5 YEAR REPORT (2000–2005)

The Canadian Ecology Centre

Partenariat pour la recherche forestière

FORESTRY Research Partnership

Centre écologique du Canada

Forestry Research Partnership
5 Year Report (2000 – 2005)

1 Approval Page

The following report is submitted to you as a summary of the activities and results of the Forestry Research Partnership from its date of inception in October, 1999 to the end of its first 5 year term in October, 2005.

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General Manager, Forestry Research Partnership

On behalf of the primary partners of the Forestry Research Partnership, we accept the first 5 year report of the Forestry Research Partnership:

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FORESTRY RESEARCH PARTNERSHIP

5 YEAR REPORT (2000–2005)

December, 2005

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Executive Summary

The Forestry Research Partnership (FRP) was created in 2000 by Tembec, the Ontario Ministry of Natural Resources and the Canadian Forest Service in response to several clauses in the 1999 Ontario Forest Accord pertaining to science partnerships and the implementation of intensive forest management practices on the forest landscape. In its short 5 year history, the FRP has organized and managed over 140 forest science projects, all supporting in one form or another the mission of the FRP - to identify, develop and implement ecologically sustainable and scientifically defensible leading edge forestry practices required to maintain and enhance an economically viable supply of quality fibre to Tembec mills, and to the communities those mills support, over the long term.

The FRP established its base of operations at the Canadian Ecology Centre (CEC) in Mattawa, Ontario. The partners agreed to support the FRP for a period of 5 years, subject to renewal before October, 2005 after a review of performance. This report describes the significant accomplishments of the first five years, and sets the stage for the next five.

The FRP grew into a strong positive force in the Ontario forest science arena during its first five year term. It developed a solid reputation for getting things done, for being cost effective, and for working openly, honestly and pro-actively with a large array of collaborators across Canada. Its flexible private/public partnership structure, coupled with ready access to the significant scientific, intellectual and financial resources of its primary partners, provided all the elements required to deliver a focused, innovative and dynamic science program.

FRP projects made significant advances in the areas of growth and yield, succession, tree improvement, forest protection, forest modeling, and economic analysis. Model based, landscape-level sensitivity analyses (simulations of various management options), calibrated with outputs from a large array of past and present research projects, were conducted to determine whether or not wood-supply goals were attainable while also sustainably managing multiple values. Knowledge gaps were identified with respect to growth and yield, biodiversity, economics, social issues, protection, education, and training. These gaps provided the direction for further research and development initiatives.

Perhaps the most significant, and valuable result of this work was an improved understanding of the interdependent relationships between wood supply, forest ecosystems, economic performance and forest management decisions. The tools produced so far, while still incomplete and imperfect, have provided a useful – and in many respects, unique - vehicle with which to evaluate the impact of the trade-offs inherent to sustainable forest management in its broad sense.

For the Tembec management units on which extensive modeling was conducted, the analysis indicated that the forecasted supply declines over time projected in current forest management plans could be arrested by implementing an aggressive

intensive silviculture program on a limited proportion of the most productive sites on the forest landbase. This intensive program, strategically applied, would produce more fibre without negative impact on other forest values, and without significant increase to forest renewal costs.

The FRP developed an exciting, effective and widely recognized extension program. FRP extension products included an FRP Web site, tech notes, over 60 workshops and field trips, continuing education and professional development courses, and published journal papers. Extension efforts, using a variety of different media, were directed to numerous forest sector audiences from the logger to the academic, and from the field forester/technician to the executive policy maker.

The FRP also worked closely with the CEC to deliver accurate and positive forest science messages to over 5,000 visiting students and their teachers per year. Linkages were established with other extension organizations in Canada, and with Oregon State University in the U.S.

The FRP met or exceeded all its financial objectives related to budget compliance, leveraging, and R&D tax credits. The combination of cash from Tembec, and scientists and technical support from CFS and MNR proved to be a winning combination in attracting approximately 25% ($2.4 million) of the Living Legacy Trust funding allocated to intensive forest management (Funding Program 4). The FRP used the resources deployed by the primary partners to leverage direct cash and in-kind contributions from numerous other partners. Five year expenditures from all sources totaled $17.8 million, of which approximately $12 million was cash.

The FRP in its first five years enjoyed strong support from the senior levels of its partner organizations, which allowed for the rapid deployment of a focused, well resourced program. The FRP produced valuable and pertinent science products, communicated the results to a broad array of stakeholders, and engaged numerous other partners in an open, dynamic and innovative program.

(left to right):

Meridian Road White Pine Study at the Petawawa Research Forest

NEBIE Site Tour in the Nipissing Forest

As with any science endeavour, much still remains to be done. The base of relevant knowledge, effective structure, and established reputation built in the first five years now must be concentrated on influencing practice and policy at an operational scale in the next five. New science questions that have emerged must be answered. The objective of finding and implementing new ways to grow more wood carries even more urgency now than it did in 2000. The overriding principle of promoting long term sustainability in Ontario's forests requires continued excellence in science and unfettered inclusiveness in transfer. The FRP has proved its worth in these elements in the first five years, and is well positioned to deliver meaningful and important results in the next five.

2

Introduction

The Forestry Research Partnership (FRP) was created in 2000 by Tembec, the Ontario Ministry of Natural Resources and the Canadian Forest Service in response to several clauses in the 1999 Ontario Forest Accord pertaining to science partnerships and the implementation of intensive forest management practices on the forest landscape. Accord Clause 5 in particular established the context for the FRP:

Accord Clause 5: Develop an Ontario forest science partnership in order to:

1. *Develop and test a range of intensive forest management (IFM) practices*
2. *Assess the impacts of IFM on increased forest growth and yield*
3. *Assess the environmental impacts of IFM*
4. *Direct science activities in support of Ontario's forest management planning requirements under the Timber Class Environmental Assessment and Crown Forest Sustainability Act*

The FRP established its base of operations at the Canadian Ecology Centre (CEC). The partners agreed to support the FRP for a period of five years, subject to renewal before October, 2005 after a review of performance. This report describes the accomplishments of the first five years, and sets the stage for the next five.

The first FRP Strategic Plan was approved by the primary partners on April 30, 2000. The Plan articulated the mission of the FRP, and described four desired outcomes (see Section 3.1) as indicators of the organization's value and success. It is against these desired outcomes that this report measures actual performance.

The FRP grew into a strong positive force in the Ontario forest science arena during its first five year term. It developed a solid reputation for getting things done, for being cost effective, and for working openly, honestly and pro-actively with a large array of collaborators across Canada. Its innovative private/public partnership structure, coupled with ready access to the significant scientific, intellectual and financial resources of its primary partners, provided all the elements required to deliver a focused, innovative and dynamic science program.

The operations of the FRP were managed by a small group of dedicated and motivated people, supported by the expertise and enthusiasm of science management staff in MNR and CFS. The FRP very quickly developed into an attractive venue for scientists interested in contributing their talents to an organization having a well articulated set of focused objectives. Most importantly, the FRP was able to provide a unique science service to its primary partners that none could have delivered within their own organizations by themselves.

3

Mission of the Forestry Research Partnership

The Mission of the Forestry Research Partnership is to identify, develop and implement ecologically sustainable and scientifically defensible leading edge forestry practices required to maintain and enhance an economically viable supply of quality fibre to Tembec mills, and to the communities those mills support, over the long term.

The Forestry Research Partnership will deliver its mission by:

- encouraging curiosity and innovation in its forestry practices in an open and transparent working environment that will encourage similar activities across the province and the country.
- obtaining knowledge, developing tools and techniques and calibrating the work of others in support of the practice – by Tembec and others - of intensive forest management within the context of ecological sustainability
- working with its partners to promote collaboration and cooperation between all users of the forest
- exercising provincial and national leadership in the sharing of information and the promotion of effective practices
- demonstrating value for money both to shareholders and to taxpayers by evaluating and documenting the costs and benefits of all projects undertaken as part of this Forestry Research Partnership.

3.1 DESIRED OUTCOMES (FROM 2000 STRATEGIC PLAN)

The success and value of the Forestry Research Partnership will be measured by the degree to which it demonstrates:

1. Certainty around current and future wood supply, with the underlying objective being to facilitate corporate capital decision-making. This will require:
   - accurate continuous inventories of the existing forest resource
   - models whose inputs are precisely calibrated, and whose outputs accurately forecast allowable cut, ecological sustainability, community stability and economic viability. These models will require constant ongoing refinement to reflect the inherent complexity of each element, and the potential volatility over time that accompanies their interaction.

2. Shareholder and taxpayer value.
   - R&D projects in forest renewal must demonstrate a positive contribution toward meeting forecasted corporate fibre supply requirements
   - R&D projects in forest harvesting and renewal must demonstrate a contribution to corporate cost reduction objectives
   - corporate money is intended to lever other funding from government, industry partners, and other stakeholders as a means of maximizing corporate benefit at minimum cost
   - R&D projects must be developed in the context of provincial and federal policy
   - all projects must promote a progressive and positive corporate image for all the partners involved

3. An effective Science Partnership that promotes good science, not only in Ontario, but across the country.
   - enlightened forest policy, sound forest management planning and useful operational tools are a natural result of a rigourous scientific approach in which many partners participate.
   - credible and defensible science will promote public acceptance and increase fibre growth at the same time.
   - the development and introduction of proven innovative forest technologies are a cornerstone of future industry development

4
Overview of Approach

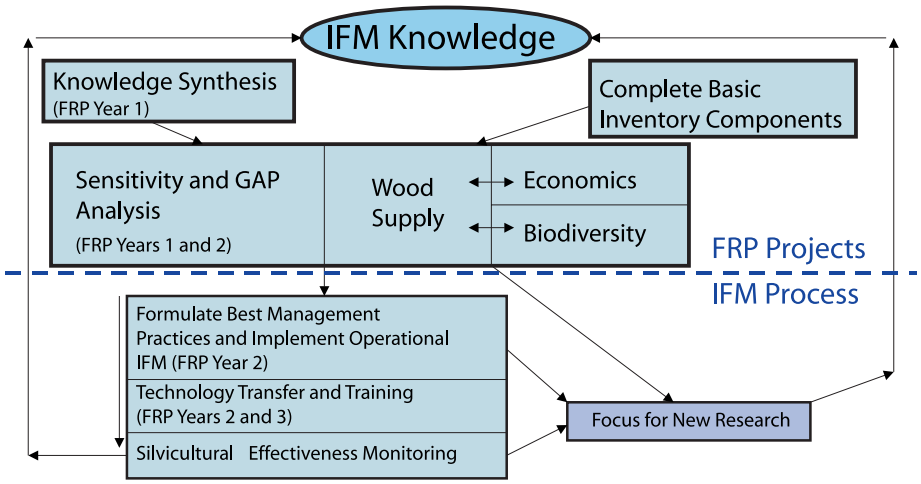
Unlike many research partnerships, the FRP chose an adaptive management approach (Fig. 1) with a very specific goal: increase available wood volume by 10% over 10 years - 10/10. Short, medium and long-term objectives were set and project selection criteria were determined before the program was initiated. Phase 1 (above the dashed line) addressed short- and medium-term objectives. Phase II (below the dashed line) addressed longer-term objectives.

The majority of the FRP work between 2000-2005 focused on Phase I, and involved building a solid foundation of knowledge and information from which to conduct a series of sensitivity analyses to determine if the long-term 10/10 goal was plausible and, more importantly, sustainable. Phase 2 will continue that process, but with a greater emphasis on application and implementation.

The first five years of FRP science work focused on assimilating information that would be pertinent to achieving the FRP objectives. Many projects, on several different themes, were initiated in parallel at the outset of the program. In a determined effort to avoid re-inventing the wheel, these projects looked to the past for data from literature reviews, from re-measurements of old trials, or from existing work underway elsewhere. Efforts were made to standardize any data collected so it could be interchanged with other projects. The objective of this

Figure 1.

IFM Science and Information Within an Adaptive Management Framework



step was to (1) generate an inventory of current knowledge, and (2) create searchable electronic databases, meta analyses, and Decision Support Systems (DSS) for (i) growth and yield, (ii) silviculture practices, (iii) protection, (iv) social factors, (v) environmental factors, and (vi) economics. The common purpose in every case was to contribute credible information to the objective of a sustainable increase in wood supply of 10% in 10 years, "sustainable" in this context meaning more wood produced in concert with good management of multiple forest values.

Model based, landscape-level sensitivity analyses (simulations of various management options) were needed to determine whether or not the 10/10 wood-supply goal was realistic and to identify knowledge gaps with respect to growth and yield, biodiversity, economics, social issues, protection, education, and training. Several key projects were undertaken, using the provincial aspatial SFMM and the spatial Patchworks models to evaluate scenarios. The Patchworks model provided, both at the stand and the forest management unit scale, a mechanism with which to evaluate the inter-relationships and interactions among the different values at play on the forest landscape, determine appropriate tradeoffs between them, and project both a sustainable allowable cut volume over time, and a spatial allocation of where that allowable volume should come from.

Knowledge transfer and extension for the FRP formed a final, all-important stage in the delivery of relevant forest science. The FRP used a variety of communications media (journals, tech notes, DVDs, Web site, workshops, field trips) as well as the venue of the CEC itself to promote extension. This approach was unique to the FRP, and allowed for high detail, high intensity, high quality, and high value learning that helped support the 10/10 goal of the Forestry Research Partnership and communicate its messages to a broad array of audiences. The FRP also worked closely with the CEC to deliver forest science and education products to students, educators and other public audiences.

5

Results – 2000 to 2005

5.1 DESIRED OUTCOMES

5.1.1 Certainty of wood supply estimates

The FRP worked at three levels to reduce the uncertainty associated with wood supply estimates:

- **Inventory science**
  The FRP brought inventory specialists from across Canada together with Tembec staff to identify ways to improve the accuracy of the forest inventory – a large source of uncertainty in supply estimates. These efforts contributed to the adoption by Tembec of new, leading edge technology to collect and interpret inventory data. This technology is currently being implemented operationally on the Romeo Malette Forest (near Timmins). This system will substantially reduce inventory errors, and will likely set a new standard for new inventories across Ontario.

- **Growth and Yield**
  New yield curves developed by the FRP were accepted for use in Forest Management Plans. These curves used data and analysis from previous and current research projects within and outside of Ontario to ensure statistical rigour in yield curve volume estimates – a marked improvement over the heavy reliance on expert opinion that preceded them. Along with other industry partners, the FRP made significant investments in the provincial Permanent Sample Plot program, which will continuously feed standardized growth and yield information into ongoing refinements to yield estimates, and will serve as a significant, exchangeable base source of data for future research projects.

- **Modeling**
  The Patchworks model was used in conjunction with the provincial SFMM model to refine wood supply calculations. This model incorporated the refinements described above (and others) into a new, sophisticated spatial analysis that examined a large number of ecological and economic inputs, and produced refined estimates of wood supply over time. This model is currently being reviewed by MNR for approved use in forest management planning.

5.1.2 Shareholder and taxpayer value

All financial objectives set in the 2000 Strategic Plan were met or exceeded in each of the first five years of FRP operation. These included overall budget compliance, leveraging of external funding, and successful receipt of tax credits by Tembec for costs incurred.

All projects undertaken by the FRP were relevant to the objective of increasing wood supply, and/or reducing costs. In some cases – yield curves, for example – the impact was immediate, direct, and obvious. In others, decision support tools were prepared, and are now available for use when they are needed (eg. insect outbreak management). In other projects the objective was to improve the science underpinning constraints to wood supply (eg. marten habitat), to ensure that the constraint as required was appropriate. Many of these are still ongoing.

The FRP maintained a practical emphasis on supporting projects that were achievable scientifically, that had good potential to influence corporate or public policy, and that did not conflict with the stated corporate objectives of the primary partners.

5.1.3 An effective Science Partnership

The FRP was recognized across Ontario as a strong and focused contributor to forest science, committed to and successful at generating high quality science for practical application to current and anticipated supply issues.

(left to right):

Wayne Bell of the Ontario Forest Research Institute, Ontario Ministry of Natural Resources

LiDAR data collection on the Forestry Research Trail at the Canadian Ecology Centre

The FRP provided science and extension services to its primary partners that none could have delivered as nimbly on its own. It used the resources of the primary partners to leverage additional external contributions, and then focused the whole to efficiently deliver the program's objectives.

The "core team" component of the extension program created a venue for facilitated interaction between scientists and field planners and practitioners. This interaction, lightly dubbed as "in-your-face transfer", provided a key enabling mechanism for the two way exchange of results, ideas, and needs at the management unit level that otherwise would not have occurred. New ideas and approaches for future FRP effort were a natural output of these core teams.

All outputs of the FRP were widely communicated without restriction across Ontario, as well as in other parts of Canada.

5.2 SCIENCE OUTCOMES

The science outcomes of the first 5 years of FRP work were:

The spatial model Patchworks, used in conjunction with the aspatial provincial model SFMM (Strategic Forest Management Model) was selected as the best available tool with which to build a framework to knit together, evaluate, and understand the results from the large array of multi-disciplinary projects undertaken by the FRP in its first five years. Sophisticated modeling and analysis was essential to adequately evaluate the interrelationships between and balance the needs of multiple values, and to understand the tradeoffs required to meet social, economic and ecological sustainability objectives.

The Patchworks model used the research outputs of numerous past and present projects (FRP as well as others) as state-of-knowledge calibrated input to the analysis of wood supply. It also used the same inventory input files as were used for the SFMM analysis in existing management plans in order to facilitate output comparisons. All guidelines and policies pertaining to the protection and maintenance of other values were included and respected throughout.

For the two management units (Romeo Malette and Gordon Cosens) on which extensive Patchworks modeling was conducted, the analysis indicated that immediate implementation of a more aggressive silviculture program would arrest the volume declines forecasted in current management plans (see red (lower flat) line vs. blue (curving) line in Figure 2). The economic net value of the wood supply, defined as revenue minus cost at mill gate, would remain stable through time. The threshold for sharing gains between industrial supply and protected areas (green (upper flat) line) negotiated under the Ontario Forest Accord would not be attained.

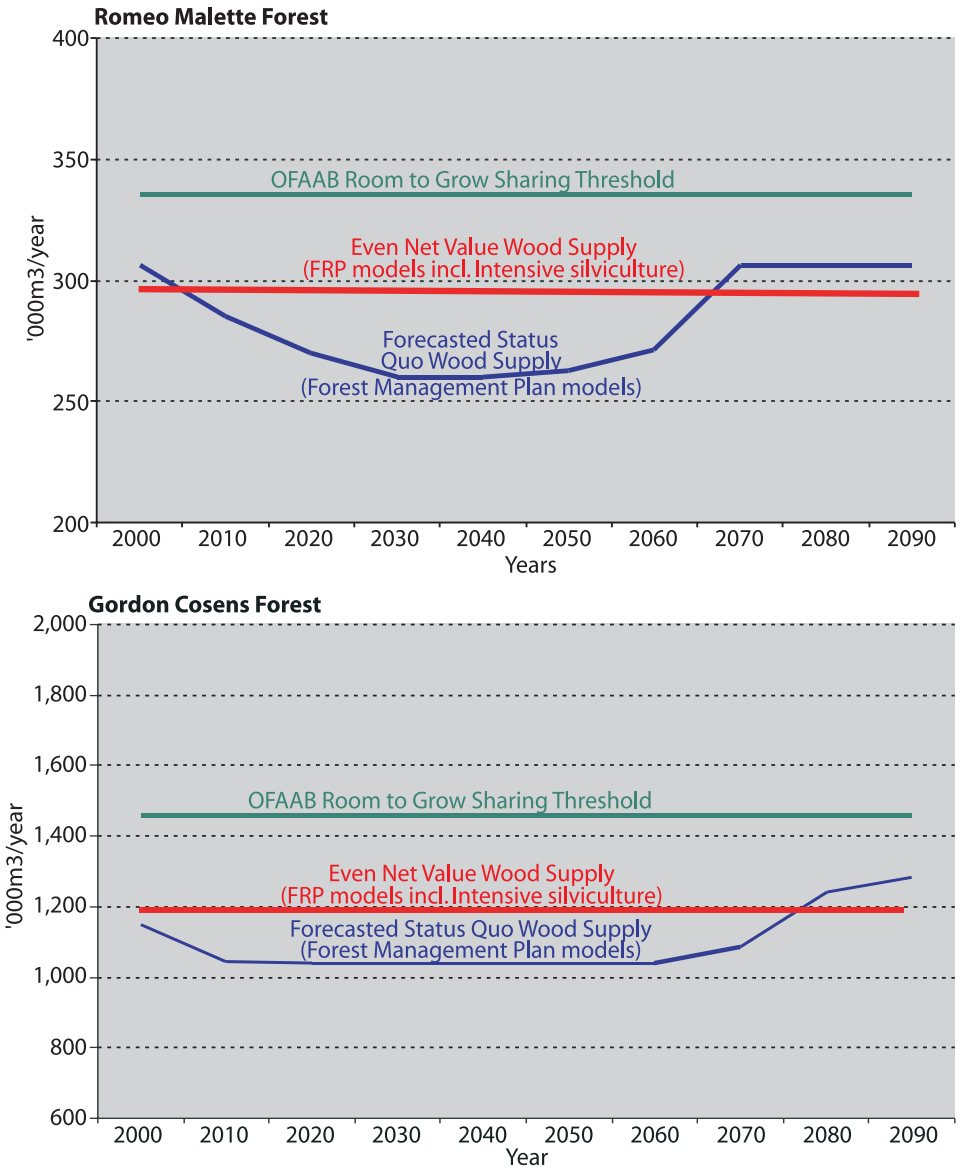
Continued compliance with government policies and guidelines, and the protection of other values are implicit in the Figure 2 graphs by virtue of their explicit consideration as objectives in the model analysis.

The results, while preliminary, indicate that significant improvements in forest productivity on the management units analyzed are possible, affordable, and sustainable. Continued refinement, particularly in the analysis of impacts of changes in one value on the quality or quantity of another, is a key requirement going forward. The 10 year timeframe targeted in the 10/10 objective, may be temporally optimistic, but is realistic and attainable.

The largest positive contribution to allowable cut volume – about 6% - is attributable to new yield curves for the major Ontario commercial species developed by the FRP – the Penner curves. These curves, based on measured data from a host of existing sources both inside and out of Ontario, are a significant and overdue improvement to the Plonski curves in use for forest management planning in Ontario since the 1960s. The Penner curves are a good example of how refinements in knowledge – drawn from multiple sources of high quality research - can contribute to improved forecasts of wood supply, with a concurrent reduction in uncertainty.

A number of Penner's yield curves include estimates for incremental growth attributable to the planting of genetically improved seedlings. The existing first generation breeding programs in Tembec areas indicate single tree volume gains of between 4% (jack pine) and 8% (black spruce). Second generation gains are much higher, ranging from 12% to 20%. The overall potential gain in allowable cut will depend on the scale of planting of improved seedlings, and the care they receive once planted. All spruce and jack pine seedlings produced for Tembec in Ontario will be grown from first generation seed by 2006. Up to 20% will be produced from second generation seed by 2011. The breeding program will consequently form an integral part of any long term strategy for enhancing forest productivity.

Figure 2.



A third area of positive contribution to allowable cut comes from pre-commercial and commercial thinning (density regulation). Several studies conducted in these areas all underscored the importance of the timing and the intensity of these interventions not only on overall volume, but on product quality and value. Silviculture strategies in forestry clearly need to be more deliberately aligned with desired final product if enhanced forest productivity is to add value to the manufacturing process. Deciding what the final manufactured product should be, however, remains a challenge given the long time horizons associated with forest regeneration.

A multi-year study examining the effects of herbaceous and woody competition on the growth of young white pine demonstrated that the "wait and see if it needs it" approach to vegetative management carries a heavy penalty in tree performance. This implies that more, and not less, use of herbicide for vegetation management is warranted, a result at odds with the certification commitments of Tembec and others to reduce the use of herbicide where possible. Consequently,

another FRP project in Kapuskasing evaluated the use of computerized navigation aids and boom-on boom-off controls in spray aircraft to reduce the application of herbicide where it isn't needed or wanted. Both of these projects are continuing, and both will contribute to the twin objectives of demonstrating care and diligence in the application of herbicides, while not forgoing the benefits they provide to enhancing forest productivity.

Several other ongoing projects examining forest inventory methods, forest succession, mixed wood management, effects of logging damage and forest protection among others are all expected to have a strong influence on evaluating forest sustainability. The results of these projects have still to be built into the Patchworks modeling framework and it is consequently too early to evaluate whether their impact on wood supply is positive or negative.

Several projects examined the constraints to wood supply required to protect other forest values. The largest of these, led by the Forest Ecosystem Science Coop, has focused on the habitat requirements of the American Marten, using field trials based in Ear Falls and Kapuskasing. This long term study is expected to produce a world class comprehensive analysis of the habitat requirements and attendant population dynamics of marten. A number of smaller related studies were also initiated, which will connect this study to the FRP 10/10 objective, and to forest management planning, through the Patchworks framework.

Considerable effort was spent in numerous projects evaluating the economic constraints on wood supply. These projects followed two tracks:

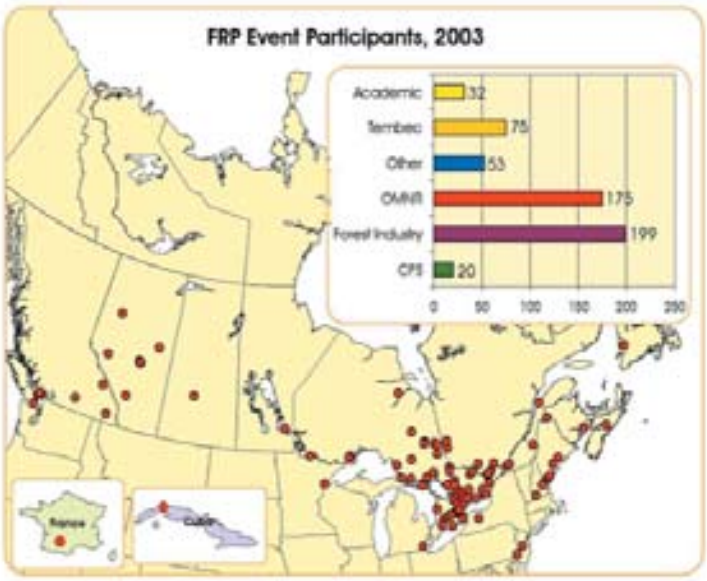
1. The first was a theoretical and general evaluation of Net Present Value at the stand scale using differing levels of discount rates, and expected costs and revenues. As with most analyses of this type, the results were bleak: any investment in EFP makes little economic sense because of the long time interval between investment and return. Returns can be improved somewhat by using a "real options" analysis, which builds better estimates of probability into its calculations. However, the only EFP strategy that projects positive returns is one of fast growing hybrid poplar plantations, where the rotation ages are short (less than 20 years), the front end investment high ($2500/hectare), and the harvest yields exceptional (350 to 400 m3/hectare). There are very few sites within the climatic regions in which Tembec operates which would support these levels of performance.

2. The second was an applied analysis and projection of actual costs and revenues of forest operations on two Tembec licences, the Romeo Malette and the Gordon Cosens. This analysis was conducted within the Patchworks framework, and provided valuable insight into the relationship between volume of wood delivered to the mill, and its value. In both forests, any significant increases in AAC above current levels, when coupled with other constraints, exert immediate downward pressure on product value. The outputs offer a powerful justification for measuring wood supply not as a traditional two dimensional analysis (volume(y axis) over time (x axis)), but as a three dimensional one (value (y axis) over volume (x axis) over time (z axis)).

5.3 TRANSFER AND EXTENSION OUTCOMES

The FRP between 2000 and 2005 developed an effective and widely recognized extension program. FRP extension products included an FRP Web site, tech notes, numerous workshops and field trips, continuing education and professional development courses, and published journal papers. Extension efforts, using a variety of different media, were directed to numerous forest sector audiences from the logger to the academic, and from the field forester/technician to the executive policy maker.

Figure 3.



The purpose of the transfer program of the FRP was to inform and influence policy and practice in Ontario forest management, using the science products of the FRP as the base. It became evident early on that transfer aimed at only one level – practicing professional, for example - would not achieve that purpose, regardless of the quality of the science. Numerous contacts, at numerous levels, with repetition of key messages, was found to be a more effective (and labour intensive) process.

The establishment of management unit specific "core teams" of forest planners and practitioners connected to FRP scientists through FRP facilitators proved to be an effective way to maintain a strong connection between new science and existing practice, and promoted positive two way communication between groups that otherwise would have had very little contact with one another.

Approximately 30% of the FRP budget was dedicated to transfer and extension. Managing extension as a program on its own proved to be a more effective approach than attaching a transfer component to each project individually, and allowed the common linkages between projects to be more clearly communicated.

The FRP added value and depth to its transfer efforts by collaborating with the Canadian Ecology Centre in the delivery of forest science and education to primary, secondary, university and post graduate students and their teachers. A number of forest based tours and student exchanges were delivered to teachers and professionals from Cuba, France, and Great Britain.

Linkages were developed between the FRP and other extension services in Canada and the U.S. Access to the large body of American expertise was promoted through information and staff exchanges between the FRP and Oregon State University.

The FRP was transparent and accessible in all its activities, and all its science products and services were widely communicated and shared without delay or restriction. Many of the workshops and field trips organized by the FRP were offered at little or no cost to participants.

5.4 PARTNERSHIP OUTCOMES

The FRP was frequently cited in its first five years as a successful and unique example of the science partnerships envisioned by the Ontario Forest Accord. The FRP provided value to its partners in different ways: for Tembec, one of the greatest benefits was access to the intellectual resources and experience of the government science community. For both governments, the infusion of focus and cash from Tembec brought increased energy and purpose to their internal science programs. All three partners benefited from the enhanced credibility afforded by a new, dynamic public/private partnership like the FRP.

The FRP was effective at engaging partners in delivering individual projects. Successful collaborations were established with all the main forest science delivery agents in Ontario (Forest Coop, Forest Genetics Ontario, ULERN), with the national forest industry research organizations (Feric, Forintek and, to a lesser extent, Paprican), and with the academic community (12 universities) across Canada, primarily through the Sustainable Forest Management Network.

The Petawawa Research Forest made a strong contribution to the FRP knowledge base and transfer program by providing valuable research insights from several large, on-going projects that have been in place for a long period of time. These projects offer the unique attributes of solid scientific design coupled with clear visual evidence that substantiates the published analytical results.

The Lake Abitibi Model Forest became an important partner in building an effective collaboration with a dynamic research program based at UQAT in Rouyn, Quebec, and transferring its results to NE Ontario. More recently, the FRP established linkages in central Quebec to improve the sharing of information and expertise between the two provinces in the Great Lakes St. Lawrence forest.

(left to right):

Fleming College Forestry Field Camp

Carbon FluxNet Research Site near Foleyet

Whiskey Jack (Canada Jay) in the Gordon Cosens Forest

The FRP actively engaged industry partners at the project level, but was less successful at attracting support from other companies at the full program level. An "open door" policy to participation, a commitment to sharing outputs in the public domain, and aggressive fund raising were among the strategies employed by the FRP to mitigate, and eventually eliminate, this limitation.

The FRP developed a positive reputation for getting things done, for being cost effective, and for working openly, honestly and pro-actively with all its partners. The philosophy throughout was to deliver the FRP objectives through the most

efficient and effective mechanisms available. In some cases, this meant accessing resources from the primary partners; in others, the preferred delivery was external.

The small organizational structure of the FRP, its significant cash budget, and its relative independence allowed the FRP to be nimble and responsive to new opportunities when they emerged, and at the same time made it attractive both to interested scientists and potential partners.

6

Challenges and Opportunities

The development of analysis tools (Patchworks, density management models, succession models, yield curves) took longer and was generally more expensive than expected. The Romeo Malette, the Gordon Cosens, and to a lesser degree the Nipissing Forests were used as pilot management units, while other Tembec management units were not analyzed in any detail.

The forest inventory (FRI) which provided the base data for many of the tools developed by the FRP was never designed for the diverse and complex analysis to which it was subjected. Not unique to the FRP, this issue remains the Achilles heel of much of the science work underway in Ontario today. Data collection for a new inventory using state of the art remote sensing technology was initiated on the Romeo Malette Forest in 2004. This new inventory, with much improved precision, will also improve the value of the FRP's scientific initiatives.

The timelines attached to many of the FRP implementation objectives established in 2000 proved to be optimistic, and failed to take adequate account of the 10 year forest management planning cycle in place in Ontario. Although virtually all of the individual projects were delivered on time, as planned, only a few could be immediately woven into the planning environment, regardless of merit or value.

FRP science products had some positive influence on provincial and corporate policy, but not as quickly nor as explicitly as had originally been intended. A number of the tools developed by the FRP for use in refining projections of wood supply (eg. yield curves, Patchworks, commercial thinning prescriptions) only began to gain the momentum required for policy acceptance late in the first five year term.

The lack of a clear governance structure for the FRP created occasional confusion between the partners. This underscored the need for good communication both between the partners, and within the partners' organizations, which didn't always occur. The roles of the Executive Committee, the Management Committee and the Secretariat were occasionally intermingled, resulting in the dissolution of the Management Committee after two years, and an unclear relationship between the Secretariat and the Executive.

7

Financial Summary

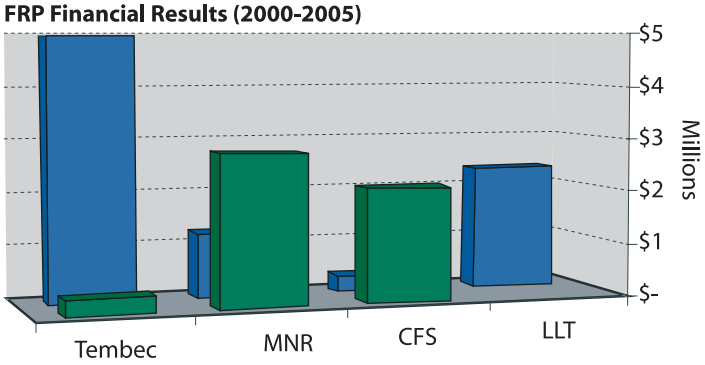
The FRP program met or exceeded all its financial objectives related to budget compliance, leveraging, and R&D tax credits.

The combination of cash from Tembec, and scientists and technical support from CFS and MNR proved to be a winning combination in attracting approximately 25% of the Living Legacy Trust funding allocated to intensive forest management (Funding Program 4).

The FRP used the resources deployed by the primary partners to leverage direct cash and in-kind contributions from other partners for its projects.

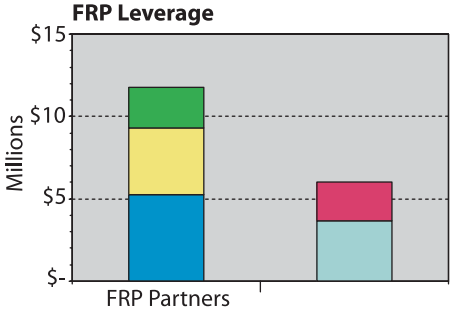
The total value of all projects in which the FRP was involved was $17.8 million, spent over 5 years, of which $12 million was cash.

FRP Financial Results (2000-2005)



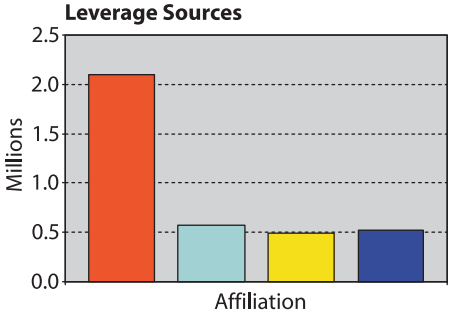
	Cash	In-kind
Tembec	$4,973,889	$295,050
MNR	$1,230,112	$2,833,276
CFS	$310,400	$2,133,362
LLT	$2,338,865	

FRP Leverage



	FRPPartners	
LLT		$2,338,865
Other		$3,688,450
CFS	$2,443,762	
MNR	$4,063,388	
Tembec	$5,268,939	

Leverage Sources



	Affiliation
Feric/Forintek	$2,098,700
Academia	$569,750
Industry	$494,500
FederalGov't	$525,500

8

Conclusion

The FRP in its first five years enjoyed strong support from the senior levels of its partner organizations, which allowed for the rapid deployment of a focused, well resourced, entrepreneurial program. The FRP produced valuable science products, and did so while engaging numerous other partners in an open and innovative program.

Most objectives set out in the original plan were met or exceeded (see Appendix 1), although the uptake of science products lagged behind the perhaps overly ambitious schedule that was originally set out. The results of numerous individual studies and projects were integrated through leading edge modeling to produce a much improved - albeit still incomplete - picture of the larger issues relating to Sustainable Forest Management. The FRP significantly improved the proactive dialogue between the clients of science and technology and the developers, enhancing understanding of each other's limitations and reducing the incidence of irrelevant science.

The clear focus on enhanced wood supply is as pertinent and pressing now as it was when the FRP was started. FRP results showing the potential to arrest continuing declines need to be tested operationally, and if validated, implemented on a larger scale with some urgency.

A flexible, motivated and entrepreneurial approach to achieving objectives positioned the FRP to effectively attract and maintain the human and financial resources required to deliver its mandate.

The challenge for the next years (2005-2010) will be to maintain the momentum and "freshness" of the FRP, while consolidating and implementing the results of the first five. This will require continued commitment by the primary partners, renewed focus on the objectives of the next five years, and clarity in the structure and function of the FRP's operations.

9

Going Forward

The principles of responsive collaboration and sound applied, science that propelled the successful start-up of the FRP remain the engine for its continuing development going forward. The FRP, in a short period of time, has generated a remarkable amount of information and analysis pertinent to its stated objectives of increasing wood supply in a sustainable context. The momentum generated so far needs to be maintained to extract maximum uptake and value from future work. To that end, the following specific goals have been articulated:

- **Goal # 1 :** Application of Enhanced Forest Productivity
  - Validate Patchworks model outputs through on the ground verification
  - Integrate research recommendations into operational EFP strategies in Forest Management Plans

- **Goal # 2 :** 10/10 Sustainability Science
  - Continue and refine the science work done to date to identify strategies that will result in a 10% increase in allowable cut in 10 years, within an ecologically and economically sustainable context.

- **Goal # 3 :** Extension
  - Continue the emphasis on networking, communication and interaction between the partners, between researchers and practitioners, and between scientists and policy makers.

- **Goal # 4 :** Policy Development & Implementation
  - Increase the effort directed to synthesizing the science outputs generated by the FRP and informing policy development and implementation provincially, both within government and within industry

- **Goal # 5 :** Expanded Forestry Research Partnership
  - Maintain an open and transparent approach to managing the FRP, and seek to attract more collaboration at both the project and program levels from a larger number of more diverse partners
  - Develop stronger linkages to other research providers, primarily in Ontario and Quebec to increase the influence and effectiveness of the FRP.
  - Maintain an entrepreneurial spirit in the FRP to enable flexibility and promote nimble responses to attractive and pertinent opportunities when they occur.

(left to right):

Al Stinson at a commercial thinning trial in the Gordon Cosens Forest

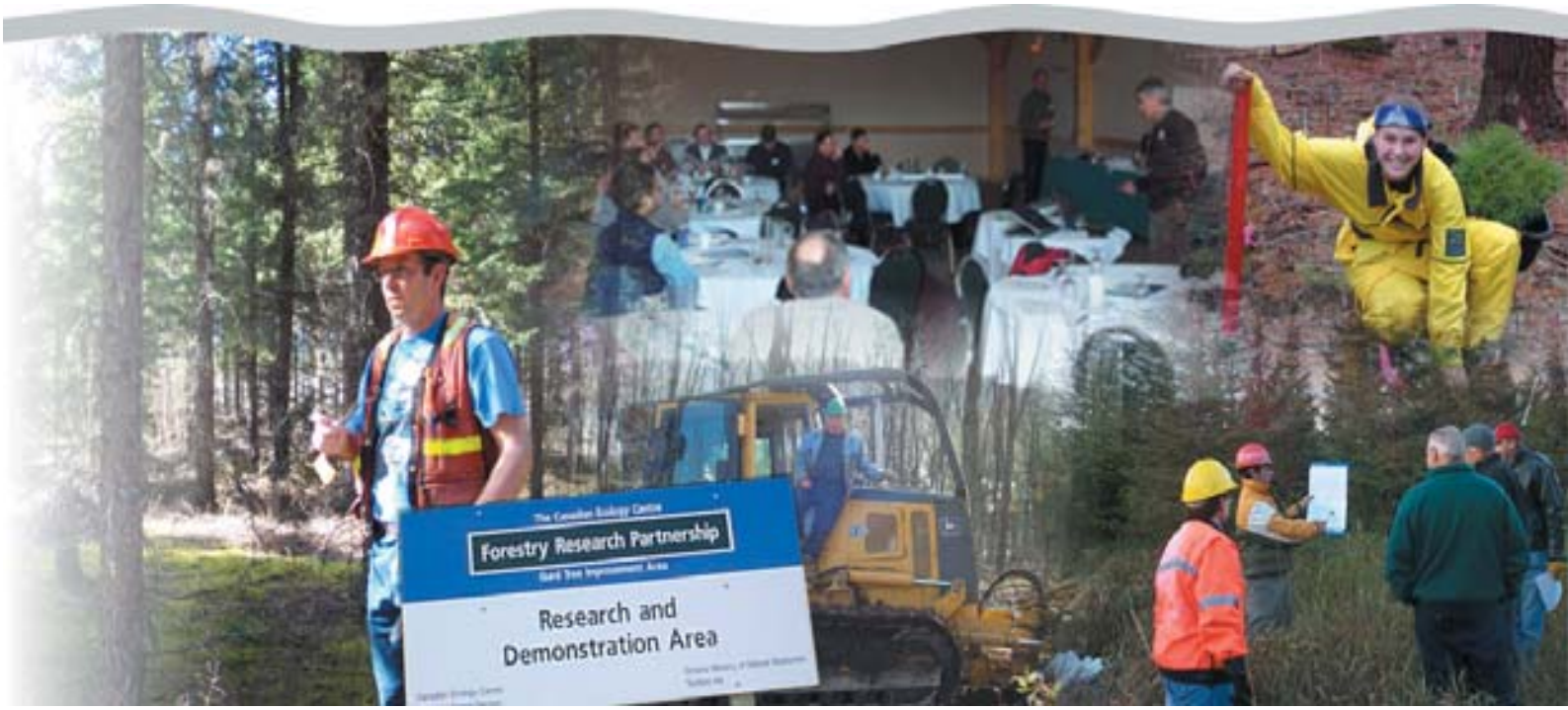
Boreal Forest Science Seminar in Timmins

NEBIE Site Preparation in the Nipissing Forest

Forestry Research Partnership sign at the Gurd Seed Orchard near Trout Creek

White Pine Competition Study Tree Plant in the Nipissing Forest

Tree Improvement Tour in the Gordon Cosens Forest



Appendix 1 – Multi Year Objectives

The table below lists the specific multi-year objectives articulated in the 2000 Plan, the results achieved, and an assessment of their impact.

Objective (Year 2000 Strategic Plan)	Results Achieved (2000-05)	Impact
CORPORATE		
The primary and dominant objective of the Forestry Research Partnership is to increase the allowable cut on Tembec's licence areas by 10% within 10 years.	• Enhanced data collection and extensive refinement to growth and yield analysis indicate a potential increase of 6% to 8% is possible. However, when these analyses were combined with spatial modeling of other values (eg. habitat), and economics, the overall gain at present is negligible. An aggressive EFP program, implemented now, will arrest further projected declines in allowable cut.	• New Class EA terms and conditions reflect policy recognition of the need to enhance forest management capability in these areas, partly as a result of FRP work. Tembec is ahead of most of the industry in these areas.
The contributions of the partners to the Forestry Research Partnership are intended to lever funding from a variety of other sources in order to maximize the value of money spent to shareholders and taxpayers. Specific minimum leverage targets will be established annually to reflect the projects planned for that specific year.	• $11.8 million in cash and in-kind contributions from the primary partners leveraged $6.0 million in contributions or collaboration from other sources, the largest of which was the Legacy Trust at $2.3 million.	• The infusion of FRP focus, energy and cash into R&D exerted a positive influence on the programs of numerous partners, and helped ensure the success of the LLT program
Projects undertaken under the Forestry Research Partnership must collectively qualify for tax credits equivalent to 27% of Tembec's annual forestry R&D expenditures. Projects that do not qualify for tax credits must be compensated by others that do, to ensure the overall tax incentive target is achieved.	• 100% of Tembec expenses made through the FRP qualified for tax credits equaling approximately 23% of total expenditures, slightly lower than target due to changes made to Ontario's credit system after the FRP target was set.	• The receipt of tax credits confirmed that the FRP was in fact practicing credible and innovative applied science. • "Bottom line" cash impacts on Tembec were significantly reduced.
Where the operational benefits of a given project have been clearly quantified and demonstrated, corporate policy will be developed to catalyze operational implementation.	• Corporate uptake of FRP outputs by any of the primary partners was slower than expected, particularly in the first 3 years. Operational implementation of many FRP products requires that they be incorporated into the forest management planning process. This is difficult to achieve from a regulatory perspective, from a scheduling perspective, and from a logistical perspective.	• Policy implementation requires more time than originally envisioned, and should be more evident in the next 5 year term.
Projects developed and implemented under the Forestry Research Partnership are intended to contribute to and be a subset of the Science Partnership envisioned in Article 5 of the 1999 Ontario Forest Accord, and as such will have their results widely distributed to other jurisdictions.	• The FRP has been frequently cited as an excellent example of an effective science partnership, in general as well as within the context of the Accord. All the results have been widely communicated, without restriction.	• The FRP has provided a model for others to emulate.

Objective (Year 2000 Strategic Plan)	Results Achieved (2000-05)	Impact
SPATIAL ANALYSIS		
Forest inventories across all Tembec's licences will be standardized and spatially automated to facilitate comparisons and analyses within and between management units.	• Standardization was completed to a level that permitted aspatial (SFMM) analysis and comparison of all Tembec FMU's in NE Ontario. • Standardization leading to spatial (Patchworks) comparisons was completed for the Romeo Malette and Gordon Cosens units only.	• Standardized data and inventory have significantly improved the utility and applicability of information
Cost effective systems will be developed to allow ground-truthing of existing forest inventories. These systems will ensure that inventory information is credible, current, usable and accurate. They will also preclude the need for costly and awkward periodic re-inventories	• FRP collaborated with the Lake Abitibi Model Forest in evaluating the use of Large Scale Photography as a cost effective inventory ground truthing tool, and with Queen's University in assessing the usefulness of LiDAR.	• Both of these technologies were considered, and the latter is in use now in NE Ontario to improve inventory and inventory-related reporting
A decision support system will be developed and implemented to identify and select optimal sites for the operational application of intensive silviculture trials described in Section 6.4 below. The size of area required will reflect the volume objectives identified earlier	• A detailed land use and regulation study on the Romeo Malette Forest (Perera, 2001) quantified area potentially available (55%) for intensive silviculture. Patchworks analysis further refined this information to the polygon scale. Field assessment to validate model recommendations has yet to occur.	• This study highlighted the land use and regulatory complexities associated with EFP implementation.
FIBRE PRODUCTION		
Tree improvement programs will be accelerated, with the objective being to maximize the availability of improved seed for operational purposes as quickly as possible, and to optimize the return from the use of that seed. Numerical objectives and schedules for production of improved seedling stock by species will be established.	Forest genetics programs across Ontario in general, and on Tembec areas in particular, were rejuvenated by a cash infusion from the LLT. All Tembec planting stock will be grown from first generation seed in 2006. 2nd generation stock should start to become available within 5 years. • Tembec and its SFL partners in Central Ontario, without LLT support, initiated a first generation program in white pine. This program will begin producing improved stock in approximately 5 years.	• Wood supply projections clearly indicate that tree breeding programs, at an adequate scale, contribute a significant proportion of the volume gains of an EFP program.
Modeling trials by species will be undertaken to determine the scale of intensive silvicultural effort required to achieve the corporate volume objective described.	• One of the Patchworks model outputs was a spatial indication of the scale and location of intensive silviculture effort, and its costs, required to achieve wood supply objectives in an SFM context.	• The model indicated that a shift in silviculture strategies – towards intensive and away from extensive – is the most economical and productive approach.
A range of intensive silvicultural trials will be established to test and adjust the modeling assumptions used above	• The provincial NEBIE network, led by MNR, was established across Ontario with FRP supported installations in the NE Boreal and GLStL. • FRP partnered with the G&Y Business Unit of the Forest Coop to build and measure the network of standardized Permanent Sample Plots in Ontario, installing approximately 100 plots/year • A multi-year hardwood installation to study hardwood productivity was established near North Bay, in collaboration with research partners from Quebec	• These projects together all contributed guidance to field managers as well as exchangeable data and analysis to scientists. • The information gained from these projects reduced uncertainty in projections of wood supply in all the major commercial species of Ontario. • Visible results in the competition study corroborated the scientific analysis, and made this project a valuable demonstration site, visited by numerous groups, both forestry and non-forestry.

Objective (Year 2000 Strategic Plan)	Results Achieved (2000-05)	Impact
FIBRE PRODUCTION(CONTINUED)		
	• A multi-year competition study for white pine was established to evaluate the growth response of white pine to different levels of herbaceous and woody competition. • Mixed wood studies established in Alberta over the past several years were replicated near Timmins to evaluate the potential benefits of mixed spruce/ poplar IFM • Trials to evaluate the results from different renewal and silviculture systems were measured and analyzed on the Petawawa Research Forest.	
Opportunities for intensive fibre farming and genetic engineering will be identified and evaluated	• Hybrid poplar trials were visited in Quebec, and an economic analysis of the viability of hybrid poplar was conducted (Insley, U. of Waterloo). Tembec acquired 70 ha. of private land in 2004 to implement a Forest 2020 agreement with CFS, using hybrid poplar and Norway spruce. • Social licence concerns precluded any work on genetic engineering	• There has been no policy or practice impact from these projects yet. The small scale experience gained may help to mitigate the high risk/ high cost associated with hybrid programs applied on a large scale, if any are contemplated in the future.
SUSTAINABILITY		
Sustainability and diversity measurement tools will be developed, compared and refined for all Tembec licence areas. Generally, projects relating to sustainability issues will be undertaken with as many provincial partners as possible to ensure the outputs have applicability at a broad scale.	• The Patchworks model has provided the capability to evaluate and optimize tradeoffs between social, economic and ecological objectives, albeit crudely. • Impacts of IFM on biodiversity have been measured and studied since the inception of the FRP in 2000 (Thompson et al), leading to a better understanding of where intensive silviculture can be practiced while minimizing or mitigating impacts on other habitat values. • The American Marten project, the largest of the sustainability projects, was led by the Forest Coop with contributions and support from virtually all of the large forest companies in Ontario	• This "global" view indicated that AAC gains of 10% are possible, but not within the first 10 years after EFP program implementation. • The science supporting aspatial targets attached to the protection of habitat values requires significant refinement in order to be meaningful when modeled spatially. • The Marten study is expected to produce world class definitive science on the needs of the American marten, and related species.
Operations proposed for areas north of the 51st parallel in Ontario (the Boreal Forest Initiative) will require considerable advance planning and analysis to ensure sustainability objectives can be met. Linkages with the aboriginal community will be promoted as the most effective way to ensure that appropriate activities are identified	• Initial contacts with the Moose Cree resulted in a MNDM grant for $80K to catalogue TEK, but no project was ever officially launched.	• No impact.
Projects designed to evaluate and improve existing guidelines will be supported	• Two ongoing projects connected to the Forest Coop Marten project were implemented to provide a closer link to provincial guidelines. • One project was completed which resulted in recommendations to amend the provincial heron/ osprey buffer guidelines.	• Local level modifications to forest practices were applied on an "exception" basis to evaluate longer term impacts. Formal changes to guidelines are being considered by the Provincial Technical Committee.

Objective (Year 2000 Strategic Plan)	Results Achieved (2000-05)	Impact
SUSTAINABILITY (CONTINUED)		
The implications of any given project on long term ecological sustainability will be analyzed as a core component of all projects	• The tradeoff analysis capability developed in Patchworks, coupled with inputs from projects in the Spatial Modeling, Fibre production, and Sustainability themes allowed for landscape level evaluation of the ecological implications of forest management activities	• With much still to do, the work done so far has significantly improved the understanding of the interactions between multiple values on the forest landscape.
The Partnership will actively support provincial level development of tenure systems that complement the long-term sustainability of the forest industry and the communities it supports	• Both Tembec and MNR staff associated with the FRP actively participated in the Enhanced Forest Productivity Sub Committee of the Provincial Forest Policy Committee. The recommendations of this committee failed to provoke changes to the tenure system in Ontario, but they did result in the creation of a $2.3 million/year Enhanced Forest Productivity Fund, administered by the Forestry Futures Fund and dedicated to funding EFP science.	• The EFP fund will help to promote the long term continuity in forest R&D that is essential to raising the standard of forest management in Ontario.
FOREST MANAGEMENT CONTEXT		
Protection Programs An evaluation of the current and potential fibre loss to insect, disease and fire will be undertaken for Tembec's Ontario wood supply. Mitigation strategies to reduce risk and maximize recovery will be developed, evaluated and implemented.	• Decision support tools (Hopkin et al), adapted from the New Brunswick version, were developed for spruce and jack pine budworm in Ontario • A risk modeling tool (Martell, McAlpine et al, University of Toronto) for fire was developed and tested on the Romeo Malette licence. Among other things, this model provides some stark warnings on the potential impacts of climate change in the boreal. • De Groot (CFS) summarized the potential risks posed by insects in the large scale implementation of intensive silviculture.	• The tools developed by these projects were transferred to field practitioners via the FRP core teams. They have not been widely used to this point. The information they generate is planned for incorporation into the Patchworks framework by the end of 2006. • There are indications of an impending outbreak of jack pine budworm in Ontario, at which time the DSS will be used to minimize impacts.
Cost Reduction Projects that improve the efficiency and reduce the costs of forest harvesting and renewal operations will be promoted.	• In collaboration with the provincial MNR Tree Marking committee, FRP hosted workshops, field trips, and harvest trials to promote careful logging, better and more economical harvest prescriptions and more efficient operations in the Great Lakes St. Lawrence. • GIS/GPS technology was installed and tested on spray aircraft in NE Ontario, in collaboration with ULERN, General Airspray, and CFS. The reduction in herbicide application rates, the improvement in application precision, and the reduction in herbicide costs have resulted in this technology being required on all aircraft employed under contract to Tembec	• These projects clearly changed forest operations in Tembec areas, in both cases with a positive impact on costs and efficiency.

Objective (Year 2000 Strategic Plan)	Results Achieved (2000-05)	Impact
FOREST MANAGEMENT CONTEXT (CONTINUED)		
All projects under the Forestry Research Partnership will include a cost/benefit analysis to evaluate their operational viability. Cost reduction strategies will be developed and evaluated for those projects where costs appear too high to justify operational implementation	• Cost and revenue modules were developed and integrated into the Patchworks model, allowing for the integrated evaluation and subsequent optimization of social, ecological and economic factors. • Economic analysis of NPVs was completed for the major commercial species in Ontario, as well as for hybrid poplar • Further work attempted - and failed - to establish a strong connection between EFP and other social values (recreation, wilderness access, forestry employment, etc.)	• Tembec forest planners are beginning to use Patchworks as a planning tool to plan more economically efficient harvest allocations. • The NPV analysis - which indicated a negative return for all native species - underscored the need to develop incentives for EFP.
The improved utilization of fibre harvested in normal operations will become a focus of projects examining harvesting systems	• An internal Tembec reorganization in 2001-02 separated R&D in (ecological) forestry from R&D into operations. This objective was transferred to operations research.	
The reduction of transportation costs remains a key priority. The "Star truck" program initiated by Tembec and FERIC in 1998 will be continued with no change to the original core objective of increasing log truck payload and reducing per cubic metre haul costs.	• The STAR truck program, carried out in collaboration with FERIC, demonstrated light weight trucks, central tire inflation, and on board computer tracking to optimize performance.	• This technology is now being implemented in Tembec operations across Canada.
Training technology using harvesting simulators will be demonstrated throughout Tembec's operations, and integrated into operator training programs if value can be demonstrated	• Harvester simulator technology developed by a Montreal consulting firm was demonstrated through the FRP in 2002 to all Tembec operations in Ontario and Quebec.	• Despite the proven value to operations, uptake has been very poor.
Opportunities to share the costs of intensive silviculture with other partners by managing carbon will be explored and promoted where value can be demonstrated	• The FRP has supported the FluxNet project in return for an eddy covariance installation on a Tembec licence, which may provide valuable baseline data for subsequent downstream carbon work.	• No impact yet
Product Quality The effects of intensive silvicultural treatments on wood properties and downstream product quality will be evaluated and tested as an integral component of fibre production strategies.	• Forintek leadership and collaboration in this area generated 4 FRP projects examining the connection between silvicultural prescriptions, wood quality, and consequent product value. The results of these projects underscored the critical need for a much closer link between crop planning and desired product outcomes.	• Recommended plantation spacing and thinning intervals and intensities in Ontario have been amended to reflect the results of these projects. • The FRP extension program, through its core teams, provided a direct connection between scientists and Tembec practitioners which promoted knowledge uptake and application.
OPERATIONAL IMPLEMENTATION		
Technology Transfer Technology transfer to the operations level will be a requirement for all projects.	• 39 workshops and science seminars, 21 field tours, 7 university/college field camps, 5 teachers' tours, and the maintenance of a comprehensive and up to date website with 58 plain language FRP project write-ups were some of the deliverables of the FRP	• The FRP linkage to the CEC provided the platform to communicate forest science and education messages to students and educators at the primary, secondary, college, undergraduate and graduate levels.

Objective (Year 2000 Strategic Plan)	Results Achieved (2000-05)	Impact
OPERATIONAL IMPLEMENTATION (CONTINUED)		
	extension program. Other products include a tech note series (TreeTips), quarterly multi-media newscasts on CD-ROM, and compendium multi-media CD-ROMs for all events.	
Broad public dissemination of projects and results will be promoted as a primary vehicle to earn public acceptance and trust.	• FRP results, products and news were disseminated through numerous media, ranging from published journal papers to Tree Tips to field trips to workshops to newsletters. • Collaboration with the CEC leveraged the extension effort and expanded the target audience to include students, teachers, and other stakeholders.	• The extension activities of the FRP communicated accurate and honest forest science messaged to a broad range of audiences across Ontario.
The Bonner and Gurd tree improvement areas will be sold to Tembec by MNR, and appropriate repairs made and signage established to reflect the Forestry Research Partnership's objective to have these areas become vibrant demonstration areas for forestry R&D projects	• Ownership was not transferred to Tembec, but both areas were re-signed with FRP signs, several demonstration projects were established, tours were conducted in both areas, and, in the Bonnor case, a partnership established with the local community (Moonbeam) to establish and maintain a trail network, promote science, and minimize vandalism. • A forestry research trail was established in Samuel de Champlain Provincial Park, with a Permanent Sample Plot in its centre. This trail is heavily used as an educational venue for visitors to the CEC and the Park.	• These initiatives significantly increased the size of the audience to whom positive forest science messages could be communicated.
While technology transfer will be a requirement of each individual project, the Program will also develop stand alone projects that seek to improve the efficiency and effectiveness of knowledge sharing.	• Managing extension as a project on its own has proven to be a far more effective approach than attaching it to each individual project. The FRP has developed an extension and transfer strategy that coordinates and focuses transfer efforts on the one hand, and attracts collaboration and funding on the other.	• This coordinated approach to transfer added value to the program, and impact to the results.
Monitoring Protocols The appropriate balance between risk and benefit will be established by implementing monitoring programs that will compare prediction to reality in those projects where future forest conditions have been forecasted	• No monitoring strategy has been developed within the FRP. The provincial NEBIE program and PSP programs, both of which the FRP was heavily involved in, were established as the beginnings of a long term monitoring program.	• Long term cost effective monitoring remains a key missing piece in forest management.
Standardized experimental design and data collection programs will be encouraged to promote the maximum potential interaction between research themes.	• The FRP insisted from the outset that any data collection proposed or funded by the FRP be carried out in conformance with the provincial Permanent Growth Plot standard.	• Data sharing between a number of projects, both within the FRP and beyond it, has facilitated interaction between many projects.
Policy Influence The collective output of all projects undertaken by the Forestry Research Partnership will be consolidated and channeled to ensure the appropriate application of science to the development of forest policy.	• Acceptance in practice and policy of FRP outputs has proven to be a more challenging task than had been anticipated. The main success stories of the 2000 – 2005 period are: 1. Penner Yield Curves more or less accepted province wide 2. GIS/GPS spray technology implementation within Tembec herbicide operations 3. Growing recognition of and effort to use Patchworks in planning 4. The NE Pilot, which contributed to the genesis of the EFP fund	• Good science, effective collaboration, and a strong emphasis on transfer and extension at numerous levels have generated positive momentum for the FRP. This is expected to result in measurable impact on EFP policy going forward.

Front Cover (from left to right):

Tom Moore of Spatial Planning Systems Ltd.

Teachers' Tour at the Canadian Ecology Centre

Back Cover (from left to right):

Carbon FluxNet Research Site near Foleyet

Al Stinson at Gurd Seed Orchard near Trout Creek

Forestry Economics Seminar at the Canadian Ecology Centre

Commercial Thinning Trial at the Bonner Centre near Moonbeam

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