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PORTRAIT OF

# AGROFORESTRY

IN QUEBEC

Executive summary

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Canada 

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## Foreword

Agroforestry is a system of land management that integrates tree and shrub plantings with crops or livestock in order to generate economic, environmental and social benefits. Although some agroforestry practices, such as windbreaks and shelterbelts, are popular in Quebec, agroforestry as a whole is not well known in the Quebec agri-food sector.

More and more organizations are becoming interested in agroforestry because of the considerable promise agroforestry systems hold for agricultural producers and for society at large. The fact that agroforestry practices are not well documented and the concept of agroforestry is not well defined has impeded the expansion of agroforestry in Quebec.

The aim of this report is to fill knowledge gaps related to the situation of agroforestry in the province. Without striving to be exhaustive, it provides a portrait of agroforestry practices and practitioners, outlines the basic characteristics of agroforestry and provides suggestions for promoting agroforestry development. The report is intended mainly for public, private and corporate decision makers with links to agroforestry. Given the wealth of information provided, the document is likely to be of interest to many other readers, such as agricultural and forestry associations and regional development stakeholders keen to explore new avenues.

It is the hope of the authors, who were brought together by the partnership established among four proponent organizations, that this portrait will give greater visibility to agroforestry and persuade many new partners to embark on the adventure that it represents.

## Abstract

As a result of growing social pressure in Quebec for the sustainable management of the province's natural resources, combined with the economic and environmental challenges facing the agricultural and forestry sectors, new approaches such as agroforestry are attracting greater attention. Although agroforestry systems exist in a number of tropical and temperate countries, they are not very well known in Quebec. Agroforestry practices nonetheless offer many advantages such as crop and livestock protection, soil and stream conservation and protection, diversification of agricultural revenues through the production of timber and non-timber forest products, promotion of biodiversity, landscape enhancement and carbon sequestration. In short, agroforestry can provide a wide range of environmental goods and services that are in keeping with the goal of integrated management of rural areas. The aim of this report is to provide a picture of agroforestry in Quebec and assess the potential that agroforestry systems hold for the province as a whole. More specifically, it will describe current agroforestry practices in Quebec, define agroforestry in the Quebec context and provide a brief strategic analysis. The report describes the agroforestry practices and systems that are already in use or are being developed, along with the key stakeholders. Recommendations are provided with a view to promoting agroforestry development in Quebec in the near future. Five preliminary strategic components are recommended: recognition of agroforestry by government and institutional decision makers; establishment of an intersectoral partnership; adoption of an economic and market development approach; solid technical and economic foundations for agroforestry development; and adequate structural and operational funding. A dynamic association of agroforestry stakeholders would make it possible to harness the strengths of individual partners to achieve the shared goal of developing and giving visibility to this promising area of endeavour.

## Introduction

While agroforestry principles and practices have long been recognized and applied in tropical countries, temperate countries have lagged behind in this regard. The desire for more environmentally responsible agricultural practices and systems has provided an ideal context for developing and implementing agroforestry in temperate regions. Agroforestry offers many benefits, including the protection of crops, livestock, soil and water resources. It also permits diversification of agricultural revenues through the production of timber and non-timber forest products. Agroforestry practices also enhance landscapes by promoting biodiversity and carbon sequestration. In short, agroforestry provides an array of environmental goods and services that support integrated management of farmland and rural spaces.

For these reasons, agroforestry is attracting more and more interest among agricultural and forestry stakeholders in Quebec. Although agroforestry is practised in most regions of Quebec in various forms, its economic and environmental potential is still largely unexploited. Tapping this potential will require a systematic approach that involves defining agroforestry, assessing development prospects across Quebec, establishing an implementation strategy and ensuring broad deployment of the strategy. Essential pre-conditions for agroforestry development include bringing together all the provincial stakeholders currently involved in agroforestry and establishing a partnership in Quebec to actively support the process. It is with this goal in mind that the present portrait of agroforestry has been drawn up.

The main objectives of this study are to describe the current state of agroforestry in Quebec, propose a definition that fits the Quebec context, provide a brief strategic analysis and put forth a number of recommendations. The mandate comprised three broad steps that correspond to the main sections of this report: 1) delineation of the field of agroforestry and the conceptual framework; 2) collection, analysis and organization of information on agroforestry practices; and 3) examination of opportunities and issues related to the development of agroforestry. The last step was carried out by proposing and organizing the preliminary strategic components and providing recommendations for agroforestry development in Quebec.

## Agroforestry in Quebec

Before we can assess the situation of agroforestry, it is necessary to provide an operational definition of agroforestry and delineate this area of endeavour in Quebec. Many general definitions of agroforestry can be found in the literature. The following definition, which draws on some existing definitions, is proposed as a simple and accurate description of the concept of agroforestry.

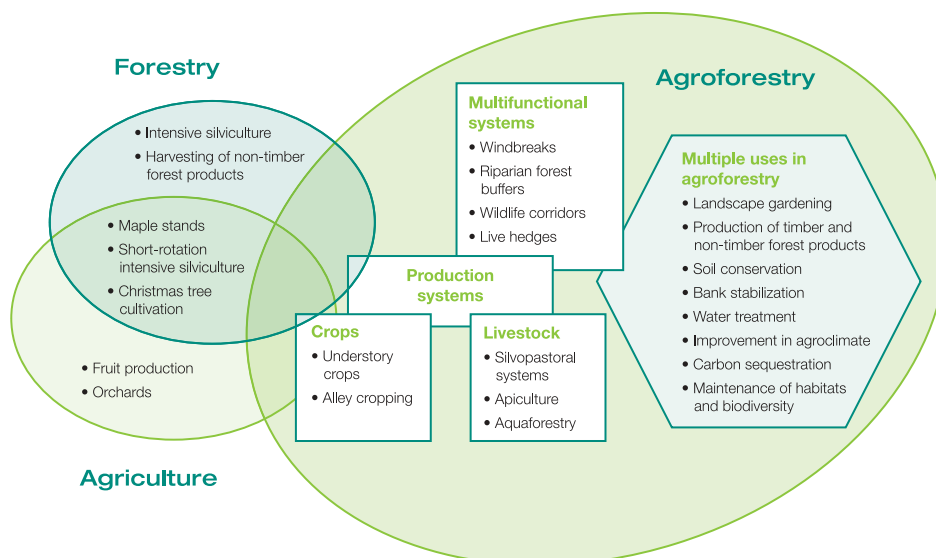
*Agroforestry is an integrated system of rural land resource management based on combining shrubs and trees with crops and/or livestock, whose interactions generate economic, environmental and social benefits.*

A variety of agroforestry systems are used around the world, and they can be classified in a number of different ways depending on the criteria employed. For example, one classification approach is based on the type of components involved: silvopastoral systems (production of livestock and woody plant species), agrosilvicultural systems (woody plant species and seasonal plants) and agrosilvopastoral systems (production of livestock, woody plant species and seasonal plants).

Agroforestry systems can also be classified on the basis of their primary function. That is the classification approach that has been adopted in this portrait of agroforestry in Quebec. Thus, although all agroforestry systems have the capacity to provide a range of products and services simultaneously, this type of classification distinguishes between systems aimed at producing goods and multifunctional systems, which combine the production of timber and non-timber products with environmental, social and land use services.

Since agroforestry is a relatively new concept in Quebec, it is important to describe this area and how it relates to similar or associated agricultural and forestry activities. The figure below provides a schematic representation of the sectors concerned. It shows how the forestry sector and the agriculture sector overlap with respect to certain types of production, which may be subsumed under either agriculture or forestry, and depicts their close relationship with agroforestry. This illustration conveys the idea that forestry and agriculture, together with the emerging area of agroforestry, share many challenges and issues that can best be addressed through joint efforts aimed at integrated development.

**Figure 1: The agroforestry sector in Quebec**



## Portrait of multifunctional agroforestry systems

Shelterbelts and windbreaks, together with riparian forest buffers, are the main multifunctional agroforestry systems found in Quebec. Whereas the wildlife corridor concept is of interest to some regional and local stakeholders, no examples of the use of live hedges—plant species grown together to form a natural fence—were identified.

### Windbreaks and shelterbelts

Windbreaks are narrow plantings of trees and shrubs, mainly tall woody species that form a linear barrier perpendicular to the prevailing winds; they protect cropland, pastureland, roads, farm buildings and houses from the harmful effects of wind and wind-blown sand and dust. Windbreaks and shelterbelts (windbreaks that cover a wider area than a single farm) represent the most popular agroforestry practice in Quebec. Since the mid-1980s approximately 400 km of windbreaks and shelterbelts have been established annually in rural Quebec. The popularity of this practice can be attributed to wide-reaching extension efforts, training for technical advisors and government financial and technical assistance programs, such as the provincial Prime-Vert program and Greencover Canada. Over the past few years, the Fédération des producteurs de porcs du Québec has been promoting the use of windbreaks to reduce odours from livestock facilities.

Extension and technical support services for agricultural producers are generally provided by agri-environmental advisory clubs (CCAÉ) and regional advisors with the Quebec Department of Agriculture, Fisheries and Food (MAPAQ), which administers Prime-Vert. The Institut de technologie agroalimentaire (ITA, La Pocatière campus) plays a lead role in R&D efforts related to windbreaks and shelterbelts in Quebec and in eastern Canada. The ITA in La Pocatière maintains close collaborative ties with Agriculture and Agri-Food Canada's Prairie Farm Rehabilitation Administration (PFRA) Shelterbelt Centre, in Saskatchewan.

### Riparian forest buffers

Riparian forest buffers are established along water courses to stabilize streambanks, protect water quality and habitats, maintain stream flows and sequester carbon. Like windbreaks, they may generate both timber and non-timber forest products, while contributing to the aesthetics of the landscape.

Quebec's policy on shorelines, littoral zones and floodplains (Politique de protection des rives, du littoral et des plaines inondables) calls on agricultural producers to maintain a three-metre-wide natural or managed (herbaceous vegetation, shrubs or trees) riparian strip between agricultural fields and streams, in order to minimize erosion and run-off. Despite this buffer strip requirement and the technical and financial assistance available under existing programs, treed riparian buffers are not as popular as windbreaks at present. The lack of interest in establishing woody riparian buffers may stem from the fact that the economic benefits are less obvious than those associated with windbreaks, which increase crop yields and reduce building heating costs.

For several years now, the concept of riparian forest buffers, which support multiple ecological and economic functions, has captured the attention of many environmental and agricultural stakeholders on account of the beneficial ecological services. In Quebec, for example, the Fondation de la faune du Québec and watershed committees are promoting these systems, and their efforts are supported through partnerships with the Union des producteurs agricoles (UPA) and agri-environmental advisory clubs. The province has a very dense drainage network with an average of 1.7 km of stream per km<sup>2</sup>, and crop productivity in zones adjacent to water courses is often suboptimal. Areas such as these would benefit from the enhancements provided by riparian forest buffers. The potential for implementing these systems and their capacity to produce goods and services that support the farmer's bottom line needs should be quantified for all agricultural lands.

## Production-oriented agroforestry systems

Production-oriented agroforestry systems include silvopastoral systems, apiculture and trees, understory crops, alley cropping and aquaforestry. Short-rotation intensive silviculture has been included in this category for the purposes of this study.

### Silvopastoral systems

Silvopastoral systems integrate trees, forage crops and livestock and harness the dynamics of managed interactions. Although livestock production and forests have long co-existed in the rural areas of Quebec, there are few silvopastoral systems in the province. Three livestock systems were identified that show similarities with silvopastoral systems:

- Rearing of big game in managed or natural woodlots that emulate their natural habitats and help to increase the yields from this type of production for commercial purposes;
- Woodlots integrated in pastureland to create shelter for cattle;
- The practice of using minimal facilities, that is, winter enclosures in woodlands to improve the health of cattle during the winter.

Livestock access to water courses can result in streambank degradation and water quality problems. In Quebec, unimpeded livestock access to water courses is prohibited under the *Agriculture Operations Regulation* (REA), which means that livestock watering facilities need to be provided.

### Apiculture combined with woody plant species

Apiculture combined with woody plant species is practised on a large scale in Quebec. The most typical use is in fruit production. A good example of this is the use of beehives in blueberry fields in the Saguenay–Lac-Saint-Jean region. Pollination of 90% of the blueberry fields in this region is stimulated by placing hives in the blueberry fields in accordance with agreements between beekeepers and blueberry growers.

### Understory crops

The cultivation of understory crops is another agroforestry practice that has a good potential in Quebec. There are two reasons for this. First, understory crops are viewed as an attractive income diversification strategy for rural regions. Second, these crops reduce human pressure on the natural populations of many shade-loving indigenous plants. In Quebec, ginseng, mushrooms, bloodroot, goldenseal and wild ginger are the main crops that can be grown in the understory. Canada yew also holds potential in this regard.

With the exception of mushrooms, understory crops are generally established in mature maple stands for ecological and logistical reasons. Indeed, these crops are good associates for maple stands since the activities they entail are carried out at different points in the season. Some organizations are playing a very active role in research and development efforts related to understory crops in Quebec: Ginseng Boréal, the Centre d'expertise sur les produits agroforestiers (CEPAF), Mycoflor Inc. (mushrooms), Laval University and the Quebec Department of Natural Resources and Wildlife (MRNFQ). Although production in Quebec is still modest, a growing number of producers (mostly maple producers) are interested in understory crops.

### Alley cropping

Alley cropping, the practice of growing an annual crop between two rows of trees or shrubs, is not well known in Quebec. It is nonetheless starting to attract interest within the university research community. Laval University's Groupe interdisciplinaire de recherche en agroforesterie (GIRAF) and other parties involved in economic research and development have joined forces to study the ecological interactions between woody plants and annual crops. Local development officers have helped to establish alley cropping sites in the Gaspé region, notably at Val d'Espoir (beans–elderberry) and Gaspé-Nord (winter squash-service berry).

The approach of integrating blueberry production with forests is related to alley cropping, since it involves growing blueberries in wide strips of cleared forest (60 m), which alternate with intensively harvested strips of forest (42 m). The development of this concept was supported by the MRNFQ and by the Canadian Forest Service (Natural Resources Canada). This approach has been implemented in four regions of Quebec (Gaspé, Saguenay–Lac-Saint-Jean, North Shore and Mauricie) covering an area of about 2,000 hectares.

### Aquaforestry

Willow and poplar plantations have the capacity to remove phosphorus and other contaminants from various types of wastewater. Only one aquaforestry approach was identified in Quebec. The Institut de recherche en biologie végétale (IRBV) is carrying out a research project that involves using willow and poplar plantings to treat fish-farm effluents. The goal is to evaluate the feasibility of using this approach to clean effluents before they are released into the water course.

### Short-rotation intensive silviculture

In short-rotation intensive silviculture, fast-growing trees and shrubs such as willow and poplar are used to maximize fibre yield. Willow seedlings are planted in the first year and then harvested, by cutting, every three years afterwards for a period of about 20 years. Cutting has the effect of promoting vigorous regrowth of the stems, thereby increasing production, which explains the lumber industry's interest in intensive silviculture. The fibre that is produced can be incorporated into particle board, for example, or be used for energy production. In the case of poplar, harvesting takes place 10 to 20 years after the trees are planted, and a new planting has to be established afterwards. There are a number of possible uses for poplar in the wood processing and pulp and paper sectors.

Although not considered an agroforestry practice per se, short-rotation intensive silviculture offers definite potential for the reclamation of abandoned land and is therefore one of the technological options that should be considered for agricultural land in harmony with other types of agroforestry production. Several organizations, including Natural Resources Canada, Agriculture and Agri-Food Canada, the MRNFQ, the Botanical Garden and the Centre d'expertise sur les produits agroforestiers (CEPAF) carry out R&D work dealing with this type of production.



## Agroforestry products and marketing efforts

Agroforestry products can be grouped into two broad categories, fibre products and non-fibre products, which are known as non-timber forest products or (NTFP).

### Timber (fibre) products

In agroforestry, windbreaks and shelterbelts, alley cropping and riparian forest buffers have considerable potential for timber production. This potential should nonetheless be assessed more precisely for all the agricultural land in Quebec. Windbreaks and short-rotation woody crops are promising fibre sources. The wood produced by intensive silviculture is intended primarily for energy production and as a source of fibre for the engineered wood and pulp and paper sectors.

Since most windbreaks have been established recently, little marketing of agroforestry timber products has taken place in Quebec. However, existing regional marketing networks for forestry softwood and hardwood products will be harnessed in order to sell wood produced through agroforestry. An analysis needs to be conducted to determine the mechanisms that can be used to market these agroforestry products.

### Non-timber forest products

Non-timber forest products represent a category of production that is still in the start-up stage in Quebec, and in many cases still at the research and development stage. For some agroforestry initiatives, like blueberry, honey and ginseng production, market channels are fairly well developed. The main categories of NTFPs are presented in the following table.

**Table 1: Categories of non-timber forest products\***

Food products	Manufacturing materials and products	Health and beauty products	Decorative and aesthetic products	Environmental products	Horticultural products
Berries	Adhesives	Medication	Christmas trees	Biogas	Ornamental trees
Honey	Alcohol	Essential oils	Cones for handicrafts	Biopesticides	Shrubs
Saps and syrups, sugars, caramel, butters	Essential oils	Cosmetics	Bark for crafts	Recycled products	Wild flowers
Mushrooms	Resins	Perfumes and fragrance	Wood crafts		Grass
Nuts	Specialty wood products	Products for animals	Carvings		Mulch
Seed	Candles	Shampoo	Floral arrangements		Soil amendments
Tea	Tissues	Soaps	Wreaths		
Vegetables	Turpentine		Natural dyes		
	Incense				

\* Source: Mompremier, E., 2003. *L'agroforesterie pour le développement durable de l'Estran (Gaspésie): Caractérisation du milieu en vue d'une valorisation de l'espace rural par des pratiques agroforestières*. Essai de Maîtrise. Université Laval, Quebec, 86 pp.; Davidson-Hunt I., Duchesne L.C. et Zasada J.C., 2001. *Non-timber Forest Products: Local Livelihoods and Integrated forest management*. From: *Forest communities in the third millenium: Linking research, business, and policy toward a sustainable non-timber forest product sector*. Proceedings of a meeting held October 1 – 4, 1999, in Kenora, Ontario, Canada. USDA Forest Service, USA, 1 – 12 p.

The existence of a market is a key factor for the development of new products. At present, the main commercial problem related to NTFPs is the lack of volume available for wholesalers in Quebec and abroad. This situation is not attributable solely to low production of woody plants in Quebec; poor organization of supply is also a problem. As a result, demand on some markets for NTFPs, such as natural and health products, cannot be met. With the growing popularity of understory crops, the production shortfall for some products could disappear in the medium term.

Developing markets while production is still being established poses risks that agricultural producers and small business cannot bear on their own. For example, the networks for some promising NTFPs, such as bloodroot and black cohosh, should be supported in the short- and medium-term through programs and the provision of marketing expertise. Furthermore, NTFPs and timber products alike could benefit from a strategy for implementing a “Quebec agroforestry product” brand.

## Agroforestry benefits for Quebec

In addition to producing non-timber forest products, agroforestry systems provide abundant services, which meet concrete social needs. Table 2 illustrates the range of agroforestry services provided and the overall socio-economic potential of agroforestry.

**Table 2: Agroforestry services\***

<b>Economic services</b>	<ul style="list-style-type: none"> <li>• Diversification of economic activities</li> <li>• Diversification of agricultural revenues</li> <li>• Increase in yield from conventional agricultural systems</li> <li>• Reclamation of fragile or marginal lands</li> </ul>
<b>Environmental services</b>	<ul style="list-style-type: none"> <li>• Increase in plant and animal biodiversity</li> <li>• Decrease in wind and water erosion</li> <li>• Improvement in soil fertility</li> <li>• Improvement in soil hydrology regimes</li> <li>• Mitigation of air, sound and odour pollution</li> <li>• Water treatment</li> <li>• Carbon sequestration and storage</li> <li>• Reduction in deforestation</li> <li>• Improvement in microclimates</li> <li>• Mitigation of climate change impacts on agriculture</li> </ul>
<b>Social services</b>	<ul style="list-style-type: none"> <li>• Job creation</li> <li>• Food security</li> <li>• Landscape enhancement</li> <li>• Improvement in public opinion regarding agricultural and forestry activities</li> </ul>
<b>Land use services</b>	<ul style="list-style-type: none"> <li>• Diversified land use</li> <li>• Use of marginal lands (abandoned agricultural land, hill slope plots, etc.)</li> </ul>
<b>Cultural services</b>	<ul style="list-style-type: none"> <li>• Use of local and indigenous knowledge</li> </ul>

\* Adapted from: Gold M.A., W.J. Rietveld, H.E. Garrett and F. Fisher, 2000. Agroforestry Nomenclature, Concepts, and Practices for the USA. In: *North American Agroforestry: An Integrated Science and Practice*. 32-63 p.; Bellefontaine R., S. Petit, M. Pain-Orcet, P. Deleporte and J. G. Bertault, 2001. *Trees outside forests: towards better awareness*. FAO Conservation Guide 35. FAO, Rome, Italy; Gordon A.M. and S.M. Newman, 1995. Temperate agroforestry: An overview. From: *Temperate agroforestry systems*. CAB International, University Press, Cambridge, 264 p.

Agroforestry, which offers practical applications supporting the concept of sustainable development, is a concrete tool for harnessing the multiple functions of agriculture. Agroforestry practices can help to give a human face to landscapes in rural regions, and they are an important part of the multi-resource approach to private forest management. The idea of integrating multiple uses through agroforestry is growing in popularity among regional economic development players, and agroforestry practices are being incorporated into various land management and development projects. Agroforestry generates environmental goods and services that can support the creation of a network of small and medium-sized spin-off enterprises, which will provide services to support producers' operations as well as product harvesting, processing and marketing.

Government agricultural policies and programs often address economic and environmental functions sectorally, resulting in the parallel development of multiple components: crop insurance; reduction in environmental risks; soil conservation; biodiversity protection; carbon sequestration, etc. Agroforestry, on the other hand, represents a powerful integration tool: a variety of objectives can be attained simultaneously through the planned implementation of agroforestry systems.

## Conceptual framework for agroforestry in Quebec

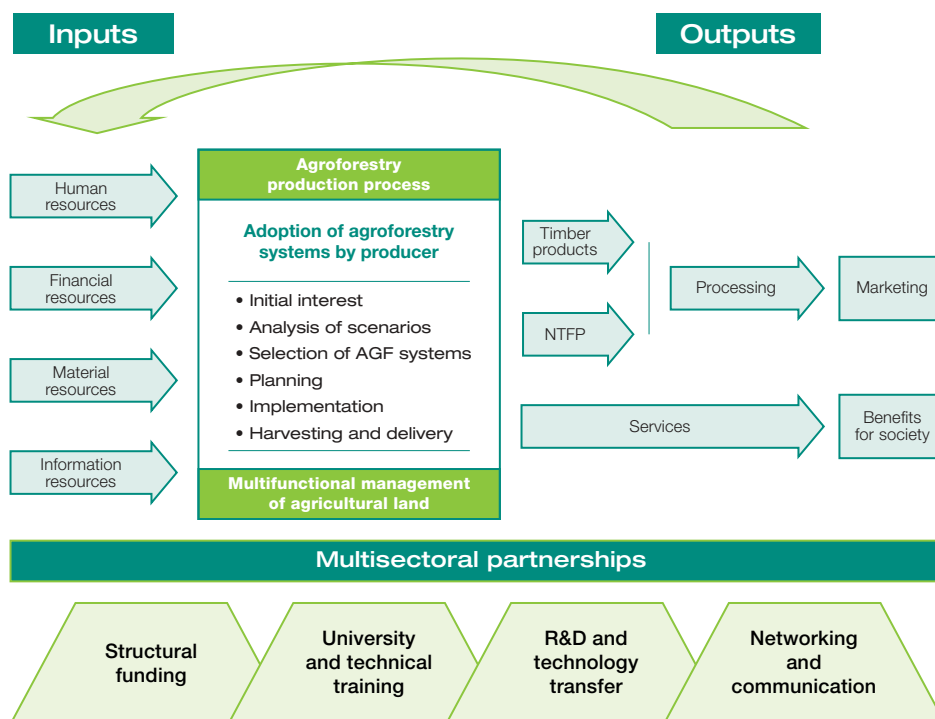
A conceptual framework is a useful tool for organizing information and guiding the analysis of important factors associated with agroforestry development. The conceptual framework illustrated in Figure 2 comprises four components that are essential to agroforestry in Quebec.

Agroforestry production, which requires the agricultural producer's commitment, is the central component. On-farm production of timber and non-timber forest products fits into the broader land use management function, which takes other elements into consideration (woodlots, forests, crops, urban centres), together with the multiple functions of agroforestry: habitat protection, landscape enhancement, protection of water resources, carbon sequestration, etc. Producers need resources if they are to be able to make managerial and operational decisions leading to the production of agroforestry goods and services. These resources, which are situated upstream of production, are the inputs to the system. They include the funding required to support production, material resources (equipment, plants, etc.), technical support and workers, as well as the information required for decision making.

Downstream from agroforestry production, products are generated that need to be processed and marketed, and services need to be harnessed or remunerated, depending on their nature and ultimate purpose. Viable agroforestry production calls for the existence of markets for products and demand for agroforestry services. Combined with the "inputs" and production components, the "outputs" part of the system shows the economic potential of agroforestry as depicted by the conceptual framework. A feedback arrow indicates that outputs have an influence on decision making related to the production process and upstream resources.

The fourth component of the conceptual framework relates to the structural elements that must be established to support the implementation of agroforestry systems: research and development, training, technology transfer, networking and communication, and the funding required to put these structural elements, or pillars, into place.

Figure 2: Proposed framework for agroforestry in Quebec



## Resources required for agroforestry development

In order to harness Quebec’s agroforestry potential, it is essential that agricultural producers have access to the requisite material, land, human, information and financial resources.

### Material and land resources

Agroforestry requires the availability of agricultural and/or forestry land depending on the system to be established. Quebec has many areas—publicly and privately owned agricultural and forestry lands—where agroforestry practices could be implemented. Farm woodlots, maple stands and abandoned land appear to hold great promise for the establishment of agroforestry systems. Abandoned parcels of land, which are also in demand for reforestation (or afforestation) activities, call for careful consideration to ensure that potential agroforestry uses will not conflict with other land uses. An inventory of available land should be conducted in order to assess Quebec’s agroforestry potential.

In addition to the usual material resources (equipment and buildings), agroforestry systems call for suitable genetic material (seed, seedlings). In Quebec, seedlings and tree and shrub seed are supplied by a network of privately and publicly (MRNFQ) owned nurseries. The planting stock required for some types of production (ginseng, mushrooms) is distributed by small independent enterprises (e.g. Ginseng Boréal and Mycoflor Inc.). Expansion of the agroforestry sector may create demand for specific plant species as well as for new products.

## Human resources

Quebec already has a pool of human resources to support agroforestry, both in the academic/scientific community and in agriculture and forestry advisory organizations. Laval University offers a master's degree in tropical and temperate agroforestry, and the ITA at La Pocatière gives technical courses on riparian buffers and windbreaks. The ITA also offers an agroforestry bridge between the CEGEP diploma (DEC) in agri-environmental technologies and the bachelor's degree in agroforestry offered at the University of Moncton, in New Brunswick. However, there is no comprehensive technical program in agroforestry covering all the agroforestry systems used in temperate climates as well as the socio-economic and management aspects of implementation in rural areas of Quebec.

In the agriculture sector, agri-environmental advisory clubs provide technical assistance for producers interested in introducing riparian buffers and shelterbelts. In addition, MAPAQ has trained advisors who handle the technical aspects of these agroforestry systems under the Prime-Vert program. Forest group ventures, which can be considered the forestry counterparts of agri-environmental clubs, are paying more and more attention to the potential offered by non-timber products from private forests and they have technicians who can support efforts to implement multi-resource forest harvesting. The most active organizations in technology transfer to agroforestry producers are the CEPAF (windbreaks and shelterbelts, riparian buffers, understory crops, intensive silviculture), Ginseng Boréal (understory crops), Mycoflor Inc. (mushrooms, understory crops). Specialized units at MRNFQ and MAPAQ, together with research facilities working on agroforestry initiatives, have a great deal of expertise. Finally, Agriculture and Agri-Food Canada's Agroforestry Division has many partnership ties with teams of researchers in Quebec, including researchers at the Canadian Forest Service, the ITA and Laval University.

## Information resources

In Quebec, knowledge acquisition in the area of agroforestry is centred in a few research groups that capitalize on the multidisciplinary character of this field in order to build partnerships with stakeholders in the environmental, agricultural, forestry and land use sectors. Nonetheless, funding sources for agroforestry research appear to be scattered and the amounts modest. One remarkable agroforestry research group is GIRAF at Laval University, which supervises research projects carried out by master's and PhD students, as well as other research activities. Scientific research findings are disseminated through symposia, such as the "L'agroforesterie au Québec" event, held in 2002, and the "Des arbres sur ma ferme" gathering, held in 2004, as well as through scientific journals and specialized works. The general public is not very familiar with agroforestry concepts. Some media outlets in Quebec, such as the agricultural magazine "La terre de chez nous" and the television show "La semaine verte," have dealt with agroforestry topics on several occasions.

## Financial resources

Funding for the implementation of agroforestry systems varies with the context—agriculture or forestry—and the desired outcome—for example, fruit production, reduction of nuisance odours, protection of water courses or landscape enhancement. In Quebec, agri-environmental incentive programs provide the greatest financial support for agroforestry systems, that is, Prime-Vert and Greencover Canada. These programs encourage agricultural producers to establish windbreaks and protective buffer strips. Although the projects have a limited scope and approval is on a farm-by-farm basis, the programs provide the opportunity to incorporate beneficial management practices into a collective process, which is highly desirable for the management of agroforestry systems.

In the forest sector, MRNFQ's private forest development program (Programme de mise en valeur de la forêt privée) can, in specific cases, encourage the implementation of agroforestry practices such as alley cropping in forest areas. Apart from these programs, several funding sources are available for individual projects that meet the specific criteria of the funding agencies, including MRNFQ, the Fondation de la faune du Québec and the Fonds d'action québécois pour le développement durable (FAQDD). Finally, in Quebec, financial assistance can be obtained through organizations such as the Financière agricole and through specific programs such as the Forest Management Funding Program, which offer financial tools adapted to such investments. Research funds, incentive programs and financial assistance are also spread across a number of sectors, departments and institutions. Furthermore, the existing incentive programs cover only two agroforestry systems, that is, windbreaks and riparian systems. Alley cropping, understory crops and silvopastoral systems are not supported at present by provincial programs.

## Agroforestry issues in Quebec

Identifying strengths and weaknesses is a way to identify the issues that need to be solved in order to further develop the activities of the agroforestry sector. A consultation carried out in April 2006 with 21 agroforestry stakeholders in Quebec provided an opportunity to identify the strengths and weaknesses of the sector. The table below provides an overview.

**Table 3: Strengths and weaknesses of the agroforestry sector in Quebec**

<b>Strengths</b>	<ul style="list-style-type: none"><li>• The multiple functions of agroforestry (environmental, economic and social) mesh well with the goals of sustainable development</li><li>• Agroforestry can help to diversify farm revenues and support regional economic development</li><li>• Agroforestry helps to maintain and enhance biodiversity and protect the environment</li><li>• Agroforestry holds promise for reclaiming abandoned farmland</li></ul>
<b>Weaknesses</b>	<ul style="list-style-type: none"><li>• Lack of funding and incentive programs covering agroforestry practices</li><li>• Insufficient links and co-ordination of efforts among stakeholders</li><li>• Technical and economic knowledge gaps related to most systems</li><li>• Training in agroforestry is not well developed</li></ul>

Thanks to the efforts of government, private sector and university stakeholders, Quebec already has a number of key elements in place: promotion of windbreak and treed buffer strip establishment; a French-language master's program in agroforestry; and several R&D centres that are playing an active role in agroforestry knowledge acquisition. In addition, producers can obtain government assistance for some agroforestry practices, notably for the creation of windbreaks and treed buffers. However, a certain number of issues need to be addressed in order to ensure that Quebec's agroforestry potential can be exploited fully.

For example, funding programs cover only a few agroforestry systems, and structured and operational financial assistance is generally in short supply, largely because of the lack of recognition of agroforestry by government and institutional decision makers. For a number of years, society has called for more sustainable management of natural resources. Agroforestry has the potential to reduce the dual pressure exerted on forests and farmland. In 2005, the European Union\* placed agroforestry on an equal footing with forestry and agriculture, and in 2002, France established incentive programs for the implementation of agroforestry systems. In Quebec, the main impediment to agroforestry development is the lack of institutional recognition within agricultural and forestry policies and programs. This is the first obstacle that needs to be overcome.

Other major issues relate to the need to integrate agroforestry into economic and commercial planning rather than viewing it solely as an agri-environmental issue; to provide for the acquisition, management and transfer of information and knowledge; and to consolidate technical and scientific training programs.

\* Reference: Le Conseil de l'Union européenne, 2005. «Règlement (CE) no 1698/25 du conseil du 20 septembre 2005 concernant le soutien au développement rural par le Fonds européen agricole pour le développement rural (Feader)» dans *Journal officiel de l'Union européenne*, 21.10.2005, L 277, 40 p.

## Conclusion

Agroforestry offers many benefits for agricultural producers and society at large. While not a silver bullet, agroforestry with its multiple environmental and economic benefits, can help the agricultural and forestry sectors find innovative solutions to present-day problems, including low profitability, environmental impacts and negative public perception. What is more, agroforestry can improve the quality of life of agricultural producers and the general public, help to diversify revenues and contribute to economic revitalization of Quebec regions, while ensuring sustainable management of natural resources.

This study has revealed that all agroforestry practices are gaining in popularity. There are a number of constraints that are preventing the full exploitation of Quebec's agroforestry potential. The lack of recognition of agroforestry by policy makers and by the general public is a major constraint that has resulted in scattered efforts to promote and develop agroforestry practices. Other constraints, such as the inadequacy of existing incentive mechanisms, inadequate co-ordination of efforts between stakeholders, and technical and economic knowledge gaps related to agroforestry systems, have been brought to light through the present study.

In light of the study findings, it is clear that both a strategy and an action plan need to be developed. To this end, five strategic preliminary components are proposed with a view to agroforestry development in Quebec:

1. Increase recognition of agroforestry among government and institutional policy makers;
2. Advocate an intersectoral partnership;
3. Adopt an economic and market development approach;
4. Establish solid technical and economic foundations for development efforts;
5. Provide adequate structured and operational financial assistance.

In order to implement the recommendations set out in this portrait of agroforestry, it will be necessary to rally all of the stakeholders currently involved in agroforestry in Quebec and enlist the participation of new partners. The investigation of the state of agroforestry conducted in preparing this portrait has laid the foundations for intersectoral co-operation, but efforts need to be devoted to broadening the base. Partnership linkages need to be established among agriculture, forestry, land use and economic development stakeholders in the public and private sectors, academia and research facilities. Together, these partners will be able to define an appropriate strategy and establish an action plan to implement this ambitious undertaking called agroforestry in the province.

## Recommendations

More concretely, the portrait and analysis have led to the identification of action that can be taken in the short- and medium-term to establish agroforestry development efforts on a solid footing.

Accordingly, in the short term, beginning in 2007, the following recommendations should be acted on:

- This report should be disseminated, particularly to decision makers and other stakeholders, in order to give greater visibility to agroforestry;
- Efforts should be devoted to forging a formal agroforestry partnership in Quebec by setting up an intersectoral co-ordination committee with a mandate to prepare an action plan and organize a workshop;
- Structured funding opportunities for agroforestry development should be explored in the public and private sectors;
- Avenues for expanding or adapting the eligibility criteria of existing agricultural and forestry programs should be explored in order to improve operational funding for implementing and maintaining agroforestry systems;
- Existing advisory organizations, such as the Centre de référence en agriculture et agroalimentaire du Québec (CRAAQ) and the Conseil de la recherche forestière du Québec, should be called on to set up an interdisciplinary scientific advisory committee dealing with issues of R&D, training and technology transfer in agroforestry;
- Efforts should be devoted to consolidating agroforestry information sources, to ensuring more effective dissemination and to facilitating linkages among stakeholders by promoting the use of Internet technologies (e.g., Web site, electronic newsletter);
- It is essential to identify and seize opportunities to give visibility to agroforestry in policies and programs (e.g. commissions and consultations).

In the medium term, that is, during 2007-2010, the following recommendations should be acted on:

- A formal agroforestry partnership should be established (its organizational form remains to be defined, e.g., consortium, cluster, centre, agency) along with a funding structure;
- New financial and technical assistance programs would need to be developed that would be better integrated among the sectors involved, in order to promote agroforestry development;
- R&D, training and technology transfer needs and priorities have to be developed and this information needs to be shared with the stakeholders concerned;
- A plan should be established for knowledge acquisition and dissemination;
- A network of demonstration sites should be set up for the various agroforestry systems applicable to Quebec;
- Operational and strategic knowledge acquisition efforts should be maintained;
- Interdisciplinary programs and training courses should be developed for professional and technical agroforestry employees.