Difficulty of controlling herbaceous vegetation (Prairie provinces)
- Difficulty of debarking harvested stems (Quebec)[5]
- Risk of soil impoverishment (Prairie provinces)
- Possible source of insects and diseases that would be harmful to other crops (Prairie provinces)
- Lack of non-specialist information and knowledge transfer for this new crop, especially in connection with the following aspects:
    - Characteristics and availability of clones (Prairie provinces)
    - Necessary machinery and possibility of adapting existing machinery (Quebec, Prairie provinces)
    - Culture methods, site preparation, maintenance, cycles (Quebec, Prairie provinces)
    - Reliable data on growth and yields (Quebec)
    - Biomass storage and handling (Prairie provinces)
    - Necessary labour force (Prairie provinces)

[5] Authors' note: for most uses of willow, debarking of the stems is not required.

Main financial drawbacks:

- High production costs:
  - Establishment costs (Prairie provinces)
  - Machinery acquisition costs (harvesting, planting) (Quebec, Prairie provinces)
  - Labour costs (Prairie provinces)
  - Grass control costs (Prairie provinces)
  - Capital cost (Prairie provinces)
  - Opportunity cost of farmland (Prairie provinces)
  - Cost of reconverting to a conventional crop (stump removal) (Quebec)

- Primary processing costs that add to production costs (Quebec)

- Uncertain markets:
  - Lack of information about markets, including their locations (Quebec)
  - Lack of competitive markets (Prairie provinces)
  - Critical mass of producers required to develop markets (Quebec)
  - Possibility that an increase in supply will cause prices to fall (Quebec)
  - Limited harvesting period (fall-winter) may impede market development (Quebec)

- Economic viability remains to be demonstrated:
  - Lack of incentives, especially for farmers (Quebec, Prairie provinces)
  - No crop insurance programs (Prairie provinces)

Main legal drawbacks:

- SRIC not recognized as an agricultural or forest crop (Quebec, Prairie provinces)
- Agricultural zoning constraints on financial support for afforestation (Quebec)

Main environmental drawbacks:

- Risk of erosion (Prairie provinces)
- Risks associated with monocultures (Quebec)
- Risks arising from the introduction of exotic species (Quebec)
- Low reliability of studies on the carbon cycle (Prairie provinces)
- Risk of pollution arising from biomass conversion (Prairie provinces)

Most frequently mentioned other drawbacks:

- Labour shortage (Quebec)
- Height of trees may affect the landscape (Quebec, Prairie provinces)

As illustrated above, the categories of factors mentioned (such as the “financial - markets” category) may appear under both “benefits” and “drawbacks”. This is attributable primarily to contexts (e.g. soils, weather conditions and markets) and to perceptions that vary for different participants. This situation also applies to the other technologies under study.

3.1.4 Anticipated implementation

Table 8 presents the proportion of participants who stated that they would apply SRIC over the next 5 years, by eligibility or ineligibility for a financial and technical support program.[6] Table 9 presents average areas that would be planted by participants who chose to apply the technology.

Table 8. Percentage of participants intending to apply short-rotation intensive culture, by support program eligibility and region

Support program eligibility	Quebec (n = 30)	Prairie provinces (n = 24)	Total (N = 54)
Yes	80%	83%	81%
No	64%[1]	33%	50%

[1] Two participants did not answer this question.

Table 9. Average area under prospective short-rotation intensive culture, by support program eligibility and region

Support program eligibility	Quebec	Prairie provinces	Total
Yes	9.4 ha	9.5 ha	9.4 ha
No	2.4 ha	6.1 ha	3.5 ha

If they were eligible for a financial and technical support program:

- Eight out of ten participants would apply this technology over the next 5 years on an average area of about 10 ha.
- The average area planted would be similar in the case of both Quebec and Prairie province participants.

If there is no financial and technical support, we observe:

- An overall decline of the order of 30% in participants' intention to apply the technology.
- A steeper decline in the Prairie provinces than in Quebec, possibly because SRIC is newer there than it is in Quebec.
- A decline in the prospective average area under SRIC; this decline seems steeper in Quebec than in the Prairie provinces.

These results indicate considerable potential for the implementation of SRIC in Quebec and the Prairie provinces if a financial and technical support program were made available.

3.1.5 Information learned in the focus group

Table 10 indicates how much the participants felt they had learned about SRIC in the focus group.

[6] According to this scenario, financial support would amount to approximately 75% of establishment costs.

Table 10. Distribution of participants' levels of learning about short-rotation intensive culture, by region

Information learned	Quebec (n = 38)	Prairie provinces (n = 28)	Total (N = 66)
No	8%	4%	6%
Yes, a little	32%	57%	42%
Yes, a lot	58%	39%	50%
No answer	3%	0%	1%
Total	100%	100%	100%

Overall, the results show that 92% of the participants felt that they had learned (either a little or a lot) about SRIC.

Participants who reported that they had learned a lot accounted for a larger fraction of the total in Quebec (58%) than in the Prairie provinces (39%). These results may be attributable to the fact that Quebec participants rated their initial knowledge levels lower (62% low or very low) than their Prairie province counterparts (25% low or very low). Participants with a low or very low initial knowledge level tended to be those who reported that they had learned a lot, whereas participants with a moderate, high or very high initial knowledge level tended to be those who said that they had learned only a little.

After estimating how much they had learned, the participants were invited to indicate which of the subjects discussed seemed to them to have been the most useful. The results are presented in Table 11.

Table 11. Categories of subjects considered the most useful in the context of focus group discussions on short-rotation intensive culture, by region

Subject category	Quebec (n = 35)	Prairie provinces (n = 33)	Total (N = 68)
Technical	28%	36%	32%
• Equipment/Methods/Risks	(23%)	(30%)	(26%)
• Site-specific	(0%)	(0%)	(0%)
• Comparison with other crops	(0%)	(3%)	(1%)
• Yields	(5%)	(3%)	(5%)
Financial	17%	33%	25%
• General	(0%)	(3%)	(1%)
• Costs	(0%)	(12%)	(6%)
• Markets	(17%)	(18%)	(18%)
Legal	3%	0%	1%
Environmental	14%	3%	9%
Other	37%	27%	32%
Total	100%	100%	100%

A review of the above table reveals the following:

- One third of the subjects that were considered the most useful had to do with technical aspects, and in particular culture methods.
- One third of the subjects are in the "Other" category and had to do with general matters such as participants' approval of the interactive focus group approach and the sharing of information.
- One quarter of the subjects had to do with financial aspects, and in particular the issue of potential markets.
- Close to 10% of the subjects had to do with environmental aspects, such as environmental uses of willows.

3.1.6 Change in interest level

In general, during the focus group exercise, interest in SRIC increased for close to 60% of the participants, remained unchanged for one participant out of three (33%) and declined for 6% of the participants (Table 12).

Table 12. Change in interest in short-rotation intensive culture, by region

Interest level	Quebec (n = 38)	Prairie provinces (n = 28)	Total (N = 66)
Diminished	3%	11%	6%
Did not change	29%	39%	33%
Increased	66%	46%	58%
No answer	3%	4%	3%
Total	100%	100%	100%

Interest levels increased more in the case of Quebec participants, possibly because their initial knowledge levels were lower than those of participants from the Prairie provinces. The proportion of respondents who indicated no change in their interest level was relatively higher in the case of participants from the Prairie provinces.

The main reasons given by the participants to explain their increase in interest level were:

- Acquisition of knowledge during the focus group session (mentioned 12 times)
- Exchanges with other producers in the focus group (10 times)
- Perception of a shift towards the use of this technology (e.g. increase in afforested areas and R&D and technology transfer activities) (5 times)

Three reasons were given when there was no change in interest level:

- The participant was already interested and remained interested (7 times)
- The participant was not interested and remained uninterested (3 times)
- The participant had already chosen one or more afforestation technologies other then SRIC (twice)

The main reasons given by participants to explain a decrease in interest level were as follows:

- Lack of concrete information, particularly about markets (once)

- Establishment costs too high (once)
- A technology that is not yet economically viable, but will become so (once)

3.1.7 Missing or unclear aspects of the non-specialist presentation

Table 13 presents categories of aspects for which information given in the non-specialist presentation was deemed to be missing or unclear.

Table 13. Categories of missing or unclear aspects in the presentation on short-rotation intensive culture, by region

Categories of aspects identified	Quebec (n = 41)	Prairie provinces (n = 109)	Total (N = 150)
Technical	58%	62%	61%
• Equipment/Methods/Risks	(48%)	(39%)	(42%)
• Site-specific	(0%)	(10%)	(7%)
• Comparison with other crops	(5%)	(7%)	(7%)
• Yields	(5%	(6%)	(5%)
Financial	29%	27%	27%
• General	(10%)	(10%)	(10%)
• Costs	(2%)	(6%)	(5%)
• Markets	(17%)	(11%)	(13%)
Legal	0%	0%	0%
Environmental	12%	3%	5%
Other	0%	8%	6%
Total	100%	100%	100%

Close to 90% of the aspects identified were technical or financial in nature. Participants would like to have more information about production methods and the economic viability of SRIC.

The following is a more detailed list of the main aspects that were deemed to have been missing or unclear, by subject category:

Technical aspects:

- Weed control (Quebec)
- Technical information on various aspects of SRIC (Quebec)
- Machinery used (Prairie provinces)
- Distance between outplants (Prairie provinces)
- Coppicing (Prairie provinces)

Financial aspects:

- Better breakdown of production costs (Prairie provinces)
- Specific information on labour costs (Prairie provinces)
- More specific identification of markets (Quebec, Prairie provinces)

- Market potential for cuttings and mulch (Quebec)
- Location/distance of markets (Prairie provinces)

Legal aspects:

- No legal aspects were mentioned

Environmental aspects:

- Carbon credits (Prairie provinces)
- Phytoremediation (Quebec)
- Biotreatment of effluent (Quebec)
- Long-term impact of SRIC on soils (Prairie provinces)

Most frequently mentioned other aspect:

- Language used in presentations should be more accessible to a non-specialist audience; area measurements should be expressed in acres (Prairie provinces)

3.1.8 Additional comments

Space was provided at the end of the questionnaire to allow participants to make additional comments.

In all, 31 comments were submitted:

- 21 were positive, especially those submitted by Quebec participants
- 7 were neutral
- 3 were negative

The main positive comments included:

- The focus group formula was described as interesting and informative, especially the non-specialist presentation, the discussions among participants, and the fact that more than one technology was discussed in a single focus group
- There was a suggestion that experimental and demonstration sites could be established in various regions
- According to representatives of pulp and paper companies, SRIC is a biomass source worth exploring for energy production in pulp and paper manufacturing

Neutral comments included:

- Suggestions about the focus group formula, such as providing participants with an outline description of focus group procedures in advance

The negative comments were expressed by representatives in the Prairie provinces. They had mainly to do with:

- Lack of practical experience in promoting this new technology
- Uncertainties as to markets

3.1.9 Issues

This section describes issues relating to research and development (R&D) and implementation (I) identified from the unprocessed results generated by the focus groups on SRIC. They are presented in the form of actions, broken down by the five categories of perceived benefits and drawbacks.

Technical aspects:

- Specify characteristics of sites suitable for SRIC (R&D)
- Document available clones (e.g. their shape, productivity and adaptability to ecological regions) (R&D)
- Ensure an adequate supply of cuttings of clones appropriate for the implementation regions[7] (I)
- Adapt and develop machinery for small and mid-size operations (R&D)
- Adapt the crop design (e.g. row spacing) to suit specific contexts, such as available machinery and production objectives (I)
- Specify stages in ground preparation as indicated by the site condition (soil composition, drainage, brush cover) (I)
- Specify measures to control competing vegetation, insects and disease (R&D, I)
- Evaluate risks of encouraging pests (insects, diseases and animals) that are harmful to other crops (R&D)
- Specify growth and yields in an operational context on the basis of various culture cycles and fertilization levels (R&D)
- Specify the medium- and long-term impacts of SRIC on soil characteristics (R&D)
- Specify how willow stumps are to be eliminated, either during or at the end of a rotation (20-25 years) (R&D)
- Specify storage and handling details for biomass produced from the operation (R&D)

Financial aspects:

- Specify production, harvesting and storage costs in an operational context (R&D, I)
- Identify potential markets by region (location, quantities, prices, trends), especially for the energy sector (R&D)

[7] Authors' note: In Quebec, the availability of willow cuttings has improved over the years, especially since 2007.

- Develop models that can be used to assess the economic viability of crops under various scenarios (R&D)

- Introduce incentives aimed at promoting the implementation of this new technology (e.g. technical and financial support programs and tax incentives) (I)

Legal aspects:

- Specify the status (agricultural crop, forest crop or other, e.g. energy crop) of SRIC, as that status affects the available incentives, zoning constraints and regulatory constraints (I)

Environmental aspects:

- Assess environmental risks associated with the introduction of exotic species, especially in the case of large-scale willow monoculture (R&D)

- Specify the carbon sequestration potential of SRIC (R&D)

- Evaluate the carbon budget for biofuel production from biomass, and perform analyses of the production and processing life cycle for biomass produced from SRIC (R&D)

- Specify the technical potential of environmental uses of willow, such as bioremediation, effluent treatment, slope stabilization, plant walls, etc., primarily to identify the corresponding markets (R&D)

Other aspects:

- Transfer knowledge about SRIC to those responsible for implementing agricultural and forestry incentive programs, and also to landowners (I)

- Involve research bodies, government agencies and landowners' associations (e.g. the UPA in Quebec) to disseminate knowledge of SRIC and promote its adoption, in particular by relying on its benefits and positive perceptions in terms of the environment (I)

- Prepare an inventory of producers and users and promote networking between the two groups (I)

3.2 Block plantation of hybrid poplar

The focus groups on block plantation of hybrid poplar (BPHP) were held in Quebec only, given that the study by Smith et al. (2005) reports the results for the Prairie provinces on the cultivation of fast-growing, high-yield species, such as hybrid poplar.

The results presented here are compared with those found by Smith et al. (2005) for shared variables.

3.2.1 Initial knowledge and experience level

Table 14. Distribution of participants' initial knowledge and experience levels with respect to block plantation of hybrid poplar

Level	Distribution N = 28[1]
Very low	32%
Low	18%
Average	25%
High	25%
Very high	0%
Total	100%

[1] N indicates the number of participants. It should be noted that for the 10 participants in the pilot focus group of July 13, 2006, initial knowledge and experience levels were not measured.

Most of the Quebec participants rated their initial knowledge level as low. Indeed, half of them described their knowledge and experience level as low or very low, while 25% of them gave themselves a "high" or "very high" rating. This variable was not measured by Smith et al. (2005).

3.2.2 Perceived benefits

As shown in Table 15, one third of the perceived benefits are technical. Environment-related benefits and financial benefits account for 30% and 28% respectively of the benefits identified by the participants.

Table 15. Categories of perceived benefits associated with block plantation of hybrid poplar

Perceived advantage category	Distribution N = 141
Technical	34%
• Equipment/Methods/Risks	(17%)
• Site-specific	(0%)
• Comparison with other crops	(8%)
• Yields	(9%)
Financial	30%
• General	(23%)
• Costs	(5%)
• Markets	(2%)
Legal	1%
Environmental	28%
Other	6%
Total	100%

Main technical benefits:

- Well known type of crop (more so than willow)
- Availability of adapted, homogeneous clones with good survival rates
- Requires smaller quantities of pesticides than conventional agriculture
- Needs relatively little maintenance work
- Mechanization feasible
- Availability of the necessary equipment
- Adequate technical assistance available
- Highly productive over the medium term
- Means of making good use of soils and land unsuitable for agriculture or less accessible land
- Means of increasing annual allowable cut

Main financial benefits:

- Availability of markets (pulp and paper mills, sawmills, peeling)
- Economies of scale possible for site preparation, harvesting and marketing owing to extensive homogeneous blocks
- Availability of financial and technical support (easier to obtain than in the case of willow)
- Increased profitability because of shorter rotations (15-25 years) than in the case of traditional species
- Relatively quick return on investment, during the lifetime of the farmer or landowner
- Characteristics of hybrid poplar wood make it suitable for use in the pallet market
- Transportation cost savings because of proximity to road network and processing centres
- Forward averaging of tax on income from harvests (since 2006)

Main legal benefits:

- Status of forestry producer, which confers eligibility for the Real Estate Tax Reimbursement Program
- Hybrid poplar not subject to the Loi sur la mise en marché des produits agricoles du Québec[8]

Main environmental benefits:

- Carbon sequestration
- Tool for combatting non-point-source pollution and noise pollution
- Tool for controlling wind erosion
- Wildlife-friendly (creation of habitat, shelter, corridors; return of game species)
- Increased biodiversity compared with conifers
- Allows application of the triad concept[9] through intensive silviculture

[8] This statement is false. As we shall see in due course, participants' perceptions will be validated at a later stage in our research.

[9] The triad/quad zoning concept has been succinctly defined by the Réseau Ligniculture Québec (2004). Essentially, this approach calls for full conservation on 12% of all forest lands, ecosystem management on 74%, conventional intensive management on 10% and ultra-intense management (i.e., intensive silviculture with fast-growing species) on 4% of those lands.

- Reduces harvesting pressure on (public) natural forests

Most frequently mentioned other benefits:

- Landscape enhancement, among other things, being more aesthetic than abandoned farm lands
- "Caring for forests" ripple effect in the case of intensive silviculture
- Good learning opportunity for landowner
- Improvement in corporate image

In general, perceived benefits are similar to those identified by Smith et al. (2005) in the Prairie provinces. These authors found that the main technical benefits were the utilization of abandoned land and the utilization of trees as a new crop. In terms of the financial aspect, the benefits identified in the Prairie provinces were the possibility of stable, diversified long-term income and a possible increase in land values.

The environmental benefits identified by Smith et al. (2005) include the benefits associated with the creation of microclimates, snow retention and the establishment of shelterbelts. The authors mention no tax-related or legal benefits, but a further advantage they do identify is the potential value of plantings of fast-growing species as a means of keeping the farm in the family.

3.2.3 Perceived drawbacks

As seen from Table 16, technical and financial drawbacks account for over 80% of all the drawbacks mentioned. Of these, close to half fall into the technical "equipment, methods and risks" category.

Table 16. Categories of perceived drawbacks associated with block plantation of hybrid poplar

Perceived drawback category	Distribution N = 157
Technical	47%
• Equipment/Methods/Risks	(37%)
• Site-specific	(2%)
• Comparison with other crops	(4%)
• Yields	(4%)
Financial	35%
• General	(15%)
• Costs	(12%)
• Markets	(8%)
Legal	6%
Environmental	3%
Other	8%
Total	100%

Main technical drawbacks:

- Machinery required for site preparation and maintenance
- Site preparation methods still under development
- Planting not mechanized
- Lack of knowledge transfer and technical training
- Research required to specify the fibre characteristics of clones and associated silvicultural treatments
- Maintenance work required during the initial years
- Technology more complex than that used for conifers
- Requires a high level of expertise and experience in enterprises wishing to produce hybrid poplar
- Few specialists to evaluate soil quality and fertilization needs
- Is a species that requires rich soils with specific characteristics
- Heat capacity remains to be determined
- Probability of planting success low or uncertain
- Wood with high water content, a financial constraint for transportation
- Stump removal necessary after harvesting
- Risks associated with large-scale monoculture
- Post-harvest stump sprout development risk remains to be determined
- Risk of spread of insect pests and disease
- Risk of browsing by deer or felling by beavers
- Possibility that hybrid poplars may obstruct or damage agricultural drains

Main financial drawbacks:

- Substantial establishment and maintenance costs
- Establishment of hybrid poplar not subsidized by some private forest development agencies
- Some agencies have limited budgets for establishment support
- Owner must have over 4 ha of land suitable for afforestation in order to be eligible for financial and technical support from regional private forest development agencies
- Period of 15 to 20 years before planting will produce any income (long-term investment)
- Reimbursement of property taxes is a marginal form of assistance for large firms
- Property assessment goes up if land is afforested
- Tax collected at harvest discourages investment for the establishment of plantations
- Existing markets (pulp, panelboard, lumber, peeling) not obvious prospects
- Medium- and long-term markets uncertain
- Hybrid poplar has a poor reputation as lumber
- No carbon sequestration market
- Less profitable than agriculture in the case of good land
- Economic viability uncertain

Main legal drawbacks:

- Not recognized as an agricultural crop
- Agricultural zoning is a major constraint on the establishment of plantations of hybrid poplar on old fields
- Considerable energy is sometimes required to obtain permission to change the authorized use of a plot of land
- Regulations in force in municipalities create uncertainty concerning the possibility of harvesting trees on private land

Main environmental drawbacks:

- Risk of a decline in biodiversity, as deciduous forests are usually mixed
- Risk that mechanical weeding may cause soil erosion
- Less carbon sequestration than in the case of spruce

Most frequently mentioned other drawbacks:

- Hybrid poplar has had a bad press owing to failures resulting from the use of unsuitable clones
- Difficult to return land to agricultural use afterward
- Risk of losing areas of farmland
- There are still many unknowns (markets, diseases, fertilization)
- The ministère des Ressources naturelles et de la Faune, one of the agencies' partners, does not believe in the culture of hybrid poplar
- The risk that environmental groups may regard the technology as unacceptable remains to be assessed, especially as regards the issues of monoculture and drainage basins
- Difficult to persuade regional private forest development agencies and society to accept BPHP
- Funding for research difficult to obtain because of the small number of users

The study by Smith et al. (2005) identifies essentially the same technical and financial drawbacks. In the Prairie provinces, however, concerns about establishment costs and market uncertainty were less frequently raised. The legal framework governing hybrid poplar growing in the Prairie provinces was not mentioned at all. On the other hand, the risk of fire was brought up only for the Prairie provinces.

3.2.4 Anticipated implementation

Table 17 presents the proportion of participants who stated that they would apply BPHP over the next 5 years, by eligibility or ineligibility for a financial and technical support program.[10] Table 18 presents average areas that would be planted by participants who chose to apply the technology.

[10] Under this scenario, financial support would amount to approximately 75% of establishment costs.

Table 17. Percentage of participants intending to apply block plantation of hybrid poplar, by support program eligibility

Support program eligibility	Distribution N = 36[1]
Yes	70%
No	37%

[1] Two missing responses in the case of ineligibility; in this case, the computation is based on 34 responses.

Table 18. Average area of prospective block plantation of hybrid poplar, by support program eligibility

Support program eligibility	Area
Yes	81 ha
No	20 ha

If they were eligible for a financial and technical support program, seven out of ten participants would apply this technology within the next 5 years on an average area of approximately 80 ha. In the absence of financial and technical support, close to four out of ten participants would apply the technology on an average area of 20 ha.

These results indicate considerable potential for the implementation of BPHP in Quebec. However, the absence of a support program would have a significant impact in the form of a decline of over 30% in the proportion of participants who would apply the technology, and an average area that is only one fourth of what it would be if a program were available.

The study by Smith et al. (2005) did not address this aspect.

3.2.5 Information learned in the focus group

An overwhelming majority (92%) of participants said that they had learned something about BPHP during the focus group exercise (see Table 19).

Table 19. Distribution of participants' levels of learning about block plantation of hybrid poplar

Information learned	Distribution N = 37
No	8%
Yes, a little	54%
Yes, a lot	38%
Total	100%

Table 20. Categories of subjects considered the most useful in the context of focus group discussions on block plantation of hybrid poplar

Subject category	Distribution N = 39
Technical	31%
• Equipment/Methods/Risks	(18%)
• Site-specific	(3%)
• Comparison with other crops	(0%)
• Yields	(10%)
Financial	20%
• General	(0%)
• Costs	(0%)
• Markets	(20%)
Legal	0%
Environmental	0%
Other	49%
Total	100%

A review of Table 20 reveals the following:

- Half the subjects considered the most useful are in the "Other" category and have to do with such matters as discussions among participants, the diversity of points of view, information received, and the benefits and drawbacks discussed by the group.

- The second group of subjects identified most frequently consists of technical aspects such as planting and maintenance methods, risks of disease, data on yields and probabilities of success.

- Subjects relating to financial aspects had to do mainly with the issue of potential markets (quantities, prices).

- None of the participants identified any legal or environmental subjects as having been among the most useful topics discussed.

The study by Smith et al. (2005) does not address the issue of learning within the focus group.

3.2.6 Change in interest level

As shown in Table 21, for 62% of the participants, their interest in BPHP did not change during the course of the focus group exercise. The percentage of participants who reported that their interest in the technology had decreased was the same as the percentage who reported that it had increased.

Table 21. Change in interest in block plantation of hybrid poplar

Interest level	Distribution N = 37[1]
Diminished	19%
Did not change	62%
Increased	19%
Total	100%

[1] Data provided by 37 participants, as one did not answer.

The main reasons given by the participants to explain their increase in interest were:

- Acquisition of knowledge (3 times)
- Comments from other participants (twice)
- Participants' confidence in this crop (once)

It is therefore reasonable to assume that the information obtained in the course of the discussion and conversations among the participants go a long way toward explaining increases in interest level.

The main reasons given where there was no change in interest level were as follows:

- The participant was already thoroughly acquainted with the subject or had not acquired any new knowledge (3 times)
- Uncertainty about potential markets (3 times)
- Return on investment too long (once)
- The participant saw it as being primarily in the interest of companies that use the fibre to adopt the technology (once)
- Significance of the drawbacks (once)

Absence of a change in interest is therefore partially attributable to the fact that the participants concerned did not acquire any new knowledge about the subject. For other participants, the situation was attributable to limiting factors, most of them having to do with the technology's uncertain economic viability.

The main reasons given by some participants to explain why their interest in BPHP had decreased were as follows:

- Markets unknown or uncertain (3 times)
- This is a high-risk crop in relation to the return on investment (once)
- Another monoculture with disease risks (once)
- Low heat value of the wood (once)
- Necessity of working on large areas with little prospect of economic viability (once)
- Absence of studies on the technology (once)
- Requirements of the regional agency on funding for the afforestation of lands zoned for agricultural use, especially as regards obtaining authorization from the ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec (MAPAQ) (once)
- Technology not intended for implementation by a farmer (once)

Decreased interest is very largely attributable to financial uncertainty, the technical risks involved, and some negative characteristics associated with BPHP.

3.2.7 Missing or unclear aspects of the non-specialist presentation

Over 90% of the missing or unclear aspects identified by participants were technical and financial (see Table 22)

Table 22. Categories of missing or unclear aspects in the presentation on block plantation of hybrid poplar

Categories of aspects identified	Distribution N = 53
Technical	57%
• Equipment/Methods/Risks	(49%)
• Site-specific	(2%)
• Comparison with other crops	(4%)
• Yields	(2%)
Financial	36%
• General	(12%)
• Costs	(0%)
• Markets	(24%)
Legal	4%
Environmental	2%
Other	2%
Total	100%

The main missing or unclear aspects, by subject category, were as follows:

Technical aspects:

- Possibility of training for forestry advisers
- Current R&D on BPHP
- Pilot projects for plantations of this type
- Plantation density
- Work required (site preparation, shaping, pruning, etc.)
- Modifications required to adapt the necessary work to different regions, sites and project objectives
- Benefits and drawbacks of various harrowing methods
- Technologies for producing heat from chips
- Proportion of afforestation with hybrid poplar plantations in a forest environment after logging
- Risk of stem dieback after planting
- Risk of browsing
- Risk of freezing rain
- Minimum soil depth should be 1 m, not 30 cm
- Hybrid poplar is inferior to willow in terms of leachate filtering capacity
- Comparison of hybrid poplar with pine and spruce
- The fact that planting success is not a matter of luck

Financial aspects:

- Cultivation objectives for plantations of this type
- Factors that may affect the economic viability of plantations: treatment costs, variations in growth and yield in different regions, and impact of wood quality on product prices
- Explain that activities subsidized by private forest development agencies are 50% funded in some regions and 80% in others
- See whether the European or American contexts can provide any useful precedents in the matter of markets, and develop comparisons with other species
- Specify moulding, panelboard and pulp markets
- Differentiate between thin peeling and thick peeling markets

Legal aspects:

- Efforts by some organizations to have hybrid poplar recognized as an agricultural crop
- Procedures involved in securing recognition as a forestry producer

Environmental aspects:

- Types of wildlife habitats created by hybrid poplar

Other aspects:

- Objectives and role of the Canadian Forest Service
- Reasons behind the Quebec government's interest in developing BPHP

Smith et al. (2005) point out the need for information—both for private landowners and the public at large—on various issues such as carbon sequestration and the technical aspects of plantations. These authors identify means of meeting those needs, including in particular information programs, technical manuals and best-practice guides.

As regards financial aspects, the main information needs identified are those relating to establishment costs, estimated return on investment, model business plans and quantified data on opportunity costs and financial incentives.

These points in the study by Smith et al. (2005) generally reflect the type of information on BPHP that Quebec focus group participants said they would like to have. However, the issues raised by the latter place greater emphasis on the various risks involved, prospective markets, and legal considerations.

3.2.8 Additional comments

In all, 13 general comments were submitted:

- 8 were positive
- 4 were neutral
- 1 was negative

The main positive comments included the following:

- Generally favourable view of the meeting (thanks; it was most interesting)
- Favourable view of discussions with other participants
- Desirability of combining BPHP with other species as a means of avoiding monoculture
- Interest in BPHP even if it is a crop that requires more work than anticipated
- The fact that the Canadian government is interested in developing BPHP in Quebec and elsewhere in Canada

Neutral comments included the following:

- More knowledge needed about the risk of diseases affecting hybrid poplars
- "Research on hybrid poplars is essential, but where will that lead us?"
- Need for meetings aimed at developing interest and markets
- In the Lanaudière region (Quebec), peeler logs would fetch prices of approximately \$75 to \$80/m^3

A single negative comment was submitted:

- "I do not believe that promoting plantations of this kind is a good thing."

3.2.9 Issues

Issues are presented below broken down in accordance with the various aspects selected for purposes of this study, with an indication of whether they have to do with research and development (R&D) or implementation (I) of the BPHP technology. They are identified mainly on the basis of perceived drawbacks, information deemed missing or unclear, and reasons for no change in interest or a decrease in interest in BPHP.

Technical aspects:

- Specify and disseminate information about soil characteristics and fertilization needs required for BPHP (R&D, I)

- Determine and document the characteristics of the various clones (e.g. their requirements, growth and yields, pest resistance, ability to withstand freezing rain) and the quality of their wood fibre for various uses, including energy production (R&D, I)

- Aim at mechanized site preparation, planting and plantation maintenance, mainly by identifying, developing and adapting appropriate machinery (R&D)

- Identify or develop affordable browsing control techniques (R&D)

- Assess the risk of obstruction or damage of drainage systems by the roots of hybrid poplars (R&D)

- Specify how stumps can be removed after final harvesting and estimate the cost of this operation (R&D, I)

Financial aspects:

- Specify the reasons why no technical and financial support for BPHP is available from some regional private forest development agencies (R&D)

- Evaluate potential and feasibility of making technical and financial assistance for BPHP available to landowners with less than 4 ha of land suitable for afforestation (I)

- Evaluate barriers to the implementation of this technology resulting from increased property assessment associated with planting of hybrid poplar and taxation of harvest income (R&D)

- For industrial plantations on private land, evaluate the potential of incentives other than reimbursement of property taxes (I)

- Identify medium-term and long-term (15 years or more) markets for hybrid poplar (location, trends, demand), including conventional sectors (lumber, pulp, peeling), the bioproduct sector (biofuels and other items) and carbon sequestration (R&D)

- Develop models for assessing the economic viability of BPHP under various scenarios, taking the opportunity cost of an agricultural use into account, and identify the main factors affecting economic viability (R&D)

Legal aspects:

- Identify and evaluate the feasibility of accommodation with a view to facilitating hybrid poplar culture on abandoned farmlands, taking into account current agricultural zoning constraints (I)

- Explore the possibility of having BPHP recognized as an agricultural crop in order to avoid agricultural zoning constraints (I)

- Evaluate the risk of municipal regulations that may compromise harvesting trees on private land (R&D)

Environmental aspects:

- Determine net carbon sequestration associated with plantations of hybrid poplar under various scenarios incorporating such variables as site condition before planting and site preparation and maintenance techniques (R&D)

- Determine the impact of BPHP on wildlife habitat and biodiversity (R&D)

Other aspects:

- Strengthen knowledge transfer and training on BPHP-related technical, financial, legal and environmental issues for various stakeholders, including landowners and technical advisers in particular (I)

- Initiate demonstration pilot projects designed primarily to correct some stakeholders' negative perceptions of hybrid poplar (I)

3.3 Willow-based riparian buffer systems

3.3.1 Initial knowledge and experience level

Close to 70% of the participants rated their initial level of knowledge about riparian buffers "low" or "very low" (see Table 23). Initial knowledge levels for Quebec participants (21% of whom gave themselves "high" or "very high" ratings) were generally higher than those for participants from the Prairie provinces (93% of whom rated their knowledge levels "low" or "very low"). This pattern is probably attributable to the fact that the protection of streams in farming areas is more of an issue in Quebec, mainly because of the problem of cyanobacteria (blue-green algae).

Table 23. Distribution of participants' initial knowledge and experience levels with respect to riparian buffers, by region

Level	Quebec (n = 14)	Prairie provinces (n = 28)	Total (N = 42)
Very low	0%	29%	19%
Low	21%	64%	50%
Average	57%	4%	21%
High	7%	4%	5%
Very high	14%	0%	5%
Total	100%	100%	100%

3.3.2 Perceived benefits

Table 24 shows perceived benefits, broken down in accordance with the categories selected, for each of the two regions and for all participants.

Table 24. Categories of perceived benefits associated with willow-based riparian buffer systems, by region

Perceived advantage category	Quebec (n = 47)	Prairie provinces (n = 138)	Total (N = 185)
Technical	38%	23%	27%
• Equipment/Methods/Risks	(17%)	(23%)	(21%)
• Site-specific	(6%)	(0%)	(2%)
• Comparison with other crops	(0%)	(0%)	(0%)
• Yields	(15%)	(0%)	(4%)
Financial	8%	16%	14%
• General	(4%)	(14%)	(11%)
• Costs	(0%)	(1%)	(1%)
• Markets	(4%)	(1%)	(2%)
Legal	6%	9%	9%
Environmental	30%	42%	39%
Other	17%	9%	11%
Total	100%	100%	100%

Technical and environmental benefits account for two thirds of the total. As we shall see, the legal benefits identified by the participants derive from environmental benefits.

Main technical benefits:

- Availability of a number of varieties/clones (Quebec, Prairie provinces)
- Establishment of buffers easy and quick (Quebec, Prairie provinces)
- Homogeneous cover making weed control easy (Quebec)
- High growth rates and yields (Quebec)
- Sprouting after harvesting (coppicing) (Quebec)

Main financial benefits:

- Increase in resale value of property (Prairie provinces)
- Income from wood sales (Quebec, Prairie provinces)
- Government incentives available (Prairie provinces)
- Diversified potential markets (e.g. pulp and paper, carbon) (Quebec)

Main legal benefits:

- Compliance with environmental regulations (Quebec)
- Protection of downstream water quality (Quebec)
- Reduction in legal action relating to downstream pollution (Prairie provinces)
- Reduction in legal action relating to downstream flooding (Prairie provinces)

Main environmental benefits:

- Filtration capacity improving water quality (Quebec, Prairie provinces)
- Erosion control and bank stabilization (Quebec, Prairie provinces)
- Carbon sequestration (Prairie provinces)
- Creation of new ecosystems (Prairie provinces)
- Wildlife habitat improvement (Quebec, Prairie provinces)
- Shelterbelt function (Quebec)

Most frequently mentioned other benefits:

- Landscape enhancement (Quebec, Prairie provinces)
- Positive perception by community (Quebec)
- Demonstration potential reached quickly (Quebec)
- Increase in rural forest cover (Quebec)
- Fishing, ecotourism (Prairie provinces)
- Potential for job creation if economically viable (Prairie provinces)

3.3.3 Perceived drawbacks

Table 25 shows perceived drawbacks, broken down in accordance with the categories selected, for each of the two regions and for all participants.

Table 25. Categories of perceived drawbacks associated with willow-based riparian buffer systems, by region

Perceived drawback category	Quebec (n = 44)	Prairie provinces (n = 139)	Total (N = 183)
Technical	32%	43%	40%
• Equipment/Methods/Risks	(32%)	(41%)	(38%)
• Site-specific	(0%)	(1%)	(1%)
• Comparison with other crops	(0%)	(0%)	(0%)
• Yields	(0%)	(1%)	(1%)
Financial	48%	35%	38%
• General	(43%)	(15%)	(22%)
• Costs	(5%)	(17%)	(14%)
• Markets	(0%)	(3%)	(3%)
Legal	4%	5%	5%
Environmental	4%	13%	11%
Other	11%	4%	5%
Total	100%	100%	100%

Overall, close to 80% of the perceived drawbacks were financial or technical in nature. Participants from the Prairie provinces identified a higher proportion of technical and environmental drawbacks, while the drawbacks identified by Quebec participants were mainly financial.

Main technical drawbacks:

- Risk of obstruction of or damage to agricultural drains by willow roots (Quebec)
- Limits access to streams (Quebec, Prairie provinces)
- Difficulty installing mulch (Quebec)
- New equipment required with limited availability (Prairie provinces)
- Difficulty harvesting on small areas along streams (Prairie provinces)
- Knowledge about these systems still very limited, especially knowledge of appropriate clones (Prairie provinces)
- Need to fence plantings (to prevent browsing) (Prairie provinces)
- Creation of new habitats that may encourage species that are harmful to other agricultural crops (Quebec, Prairie provinces)

Main financial drawbacks:

- Low or uncertain profitability owing to:
  - Loss of productive farmland (Quebec, Prairie provinces)
  - Loss of growth in adjacent areas (Quebec)
  - Uncertainty about the availability of support programs (Quebec, Prairie provinces)
  - High establishment and maintenance costs, for equipment acquisition in particular (Quebec, Prairie provinces)
  - Lack of details regarding costs and harvesting methods (Quebec)

- Absence of clearly defined markets, so marketing efforts will be required (Prairie provinces)

Main legal drawbacks:

- Risk that it may not be possible to harvest willow because of existing or future regulations (Quebec)
- Lack of tax incentives (Quebec)
- Legal action in the event of flooding that may be promoted by riparian buffers (Prairie provinces)

Main environmental drawbacks:

- Possible reduction in filtration following harvesting (Quebec)
- Risk of relaxing best agri-environmental management practices owing to a false sense of security (Quebec)
- Creation of wildlife habitats that may attract species such as mosquitoes which can spread the West Nile virus (Prairie provinces)
- Snowpack buildup may aggravate high flows (Quebec, Prairie provinces)

Most frequently mentioned other drawbacks:

- Addition of operations and time in farm management (Quebec)
- Lack of co-ordination among authorities with legislative power (Quebec)
- Possible negative image of the establishment of riparian buffers (Quebec)
- Ineffectiveness of incentive programs (Prairie provinces)
- No government long-term plan (Prairie provinces)
- Lack of public education (Prairie provinces)
- No links with other stakeholders who might be able to take advantage of the biomass that would become available (Prairie provinces)

A number of the drawbacks referred to are expressed as potential risks, such as the risk of obstructing agricultural drains, the risk that riparian buffers may not be economically viable, or that they may encourage harmful species.

3.3.4 Anticipated implementation

Table 26 presents the proportion of participants who stated that they would establish riparian buffers over the next 5 years, by eligibility or ineligibility for a financial and technical support program. Table 27 presents average areas that would be planted by participants who chose to apply the technology.

Table 26. Percentage of participants intending to establish willow-based riparian buffer systems, by support program eligibility and region

Support program eligibility	Quebec (n = 14) [1]	Prairie provinces (n = 28) [1]	Total (N = 42)
Yes	50%	63%	59%
No	10%	30%	24%

[1] In Quebec, data from four participants are missing because it would not be feasible to establish a riparian buffer on their lands. In the Prairie provinces, data from four participants have been omitted because they were members of the family of a participant who was a farmer.

Table 27. Average area of prospective willow-based riparian buffer systems, by support program eligibility and region

Support program eligibility	Quebec	Prairie provinces	Total
Yes	1.0 ha	4.2 ha	3.4 ha
No	3.0 ha[1]	3.6 ha	3.5 ha

[1] This increase in average area in the absence of an incentive program is explained by the fact that a landowner who stated that he intended to establish riparian buffers on 3 ha of land if he was eligible said that he would do the same even if he was not eligible. The four other participants who stated that they intended to establish buffers only if they were eligible would do so on smaller areas. Hence the average figure of approximately 1 ha.

Over half of the respondents stated that they would apply this technology over the next 5 years if they were eligible for a financial and technical support program. A higher percentage is observed for the Prairie provinces than for Quebec.

In the absence of financial and technical support, the results indicate:

- an overall decrease of over 50% in participants' intention to apply the technology
- a decrease that is more pronounced in Quebec than in the Prairie provinces
- a probable decrease in average area in the absence of a support program

These data seem to indicate high potential for implementation by early adopters given the availability of a support program. Absence of support programs would have a marked impact on implementation of the technology.

3.3.5 Information learned in the focus group

All participants reported that they had learned something about willow-based riparian buffer systems during the focus group exercise (see Table 28).

Table 28. Distribution of participants' levels of learning about willow-based riparian buffer systems, by region

Information learned	Quebec (n = 14)	Prairie provinces (n = 28)	Total (N = 42)
No	0%	0%	0%
Yes, a little	57%	64%	62%
Yes, a lot	43%	36%	38%
Total	100%	100%	100%

After indicating their levels of learning during the focus group exercise, participants were asked to indicate which of the subjects discussed they had found most useful. The results are shown in Table 29.

Table 29. Categories of subjects considered the most useful in the context of focus group discussions on willow-based riparian buffer systems, by region

Subject category	Quebec (n = 15)	Prairie provinces (n = 24)	Total (N = 39)
Technical	67%	46%	54%
• Equipment/Methods/Risks	(67%)	(46%)	(54%)
• Site-specific	(0%)	(0%)	(0%)
• Comparison with other crops	(0%)	(0%)	(0%)
• Yields	(0%)	(0%)	(0%)
Financial	26%	8%	15%
• General	(13%)	(8%)	(10%)
• Costs	(0%)	(0%)	(0%)
• Markets	(13%)	(0%)	(5%)
Legal	0%	0%	0%
Environmental	0%	12%	8%
Other	7%	33%	23%
Total	100%	100%	100%

Over 50% of the subjects deemed by the participants to have been most useful were in the "equipment, methods and risks" category. The "other" category came next with 23%, followed by "financial" with 15% and "environmental" with 8%.

Technical and financial aspects were cited more frequently in Quebec than in the Prairie provinces, whereas the reverse was the case for subjects in the "Other" category. The latter had to do with the functioning of the focus group, such as the way participants shared points of view and discussed benefits and drawbacks.

3.3.6 Change in interest level

As shown in Table 30, none of the 42 participants reported a decrease in his/her interest in willow-based riparian buffers in the course of the focus group exercise. Participants were

almost evenly divided between those whose interest levels had remained unchanged and those whose interest levels had increased.

Table 30. Change in interest in willow-based riparian buffer systems, by region

Interest level	Quebec (n = 14)	Prairie provinces (n = 28)	Total (N = 42)
Diminished	0%	0%	0%
Did not change	43%	57%	52%
Increased	57%	43%	48%
Total	100%	100%	100%

The main reasons given by participants who said there had been no change in their interest were:

- My land is not suitable for this technology (6 times)
- I was not interested and still am not interested (6 times)
- I was convinced before and remain convinced (twice)

Three main reasons were given in explanation of increased interest levels:

- Knowledge and information received during the course of the focus group (10 times)
- The benefits of the technology (e.g. filtering, benefits for beekeepers) (7 times)
- Potential profitability (5 times)

In terms of differences between the regions, we may note that virtually all the participants who said that there had been no change in their interest level because their land was not suitable for this type of technology were from the Prairie provinces.

3.3.7 Missing or unclear aspects of the non-specialist presentation

Over 80% of the missing or unclear aspects identified by participants were technical and financial (see Table 31).

Table 31. Categories of missing or unclear aspects in the presentation on willow-based riparian buffer systems, by region

Categories of aspects identified	Quebec (n = 58)	Prairie provinces (n = 96)	Total (N = 154)
Technical	50%	56%	54%
• Equipment/Methods/Risks	(44%)	(51%)	(49%)
• Site-specific	(3%)	(2%)	(2%)
• Comparison with other crops	(3%)	(0%)	(1%)
• Yields	(0%)	(3%)	(2%)
Financial	33%	24%	27%
• General	(16%)	(6%)	(10%)
• Costs	(12%)	(5%)	(6%)
• Markets	(5%)	(13%)	(11%)
Legal	12%	3%	6%
Environmental	3%	4%	4%
Other	2%	12%	8%
Total	100%	100%	100%

Main technical aspects:

- Width and alignment of buffers (Quebec)
- Use of plastic mulch (Quebec)
- Site preparation and maintenance work required (Quebec, Prairie provinces)
- Possible releases of fertilizers and pesticides via the drainage system (Quebec)
- Possibility that the roots of the willows will obstruct agricultural drains (Quebec)
- Risks of wildlife damage to buffers (Quebec, Prairie provinces)
- Risk of damage to farm machinery (Quebec)
- Equipment and mechanization requirements (Prairie provinces)
- Varieties of willow that are suited to the climate, soil and slope of the land (Quebec, Prairie provinces)
- Comparison of willow with another species such as switchgrass (Quebec)
- Objectives and benefits of the technology should be specified (Prairie provinces)
- Weed control (Prairie provinces)

Main financial aspects:

- Data on financial viability (Quebec, Prairie provinces)
- Establishment, maintenance and harvesting costs (Quebec, Prairie provinces)
- Loss of arable land (Quebec)
- Potential markets (location, trends) for willow (Quebec, Prairie provinces)
- Incentives for the establishment of riparian buffers (Quebec)

Main legal aspects:

- Tax measures applicable to a reduction in arable land area owing to a buffer strip 10 m wide (Quebec)
- Minimum required distance away from a stream (Quebec)

- Regulations governing the width of riparian buffers more stringent in some regions (Quebec)
- Regulations applicable to a landowner who does not have agricultural producer status (Quebec)
- Legal and regulatory framework for pesticide spraying near streams (30 m strip) (Prairie provinces)
- Responsibilities associated with the planting of trees near streams (Prairie provinces)
- Landowner's responsibilities in the event no harvesting is done (Prairie provinces)

Main environmental aspects:

- Carbon budget and energy yield from this technology (Quebec)
- Energy yield as compared with the use of willow in SRIC (Quebec)
- Impact of this practice on water and the environment (Prairie provinces)
- Risk of causing high flows (Quebec)
- Surface water runoff containing fertilizing substances such as phosphorus (Prairie provinces)

Most frequently mentioned other aspects:

- Clarity of presentation, including the use of less technical terminology (Prairie provinces)
- Need for information about existing programs or policies (Prairie provinces)

3.3.8 Additional comments

Space was provided at the end of the questionnaire to allow the participants to make additional comments. As we have seen, not all participants availed themselves of the opportunity.

In all, 20 comments were made, 18 of which were from participants from the Prairie provinces. Nine comments were positive, four neutral and seven negative.

The main positive comments were as follows:

- "A relevant exercise that should be repeated with the same group a year from now, to discuss work accomplished and the extent to which target objectives have been met. Thank you for the invitation."
- "I am fascinated by the various uses of trees and am interested in new ways of using them in our environment."
- "Harvesting environmentally feasible. I also think that in the long run, it is a fantastic idea in environmental terms."
- "Quality of the presentation"
- "A useful and informative exercise"

Neutral comments included the following:

- "It is not desirable to create things that may cause other problems in the future; it is preferable to go for solutions that do not require work that has to be repeated regularly"

- "I am still interested, but there are a number of questions that should be addressed."

Negative comments submitted included the following:

- "Seems to be a government initiative with no grassroots support, no data, no reality; the focus group is not representative of a constituency of farmers."
- "In my opinion, applies only to a very specific situation."
- "There should be more of a focus on an environment with a number of species, not willow alone. There should be more of a focus on technology transfer."
- "On the issue of harvesting specifically, I do not think the benefits are viable".
- "Cost/income models required!"

3.3.9 Issues

On the basis of a review of the results obtained, it is possible to identify research and development (R&D) and implementation (I) issues arising in connection with willow-based riparian buffer systems. These issues are presented here in the form of actions for each aspect category discussed.

Technical aspects:

- Evaluate the risk that the roots of the willows may obstruct or damage agricultural drains (R&D)

- Determine to what extent fertilizers and pesticides may be discharged via drainage systems, thereby reducing the effectiveness of riparian buffers (R&D)

- Evaluate the risk of favouring the presence of insects, diseases or animals that are harmful to willows and other crops (R&D)

- Specify to what extent the reduced stream access resulting from riparian buffers represents a significant constraint for landowners (I)

- Specify harvesting methods, especially as regards constraints associated with operating on small areas (R&D)

- Specify whether the necessary equipment and its availability represent an implementation constraint (I)

- Specify to what extent riparian buffers cause growth and yield losses in adjacent crops (R&D)

Financial aspects:

- Specify harvesting costs (R&D)

- The cost estimate should take into account equipment acquisition, losses of arable land and possible decreases in yield for adjacent crops (R&D)

- Provide incentives for the implementation of this new technology (e.g. technical and financial support programs and tax incentives) (I)

- Specify potential markets (location, quantities, prices, trends) (R&D)

Legal aspects:

- Evaluate the risk of regulations that may compromise periodic harvesting of willow stems (I)

- Evaluate co-ordination among authorities with legislative power (I)

Environmental aspects:

- Determine whether the protection capacity of riparian buffers is significantly reduced following periodic harvesting of stems (R&D)

Other aspects:

- The additional operations and time that this crop requires would represent a significant extra workload for some landowners, especially farmers (I)

- Provide technology transfer agents and producers with non-specialist information (I)

3.4 Willow or hybrid poplar-based alley cropping

3.4.1 Initial knowledge and experience level

As shown in Table 32, the participants reported that they were fairly familiar with alley cropping in general (not necessarily with willow or hybrid poplar): close to 60% of them rated their initial knowledge and experience as high or very high, while 24% rated it as low or very low.

There were, however, significant regional disparities. In the Prairie provinces, 86% of the participants rated their knowledge and experience levels as high or very high, whereas the opposite was observed for Quebec participants, 71% of whom indicated a low or very low level of initial knowledge and experience.

Table 32. Distribution of participants' initial knowledge and experience levels with respect to alley cropping systems, by region

Level	Quebec (n = 14)	Prairie provinces (n = 28)	Total (N = 42)
Very low	50%	0%	17%
Low	21%	0%	7%
Average	21%	14%	17%
High	7%	43%	31%
Very high	0%	43%	28%
Total	100%	100%	100%

3.4.2 Perceived benefits

Table 33 shows that over 70% of all perceived benefits were technical or environmental.

Table 33. Categories of perceived benefits associated with willow or hybrid poplar-based alley cropping systems, by region

Perceived benefit category	Quebec (n = 51)	Prairie provinces (n = 105)	Total (N = 156)
Technical	27%	41%	36%
• Equipment/Methods/Risks	(20%)	(40%)	(33%)
• Site-specific	(1%)	(0%)	(1%)
• Comparison with other crops	(0%)	(0%)	(0%)
• Yields	(6%)	(1%)	(2%)
Financial	10%	23%	19%
• General	(8%)	(15%)	(13%)
• Costs	(0%)	(3%)	(2%)
• Markets	(2%)	(5%)	(4%)
Legal	2%	0%	1%
Environmental	45%	31%	36%
Other	16%	5%	8%
Total	100%	100%	100%

There were some clear differences between the two regions. Technical benefits were perceived more frequently in the Prairie provinces (41%) than in Quebec (27%). The same was true of financial benefits, with 23% in the Prairie provinces, compared with 10% in Quebec. In contrast, environmental benefits were mentioned more frequently in Quebec (45%) than in the Prairie provinces (31%).

Main technical benefits:

- Greater snow accumulation (Quebec, Prairie provinces)
- Shelterbelt effect (Quebec, Prairie provinces)
- Reduction in quantities of fertilizers applied (Quebec)
- Reduction in insecticide use (Quebec, Prairie provinces)
- Potential for increased overall per-hectare yields (Quebec)
- Crop diversification (Prairie provinces)
- Production of high-quality wood (Prairie provinces)
- Better use of space (Prairie provinces)
- Reconciliation of agricultural and forestry objectives (Prairie provinces)

Main financial benefits:

- Income diversification (Quebec, Prairie provinces)
- Potential for increased overall per-hectare income (Quebec, Prairie provinces)
- Possibility of earning carbon credits (Quebec, Prairie provinces)
- Increased income from land (Prairie provinces)
- Lower production costs as a result of using smaller-scale machinery (Prairie provinces)

Main legal benefits:

- Crop suitable in terms of meeting environmental standards (Quebec)
- (No benefits identified by participants from the Prairie provinces)

Main environmental benefits:

- Carbon sequestration (Quebec, Prairie provinces)
- Creation of wildlife habitats and increased biodiversity (Quebec, Prairie provinces)
- Soil stabilization or reduction of wind erosion (Quebec, Prairie provinces)
- Reduction in non-point-source pollution (Quebec)
- Reduction in insecticide use (Quebec)
- Better soil water retention (Prairie provinces)

Most frequently mentioned other benefits:

- Landscape enhancement (Quebec, Prairie provinces)
- Compliance with the multiple resource management plans of regional county municipalities (Quebec)

3.4.3 Perceived drawbacks

As shown in Table 34, close to 90% of the perceived drawbacks identified by the participants were technical (62%) or financial (25%) in nature.

Table 34. Categories of perceived drawbacks associated with willow or hybrid poplar-based alley cropping systems, by region

Perceived drawback category	Quebec (n = 57)	Prairie provinces (n = 103)	Total (N = 160)
Technical	56%	66%	62%
• Equipment/Methods/Risks	(47%)	(63%)	(56%)
• Site-specific	(0%)	(0%)	(0%)
• Comparison with other crops	(7%)	(0%)	(3%)
• Yields	(2%)	(3%)	(3%)
Financial	25%	25%	25%
• General	(11%)	(12%)	(11%)
• Costs	(14%)	(11%)	(12%)
• Markets	(0%)	(2%)	(2%)
Legal	9%	1%	4%
Environmental	2%	1%	1%
Other	9%	7%	7%
Total	100%	100%	100%

Main technical drawbacks:

- Row maintenance operations (Quebec)
- Need for new equipment, modifications to existing equipment and equipment-related problems arising from the attempt to practise both types of culture (e.g. risk of damaging trees with farm machinery and risk of damaging agricultural crops when harvesting trees) (Quebec, Prairie provinces)
- Risk of competition between agricultural crops and tree crops, e.g. competition for sunlight (Quebec, Prairie provinces)
- Creation of habitats that may encourage agricultural crop pests (Prairie provinces)
- Risk of increased moisture that would be harmful to agricultural crops (Quebec, Prairie provinces)
- Risk that the roots of the trees may obstruct or damage agricultural drains (Quebec)
- Stumps must eventually be removed (Quebec)
- General lack of knowledge about this type of culture system (Prairie provinces)

Main financial drawbacks:

- The establishment of hybrid poplars would entail significant costs that would have to be borne for 15-20 years before there would be any prospect of obtaining income from wood sales (Quebec)
- Cost of modifying farm machinery (Quebec)
- Value of hybrid poplar inadequate (Quebec)
- No support programs for culture systems of this kind (Quebec, Prairie provinces)
- Economic viability remains to be demonstrated (Quebec, Prairie provinces)

Main legal drawbacks:

- Status of agroforestry not yet clearly defined (Quebec)
- Risk of constraints arising from agricultural zoning (Quebec)
- Municipal regulations that may be a constraint on harvesting of trees (Quebec)
- Civil liability associated with harvesting of trees (Prairie provinces)

Main environmental drawbacks:

- Risk of soil compaction on agricultural land owing to the passage of equipment used for tree culture (Prairie provinces)

Most frequently mentioned other drawbacks:

- Little time available for this type of culture (Quebec)
- Reduction in land available for growing food crops (Quebec)
- Alley cropping not readily compatible with drainage work implemented in the 1970s for the purpose of expanding cropland (Quebec)
- “Farmers do not want to go back to afforestation” (Prairie provinces)
- “Mixing two types of culture systems makes no sense” (Prairie provinces)
- “Not the best option” (Prairie provinces)

3.4.4 Interest in prospective implementation

In contrast to the methodology used for the other three technologies included in the study, in this case participants were asked to state whether they would be interested in applying willow or hybrid poplar-based alley cropping systems if they were to become operational in the medium term[11]. Table 35 shows a breakdown of participants' replies, by region.

Table 35. Distribution of participants by interest in applying willow or hybrid poplar-based alley cropping systems over the medium term, by region

Interest level	Quebec (n = 14)	Prairie provinces (n = 24)[1]	Total (N = 38)
Greatly interested	14%	4%	8%
Perhaps	50%	63%	58%
Not at all interested	36%	33%	34%
Total	100%	100%	100%

[1] Data for the Prairie provinces refer to 24 out of 28 participants, owing to the fact that four participants were members of the family of a participant who was a farmer.

Fewer than 10% of the participants said that they were highly interested in alley cropping. A significant percentage (58%) said they were not sure whether they would consider implementing the technology. Over one third (34%) said they would definitely not do so.

The reasons given by participants to explain their replies are shown in Table 36.

Table 36. Main reasons given to justify levels of interest in applying willow or hybrid poplar alley cropping systems

Reasons for answering "Very much"
• Participant considers himself primarily a forest producer and his trials with hybrid poplar are conclusive (Quebec) • Participant is already using a silvopastoral system with trees and cereals (Prairie provinces) • If this culture system were to become economically viable, the result would be to encourage organic farming, diversify income and make it possible to make use of abandoned farmlands for purposes other than afforestation (Quebec)
Reasons for answering "Maybe"
Under constraining biophysical conditions: • Out of curiosity; for acreage on which organic farming is not easily economically viable because of low yields (Quebec)

[11] The question was worded as follows: "In the event that willow/hybrid poplar-based alley cropping systems become operational in the medium term, would you consider the possibility of applying these systems on your lands?" Participants were given a choice of three answers, and were invited to state the reasons for their choice.

- Under certain conditions (e.g. very windy areas) or in the event of climate change (Quebec)
- With willow, if it can grow in moderately fertile soils (Quebec)

<u>If economic viability is demonstrated</u>:

- Provided it is economically viable (Quebec, Prairie provinces, 3 times)
- If there is only a small negative impact on agricultural yields (Quebec)
- "If there were some evidence that it could be done economically under certain conditions, I might consider it" (Prairie provinces)
- If the price of fuel rises, growing fruits and vegetables will no longer be economically viable in Manitoba (Prairie provinces)

<u>If technical feasibility can be demonstrated</u>:

- Needs more studies and demonstration sites (Prairie provinces)
- Because not enough is known (Quebec)
- More information needed (Prairie provinces, twice)
- "Show me a system that has actually performed satisfactorily" (Prairie provinces)
- It is more rational than block plantings (Prairie provinces)

<u>With specific species</u>:

- "Hybrid poplar only. Willow is not an option because of markets and herbaceous vegetation control management. Only an option, as I am a hobby farmer with small-scale equipment, and I need an aesthetically and recreationally viable alternative (farm tourism)" (Prairie provinces)
- Only with pasture and poplar (Prairie provinces)
- Possibly if forage plants are my primary crop (Prairie provinces)
- Probably not feasible with cereal grains (Prairie provinces)
- Combining with organic fruits or vegetables (Prairie provinces)

Reasons for answering "Not at all"

<u>Benefits of alley cropping attainable by other means</u>:

- I am interested in alley cropping, but with wider strips and lumber production (more reliable markets) (Quebec)

- At the present time, the same benefits can be obtained with shelterbelts. The land is seeded with forage plants and used as pasture (Prairie provinces)

Not suitable because:

- Not suited to drained land (Quebec)
- Have no small-scale equipment (Prairie provinces)
- Results in loss of land area that is needed for, most notably, spreading (of solid or liquid manure) (Quebec)
- Not compatible with large-scale agricultural operations (cereal crops or ranching) (Prairie provinces)
- Not suited to agricultural cropping (Prairie provinces)
- Municipalities' by-laws on tree harvesting are too changeable (Quebec)
- Economic viability not obvious, reduced sunlight between rows, not adapted to drained land (Quebec)
- I can see no financial benefits and only very limited environmental benefits (Prairie provinces)
- "Let someone else try it first" (Prairie provinces)

As can be seen, there is some overlap between the reasons given by participants who said they might apply the technology and those given by participants who said they definitely would not apply it. The reasons given by both groups appear to be located at different points along a single hesitation/refusal continuum.

3.4.5 Information learned in the focus group

Overall, the results indicate that 90% of the participants considered that they had learned either a little or a lot about alley cropping (see Table 37). However, differences between the two regions are observed. Fewer participants from the Prairie provinces (18%) than in Quebec (43%) said that they had learned a lot about the technology, probably because their initial knowledge level was generally higher. There were also more participants from the Prairie provinces who reported that they had learned nothing about alley cropping (14%, compared with 0% for Quebec).

Table 37. Distribution of participants' levels of learning about willow or hybrid poplar-based alley cropping systems, by region

Information learned	Quebec (n = 14)	Prairie provinces (n = 28)	Total (N = 42)
No	0%	14%	10%
Yes, a little	57%	68%	64%
Yes, a lot	43%	18%	26%
Total	100%	100%	100%

As shown in Table 38, two thirds of the subjects that were considered the most useful were technical in nature.

Differences were observed between the two regions. Technical issues were more frequently mentioned by participants from the Prairie provinces (72%) than by their Quebec counterparts (53%). Quebec participants, on the other hand, placed greater emphasis on financial aspects, especially costs and markets. Environmental issues were raised only in Quebec.

Table 38. Categories of subjects considered the most useful in the context of focus group discussions on willow or hybrid poplar-based alley cropping systems, by region

Subject category	Quebec (n = 17)	Prairie provinces (n = 25)	Total (N = 42)
Technical	53%	72%	64%
• Equipment/Methods/Risks	(53%)	(72%)	(64%)
• Site-specific	(0%)	(0%)	(0%)
• Comparison with other crops	(0%)	(0%)	(0%)
• Yields	(0%)	(0%)	(0%)
Financial	24%	8%	14%
• General	(6%)	(4%)	(5%)
• Costs	(6%)	(0%)	(2%)
• Markets	(12%)	(4%)	(7%)
Legal	0%	0%	0%
Environmental	6%	0%	2%
Other	18%	20%	19%
Total	100%	100%	100%

3.4.6 Change in interest level

Results on changes in participants' interest in alley cropping during the focus group discussions are shown in Table 39.

Table 39. Change in interest in willow or hybrid poplar-based alley cropping systems, by region

Interest level	Quebec (n = 14)	Prairie provinces (n = 27) [1]	Total (N = 41)
Decreased	0%	22%	15%
Did not change	57%	59%	58%
Increased	43%	19%	27%
Total	100%	100%	100%

[1] One participant did not provide a response.

Overall, close to 60% of the participants stated that their interest in alley cropping had remained unchanged. Among the others, more increases than decreases in interest level were reported. In Quebec, none of the participants reported decreased interest in this technology in the course of the focus group exercise.

Participants from the Prairie provinces who reported that their interest levels had decreased gave two main reasons: lack of information and, to a lesser extent, lack of evidence of success.

The participants who said their interest in the technology had not changed offered a number of reasons in explanation:

- Lack of evidence of economic viability (Quebec, Prairie provinces)
- Lack of basic and practical information (Prairie provinces)
- Challenges and constraints to be overcome, particularly in terms of labour availability and skills (Quebec, Prairie provinces)
- No new information acquired (Quebec, Prairie provinces)
- Participants hold contradictory opinions (Quebec)
- "I was interested in this project before, and I am still interested in it" (Prairie provinces)

Three main reasons were given for increased interested in this technology:

- Information acquired during the presentation and through discussions among the participants (Quebec, Prairie provinces)
- The new opportunities afforded by this approach, especially the opportunity of producing two types of crop (Quebec, Prairie provinces)
- The social contribution that this new technology can make (Quebec)

It is interesting to note that the concept of information plays an important role here. Information that is deemed to be inadequate or insufficient is associated with decreased or unchanged interest in the technology, whereas new information or an exchange of comments may, in other situations, spark an increase in a participant's interest in it.

3.4.7 Missing or unclear aspects of the non-specialist presentation

Table 40 presents information considered to be missing or unclear, broken down in accordance with the categories selected, for each of the two regions and for all participants.

Table 40. Categories of missing or unclear aspects in the presentation on willow or hybrid poplar-based alley cropping systems, by region

Categories of aspects identified	Quebec (n = 35	Prairie provinces (n = 87)	Total (N = 122)
Technical	80%	83%	82%
• Equipment/Methods/Risks	(71%)	(75%)	(74%)
• Site-specific	(6%)	(2%)	(3%)
• Comparison with other crops	(3%)	(6%)	(5%)
• Yields	(0%)	(0%)	(0%)
Financial	20%	6%	10%
• General	(14%)	(2%)	(6%)
• Costs	(6%)	(2%)	(2%)
• Markets	(0%)	(2%)	(2%)
Legal	0%	0%	0%
Environmental	0%	1%	1%
Other	0%	10%	7%
Total	100%	100%	100%

Overall, technical matters account for a very large portion (82%) of the missing or unclear aspects identified by participants, followed by financial matters (10%). Other subject categories account for less than 10% of participants' responses. Financial aspects were raised more frequently in Quebec (20%) than in the Prairie provinces (6%).

Main technical aspects:

- Use of conventional machinery that is already available (Quebec, Prairie provinces)
- Rows as a constraint on mobility of machinery (Quebec, Prairie provinces)
- Tree planting, maintenance and harvesting technology (Quebec, Prairie provinces)
- Distance of trees from existing drains (Quebec, Prairie provinces)
- Growing conditions of the main crop (shade, moisture, microclimates) (Quebec, Prairie provinces)
- Target objectives, benefits (Prairie provinces)
- Indicated crops (Prairie provinces)

Main financial aspects:

- Overall per-hectare profitability (Quebec, Prairie provinces)
- Establishment costs (Prairie provinces)
- Tree harvesting costs (Quebec)
- Order of magnitude of prospective carbon credits (Quebec)
- Existing markets (Prairie provinces)

Main legal aspects:

- (None mentioned)

Main environmental aspects:

- Carbon sequestration (Prairie provinces)

Most frequently mentioned other aspects:

- More specific information before reaching a decision (Prairie provinces)
- Existing incentive programs (Prairie provinces)
- Need for demonstration sites and case studies (Prairie provinces)

3.4.8 Additional comments

Space was provided at the end of the questionnaire to allow the participants to make additional comments.

A total of 16 comments were submitted. Five were positive, six neutral, and five negative. Over 80% of the comments were submitted by participants from the Prairie provinces.

The main positive comments included the following:

- These systems offer good medium- and long-term potential (Quebec, Prairie provinces)
- Positive experience and knowledge acquired (Prairie provinces)
- "I think it is an excellent way of presenting trees and forestry on a farm, and one that can help sell agroforestry, which would mean an easier transition for farmers who are currently growing cereal grains" (Prairie provinces)

Neutral comments included:

- "In Europe, is it economically viable without subsidies?' (Quebec)
- At this preliminary stage in the development of this technique, the government should assume R&D costs (Prairie provinces)
- Systems should be specified for different regions, taking soils, climate, demography and so on into account (Prairie provinces)

The main negative comments were as follows:

- Lack of knowledge about these systems (Prairie provinces)
- Apparent lack of concordance with field crops (Prairie provinces)

3.4.9 Issues

On the basis of results obtained, research and development (R&D) and implementation (I) issues arising in connection with willow or hybrid poplar-based alley cropping systems can be identified:

Technical aspects:

- Specify and reduce:
  - constraints on machinery and equipment created by rows (R&D)
  - the negative impact of tree rows on agricultural crops (R&D)
  - work required to maintain rows and eventually remove stumps (R&D)
  - risks of fostering the presence of species or conditions harmful to agricultural crops (R&D)
  - risks that tree roots may obstruct or damage agricultural drains (R&D)

- Assess the accuracy of some perceived benefits, such as the reduction in quantities of fertilizers and insecticides required (R&D)

- Significantly increase technical knowledge about these systems, in particular the overall per-hectare yields that can be obtained (R&D)

Financial aspects:

- Reduce costs associated with the use of specialized equipment or modifications to existing equipment (R&D)

- Once sufficient technical knowledge is available, develop models that can be used to evaluate the economic viability of these systems in an operational context, under various scenarios, including income that may be generated from carbon sequestration (R&D, I)

Legal aspects:

- Evaluate the risk of municipal regulations that may compromise harvesting of stands on private land (R&D)

- Specify the status of this type of crop (e.g. agroforestry or agriculture), as its status directly impacts constraints arising from agricultural zoning and municipal by-laws in Quebec (I)

Environmental aspects:

- Assess the accuracy of the perceived environmental benefits reported by participants, such as enhanced carbon sequestration, reduced non-point-source pollution and reduced insecticide use (R&D)

Other aspects:

(None mentioned)

As can be seen, most of these issues are associated with research and development rather than implementation given the preliminary state of research on this technology.

4. COMPARATIVE ANALYSIS OF RESULTS FOR THE VARIOUS TECHNOLOGIES

4.1 Initial knowledge and experience level

Table 41 presents comparative percentage figures for participants who rated their initial knowledge and experience level as “high” or “very high”, for the four technologies.

Table 41. Proportion of participants indicating a high or very high initial knowledge and experience level, by technology and region

Region	Short-rotation intensive culture	Block plantation of hybrid poplar	Riparian buffers	Alley cropping
Quebec	17%	25%	21%	7%
Prairie provinces	36%	Not applicable	4%	86%

In the case of the three systems discussed both in Quebec and in the Prairie provinces, the initial knowledge and experience reported by the participants differed greatly in the two regions. In the case of SRIC and alley cropping, they were significantly higher in the Prairie provinces. The opposite was true for riparian buffer systems.

The fourth technology, block plantation of hybrid poplar, was discussed only in Quebec. A larger percentage of participants rated their knowledge and experience level as “high” for this technology than they did for the other three.

4.2 Perceived benefits

To facilitate comparison of the technologies, percentage values for the five categories of perceived benefits are presented in decreasing order, by region and technology, in Table 42. The rank is indicated in the second column. Where two categories are tied, the rank assigned to the first of the two reflects the order of categories used in the comments form. The categories[12] are listed as follows: technical benefits (Tech.), financial benefits (Fin.), legal benefits (Leg.), environmental benefits (Env.) and other benefits.

[12] This notation is also used in three other analogous tables in this section.

Table 42. Categories of perceived benefits associated with technologies, by region

Region	Rank	Short-rotation intensive culture	Block plantation of hybrid poplar	Riparian buffers	Alley cropping
Quebec	1	Tech. 44%	Tech. 34%	Tech. 38%	Env. 45%
	2	Fin. 31%	Fin. 30%	Env. 30%	Tech. 27%
	3	Env. 18%	Env. 28%	Other 17%	Fin. 10%
	4	Other 5%	Other 6%	Fin. 8%	Other 16%
	5	Leg. 2%	Leg. 1%	Leg. 6%	Leg. 2%
Prairie provinces	1	Env. 42%		Env. 42%	Tech. 41%
	2	Tech. 29%		Tech. 23%	Env. 31%
	3	Fin. 23%	N/A	Fin. 18%	Fin. 23%
	4	Other 4%		Leg. 9%	Other 5%
	5	Leg. 1%		Other 9%	Leg. 0%
Total	1	Tech. 36%	Tech. 34%	Env. 39%	Tech. 36%
	2	Env. 30%	Fin. 30%	Tech. 27%	Env. 36%
	3	Fin. 27%	Env. 28%	Fin. 14%	Fin. 19%
	4	Other 4%	Other 6%	Other 11%	Other 8%
	5	Leg. 2%	Leg. 1%	Leg. 9%	Leg. 1%

Three large groups of benefits (technical, financial and environmental) account for 80% to 90% of all perceived benefits. It can be seen that more technical benefits have been identified than financial benefits for all four systems. It is important to bear in mind that technical benefits may often translate into financial benefits.

Also noted is the relative importance (31% to 42%) of environmental benefits identified by participants from the Prairie provinces: in all cases benefits in that category were ranked first or second.

As might have been expected, the relative importance of environmental benefits was greater for the two agroforestry systems than for the afforestation systems.

For their part, legal benefits are more prominent in the case of riparian buffers. This seems to be due to the legal context and issues relating to stream protection in Quebec and flooding hazards in the Prairie provinces.

4.3 Perceived drawbacks

As shown in Table 43, for all four systems taken together, technical and financial drawbacks accounted for between 78% and 87% of all the perceived drawbacks identified by the participants.

Table 43. Categories of perceived drawbacks associated with technologies, by region

Region	Rank	Short-rotation intensive culture	Block plantation of hybrid poplar	Riparian buffers	Alley cropping
Quebec	1	Fin. 45%	Tech. 47%	Fin. 48%	Tech. 56%
	2	Tech. 38%	Fin. 35%	Tech. 32%	Fin. 25%
	3	Leg. 13%	Other 8%	Other 11%	Leg. 9%
	4	Env. 3%	Leg. 6%	Leg. 4%	Other 9%
	5	Other 1%	Env. 3%	Env. 4%	Env. 2%
Prairie provinces	1	Tech. 43%		Tech. 43%	Tech. 66%
	2	Fin. 42%		Fin. 35%	Fin. 25%
	3	Env.12%	N/A	Env. 13%	Other 7%
	4	Leg. 2%		Leg. 5%	Leg. 1%
	5	Other 1%		Other 4%	Env. 1%
Total	1	Fin. 43%	Tech. 47%	Tech. 40%	Tech. 62%
	2	Tech. 41%	Fin. 35%	Fin. 38%	Fin. 25%
	3	Env. 8%	Other 8%	Env. 11%	Other 7%
	4	Leg. 6%	Leg. 6%	Leg. 5%	Leg. 4%
	5	Other 1%	Env. 3%	Other 5%	Env. 1%

Environmental drawbacks account for a significantly smaller portion of the total than was the case for environmental benefits.

Alley cropping was identified as having a larger percentage of technical drawbacks. This reflects the fact that this technology is less highly developed than the other three.

Perceived legal drawbacks were identified mainly in Quebec, notably for short-rotation intensive culture and alley cropping. In the case of SRIC, participants mentioned the agricultural use zoning as a constraint on financial support for afforestation and non-recognition of SRIC as an agricultural crop. In the case of alley cropping, participants mentioned the issue of its agroforestry status, regulatory constraints and constraints relating to agricultural zoning.

4.4 Anticipated implementation

In the following two tables, the technologies are compared from the perspective of participants' intentions with respect to their implementation, and, for three out of the four, the area that would be dedicated to the technology in question by those who said they would apply it. We may recall at this point that the time horizon for implementation was 5 years for three of the four technologies, and that no time horizon was specified for alley cropping. For the latter technology, it is assumed that the technology will become operational.

Table 44. Proportion of participants intending to implement a technology, by support program eligibility and region

Region and eligibility	Short-rotation intensive culture	Block plantation of hybrid poplar	Riparian buffers	Alley cropping[1]
Quebec				
• Yes	80%	70%	50%	
• No	64%	37%	10%	14%
Prairie provinces				
• Yes	83%	N/A	63%	
• No	33%		30%	4%
Total				
• **Yes**	81%	70%	59%	
• **No**	50%	37%	24%	8%

[1] In this case, the question participants were asked included nothing about eligibility for financial and technical assistance.

Assuming eligibility for a support program, it appears that over 50% of the participants would implement the technology in the three cases. Anticipated implementation levels were high for SRIC, somewhat lower for BPHP, and lower still for riparian buffers. For these three technologies, the impact of support program availability was significant: in the absence of such a program, anticipated implementation levels were between 38% and 68% lower.

For alley cropping, the low anticipated implementation levels are attributable to the fact that only preliminary R&D results on this technology are available as yet, as may be seen from the substantial technical drawbacks identified by participants.

The relative scale of the average areas for the various systems (see Table 45) appears logical, with the highest values for block plantation of hybrid poplar and the lowest for riparian buffers. The large average area values observed for block plantation of hybrid poplar are attributable in part to the fact that some of the Quebec participants were large landowners who were already involved in planting hybrid poplars.

In addition, average area figures are markedly lower for two of the three technologies in the absence of a support program.

Table 45. Average prospective afforested areas, by support program eligibility and region

Region and eligibility	Short-rotation intensive culture	Block plantation of hybrid poplar	Riparian buffers
Quebec			
• Yes	9.4 ha	81 ha	1 ha
• No	2.4 ha	20 ha	3 ha[1]
Prairie provinces			
• Yes	9.5 ha	N/A	4.2 ha
• No	6.1 ha		3.6 ha
Total			
• **Yes**	9.4 ha	81 ha	3.4 ha
• **No**	3.5 ha	20 ha	3.5 ha

[1] An explanation of the mathematical cause of this increase in area in the absence of a support program is given in note 1 to Table 27.

4.5 Information learned in the focus group

Table 46 has been constructed by combining percentage values found for participants who indicated that they had learned a little or a lot within the focus group.

Table 46. Proportion of participants indicating that they had learned about a technology, by region

Region	Short-rotation intensive culture	Block plantation of hybrid poplar	Riparian buffers	Alley cropping
Quebec	90%	92%	100%	100%
Prairie provinces	96%	N/A	100%	86%
Total	92%	92%	100%	90%

For all the technologies, over 90% of the participants reported that they had learned something in the focus group exercise. This result indicates that the non-specialist presentation and the group discussions were consistently able to affect the subjective learning level, regardless of the technology in question.

This subjective perception of having learned something is observed both among participants whose initial knowledge and experience levels were low (as in the case of participants from the Prairie provinces with respect to riparian buffers or of Quebec participants with respect to alley cropping) and among those whose initial knowledge levels were high (as in the case of participants from the Prairie provinces with respect to SRIC or alley cropping).

Table 47 presents the subjects considered by the focus group participants to be the most useful, with combined results for Quebec and the Prairie provinces. As can be seen, for all the technologies considered, subjects in the technical, financial and other categories account for the vast majority of the total (from 89% to 100%, depending on the technology).

Table 47. Categories of subjects considered the most useful, by technology and region

Region	Rank	Short-rotation intensive culture	Block plantation of hybrid poplar	Riparian buffers	Alley cropping
Quebec	1	Other 37%	Other 49%	Tech. 67%	Tech. 53%
	2	Tech. 28%	Tech. 31%	Fin. 26%	Fin. 24%
	3	Fin. 17%	Fin. 20%	Other 7%	Other 18%
	4	Env. 14%	Leg. 0%	Leg. 0%	Env. 6%
	5	Leg. 3%	Env. 0%	Env. 0%	Leg. 0%
Prairie provinces	1	Tech. 36%		Tech. 46%	Tech. 72%
	2	Fin. 33%		Other 33%	Other 20%
	3	Other 27%	N/A	Env. 12%	Fin. 8%
	4	Env. 3%		Fin. 8%	Leg. 0%
	5	Leg. 0%		Leg. 0%	Env. 0%
Total	1	Tech. 32%	Other 49%	Tech. 54%	Tech. 64%
	2	Other 32%	Tech. 31%	Other 23%	Other 19%
	3	Fin. 25%	Fin. 20%	Fin. 15%	Fin. 14%
	4	Env. 9%	Leg. 0%	Env. 8%	Env. 2%
	5	Leg. 1%	Env.0%	Leg. 0%	Leg. 2%

At first glance, it is surprising to observe that, overall, the “other” category is one of the leading two categories of subjects that were considered to be the most useful. In Quebec, “other” subjects rank first for BPHP and SRIC. For the most part, these other subjects have to do with the interactive focus group formula, such as the sharing of information, experience and views among the participants.

While environmental aspects were frequently included among the perceived benefits of the various technologies, they were less frequently mentioned as being among the most useful of the subjects. As a rule, subjects in the “legal aspects” category ranked last among those considered by the participants to have been the most useful.

4.6 Change in interest level

Table 48 presents, for all four technologies, a comparison of participants’ change in interest level during the focus group exercise. As noted earlier, participants were given a choice of three answers: (1) interest level decreased, (2) interest level remained unchanged, or (3) interest level increased.

Table 48. Change in interest in technologies, by region

Change in interest level / Region	Short-rotation intensive culture	Block plantation of hybrid poplar	Riparian buffers	Alley cropping
Decrease				
• Quebec	3%	19%	0%	0%
• Prairie provinces	11%	N/A	0%	22%
• Total	6%	19%	0%	15%
No change				
• Quebec	29%	62%	43%	57%
• Prairie provinces	39%	N/A	57%	59%
• Total	33%	62%	52%	58%
Increase				
• Quebec	66%	19%	57%	43%
• Prairie provinces	46%	N/A	43%	19%
• Total	58%	19%	48%	27%

N.B.: For SRIC, 3% of the participants in Quebec and 4% of those in the Prairie provinces did not answer.

Both in Quebec and in the Prairie provinces, the two technologies for which significant increases in interest levels were observed were SRIC and riparian buffers. For both technologies, the main reasons given by participants to explain their increased interest were similar, namely the knowledge and information they had acquired. Where there was no change in interest level, again the reasons given were similar: most participants said that they had been interested (or not interested) before.

For alley cropping, the pattern of results was similar to the pattern observed in the case of block plantation of hybrid poplar, with approximately 60% of the participants stating that there had been no change in their levels of interest. Some participants were already interested, but the others gave various reasons to explain why their interest in these two technologies had remained unchanged. In the case of participants who said their interest level had increased, the reasons most frequently mentioned were the information presented during the meetings and the discussions with other participants.

Lastly, for all four technologies, the reasons given for decreased interest levels had to do with issues that were as yet unclarified or unresolved.

4.7 Missing or unclear aspects

As shown in Table 49, aspects of the non-specialist presentations that were identified by participants as missing or unclear were very largely (81%-93%, depending on the technology) technical or financial in nature.

Table 49. Categories of missing or unclear aspects of presentations on technologies, by region

Region	Rank	Short-rotation intensive culture	Block plantation of hybrid poplar	Riparian buffers	Alley cropping
Quebec	1	Tech. 58%	Tech. 57%	Tech. 50%	Tech. 80%
	2	Fin. 29%	Fin. 36%	Fin. 33%	Fin. 20%
	3	Env. 12%	Leg. 4%	Leg. 12%	Leg. 0%
	4	Leg. 0%	Env. 2%	Env. 3%	Env. 0%
	5	Other 0%	Other 2%	Other 2%	Other 0%
Prairie provinces	1	Tech. 62%	N/A	Tech. 56%	Tech. 83%
	2	Fin. 27%		Fin. 24%	Other 10%
	3	Other 8%		Other 12%	Fin. 6%
	4	Env. 3%		Env. 4%	Env. 1%
	5	Leg. 0%		Leg. 3%	Leg. 0%
Total	1	Tech. 61%	Tech. 57%	Tech. 54%	Tech. 82%
	2	Fin. 27%	Fin. 36%	Fin. 27%	Fin. 10%
	3	Other 6%	Leg. 4%	Other 8%	Other 7%
	4	Env. 5%	Env. 2%	Leg. 6%	Env. 1%
	5	Leg. 0%	Other 2%	Env. 4%	Leg. 0%

In all cases, technical aspects come first, followed by financial aspects. As the table shows, for alley cropping, technical aspects occupy a definitely preponderant position. This situation is attributable to the fact that the state of R&D on this technology is still embryonic.

Except in the case of the SRIC technology in Quebec, environment-related subjects occupy a relatively minor position among missing or unclear aspects.

Legal subjects were mentioned mainly in Quebec, with reference to block plantation of hybrid poplar and riparian buffers. This situation may be attributable to the regulatory context in force in that province (agricultural zoning, stream protection).

4.8 Additional comments

Table 50 has been constructed by assigning comments on each of the technologies to three categories: negative, neutral and positive. Number of participants and relative percentage are presented for each type of comment.

On the basis of these data, a ratio of the number of positive comments to the number of negative comments was developed. No weighting was assigned to the various comments to take their content into account. Results for Quebec and the Prairie provinces were combined in view of the fact that for some of the technologies, very small numbers of comments were submitted.

Table 50. Distribution of negative, neutral and positive comments, by technology

Type of comments	Short-rotation intensive culture	Block plantation of hybrid poplar	Riparian buffers	Alley cropping
Negative	3 (10%)	1 (8%)	7 (35%)	5 (31%)
Neutral	7 (22%)	4 (31%)	4 (20%)	6 (38%)
Positive	21 (68%)	8 (61%)	9 (45%)	5 (31%)
Positive/negative ratio	7.0	8.0	1.3	1.0

In the interpretation of this comparative table, two constraints must be taken into account. First, not all the participants provided additional comments of this kind, and this implies a possible problem of representativeness. Second, the use of a positive-to-negative ratio tends to mask a significant proportion of neutral comments.

An initial review of the data in the table indicates that, on the basis of the positive-to-negative comment ratio, the two afforestation technologies (SRIC and BPHP) appear to have been regarded more favourably than the two others. For both SRIC and BPHP, seven or eight favourable comments were submitted for every negative comment.

The second group of technologies, for which almost as many negative comments as positive comments were provided, comprises the two agroforestry technologies (riparian buffers and alley cropping).

4.9 Issues

Table 51 provides a comparison of the distribution of issues identified by participants, by technology and issue category.

Table 51. Distribution, for each technology, of the number of issues, by category

Issue category	SRIC	BPHP	Riparian buffers	Alley cropping	Total
Technical	12	6	7	4	29
Financial	4	6	4	2	16
Legal	1	3	2	2	8
Environmental	5	2	1	1	9
Other	3	2	2	1	8
Total	25	19	16	10	70

The table shows that the largest number of issues identified by the participants was associated with short-rotation intensive culture, followed by block plantation of hybrid poplar and riparian buffers. It should be noted that some of these issues are common to more than one technology.

For all technologies combined, technical and financial issues occupy a preponderant position. This is consistent with the results observed for perceived drawbacks and missing or unclear aspects.

Table 52 presents a summary of all 47 distinct issues relating to the four technologies under study. A boldface capital **X** indicates that for a particular technology, the issue was identified in the course of focus group discussions on that technology. A lower-case x indicates that for a particular technology, the issue was identified in the focus group discussions on a different technology, but the authors considered that it appeared, on the face of it, relevant to that technology as well.[13] The issues are presented in decreasing order of the number of technologies to which they apply, regardless of their respective categories.

Table 52. Summary of issues, by technology

Issue	Technology			
	SRIC	**BPHP**	**RB**	**Alley cropping**
Determine and document the characteristics of the various clones available (R&D, I)	**X**	**X**	x	x
Evaluate the risk that roots may obstruct or damage agricultural drains (R&D)	x	**X**	**X**	**X**
Reduce costs associated with the use of specialized equipment or modifications to existing equipment (R&D)	x	x	x	**X**
Evaluate the risk of municipal regulations that may compromise harvesting of willow stems on private land (Quebec) (I)	x	**X**	**X**	**X**
Develop models that can be used to assess economic viability under various scenarios (R&D)	**X**	**X**	x	**X***
Assess environmental risks associated with the introduction of exotic species (R&D)	**X**	x	x	x
Determine carbon sequestration potential under various scenarios (R&D)	**X**	**X**	x	x
Determine the impact of the technology on wildlife habitat and biodiversity (R&D)	x	**X**	x	x
Set up demonstration sites (I)	x	**X**	x	x
Ensure an adequate supply of cuttings from clones appropriate for the implementation regions (I)	**X**	x	x	
Develop mechanized site preparation, clone planting and maintenance techniques suitable for various conditions (R&D)	**X**	x	x	
Adapt and develop machinery for small and mid-size operations (R&D)	**X**	X	**X**	

[13] As will be seen in due course, the relevance of all the issues identified in the course of the focus group discussions will be evaluated at a later stage in our research.

Issue	Technology			
	SRIC	BPHP	RB	Alley cropping
Specify whether the necessary equipment and its availability represent an implementation constraint (I)	x	x	**X**	
Adapt the crop design to suit specific contexts, such as available machinery and production objectives (I)	**X**	x	x	
Evaluate risks of encouraging organisms that are harmful to other crops (R&D)	**X**		**X**	**X**
Specify harvesting methods (R&D)	x	x	**X**	
Specify growth and yields in an operational context (R&D)	**X**	x	x	
Specify storage and handling of biomass produced from the operation (R&D)	**X**	x	x	
Specify potential markets for the various uses (R&D)	**X**	**X**	**X**	
Evaluate and propose incentives (tax measures, technical or financial support programs) (I)	**X**	**X**	**X**	
Specify production, harvesting and storage costs in an operational context (R&D)	**X**	x	**X**	
Specify the status of the crop (agricultural crop, forest crop) (I)	**X**	**X**		**X**
Evaluate co-ordination among authorities with legislative power (I)	x	x	**X**	
Determine (i.e. invalidate or confirm) the environmental benefits perceived by participants compared with conventional agriculture, such as enhanced carbon sequestration, reduced non-point-source pollution and reduced insecticide use (R&D)	**X**		x	**X**
Evaluate the carbon budget for biofuel production from biomass (R&D)	**X**	x	x	
Perform analyses of the production and processing life cycle for biomass produced from the operation (R&D)	**X**	x	x	
Produce non-specialist information and strengthen program technology transfer for various stakeholders, including landowners (I)	**X**	**X**	**X**	
Involve the various stakeholders in order to make the technology better known and promote its adoption (I)	**X**	x	x	

Issue	Technology			
	SRIC	BPHP	RB	Alley cropping
Prepare an inventory of producers and users and promote networking between the two groups (I)	**X**	x	x	
Specify and disseminate information about the soil characteristics required (R&D, I)	**X**	**X**		
Specify the medium- and long-term impacts of culture on soil characteristics (R&D)	**X**	x		
Specify measures to control competing vegetation, insects and disease (R&D, I)	**X**	x		
Identify or develop affordable browsing control techniques (R&D)	x	**X**		
Specify methods and cost of eliminating stumps at the end of a rotation (R&D, I)	**X**	**X**		
Determine the impact of buffers or rows on adjacent crops (R&D)			**X**	**X**
Evaluate factors exerting a braking effect on adoption of the technology as a result of increased property assessment and taxation of harvest income (R&D)	x	**X**		
Identify and evaluate the feasibility of accommodation with a view to facilitating culture on abandoned farmlands, with regard to current agricultural zoning constraints (Quebec) (I)	x	**X**		
Specify the potential of environmental uses of willow (R&D)	**X**		x	
Specify and reduce row maintenance operations (R&D)				**X**
Reduce insofar as possible constraints on machinery and equipment arising from rows (R&D)				**X**
Specify to what extent the reduced stream access resulting from riparian buffers represents a significant constraint for landowners (I)			**X**	
Significantly increase technical knowledge about these systems, in particular the overall per-hectare yields that can be obtained (R&D)				**X**
Specify the reasons why no technical and financial support for BPHP is available from some regional private forest development agencies (Quebec) (R&D)		**X**		

Issue	Technology			
	SRIC	BPHP	RB	Alley cropping
Evaluate potential and feasibility of making technical and financial assistance for BPHP available to landowners with less than 4 ha of land suitable for afforestation (Quebec) (I)		X		
Determine whether the protection capacity of riparian buffers is significantly reduced following periodic harvesting of stems (R&D)			X	
Estimate to what extent fertilizers and pesticides may be discharged via drainage systems (R&D)			X	
The additional operations and time that this crop demands would represent a significant extra workload for some landowners, especially farmers (I)			X	

* Over the medium term, when sufficient technical knowledge has been acquired.

A review of Table 52 reveals the following:

- For the various systems under study, approximately two thirds of the issues have to do with R&D rather than system application, except in the case of alley cropping. In that case, over 80% of the issues identified have to do with R&D, reflecting the preliminary state of research on the system in question.

- Approximately 80% of the issues are common to more than one technology. Of such issues, nine (including eight that concern R&D) are common to all four technologies.

- SRIC and block plantation of hybrid poplar are the two technologies that share the largest number of issues. However, a significant portion of those issues are also shared by willow-based riparian buffer systems.

- There are nine issues that refer to a single technology. Of those nine, four have to do with riparian buffers, three with alley cropping, and two with block plantation of hybrid poplar.

5. CONCLUSIONS

The three objectives of this study were met. First, the focus group sessions resulted in the identification, from the landowners' viewpoint, of development- and implementation-related issues for each of the technologies considered. These issues were classified as technical, financial, legal, environmental or other in nature. A number of them seem to be generalizable to other technologies besides those for which the landowners identified them.

Second, potential for short-term implementation was evaluated for three of the four technologies under study, and potential for medium-term implementation was evaluated for alley cropping. Potential for the short-term implementation of short-rotation intensive culture, block plantation of hybrid poplar and willow-based riparian buffer systems appeared to be very good. However, anticipated implementation levels were substantially lower in the absence of technical and financial incentives. The low anticipated implementation level observed for alley cropping appears to reflect the preliminary state of knowledge of this technology.

Third, the focus group approach selected for the study made it possible to compare the results obtained for the various technologies and geographic areas. In addition to the potential for implementation of these technologies, many significant differences were observed, as, for example, the relative importance of environmental benefits identified by participants from the Prairie provinces and the relative importance of legal drawbacks identified by Quebec participants for short-rotation intensive culture and alley cropping.

Not only were the initial objectives met, but the study led us to draw the following conclusions:

- The focus group format used was favourably viewed by a large majority of the participants. That format includes an educational component, mainly in the form of a non-specialist presentation that provided a basis for informed discussion. A number of participants indicated that they appreciated the opportunity to obtain information and exchange views.

- The use of a number of multiple-choice questions with written answers yielded additional qualitative information, compared with the conventional focus group approach. While these questions were not discussed within the groups, they afforded a means of estimating the effect of the focus groups on the participants. For example, significant increases in interest levels were observed in the case of two of the technologies, namely short-rotation intensive culture and willow-based riparian buffer systems. It appears, then, that the focus-group approach with a non-specialist presentation might be an effective means of promoting the implementation of new afforestation and agroforestry technologies by early adopters. Similarly, the perceived benefits of these technologies as identified by the participants may be taken into account by program managers to promote their adoption.

- The decision to have each focus group discuss two or three technologies proved to be a judicious one, judging from the fact that a large quantity of relevant information was obtained while less time was required for the group sessions and the associated costs were lower. Moreover, a number of participants expressed approval of this approach, as it had enabled them to discuss two or more related technologies in the course of a single day.

- The fact that the study was limited to two Canadian regions (four provinces) and 23 focus groups was obviously a limitation. Other potential issues might have been identified if similar focus groups had been held in other provinces, or if larger numbers of focus groups had been held in each region. However, the approach adopted appears to us to have been an efficient choice in view of the budget constraints we were facing. Indeed, we suggest that this study has enabled us to identify a significant portion, if not the majority, of key R&D and implementation issues from the viewpoint of Canadian landowners. This is based on four reasons:

    1. A number of the issues stem from information provided by participants in both regions, Quebec and the Prairie provinces, which indicates the national scope of the issues in question, despite differences in characteristics between participants in these two regions.

    2. Implementation contexts are different in the two regions, especially as regards the characteristics of potential culture sites (soils, size, weather conditions). We can therefore assume that these two regions include a significant portion of the specific implementation contexts found across Canada.

    3. The structure of the focus groups made it possible to systematically address the main factors used to identify these issues, particularly with respect to the drawbacks of the technologies, the reasons given to explain participants' intentions concerning prospective implementation, and aspects of the presentations that the participants regarded as inadequate (missing or unclear).

    4. The generalization of issues to technologies other than those for which they had originally been identified by participants made it feasible to increase the number of issues identified for each of them, thereby taking advantage of the similarities between the technologies.

At this stage in our research, the issues identified by participants have not yet been specified and validated with specialists in the various aspects discussed in the focus groups. We propose to do this in 2008-2009. In some cases, current knowledge will reject a perceived issue, limit it to certain specific situations, or enable stakeholders to identify practical, economical solutions that are already available. In other cases, however, the specialists will validate the relevance of issues perceived by landowners and will contribute to the task of specifying their relative significance. We are assuming that a number of these issues are not yet known to researchers and other stakeholders responsible for developing and applying these technologies. In these cases, the new issues identified by the participants will have to be taken into account in the process of developing these technologies and promoting their adoption.

6. ACKNOWLEDGEMENTS

This study would not have been possible without the contributions of many of our colleagues in the Canadian Forest Service. Particular thanks go to:

- Derek Sidders, of the Northern Forestry Centre, Canadian Wood Fibre Centre, Edmonton, Alberta, who made a major contribution to this study by revising the non-specialist technical presentation on short-rotation intensive culture to adapt it to the context of western Canada and by providing logistical support and assistance in recruiting participants for the focus groups held in the three Prairie provinces.

- Brent Joss, of the Northern Forestry Centre, Canadian Wood Fibre Centre, Edmonton, Alberta, who acted as assistant facilitator at the meetings held in Edmonton, Saskatoon and Winnipeg.

- Bonita (Bonnie) McFarlane, Senior Human Dimensions Specialist, Northern Forestry Centre, Edmonton, Alberta, for her help in preparing various documents used during the focus groups.

- Michèle Bernier-Cardou, Senior Statistician, Laurentian Forestry Centre, Quebec City, Quebec, for her advice on statistical data analysis.

- Diane Paquet and Marie Pothier of the Policy and Liaison Directorate, Laurentian Forestry Centre, Quebec City, Quebec, for preparing various documents.

- Pamela Cheers and Isabelle Lamarre of the Policy and Liaison Directorate, Laurentian Forestry Centre, Quebec City, Quebec, who edited the French and English versions of this study.

In addition, we wish to thank outside collaborators whose assistance enabled us to prepare, revise and adapt the content of the non-specialist presentations that provided the basis for the focus group discussions:

- Michel Labrecque of the Institut de recherche en biologie végétale, Montreal, Quebec, for his contribution on the short-rotation intensive culture of willow.

- André Vézina of the Institut de technologie agroalimentaire, La Pocatière Campus, La Pocatière, Quebec, for his assistance with the preparation of material on riparian buffers and the identification of participants for the focus groups held in the Lower St. Lawrence region.

- Bill Schroeder and John Kort of Agriculture and Agri-Food Canada's Prairie Farm Rehabilitation Administration (PFRA), Indian Head, Saskatchewan, for their expertise and advice on adapting the content of presentations on riparian buffer systems and alley cropping for focus group participants from the Prairie provinces.

- Alain Olivier and David Rivest of the Department of Phytology, Université Laval, Quebec City, Quebec, for their assistance with the preparation of the non-specialist presentation on alley cropping and the identification of Quebec participants who were familiar with this type of culture system.

The task of identifying focus group participants was facilitated by the contributions of private forest development agencies in Quebec. In particular, we would like to mention the assistance provided by Florent Morin and Marc-André LeChasseur of the Agence régionale de mise en valeur des forêts privées du Bas-St-Laurent, André Gélinas of the Agence des forêts privées de Québec-03 and Claudine Lajeunesse of the Agence forestière de la Montérégie.

Yvon Pesant, of the Montérégie Regional Directorate (Eastern Sector, Saint-Hyacinthe office) of the ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec (MAPAQ), also contributed to the task of identifying participants in the focus groups held in Saint-Hyacinthe.

We would like to thank the focus group participants who kindly gave us their time. Their contribution enabled us to discover the views of landowners, who will ultimately decide whether or not to adopt the technologies explored in the context of this research and development project.

The final version of this information report was prepared with the help of a number of specialists who kindly read it over and offered us comments and suggestions with a view to improving its content and format. We thank them all. Their names are listed below:

- Francis Allard, Agro Énergie, St-Roch-de-l'Achigan, Quebec
- Marjolaine Bernier-Leduc, Régénérons vers l'avenir, Paspébiac, Quebec
- Raphaël Chevalier, Conseil pour le développement de l'agriculture du Québec, Longueuil, Quebec
- Marc-André Côté, Union des producteurs agricoles, Longueuil, Quebec
- Jean-Pierre Dansereau, Fédération des producteurs de bois du Québec, Longueuil, Quebec
- Pierre Gagné, Réseau Ligniculture Québec, Quebec City, Quebec
- Michel Labrecque, Institut de recherche en biologie végétale, Montreal, Quebec
- Gil Lambany, ministère des Ressources naturelles et de la Faune du Québec, Quebec City, Quebec
- Yvon Pesant, ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec, Saint-Hyacinthe, Quebec
- André Vézina, Institut de technologie agroalimentaire, La Pocatière Campus, La Pocatière, Quebec

7. BIBLIOGRAPHY

Babie, E. 2001. The practice of social research. 9th ed. Wadsworth Publ. Co., Belmont, CA.

Copestake, M. 2003. Landowner incentive focus sessions: “What incentives are required to get trees in the ground?”. Eastern Ontario Model Forest, Kemptville, ON.

Garrett, H.E.; McGraw, R.L. 2000. Alley cropping practices. Pages 149-188 *in* North American agroforestry: an integrated science and practice. H.E. Garrett, W.J. Rietveld and R.F. Fisher, eds. American Society of Agronomy Inc., Madison, WI.

Keoleian, G.A.; Volk, T.A. 2005. Renewable energy from willow biomass crops: Life cycle energy, environmental and economic performance. Crit. Rev. Plant Sci. 24:385-406.

Krueger, R.A.; Casey, M.A. 2000. Focus groups: a practical guide for applied research. 3rd ed. Sage Publications Inc., Thousand Oaks, CA.

Labrecque, M.; Teodorescu, T.I. 2006. La culture intensive de saules en courtes rotations (CICR). Institut de recherche en biologie végétale et Jardin botanique de Montréal, Montreal, QC.

Marchand, P.P.; Masse, S. 2007. Short-rotation afforestation and agroforestry on Quebec private land: review of laws, regulations, policies, and programs. Nat. Resour. Can., Can. For. Serv., Laurentian For. Cent., Quebec City, QC. Inf. Rep. LAU-X-130E.

Martineau, A.; Bouthillier, L. 2007. Repères sur l’acceptabilité sociale de la ligniculture de peuplier hybride en Estrie. Info-RLQ, 4(1), 1-4.

Ménétrier, J.; Perron, M.; Daoust, G.; Sirois, G. 2005. Le boisement de friches. Programme de Forêt 2020, Notice d’information, Gouvernement du Québec, Minist. Ressour. nat. Faune and Nat. Resour. Can., Can. For. Serv., Quebec City, QC.

Merton, R.K. 1987. The focussed interview and focus groups. Public Opin. Q. 51:550-566.

Merton, R.K.; Kendall, P.L. 1946. The focused interview. Am. J. Sociol. 51:541-557.

Merton, R.K.; Fiske, M.; Kendall, P.L. 1956. The focused interview. Free Press, New York, NY.

Merton, R.K.; Fiske, M.; Kendall, P.L. 1990. The focused interview. 2nd ed. Free Press, New York, NY.

Morgan, D.L.; Krueger, R.A. 1998. The focus group kit. Sage Publications Inc., Thousand Oaks, CA.

Réseau Ligniculture Québec. 2004. La ligniculture dans le cadre du zonage de la triade/quad : une vision novatrice du développement durable pour le Québec forestier. Brief submitted to la Commission d’étude sur la gestion de la forêt publique québécoise, Quebec City, QC.

Rogers, E.M. 2003. Diffusion of innovations. 5th ed. Free Press, New York, NY.

Schultz, R.C.; Isenhart, T.M.; Simpkins, W.W.; Colletti, J.P. 2004. Riparian forest buffers in agroecosystems – lessons learned from the Bear Creek Watershed, central Iowa, USA. Agrofor. Syst. 61:35-50.

Smith, R.A.; McFarlane, B.L.; Parkins, J.R.; Pohrebniuk, P.A.M. 2005. Landowner perspectives on afforestation for carbon sequestration in Canada's Prairie provinces. Nat. Resour. Can., Can. For. Serv., Northern For. Cent., Edmonton, AB. Inf. Rep. NOR-X-401.

van Oosten, C. 2006. Hybrid poplar crop manual for the Prairie provinces. Saskatchewan For. Cent., Prince Albert, SK.

Williams, P.A.; Gordon, A.M.; Garrett, H.E.; Buck, L. 1997. Agroforestry in North America and its role in farming systems. Pages 9-84 *in* Temperate agroforestry systems. A.M. Gordon and S.M. Newman, eds. CAB International, Wallingford, U.K.

Appendix 1

Selection criteria for participants from Quebec

Short-rotation intensive culture of willow and block plantation of hybrid poplar

1. Participants must be interested in a group discussion on afforestation on farmland, especially old abandoned farmland.

2. Approximately half the participants should be primarily interested in discussing short-rotation intensive culture of willow and the other half primarily interested in discussing block plantation of hybrid poplar.

3. Some of the participants should be farmers.

4. Some participants should have at least 4 ha of land suitable for afforestation, part of which may be wooded.

5. Some participants should have had practical experience with the technologies under discussion.

Willow-based riparian buffers and willow or hybrid poplar-based alley cropping

1. Participants must be interested in a group discussion on these two agroforestry systems.

2. Approximately half the participants should be primarily interested in discussing willow-based riparian buffers and the other half primarily interested in discussing willow or hybrid poplar-based alley cropping.

3. Participants who are primarily interested in riparian buffers:

    - must have unwooded land adjacent to a stream;
    - (preferably) have a non-point-source pollution or erosion problem;
    - (preferably) have a riparian buffer strip;
    - (preferably) have at least 4 ha of land suitable for afforestation, of which part may be wooded.

4. Participants who are primarily interested in alley cropping:

    - (preferably) are farmers;
    - (preferably) have had experience with alley cropping or shelterbelts;

Appendix 2

Selection criteria for participants from the Prairie provinces

1. Participants must be interested in a group discussion on short-rotation intensive culture of willow or hybrid poplar, willow-based riparian buffer systems and willow or hybrid poplar-based alley cropping.

2. Preferably, approximately equal numbers of participants who are primarily interested in one of these technologies will be selected.

3. Participants who are primarily interested in willow-based riparian buffer systems must possess unwooded land adjacent to a stream. In addition, some of these persons must be confronted with a non-point-source pollution problem or an erosion problem.

4. Participants who are primarily interested in alley cropping must be farmers. Experience with alley cropping or possession of shelterbelts will be deemed desirable.

5. Variety in the size of areas where the technologies can potentially be applied will be deemed desirable.

Appendix 3

Example of recruitment text for prospective participants

Name _____

Address _____

Telephone number _____

CONTACT

Good morning, may I speak to Mr/Ms _____?

If the person is not there*:*

What would be the best time to reach him/her?

Make a note of the day and time and call back.

EXPLANATION OF THE PROJECT

My name is _____ , I am with the Canadian Forest Service.

The Canadian Forest Service is organizing a series of one-day focus groups as part of a research project. Focus groups are sessions during which a group of people discuss subjects introduced by a facilitator and express their comments, impressions and perceptions about them.

These focus groups will be discussing afforestation on farmland, especially abandoned farmland, and agroforestry, which combines the production of trees and agricultural crops.

There will be a non-specialist presentation on _____ , followed by a group discussion.

The discussions will be recorded, but the results will be presented confidentially and anonymously, to ensure that participants cannot be identified.

Would you be interested in taking part in a session of this kind with approximately 10 other landowners?

SELECTION CRITERIA

But first, we have to see whether you fit the profile of the persons we are looking for to participate in the focus group. I'd like to ask you a few questions, if I may.

(insert applicable questions/criteria here)

You meet the criteria for participation in these focus groups.

(***I'm sorry, but you do not meet the criteria for participation in these focus groups. Thank you for your patience. Some other time, perhaps!***)

In return for your participation, you will receive $100.00 (for the day).

The session that we are organizing will be held on _____ from _____ to _____ . It will continue in the afternoon from _____ to _____. Lunch will be served at the venue. Will that date be convenient for you?

If the person will not be available, thank him or her and hang up.

If the person will be available, continue.

THE FOCUS GROUP

The focus group will meet at _____ .

You should plan to be there by _____ . The session will be over by approximately _____ .

Do you know how to get there?

Do you think you will be able to make it?

It's important that you be there by _____ .

As I said, we will pay you $100.00 for your participation.

I would also like to emphasize that at the focus group meeting, everything you do will be on a voluntary basis, and you will be entirely free to leave at any time for any reason.

I will send you a letter confirming your participation in this focus group, and containing a summary of the project. The letter will specify the date, time and place of the focus group. What is the address to which the letter should be sent?

Make a note of the name, address and telephone number(s).

I should remind you once again that we will begin on time, at _____ on _____ . So if you turn up for the focus group after the session has begun, you may not be able to participate, and in that case we will be unable to pay you your $100.00. So it is most important for you to be there in good time.

To make sure that all the participants remember about the focus group, we will be contacting you the day before to remind you about it. Is _____ the best telephone number at which to reach you?

Thank you very much. I'm looking forward to meeting you on _____ at _____ .

Appendix 4

Script used in focus groups: the case of short-rotation intensive culture[1]

1- Presentation of the facilitator and the assistant. Meeting objectives, one of three series of focus groups across the Prairies (Edmonton, Saskatoon, and Winnipeg), others in Quebec, T&I Project, and procedures for this focus group.

2- Introductions of participants, occupations, experience/knowledge

First, I would like to review the material that has been sent to each of you. On the first page you will find a summary of the project. On the second you will find a participation consent section. It is important to write your address clearly and to sign the form so that we can send you your cheque.

WAIT A FEW MOMENTS

I am going to give you a comment sheet. Your comments and answers will be kept confidential and participants will remain anonymous.

GIVE EVERYONE the Concentrated Biomass for Energy Plantation comment sheet.

Before I have participants around the table introduce themselves, I would like you to take a few moments to enter the following into the area indicated on the sheet that I have given you:

- Your name

- Your occupation

- And in reply to Question 1, your level of experience with Concentrated Biomass for Energy Plantation.

WAIT A FEW MOMENTS

If you are ready, we will have all participants around the table introduce themselves. In addition to telling us your name, I would like you to tell us

> ***a) your occupation;***
>
> ***b) and your level of experience with and knowledge of Concentrated Biomass for Energy Plantation. Please provide a brief description of your experience and knowledge.***

I will write the answers on the flipchart. Let's start with you.

HAVE PARTICIPANTS INTRODUCE THEMSELVES

[1] For the Prairie provinces, the equivalent term "concentrated biomass for energy plantation" was used, as shown in this script and in documents in other appendices.

TAKE NOTES

Write on the flipchart the results for (b): the number of times that each of the five categories of levels of experience and knowledge (very low, low, average, high, very high) are mentioned.

3- Factual presentation on the technology (15-20 minutes)

We will now give you a presentation on Concentrated Biomass for Energy Plantation in layperson's terms. But before we do that, we will give all of you a copy of this presentation. You can keep it and use it to make notes.

- Distribute the paper copy of the PowerPoint presentation.
- Start the PowerPoint presentation.

After the PowerPoint presentation:

I would now like you to use your comment sheet.

In reply to Question 2 (2a and 2b), note your missing or unclear aspects of the non-specialist presentation on Concentrated Biomass for Energy Plantation.

The objective is to ensure that all participants fully understand the information given in the presentation.

I would like you to save your comments on the benefits and drawbacks for later.

***You will have an opportunity to express your comments later during the roundtable discussion*.**

4- Commentaries on missing or unclear aspects

If you are ready, we can begin the round table.

ROUND TABLE

Each participant reads his or her comments on the factual presentation.
The facilitator or the expert, as the case may be, answers the questions.

5- Benefits of Concentrated Biomass for Energy Plantation (Question 3)

I would now like you to take a few minutes to write on your comment sheet your answer to Question (3) about the various benefits of Concentrated Biomass for Energy Plantation you see as landowner.

I suggest that you classify them according to five categories of benefits: technical, financial, legal, environmental and other.

WAIT A FEW MINUTES. Each participant identifies the benefits of the technology from an owner's point of view.

We will now have all of you take turns telling us the benefits that you see as an owner.

I will take note of the various benefits you see as an owner.

I will classify your comments according to the five categories of benefits.

Feel free to mention benefits that have already been identified by other participants. The number of times that a particular benefit is mentioned has some importance.

Let's begin with the technical benefits.

1. ***Technical benefits***
2. ***Financial benefits***
3. ***Legal benefits***
4. ***Environmental benefits***
5. ***Other benefits***

HAVE PARTICIPANTS TAKE TURNS PROVIDING THEIR COMMENTS
TAKE NOTES

Do you see benefits other than those already identified?

HAVE PARTICIPANTS TAKE TURNS PROVIDING THEIR COMMENTS

TAKE NOTES

6- Drawbacks of the Concentrated Biomass for Energy Plantation (Question 4)

I would now like you to take a few minutes to write on your comment sheet your answer to Question (4) about the various drawbacks of Concentrated Biomass for Energy Plantation you see as an owner.

***I suggest that you classify them according to five categories of disadvantages: technical, financial, legal, environmental and other*.**

WAIT A FEW MINUTES. Each participant identifies the drawbacks of the technology from an owner's point of view.

We will now have all of you take turns telling us the drawbacks you see as an owner.

I will take note of the various drawbacks you see as an owner.

I will classify your comments according to the five categories of drawbacks.

Feel free to mention drawbacks that have already been identified by other participants. The number of times that a particular drawback is mentioned has some importance.

Let's begin with the technical drawbacks.

1. ***Technical drawbacks***
2. ***Financial drawbacks***
3. ***Legal drawbacks***
4. ***Environmental drawbacks***
5. ***Other drawbacks***

HAVE PARTICIPANTS TAKE TURNS PROVIDING THEIR COMMENTS
TAKE NOTES

Do you see drawbacks other than those already identified?

HAVE PARTICIPANTS TAKE TURNS PROVIDING THEIR COMMENTS
TAKE NOTES

7- Planting intentions

Before carrying out a simulation exercise, I would like you to take a few minutes to provide written answers to Questions 5 and 6.

WAIT A FEW MINUTES.

If you are ready, I will ask you two questions.

For the answers to questions 5 and 6, tell me in each case how many hectares you would plant in the next five years.

HAVE EACH PARTICIPANT GIVE HIS OR HER ANSWERS
AND NOTE DOWN THE NUMBER OF HECTARES

8- What was learned

I would now like you to take some time to answer Questions 7, 8, 9, 10 and 11 on the comment sheet. Your written comments will be looked at, but will not be discussed today. They will be useful for us in writing the report.

Do not forget to give me your comment sheet when you have finished.

Appendix 5

Summary of study and consent form: the case of the Prairie provinces

Project Summary

"Social Factors Affecting the Adoption of New Afforestation and Agroforestry Technologies"

A socio-economic research team from the Canadian Forest Service's Policy and Liaison Directorate is conducting a project in Quebec and in the three Prairie provinces on various social factors, such as attitudes, opinions and perceptions, which have an impact on the adoption of afforestation and agroforestry technologies for energy purposes. Three types of systems are being studied: 1. concentrated biomass for energy plantations; 2. alley cropping; and 3. willow-based riparian buffer systems.

The project will provide a picture of the factors promoting or hindering the adoption of such technologies. A focus group approach has been selected for this study. Approximately 10 participants will attend a factual presentation on a given technology, and discuss, for approximately two hours, the issues related to adopting this technology. A facilitator will ask questions and an assistant facilitator will take notes.

With the participants' consent, we will note the various comments and input provided, and the group's discussion will be recorded on audio cassette so that we do not miss any details of what is said. The information you provide will be kept anonymous and confidential. The data from the different focus groups will be combined for processing, and the results will be presented in a way that respects the participants' anonymity.

Only those people working on this study (Sylvain Masse, Pierre Marchand, Derek Sidders and Brent Joss) will have access to the focus group notes and recordings. The audio cassettes and written notes will be kept at the Laurentian Forestry Centre of the Canadian Forest Service, in Quebec City.

We do not foresee any risks related to your participation in this study. Your participation is voluntary, and you can withdraw at any time.

The results obtained will be analyzed and used for the publication of a Canadian Forest Service information report, as well as scientific and technical articles.

Should you have any queries or concerns, feel free to contact us. If you would like to receive a copy of the information report when it becomes available, please let us know.

Sylvain Masse, F. Eng., M.Sc.
Project Manager
Canadian Forest Service, 418-648-7152
e-mail: smasse@rncan.gc.ca

Pierre P. Marchand
Research Officer
Canadian Forest Service, 418-649-8072
e-mail: pierre.marchand@rncan.gc.ca

Derek Sidders
Prairie Logistics Coordinator
Canadian Forest Service, 780-435-7355 or 780-951-6402 (Cell)
email: dsidders@nrcan.gc.ca

Consent for Participating in the Study

"Social Factors Affecting the Adoption of New Afforestation and Agroforestry Technologies"

Focus group on:

Location:

Date:

I hereby acknowledge that:

I understand and agree that the comments and input I provide during the focus group meeting will be recorded.

I understand that I am participating in a study.

I have received and read the project summary.

I understand the risks and advantages of participating in the study.

I had the opportunity to ask questions about this study.

I understand that I can end my participation in this study at any time.

I understand that anything I say will be kept confidential.

I know who will have access to the information that I provide.

I understand the purposes for which the information will be used.

I understand that in consideration for my participation in the study I will receive compensation of $100.00.

Signature: _____ Date: _____

Name: _____

Street/RR# _____

City: _____

Province: _____

Postal code: _____

I would like to receive a copy of the report that will be produced based on this study:
( ) YES
( ) NO

Payment authorized by: _____ Date: _____

Appendix 6

Comment sheet on short-rotation intensive culture: the case of the Prairie provinces

The following questions will help you organize your comments for the discussion. We will use your answers to write a report on all the focus groups set up in the Prairies. We promise that respondents will remain anonymous and that their answers will be kept confidential. Please return this comment sheet to us when you have filled it out.

Name: _____

Occupation: _____

1- What is your **level of experience with and knowledge of** Concentrated Biomass for Energy Plantation? (Please check the appropriate answer).

( ) Very low
( ) Low
( ) Average
( ) High
( ) Very high

2- Concerning the **factual Presentation** on Concentrated Biomass for Energy Plantation

a) What are the aspects of this presentation that should be **clarified**?

b**) What information is missing** from the presentation?

3- What are the **benefits** of Concentrated Biomass for Energy Plantation that you see as an owner?

Technical benefits:

Financial benefits:

Legal benefits:

Environmental benefits:

Other benefits:

4- What are the **drawbacks** of Concentrated Biomass for Energy Plantation that you see as an owner?

Technical drawbacks:

Financial drawbacks:

Legal drawbacks:

Environmental drawbacks:

Other drawbacks:

5- **If we assume that you are eligible** for technical and financial assistance under a program with subsidies representing 75% of the establishment costs, how many hectares of concentrated biomass for energy plantation would you establish in the next 5 years? _____ hectare(s)

6- **If we assume that you are not eligible** for technical and financial assistance under a program with subsidies representing 75% of the establishment costs, how many hectares of concentrated biomass for energy plantation would you establish in the next 5 years? _____ hectare(s)

7- Do you feel that you **learned anything** today about concentrated biomass for energy plantation? (Please check the appropriate answer.)

( ) No
( ) Yes, a little
( ) Yes, a lot

8- Of the topics discussed in this focus group on concentrated biomass for energy plantation, **which topic** was **the most useful for you**?

9- During this focus group, did **your interest** in concentrated biomass for energy plantation change? (Please check the appropriate answer.)

( ) My interest diminished
( ) My interest did not change
( ) My interest increased

10- What contributed to this change or lack of change in your interest?

11- Other comment(s)?

Presentation on short-rotation intensive culture of willow: the case of the Prairie provinces

Concentrated Biomass for Energy Plantations (Willows and Hybrid Poplar)

Presentation outline

1. Why plant willows and hybrid poplars?
2. Concentrated biomass for energy plantations
3. Yields
4. Potential markets
5. State of technology development
6. Active research and development objectives
7. Government incentives

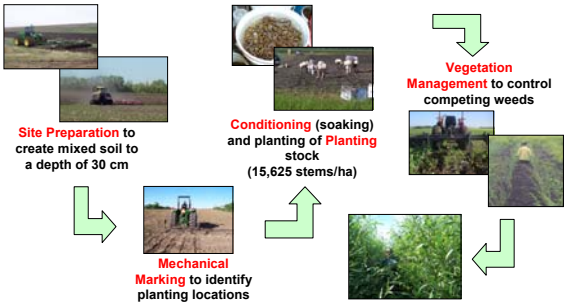
1. Why Plant Willows and Hybrid Poplars?

- Easy propagation by cuttings (clones)
- Moderate site requirements (heavy-medium texture, moderately fertile, moderately well drained soil)
- Rapid growth
- Production of shoots after harvesting
- Diversity of species and clones
- Small area requirement

2. Concentrated Biomass for Energy Plantations (CBEP)

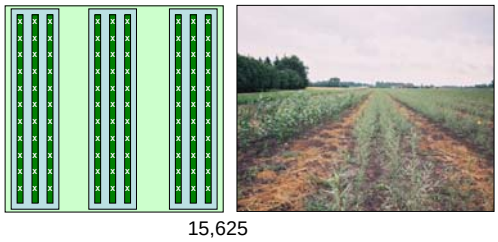
- High density plantation (15-18,000 cuttings/ha)
- Harvesting based on very short cyles (3-4 years)
- Multiple generations from single root system (6-7)
- High density of shoots after cutting (50,000 to 80,000/ha)

Establishment Practices



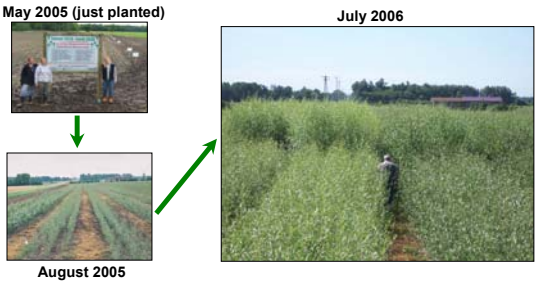
Concentrated Biomass for Energy Plantation Planting Design

Trees are planted in 120 cm (4 ft) wide beds established at 2 m intervals.
Each bed consists of 3 single rows established at 60 cm (2 ft) intervals.
Trees are planted at 60 cm (2 ft) intervals along each row.



15,625 Stems/ha

Concentrated Biomass for Energy Plantation Results (Portage la Prairie site)



Weeding between seedlings

Weeding between rows with a rotary cultivator

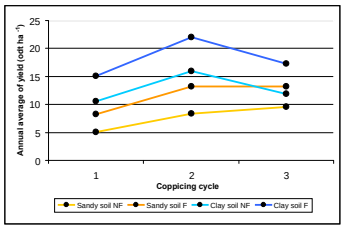
(Selected photos from Quebec)

Inadequate tending of competitive vegetation

3. Yields

- 10 to 25 dry tonnes per hectare per year (small experimental plantations)
- Estimated at a minimum of 10 tonnes/ha/year in operational applications and moderate-large plantations
- Propagation materials: 1/2 million 20 cm cuttings/ha in year 1, 1.0 million/ha in year 2

Average Annual Yield of Experimental Plantations in Quebec



Opportunities

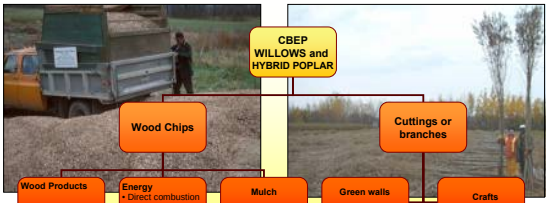
- Availability of moderate agricultural land (small parcels)
- Crop method similar to conventional agricultural practices
- Potential revenue in the short term
- Can meet specific needs for resources for which there is growing demand

Average Production Costs of Experimental Plantations in Quebec

Generations	Duration	Costs ($/ha)	Cost Breakdown			
			Establishment	Maintenance	Harvesting	Total
First	3 years	4,000	55%	15%	30%	**100%**
Second	3 years	2,000	0%	21%	79%	**100%**
Third	4 years	2,000	0%	21%	79%	**100%**
Total	**10 years**	**8,000**				

Total harvest: 180 dry tonnes per hectare
Cost per tonne: $45

4. Potential Markets



CBEP WILLOWS and HYBRID POPLAR

Wood Chips

Cuttings or branches

Wood Products
- Panels
- Cardboard

Energy
- Direct combustion
- Co-generation
- Gasification

Mulch

Green walls

Bioremediation

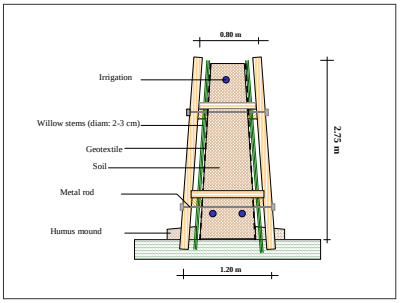
Crafts

Propagation (cuttings)

Horticulture

Environmental Uses of Willows: Erosion Control

Construction Principles



5. State of Technology Development

Developed initially in Europe and Scandinavia:

- For energy production purposes
- 15,000 ha under cultivation in Sweden
- Approximately 12,500 ha under cultivation in New York State by 2010 (Salix Consortium)

Adapted to the Quebec context in the past 15 years by the Institut de recherche en biologie végétale (IRBV):

- Approximately 30 ha of experimental plantations

Adapted to Ontario and the Prairies in 2005 and 2006 by the Canadian Forest Service and private landowners:

- 38 ha of experimental plantations established (23 in 2005, 15 in 2006)

Concentrated Biomass for Energy Plantations: Prairies and Ontario

Established in 2005 and 2006

6. Active R&D Objectives

- Double the average productivity of large plantations (20 tonnes/ha/year) through:
  - Selection of species and clones
  - Better site selection (more productive)
  - Refined management practices
- Reduce production costs by 15% through:
  - Mechanization of planting, cultivation and harvesting

Active R&D Objectives (cont'd)

- Determine yields after several generations
- Assess insect and disease-related risks (little damage to date)
- Test the technology in various Prairie regions
- Verify the marketing potential
- Demonstrate portable conversion technologies

7. Government Incentives

Federal research programs:

- Through the Canadian Forest Service, primarily with technical development support and applied research

Provincial research programs:

- Manitoba Conservation: No formal program.
- Saskatchewan Forest Centre: Development fund support (landowners and researchers submit proposals that contribute to the development of agro-forestry technologies)
- Alberta: No formal program