Making Lemonade from Trees...

How the Domtar Pulp Mill Shut Down Is Creating New Opportunities For Eastern Ontario

Industry Canada Industrie Canada
Canada

STORMONT, DUNDAS & GLENGARRY
Community Futures Development Corporation
Société d'aide au développement des collectivités

Supported by FedNor / Industry Canada through the Stormont, Dundas and Glengarry Community Futures Development Corporation

A Community Response to the Shutdown of the Domtar Pulp Mill at Cornwall Ontario

March 31, 2005
Second edition June 28, 2005

Technical Report

Design by Virginia Adams

ISBN 1-896392-77-6

ACKNOWLEDGEMENTS

The Eastern Ontario Model Forest acknowledges the support of:

- FedNor / Industry Canada through the Stormont, Dundas and Glengarry Community Futures Development Corporation
- Resource Stewardship S.D.&G. Council
- EOMF Mapping and Information Services and
- the writers, researchers, facilitators, experts, contractors and staff who responded to the challenge of addressing the impacts and opportunities arising from the shutdown of the Cornwall Domtar Pulp Mill in 2005

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PREFACE

The implications of Domtar's indefinite closure of the Cornwall pulp mill and one paper machine, extended well beyond the boundaries of the City of Cornwall where the mill is located. A group of partners with a long history of working together recognized the need to understand the situation more precisely and to take action to either mitigate or help shape the changes unfolding in the broader community. Or "When the world hands you a lemon; make lemonade."

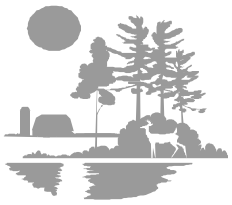
Forest sustainability necessitates a balance of the social, environmental and economic values associated with the forest. There were four key areas of focus needed to ensure the continued sustainable management of private forests: the 300 landowners directly involved, the mill itself, the overall landscape and new opportunities relative to conservation, economic and social values.

The thoughtful input of many individuals, organizations, consultants, industry and government sector staff, has wisely shaped the effort to date. The financial support of SD&G Economic Development and FedNor and the commitment of Resource Stewardship S.D.&G. has allowed the situation to be addressed with substance, positioning the community to respond to the challenges more effectively and to pursue new opportunities which result from the economic changes locally as well as globally. Jim Hendry and Derrick Moodie have been especially influential in the success of this project.

The final three chapters support the first two chapters of the report.

Chapter One consolidates the ideas and expertise of the many experts involved in this report and sets the direction. The business case in Chapter Two demonstrates the need for quick, coordinated, well researched action while the final three chapters follow up with the data, tools and evidence, useful to future decision making and action.

Brian Barkley, Eastern Ontario Model Forest
Sandra S. Lawn, Eastern Ontario Model Forest
Editors



BACKGROUND

On December 9th, 2004 Domtar announced "…it will close indefinitely part of its operations at its Cornwall mill. More specifically, the company will shut down the pulp mill, a paper machine, and a sheeter at this location." The closure took effect on March 8, 2005 and will last until such time as economic and market conditions allow these assets to operate profitably. In so doing, Domtar will be curtailing production by 150,000 tons of pulp and 85,000 tons of paper. This measure will impact approximately 390 direct jobs, 300 landowners and many loggers and contractors. Domtar also announced that it will eliminate a further 400 jobs across the company's operations in Canada and the United States, including management and staff functions, by the end of 2005."[1]

The closure, along with the release of pulp furnish back into the market place, has disruptive impacts at various levels of the forest products market in eastern Ontario and the Cornwall mill's woodshed that extends into Quebec and New York State.

The announcement of the shutdown of the Domtar Pulp Mill at Cornwall Ontario initially had a chilling effect on the community of Stormont, Dundas & Glengarry and the City of Cornwall. The news was widely broadcast and people were worried. Meetings were held, reports were written, and emails and phone calls were exchanged.

Support from FedNor and Stormont, Dundas & Glengarry Community Futures Development Corporation encouraged the Eastern Ontario Model Forest and Resource Stewardship S.D.&G. to proceed with stage one of an action plan for the rural communities negatively affected by the Domtar Pulp Mill shutdown.

This publication is a consolidation of five reports prepared by leading experts in a variety of fields. It demonstrates the importance of thorough research, the integration of innovative ideas and the dissemination of the knowledge and tools necessary for sound environmental and economic action.

[1] Source: http://www.domtar.com/Navigateur_Standard/PRESS_RELEASE/EN/HTML/3157_EN.asp?Category=3

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Chapter One "Expert Roundtable on Strategies and Recommendations for Alternate Uses of Wood Fibre" Sandra Lawn

Chapter One includes the output of an expert roundtable assembled and facilitated by Sandra S. Lawn, Project Leader with the EOMF. Foresters, engineers, government, non-government and industry representatives shared key knowledge with the researchers and each other. A literature review also provided background for the report.

Chapter Two "Bio-products Demonstration Business Case" Peter Milley

Chapter Two is a demonstration business case for a selected biomass opportunity and was developed by Peter Milley of Halifax Global Inc. Peter Milley has over fifteen years of consulting experience in market research and strategy development and corporate/industrial planning. He is internationally recognized for expert evaluation of current market trends and positioning and assessing new market and product opportunities for dimension, engineered, composite and other value added wood products.

Industry experience includes service as Vice President Corporate Development for the North American operations of a leading international wood products manufacturer.

Chapter Three "Closer Examination of Economic, Social and Ecological impacts" Laurie Gravelines

Chapter Three is an examination of the economic, social and ecological impacts including a detailed assessment of the current wood supply in Eastern Ontario with a concentration on Stormont, Dundas & Glengarry. The lead and writer of this chapter is Laurie Gravelines, resource economist. Laurie Gravelines received his BA (Hons.) in economics from the University of Manitoba in 1973. He has held a variety of positions with the Manitoba and Ontario provincial governments, specializing in the economics of natural resource management. He is also the facilitator for the Social Science Committee of the Lake Abitibi Model Forest.

Chapter Four " Digitizing Stormont, Dundas, and Glengarry Forest Resource Inventory" Greg Moffatt and Mark Rowsell

Chapter Four is the creation of tools for modeling the effect of change, threats and opportunities; including but not limited to an updated forest resource inventory of the most affected area. Training will be provided for economic development officers and resource mangers in the use of the Geographic Information System mapping for analysis and demonstration. The lead in this project is Mark Rowsell, geographer and manager of the EOMF Information and Mapping Service. Greg Moffatt, forester with the EOMF, wrote chapter Five. Dendron Resource Surveys Inc., Ottawa, was retained to complete the digitizing.

Chapter Five "Building the Case for Sustainable Management of Private Woodlots" Cher Brethour and Terri-lyn Moore

This chapter is building a case for sustainable woodlot management versus conversion to an agricultural use. It provides evidence for continuity of the Private Wood Lot Program. The lead for this report was Jim Hendry, Stewardship Coordinator for Resource. The authors of the report are: Cher Brethour and Terri-lyn Moore of the George Morris Centre, 225-150 Research Lane, Guelph, Ontario, N1G 4T2

EXECUTIVE SUMMARY

The bad news is: the suspension of the pulp mill operation will have a significant, negative, direct impact on the local economy. 2.7 % of jobs are lost - equivalent to an economic loss of $83 million annually.

But the good news is: the potential of Eastern Ontario and Northern New York mixed wood forest - the largest such block in North America, is notable: “that map is our wood basket and it is impressive. It is the only square with surplus wood in North America.” states Wayne Young RPF, Domtar.

Opportunities are rapidly emerging

Bio-energy, chemicals, wooden items, foodstuffs and pharmaceuticals all are receiving attention.

In Eastern Ontario at least four clusters related to biomass are being contemplated; events are moving rapidly, the price of oil is on an upward trend, the United States is aggressively pursuing research, pilot projects, plantations and new technology. Worldwide, many countries are already well advanced.

An integrated biomass development plan is beginning to emerge in Eastern Ontario, connecting the opportunities for bio products and bio-energy from forest and agricultural based biomass and the agricultural and municipal biomass waste streams.

Objectives for Stormont Dundas and Glengarry and Eastern Ontario

There is need for stronger partnerships with neighbouring communities such as Renfrew, Leeds & Grenville, Prescott & Russell and Lanark counties and others in eastern and northeastern Ontario. Also desirable is a greater role for Kemptville and Alfred Campuses of Guelph University and/or other institutions in integrated programs of applied science and research, the training of loggers, woodlot owners, technicians and others that would work in the forest related businesses.
The promotion of sustainability and marketability of wood based biomass through expansion of certification is essential; 331 woodlots are certified now.

Using the entire tree and creating demand where none existed can be achieved in a sustainable way.

Completion of the forest resource inventory for the entire county of SD&G in concert with a completed FRI for the rest of Eastern Ontario and ultimately southern Ontario is key.

The promotion of biomass economic development opportunities through the use of scientific innovation, understanding of benefits of carbon credits and construction trends and the training of economic development officers in this sector is basic.

The provision to woodlot owners of decision making support and tools in good, plain language; increased knowledge with programs, newsletters, the web and other communication needs work.

Next Step

A task force or steering committee needs to identify the responsible bodies, timelines and resources needed. Strong leadership will be required, including but not limited to the SD&G Community Futures Business Development Corporation, Resource Stewardship S.D.&G., the EOMF, government decision makers and the private sector.

This group could be responsible for seeking supporting resources and maintaining the momentum being generated by all of these ideas.

Key sustainability considerations

Forest Certification pioneered in Eastern Ontario by the EOMF, was through the Forest Certification Council whose agent is Smart Wood. Certified wood was 58,000 m^3 or 13% of Cornwall Mill's consumption.[2]

A key point for landowners is: maintaining the woodlot for timber production between the years 2005 and 2021 is the more economically viable use of the land.

Current FRI data for a 40 km radius around Cornwall is now complete and lodged with the EOMF.

If the volumes of ethanol produced by the bio-refinery were insufficient to support an economic scale generating plant, purpose grown biomass and other mill residues, (from a wood products manufacturing centre, for instance), as well as from other forest products producers in the region, could be used as co-fuel to support an economic scale generating plant.

Some Fundamental Evidence

The Cornwall mill required 425,000 cubic meters of wood per year; in the recent past Domtar obtained 69.3% from NY, 25.9% from Ontario and 4.8% from Québec.

In view of the developing demand-supply relationship in the regional wood market, it would be prudent to assume that wood prices will not decline and that volumes will be maintained.

The research results indicate that co-location of an ethanol plant with an existing biomass power plant offers significant cost advantages.

We do not see fibre availability as an insurmountable barrier to development of one or more of these projects.

Buyers for ethanol, acetic acid and other derivative products can be readily identified within the north central region of North America.

These buyers are well within economic range for bulk truck or rail transport from a Cornwall/Eastern Ontario facility.

Markets for the electricity and wood products contemplated in the options and variations are known and well understood. Developing markets for these products is not anticipated to present unmanageable business risks to any of the component elements.

Urgency

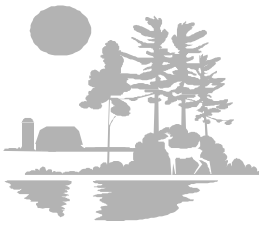
Thus, there is some urgency and significant gains to be realized by moving forward quickly with the next stage of evaluation and pilot development of the bio-refinery concept and the development of other forest biomass based opportunities.

As well, because the bio-refinery concept is intended for installation in existing chemical pulp mills, these facilities are provided with potential for improved efficiencies, reduced fibre costs, and extended economic life. The result is continuing utilisation of existing infrastructure, and preservation of jobs, both in the mill and in the woodlands.

[2] Editor's note: in the Eastern Ontario Model Forest region (Lanark, Leeds & Grenville, Stormont, Dundas & Glengarry, City of Ottawa and Prescott and Russell) forest cover is 34%; 88% of that is owned by 8,000 owners and the forests are one-third conifer and two thirds deciduous.

CHAPTER ONE: EXPERT ROUNDTABLE ON STRATEGIES AND RECOMMENDATIONS FOR ALTERNATE USES OF WOOD FIBRE

PROCEEDINGS OF ROUNDTABLE



Agroforestry Centre of Kemptville Campus of Guelph University
March 30, 2005; 9:00 a.m. to 3:00 p.m.

PURPOSE OF EXPERT ROUNDTABLE

An expert roundtable of scientists, engineers, foresters, researchers, business, government and economic development professionals was assembled to explore:

1. alternative uses of current fibre supply and future supply
2. co-generation opportunities and examples
3. trends and markets for bio-energy
4. value-added wood products
5. potential revenues and
6. most viable uses of the wood fibre no longer flowing to the pulp mill.

Another valid purpose of the roundtable was to strengthen and enhance existing networks of the multidisciplinary professionals involved in the complex wood biomass sector.

To begin the day, self-introductions of the participants reinforced the opportunity for some good thinking. Present were: Brian Barkley, manager of the EOMF; Bob Benson: retired (Tembec) chemical engineer; George Brook of the Ottawa Life Sciences Centre; Denys Cooper of the National Research Council; Martha Copestake, forestry engineer with EOMF; Laurie Gravelines, natural resources economist; Jim Hendry, SD&G Stewardship Coordinator; Jeff Karau: NRCAN; Sandra Lawn, project leader, EOMF; Ian Manson, OMNR; Peter Milley of Halifax Global Management Consultants; Derrick Moodie, executive director, Stormont Dundas and Glengarry Community Futures Development Corporation; Bryan Murray, National Research Council; Jamie Stephen, BIOCAP at Queen's University; Dave Winston, formerly Director of Canadian Forest Service, NRCAN; and Wayne Young: Domtar Inc., Cornwall**.**

Two invitees, Martin Zimmer of LaFleche Environmental Inc. and John Dodd of KMW Systems Inc., who were unable to attend on the 30th, met with the facilitator, Sandra Lawn on March 31, 2005 at the EOMF offices. Their ideas on "Hurdles and Strategies" are included in the matrix below.

Following short presentations on progress to date by the project leads: Brian Barkley, Jim Hendry, Peter Milley and Laurie Gravelines and, the day continued with two short stories intended to set the tone for the creative thinking that was the order of the day.

"Making Lemonade Up North:" a short story by Bob Benson, P.Eng.

The small town of Témiscaming, Quebec had for many years, depended on Canadian International Paper for its life. It was a company town until one day in 1971 the owners succumbed to the pressures of environmental controls and an antiquated acid sulfite process that sent 700 tons of solids into the water every day. The plant was to be closed.

But, a town of 3,000 people was not about to tolerate such a blow and when CIP tried to move $10 million of cut timber down the Ottawa River, the townspeople leapt into their boats, linked arms and created a legend. Two National Film Board films now document their boldness!

One of the leaders was a young engineer called Frank Dottori who helped reinvent the company; raising money locally, cutting the number of employees from 2400 to 1200; downsizing the number of unions from 12 and starting a new company. Tembec today has 10,000 employees worldwide; it extracts many products from the trees of northern Québec and Ontario. They have pioneered biomass burners, created “binder” for concrete and animal feeds, lignosulfite, converted waste sludge to food grade ethanol and produced high quality pulp as well.

“Developing a Blue Ocean Strategy:” a second short story

Chan Kim and Renée Mauborgne in the October 2004 edition of the *Harvard Business Review* describe a Québec enterprise, which instead of competing in an overcrowded market space, recreated the circus and the theatre, producing Cirque de Soleils with revenues doubling 22 times over 10 years. Guy Laliberté created a “Blue ocean strategy that sprang quickly into an uncontested market space making competition irrelevant and creating and capturing new demand.” He was able to align his enterprise activities in pursuit of differentiation *and* low cost.

When “demand is created rather than fought over, there is ample opportunity for growth that is both profitable and rapid” [3]

[3] Kim, W. Chan and Renée Mauborgne “Blue Ocean Strategy.” *Harvard Business Review*, 82 - 10, (October 2004) pp 76-84.

THE ROUNDTABLE DELIBERATIONS SUMMARIZED:

Forest products sector	Hurdles for Eastern Ontario	Strategies for SD&G and Eastern Ontario
View from the woodlot	Some see themselves as farmers first - "I am a farmer and I own a wood lot." Poor quality inventory: type and quality; the long struggle to get this done is not yet over Ownership fragmentation with varying sizes, age/class, differing visions and attitudes creating uneven results Many are not taking a long term view of the investment vs. short term financial gain (see Chapter Five) Competition for land use, encroaching urbanization Property rights are an issue complicated by the complex taxation structure especially as tied to market value assessment and Managed Forest Tax Incentive Plans Reasonable access to seedlings perceived as a problem by some Climate change, exotic pests e.g. emerald ash borer create concerns about forest health: a worry	Develop an Implementation Plan with communication, technology, product development, research, science and sustainability and business development built into it Complete a high quality, current Forest Resource Inventory Provide leadership and co-ordination; create mutual support; develop one well structured organization for woodlot owners; demonstrate the long term view of investment; prove the power of the market place and innovation; emphasize market reward Integrate efforts; demonstrate partnerships, trust, relationships between owners and buyers through communication, interaction Be multidisciplinary Promote and support the Ferguson Forest Station at Kemptville Promote sustainability through expansion of certification: 331 woodlots certified now; consider the urban forest Highlight examples such as IKEA with a plant in North Bay and using only certified wood Develop business cases - attract business to locate here from Europe and elsewhere

Forest products sector	Hurdles for Eastern Ontario	Strategies for SD&G and Eastern Ontario
		Provide decision making support and tools in good, plain language; increase knowledge with programs, newsletters, the web Create a website for trees and forest care such as that for wetlands: www.wetkit.net. Reforestation planning; partner-ships with conservation authorities, municipalities, woodlot owners, service groups Prepare for carbon credit opportunities
Logging	Many don't view trees as a crop to be sustainably managed Aging equipment; suppliers limited in eastern Ontario Aging loggers Presence of high graders Could be a crisis as young loggers are not getting the training Conestoga College program is undersubscribed; but students always get jobs	Adopt a more Scandinavian approach through exchanges, information sharing Create knowledge in the high schools; encourage program at Kemptville and/or Alfred campus of Guelph University or encourage Conestoga to recruit students from eastern Ontario Promote eastern Ontario assets including four lane "haul roads."
Wood products	Biodiversity could be at risk; monocultures create challenges of their own Not all components of a product can be locally sourced Transportation can be difficult when woodlands are widely separated	Integrate variety of ideas emphasizing that there should be no single product; aim to use whole tree; start off using sawdust. Create demand where none existed (Cirque de Soleils approach) Develop further strong and

Forest products sector	Hurdles for Eastern Ontario	Strategies for SD&G and Eastern Ontario
	Global competition from countries such as China with lower production costs and good quality wood products Short term gain is more attractive to some Some ideas with potential have just not taken off e.g. polylactic acid - Dow and Cargill in U.S. believed it would form a modern material, compostable and biodegradable; only one plant so far and below capacity Some people are leasing Domtar lands for their exclusive use. There are the questions of liability and this practice is growing Sometimes products called plastic wood have no wood at all! Chemical companies such as Dow and Dupont are getting into renewable feed stock and turning toward non-wood fibre such as corn Access to market is seen as a problem by many Fractionation through pyrolysis is a complex process with key questions such as what to do with the char U.S. activity is a barrier on one hand and an opportunity on the other; oriented strand board (OSB) is coming back but there are advantages in the U.S. that we cannot match.	trusting networks "Look at products we can make here!" Outputs can vary widely: from a huge variety of industrial chemicals, pharmaceuticals, maple products, nuts, medicinal plants, firewood, value added wood products such as home renovation products, composites, factory built houses (for the north?) Forest provides full range of values including fuel wood and recreation Create access to markets by co-operative action such as a "fire wood yard." Find innovative use of wood residues, sawdust, bark, thinnings, branches, leaves etc. Shipping via the St. Lawrence Seaway/Great Lakes corridor from the deep-sea port at Edwardsburgh/Cardinal is an asset to build on. Wood pellet idea is especially attractive at deep sea port Tourism is big: hunting, fishing, forest trails - treat it seriously Connect BIOCAP projects to Eastern Ontario as much as possible; BIOCAP is research based and is working with companies such as Dynamotive with respect to wood flooring and Ensyn with respect to food additives

Forest products sector	Hurdles for Eastern Ontario	Strategies for SD&G and Eastern Ontario
		Keep scale, market and demand in forefront and proceed in combination with the development of other products including bio-energy Domtar is no longer buying wood. This may drive down the cost of fibre basket. 20% of wood could be made into veneers; this is where 80% of the profit is (in the Adirondacks.)
Paper and allied products	Finding by-products from pulp digesting process has not been done Pulp and paper market is highly susceptible to commodity markets and monetary policy Domtar plans to use natural gas as co-generation fuel There is no magic bullet to inspire reversal of Domtar's decisions Used to get $80 per tonne for bark for landscaping	Retrofitting of the pulp mill digesters as alternate use "Even if economics are marginal - return on investment is not so bad" Research other biomass fuels for Domtar co-generation
Wood biomass energy	Bio-energy is becoming almost trendy, with fuel costs making the news daily ($55.40 per barrel on March 30th, $60.54 US on June 28, 2005 and predictions of prices as high as $100) Varying processes with varying levels of efficiency and complexity require high level of skill and training by decision makers and operators	Consolidate biomass availability data in Eastern Ontario from forest, agriculture and municipal waste sources; develop a "green power" master plan Connect with research: e.g. Kerry Rowe at Queen's is doing landfill research Sort through interconnections and production niches for co-generation and/or bioenergy. Greenhouses, aquaculture and

Forest products sector	Hurdles for Eastern Ontario	Strategies for SD&G and Eastern Ontario
	Taxes on fuels can influence economic viability and market vulnerability IOGEN will be using straw not lignocellulose fibre Co-generation at Domtar will be from natural gas combustion	value added wood products are niches of interest and potential. Build on the SD&G Bioproducts successes in and around Winchester Off-grid power systems - another niche market Develop clear assessment of economic return, long and short term: "lignocellulosis based facilities of the future will also require a variety of products to provide adequate economic returns." IEA Bioenergy Connect with large companies such as Lafarge, Dofasco, Ontario Power Generation etc. who are sourcing their energy from multiple locations
Forestry services and community economic development	Owners perceive reasonable access to services and advice that used to be provided by the Ontario Ministry of Natural Resources, as a problem. Labour could be in a crisis in future: skill level requirements are high; workers need to work with and maintain high tech equipment Conestoga College's Wood Working Centre of Ontario graduates are in demand but sometimes there are only 20 students in a high demand program Skilled trades people are aging The National Research Council's IRAP (Industrial	Communication plan including working with young people to appreciate the opportunities in the environment, silviculture, forestry, chemistry, biology, industrial design, research, GIS, business etc Create closer links with BIOCAP and the stakeholders and policy makers at all levels of government. Keep a watch on research generated opportunities Train and include economic development officers and resource managers, reaching out to them; they are key. Use dynamic networks of

Forest products sector	Hurdles for Eastern Ontario	Strategies for SD&G and Eastern Ontario
	Research Assistance Program) has an interest in skills but many don't know about it. Need for skilled trades such as electronic technicians, carpenters; apprenticeships and co-op apprenticeships Literacy is also an issue; 30% of Ontario students never graduate from high school; 42% of over 15 year old Canadians read at a low level	contacts Need a clear vision and to make this vision clear Need buy-in; give reason for why do this here? Guidance teachers in high schools need to be tuned in Appreciate the potential of Eastern Ontario and Northern New York mixed wood forest - the largest such block in North America: "that map is our wood basket and it is impressive. It is the only square with surplus wood in North America." Stated Wayne Young. Cornwall mill used mixed hardwood, 50% maple: soft and hard. Capitalize on the opening up of wood supply with Domtar out of the picture Lower the risks for the "tire kickers" and entrepreneurs with detailed community inventories that incorporate the forest sector.

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CHAPTER TWO:
TESTING THE ECONOMIC FEASIBILITY AND POTENTIAL OF FOREST BASED BIO-PRODUCT PRODUCTION IN SD&G
BY PETER MILLEY

INTRODUCTION AND OVERVIEW

This chapter demonstrates the development of a generic business case for a bio-product that is produced from the forest resources of the Eastern Ontario and adjoining areas. The intent is to demonstrate to woodlot operators, scientists, engineers, entrepreneurs, economic developers and others involved with the forests of Eastern Ontario, the diverse uses for wood resources beyond the conventional applications of pulp, lumber and panel products.

Scientific institutions and various corporations across the globe are exploring and developing a wide range of techniques and technologies with vast potential for renewable sources of clean energy, chemicals, pharmaceuticals and value added wood products. All of these could be harvested from our mixed wood forests.

Given the results of the expert roundtable held on March 30, 2005 (described earlier in this publication) and our own subsequent wide ranging secondary source research and literature review, we conclude that it will be most productive to focus on a business case for elements of a forest bio-refinery initiative.

It is further noted that the Ontario Government recently announced initiatives that make the development of this demonstration business case even more relevant.[4]

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[4] Editor's note: excerpts from June 17, 2005 press release from Queen's Park -- A new $520-million, 12-year fund that will boost ethanol production in Ontario…

"By supporting the production of ethanol fuel, we're helping our farmers, creating jobs in rural Ontario and moving forward with our plan to reduce greenhouse gases and the harmful emissions that cause smog," said Premier McGuinty.

"This fund will improve the air we breathe by encouraging the construction of ethanol plants to meet the growing demand for cleaner-burning fuels."

The Ontario Ethanol Growth Fund, announced today, provides:

* Capital assistance to help meet financial challenges
* Operating assistance to address changing market prices
* Support for independent retailers selling ethanol blends
* A research and development fund to pursue opportunities for research and innovation.

Relevant Research and Development Initiatives

International Energy Agency (IEA) Bioenergy

IEA Bioenergy was set up in 1978 by the International Energy Agency (IEA) to improve cooperation and information exchange between countries that have national programmes in bioenergy research, development and deployment. IEA (International Energy Agency) Bioenergy aims to accelerate the use of environmentally sound and cost-effective bioenergy on a sustainable basis, and thereby achieve a substantial contribution to future energy demands.

IEA Bioenergy is concerned that the use of forests for energy be efficient, economically sound and environmentally sustainable. This has been a primary focus of the work of IEA Bioenergy since its inception and the particular concern of Task 18, "Conventional Forestry Systems for Bioenergy" for the past three years. This work will continue over the coming three years with Task 31, "Conventional Forestry Systems for Sustainable Production of Bioenergy."

Countries involved include: Australia, Austria, Belgium, Brazil, Canada, Croatia, Denmark, European Commission, Finland, France, Ireland, Italy, Japan, New Zealand, Norway, South Africa, Sweden, Switzerland, The Netherlands, United Kingdom, and USA. In April 2005, the Eastern Ontario Model Forest led a delegation of IEA Bioenergy delegates on a well-appreciated tour of eastern Ontario including a Domtar plantation in Stormont, Dundas & Glengarry and the Ferguson Forest Station in North Grenville.

Specific projects reviewed and relevant to the eastern Ontario forests include:

- *"Biotechnology for the Conversion of Lignocellulosics to Ethanol"*
  The work of this project highlighted technical advances that have been made in the various process steps of biomass-to-ethanol. For example, the fermentation of xylose, the major component of hardwood and agricultural derived hemicellulose has evolved from being difficult or impossible in the early 1980s to the stage where theoretical yields of ethanol can be achieved.

- *"Production of Energy from Sustainable Forestry"*
  The objectives are to develop an integrative framework for information related to biomass production for energy from sustainable forestry, based on leading-edge science and technology; and to share and promote the use of such an information framework with advanced information technology and a high level of collaboration.

- *"Liquid Biofuels"*
  The overall objective of this project area is to continue to assist with the development of advanced technologies that convert lignocellulosic biomass to ethanol. Advanced biofuels technologies can potentially result in lower-cost biofuels. The participants will have either active research and development programs or companies interested in commercializing lignocellulosics-to-ethanol within their countries in order to meet this objective. They will carry out cooperative research work towards reaching the objectives above. This will be based on the national research and development programs.

Research at Syracuse University of New York, College of Environmental Science and Forestry (SUNY-ESF)

There is an ongoing research-based relationship between SUNY-ESF and the EOMF. The sharing of the subsequent information was the result of a field trip to SUNY on March 31, 2005 and it is gratefully acknowledged.

Willow Biomass Project (ongoing)

Willow biomass is an environmentally sound, locally produced, renewable source of energy and bio products. Research conducted by SUNY-ESF has reconnected the historic willow cultivation industry to central New York. For almost two decades SUNY-ESF has teamed up with over 20 organizations to facilitate the commercialization of willow crops and other woody biomass for bioenergy and bio products in the Northeast and Midwest United States. The school currently has the largest willow crop in all of North America.

Other organizations involved in this project: United States Department of Agriculture, New York State Energy Research and Development Authority, United States Department Of Energy, Niagara Mohawk, Antares, NRG Energy Inc., Office of Congressman James T. Walsh, NYS Electric and Gas, Northeast Biofuels, and the States of Delaware, Maryland, New Jersey and Pennsylvania. The work, while still in the testing phase, has also received support from International Paper, the world's largest paper company and from Lyonsdale Biomass, a wood-fuelled energy producer.

Willow biomass crops increase habitat diversity. They are planted on open, agricultural land, not on cleared forestland. A crop can be harvested six to seven times before replanting is required. Willow's genetic diversity and short breeding cycle can be utilized to produce improved varieties. Willows vigorously resprout after each harvest. The amount of heat in a dry ton of willow is similar to other hardwoods.

The process involves the removal of sugars and acetic acid from willow biomass and then burning or gasifying the remaining material. Trees can be harvested close to year round, eliminating or significantly reducing the need to stockpile large inventories of raw material. The sugars separation process also produces acetic acid, which is used primarily in manufacturing polyvinyl acetate, a plastic. It should also be noted that the commercial value of acetic acid is nearly three times that of ethanol.

Forest Bio-Refinery Initiative

The steps in the process being developed include:

- adding hot water extraction vessels (low pressure digesters)
- extracting soluble hemicelluloses
- separating the acetic acid and
- fermenting the sugar to fuel-grade ethanol with known processes.

Ethanol is at the “low end” in value of potential products that can potentially be derived from this process. Removal of the “sugars” should improve the throughput potential of existing pulp operations because the conventional pulping process would subsequently remove the hemicelluloses in any event. According to SUNY-ESF further work is needed on the energy offsets.

As well, potential for development of further value includes a “fermentation system” to produce high value chemicals and produce ethanol with “residuals from the system.”

After the chips are removed, the process involves filtering the watery solution that remains through a membrane that separates the sugars and acetic acid from the water. The sugars are then fermented to produce ethanol. After the desired components are extracted, the residue can be burned or gasified for combined heat and power uses.

Future planned research and development work involves ESF's bio-refinery being used to devise a new and subtler method for separating wood into its components, such as cellulose, the polysaccharide (sugar) and polysaccharide xylan, which is primarily dissolved in the pulping process.

United States National Renewable Energy Laboratory (NREL)

NREL's mission is to develop renewable energy and energy efficiency technologies and practices, advance related science and engineering, and transfer knowledge and innovations to address the nation's energy and environmental goals.

The Biomass Program supports NREL Research & Development that focuses on biomass characterization, thermo chemical and biochemical biomass conversion technologies, bio-based products development, and biomass process engineering and analysis. NREL also works to develop cost-effective, environmentally friendly, biomass conversion technologies to reduce our nation's dependence on foreign oil, improve our air quality, and support rural economies.

For the past 3 years, softwood research activities at National Renewable Energy Laboratory (NREL) have focused on investigating the feasibility of converting softwood forest thinnings to ethanol using two-stage dilute sulphuric acid hydrolysis technology.

The National Bioenergy Centre (NBC) was established in October 2000 to support the science and technology goals of the U.S. Department of Energy (DOE) Biomass Program. Based at the National Renewable Energy Laboratory (NREL), this virtual centre unifies DOE's efforts to advance technology for producing fuels, chemicals, materials, and power from biomass. The NBC has primary responsibility for carrying out the agenda of the Office of the Biomass Program of DOE's Office of Energy Efficiency and Renewable Energy (EERE) and other related goals. Collaborating with industrial, academic, related EERE programs, and other governmental research, development and commercialization efforts, is central to that agenda.

Processes involved include single-stage and two-stage dilute sulphuric acid hydrolysis of California softwood forest thinnings (whole tree chips) were carried out using a 4-L batch steam

digester at NREL. Other processes involved were: sulphur dioxide-steam explosion pre-treatment, sugars recovery from first-stage hydrolysates, ethanol fermentation, and rapid analysis of biomass materials.

Specific projects have included:

- "The Northeastern California Ethanol Manufacturing Feasibility Study"
  This study involves mainly forest thinnings (70% White fir, 20% Ponderosa pine, and 10% Douglas fir). The design is for six sites (five with already existing biomass power plants) with 230-300,000 BDT/year at each site and a delivered price of $30-40/BDT. A preliminary evaluation of the process economics for each of three technologies (concentrated sulphuric acid, dilute sulphuric acid, dilute nitric acid) was undertaken. Other activities include a site characterization study, ethanol market assessment, environmental impact assessment, and socio-economic impact assessment. There are currently two locations (Oroville and Chester) undergoing detailed industrial assessment.

Future projects planned by NREL include process design and ASPEN Plus simulation models for a 2,000 dry metric ton/day softwood-to-ethanol plant using two-stage dilute sulphuric acid hydrolysis technology. Merrick & Company (Aurora, CO) developed a conceptual design for an 800 dry metric ton/day plant for a site near Martell, CA. Two scenarios were investigated: a stand-alone plant and a plant co-located with a biomass power plant. A feasibility study was also conducted for a 275 dry metric ton/day plant for converting softwood residues to ethanol in Southeast Alaska.

The research results indicate that co-location of an ethanol bio-refinery with an existing wood processing facility, such as a pulp mill, offers potentially significant cost and performance advantages.

FACILITY CONCEPT AND OPTIONS

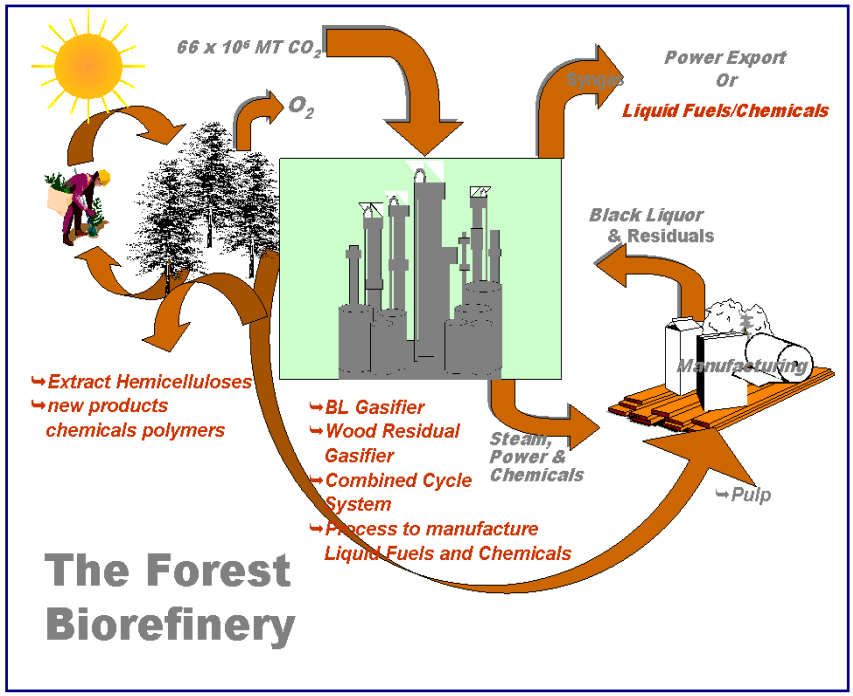
Overview of the Forest Bio-Refinery

Conceptually, the forest bio-refinery is intended to be implemented in a conventional pulp mill environment, after the round wood has been converted to chips, but before the chips enter the digester process.

The process involves treatment of the chips with high temperature water to remove the hemicelluloses (sugars). The water-based solution is then treated through a membrane filtration system to separate the water and the hemicelluloses and the hemicelluloses are then processed through a fermentation process to create ethanol fuel which can be used to generate electricity or to power transportation vehicles or any of a number of other applications.

Work done so far by SUNY-ESF researchers suggests that the process of removal of the hemicelluloses (sugars) sufficiently reduces the mass of the fibre ultimately to be converted to

pulp that the pulping process will likely be accelerated and made somewhat more efficient. The net effect of this on an existing mill is thus a *de facto* increase in pulping capacity.



Schematic Courtesy of SUNY-ESF

Essentially, the concept is built on three foundation elements:

- Sustainable Forest Productivity
- Extracting Value Prior to Pulping and
- Generating New Value Streams from residuals and spent pulping liquors.

The forest bio-refinery thus serves as a vehicle through which forest stewardship combines with wood processing in a manner that enables fibre, fuel, chemicals, and power streams with market and intrinsic societal values, to be extracted, refined and used effectively.

The extraction of ethanol as a continuously renewable fuel source offers potential for substitution of fossil fuels in conventional combustion applications, offering possibilities of reducing greenhouse gas emissions.

As well, because the bio-refinery concept is intended for installation in existing chemical pulp mills, these facilities are provided with potential for improved efficiencies, reduced fibre costs, and extended economic life. The result is continuing utilisation of existing infrastructure, and preservation of jobs, both in the mill and in the woodlands.

Options and Variations On The Theme

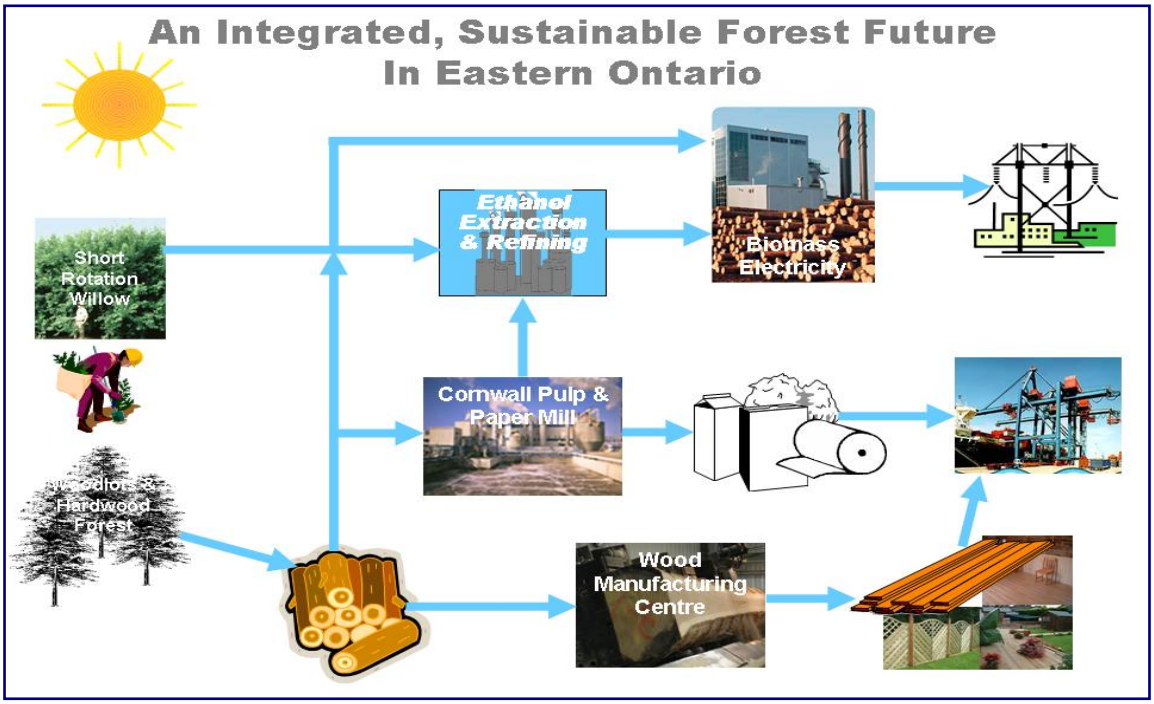
As indicated in the schematic shown above, there is potential for addition of other processes to the refinery concept. These include gasification for conversion of other extracts into fuels or other useful feedstocks.

Other options and variations on the concept that could be incorporated into and developed with the bio-refinery concept include:

- growth of plantation biomass, (see discussion of willow biomass research initiative in Introduction), as a dedicated furnish source for ethanol refining
- development of a large-scale ethanol refining facility (perhaps several hundred million litres / yr), which could collect and process water / hemicellulose solutions from several mills within the region in which bio-refineries had been installed, as well as potentially process fibre from plantation biomass such as willow
- use of ethanol and other pulp mill residuals as fuels or co-fuels for generation of electricity in sufficient volumes to warrant sale to an external receiver e.g. provincial power grid and
- enhanced merchandising of harvested timber to facilitate direction of saw log grade material to a primary / secondary wood products manufacturing complex, from which chips and other residual products could be sold into the bio-refinery.

Towards A Sustainable Forest Future

When considered as an integrated whole, these component elements could combine to form a sustainable forest-based economic system in Eastern Ontario, as illustrated below.



As mentioned above, there is potential to increase the throughput of the bio-refinery by including in its furnish, purpose-grown biomass such as willow. As well, chips, sawdust and shavings from a wood products processing facility could be incorporated into the furnish flow to increase further the potential output of ethanol, acetic acid and other products.

Also as noted previously, an alternative "sales" option for the ethanol output from the bio-refinery could be for use as fuel for an electrical generation facility located in Eastern Ontario. If the volumes of ethanol produced by the bio-refinery were insufficient to support an economic scale generating plant, purpose grown biomass and other mill residues, (from a wood products manufacturing centre, for instance), as well as from other forest products producers in the region, could be used as co-fuel to support an economic scale generating plant.

If located on the same site as the proposed wood products manufacturing centre, heat from the generating plant could be sold to and used by the wood centre for kiln drying and possibly other manufacturing processes and facilities.

It has been assumed the electricity generated could be sold to the Hydro One grid or to a municipal utility. However, depending on the capacity of the generating plant, it would also be possible that an industrial user – e.g. Domtar Paper in Cornwall – could be a viable customer for the entire output of the facility.

Extensions of this system beyond the product possibilities illustrated are also possible. For example, acetic acid, a co-product from the ethanol refining process, could be used as a feedstock for a plastics manufacturing facility, and further transformations of paper and wood products from the Cornwall and Wood Centre complexes could also be supported.

Feasibility analysis of these other various options and combinations is outside the scope of this assignment but is certainly recommended.

FIBRE CONSUMPTION AND AVAILABILITY

Requirements for Forest Bio-refinery

The technology and refining process inherent in the SUNY-ESF forest bio-refinery has been developed to extract hemicelluloses efficiently and effectively from the most common dense hardwood species in New York State – the sugar maple – as well as other common northern hardwood species.

All these species are prevalent in Eastern Ontario, which is in effect a geographic continuation of the St. Lawrence forest which surrounds the eastern end of Lake Ontario.

If the bio-refinery were to be installed in a reactivated Cornwall pulp mill, fibre requirements would be roughly similar to or slightly increased from Domtar's pre-shutdown requirements – approximately 470,000 m^3.

If a wood processing complex were added to the industrial complex or established in the area, consumption of round wood would likely increase by another 150,000 – 200,000 m^3, (or potentially more, depending on products being manufactured at the complex). As much as half this volume (75,000 – 100,000 m^3) could be available as furnish for the forest bio-refinery or as biomass combustion fuel.

Estimated Available Suitable Fibre

Fibre supply availability analysis is the focus of another research project within this overall initiative and is addressed in the following chapters. However, anecdotal evidence combined with Ontario Forest Resource Inventory data suggests that adequate supplies of standing hardwood timber exist within the boundaries of the EOMF. Knowledgeable individuals interviewed during the research for this business case project have suggested that as much as an additional 750,000 m^3 ± 25% of dense hardwoods could be harvested annually from the Eastern Ontario Model Forest region on a sustainable basis.

If there is a constraint on availability of that timber, it is likely to be on the availability of appropriate harvesting capacity. However, if development of the forest bio-refinery, a wood products manufacturing centre, and biomass fuelled electrical generating capacity were to proceed, we anticipate the results would be increased, sustainable demand for hardwood fibre which in turn would stimulate the entry of new harvesting contractors to the business.

Thus, we do not see fibre availability as an insurmountable barrier to development of one or more of these projects.

REVENUES, COSTS AND FINANCIAL ISSUES

Readers are asked to note specifically that the revenues, Halifax Global or SUNY-ESF has not developed costs and other financial aspects of the project discussed in this section beyond "order of magnitude" estimates. Precision of some of the cost estimates – especially with respect to anticipated capital costs – may not be more accurate than ± 50% and serve primarily as a demonstration of potential.

Development of more precise estimates will be possible only with more detailed information about mill configurations, possible equipment being used, availability of underutilised and available alternate facilities, (e.g. fermentation-capacity) and so on, is required. Indeed, it will be necessary to evaluate the concepts and opportunities presented in this document at the level of a comprehensive pre-feasibility evaluation, in order to arrive at more precise cost and performance estimates.

Estimated Output Yields and Revenues

If we assume the reactivated pulp mill continued to consume approximately 250,000 oven-dried metric tonnes (odmt) (470,000 m^3), of fibre, the theoretical potential ethanol yield from an installed bio-refinery at the facility would be in the order of 20 – 22 million litres. Production of acetic acid from that same facility would be in the range of 7 million litres. At current prices of approximately CAD 0.37 / litre for ethanol and approximately CAD 0.56 for acetic acid, a bio-refinery with that output level would generate theoretical potential incremental revenue to the pulp mill of approximately CAD 12.0 million.

After operating and capital costs were subtracted, the bio-refinery could theoretically generate improved cash flows in the range of CAD 8 million for the Cornwall pulp mill.

Most importantly, these incremental revenues would offset the cost of fibre going into the reactivated pulp mill. Based on data provided in Chapter Three, we have estimated that prior to shutdown, the total fibre cost at the Cornwall pulp mill would have been approximately CAD 23 million. The incremental revenues that could potentially be generated from ethanol and acetic acid production at the bio-refinery would therefore represent a potential fibre cost reduction for the mill of as much as 25 – 30%, if the bio-refinery and ethanol production were fully integrated into the pulp mill operation.

However, even if the pulp mill were to sell the extracted hemicelluloses in bulk and in unrefined state, to an ethanol producer, it is likely that effective wood cost reductions of 12 – 15% could be achieved.

In addition, researchers at SUNY – ESF indicate that further cost performance improvements can be achieved through increased pulp digester throughput that results from prior removal of the hemicelluloses. These cost performance improvements have not been factored into the financial estimates incorporated into this report.

Investment Requirements

Based on existing pulping capacities at the Cornwall mill -- ≈ 400 tonnes/day – investment and financial estimates for a bio-refinery developed by SUNY-ESF researchers can be summarized as follows:

- 22 million litre/year of ethanol output, assuming 400 tonnes/day and 140,000 tonnes / yr. hardwood pulp output
- estimated ethanol refinery capital costs: CAD 10 – 12 million
- estimated "Variable Operating Costs": CAD 0.11 / litre and
- estimated "Capital Charge": CAD 0.07 / litre:

Estimated Financial Performance Implications and Improvements

Based on the above, the financial implications are as follows:

- estimated ethanol revenues @ CAD 0.37 / litre equalling approximately CAD 8.2 million; plus acetic acid revenues of approximately CAD 3.9 million.
- operating costs are estimated at CAD 2.4 million, capital charges are estimated at CAD 1.3 million.
- net cash returns are estimated at CAD 8.3 million, representing an approximate 18-month payback period for the facility.
- benefits to the current Kraft pulp mill include lower costs and / or higher capacity achieved because –
    - "debottlenecking" of the recovery boiler helps increase throughput capacity
    - removal of the hemicelluloses enhances and enables future gasification and autocausticizing and
    - introduction of the process also enables free-free pulping.

Readers are asked to note these investment and financial performance estimates are preliminary only and require further validation. These estimates have been developed or extrapolated from information provided to us by SUNY-ESF, which, as noted above, may not be more accurate than ±50%.

Other Potential Financial Implications

As the bio-refinery concept will involve early stage and potentially first time implementation of technologies still under development, there could well be tax benefits to be gained by industrial partners in the project, in the form of research and development tax credits.

As well, we would anticipate that the potential of the bio-refinery concept to further Canada's greenhouse gas emission reduction targets under the Kyoto Protocol could make the project eligible for government funding to support at least pilot scale implementation to establish "proof of concept."

Other Benefits / Returns From the Bio-Refinery

Other benefits can be anticipated to accrue to the communities in which bio-refineries can be located. These include:

- increased numbers of long-term high paying jobs located in predominantly rural areas and smaller communities
- in Ontario, the bio-refinery concept presents a relatively short-term opportunity for incremental electricity generation capacity, powered by renewable source, clean burning fuel – ethanol
- anticipated improvement in environmental attributes of the industry through VOC capture-for-use and increased extractives yield and quality. SUNY-ESF anticipates that an indirect result of implementation of the bio-refinery concept would be reduced chemical use in the kraft pulping process and
- profitability of the forest products industry would also improve as a result of reduced costs of production.

The development of a bio-refinery complex in Eastern Ontario could also be expected to stimulate development of other businesses in the area that would be based on serving this new industry. These developments can more readily be attracted to Eastern Ontario if the area seizes the opportunity to take a leadership position in development of these biomass-based industries.

These other derived business developments could include:

- ethanol-focused engineering firm(s) being provided with opportunities in an opening new market
- similarly, micro-organism/enzyme supplier(s) would be presented with opportunities in an opening new market
- research organizations / institutions focused on commercialisation of these and related technologies would be presented with opportunities for expansion of the scope of their activities or, for those based elsewhere, with opportunities to establish operations in Eastern Ontario and
- equipment manufacturers would also be provided with opportunities to develop products for and sell into, an emerging new market.

MARKETS

The key direct products extracted from the hemicelluloses are ethanol and acetic acid. Markets for both products are well established. Indeed demand for ethanol is growing significantly as its use is increasingly being mandated in the US and elsewhere as a gasoline additive that reduces harmful emissions from automobiles.

Approximate current prices for both products are as follows:

Ethanol	CAD 0.37 / litre
Acetic Acid	CAD 0.56 / litre

These are the price levels used in the financial estimates presented in Chapter Three.

Other products that can be generated either directly from further processing of the hemicelluloses or indirectly from application/use of one of the direct products can include:

- electricity
- polyester
- polypropylene diol
- other polymers
- steam and
- other liquid fuels and chemicals.

Buyers for ethanol, acetic acid and other derivative products can be readily identified within the north central region of North America. These buyers are well within economic range for bulk truck or rail transport from a Cornwall facility. By selling the products in bulk form as output from the ethanol refinery, it is unlikely that the facility would incur significant marketing, sales or distribution cost, thereby preserving the margins estimated in the preceding section.

Markets for the electricity and wood products contemplated in the options and variations discussed in Chapters One and Three of this report are known and well understood. Developing markets for these products is not anticipated to present unmanageable business risks to any of the component elements.

PEOPLE REQUIREMENTS AND ISSUES

Through our research of the bio-refinery concept, we have identified a number of challenges and opportunities related to workforce requirements in connection with development of the bio-refinery and related facilities. We have not undertaken a complete analysis of these issues but can offer the following observations and comments.

- There are shortages of experienced and skilled workers in the logging and harvesting industries. While this appears primarily to be an outcome from the aging of the workforce, it may also reflect the business uncertainties that result from the historic pattern of economic cycling that has characterised the sector. We anticipate that with the establishment of sustainable businesses in Eastern Ontario, (both the bio-refinery and related businesses,) new contractors will emerge willing to invest in and develop needed harvesting capacity.

- The jobs that will be created in the bio-refinery and related or derivative industries are advanced, knowledge-intensive roles. It is not clear that adequately skilled workers are readily available in Eastern Ontario to fill such positions in the short term. This situation could certainly provide opportunities for introduction of new training programs at the Kemptville and Alfred campuses of the University of Guelph. Such courses and programs could be focused on a wide range of needs and opportunities, covering everything from biotechnology business education, to integrated environmental sciences.

- As well, development of the bio-refinery and related industries could also create a short-term need for recruitment of skilled, educated workers from elsewhere in Canada or internationally. We would anticipate that with suitable promotion, activity about the availability of advanced technology, environment-focused employment opportunities being undertaken by the economic development agencies in Eastern Ontario, these near term workforce requirements could be met.

- Development of biomass plantations will require workers with advanced skills and knowledge in applied agroforestry disciplines. It is not clear at this point whether such skilled workers can be found in Eastern Ontario in the near term. Again, this opportunity could indicate a need for new agroforestry focused training programs at the Kemptville and Alfred campuses of the University of Guleph and / or create a need for recruitment of appropriately qualified people from elsewhere.

- The opportunities resulting from the bio-refinery and bio-products production should result in the expansion of research activities in the region by such institutions as the National Research Council, Natural Resources Canada, Forintek, the University of Guelph, Carleton University, Queen's University, the University of Ottawa, the College of Environmental and Forestry Sciences and the State University of New York. The Athena Sustainable Materials Institute and others can be expected to create need for recruitment of individuals with advanced science and technology educations.

GENERAL PROJECT RISKS

Further analysis will be needed to support any in-depth analysis of the risks that may be involved in the proposed bio-refinery development. As this project would involve implementation of new or relatively new technologies – some, as first time implementations, it will be possible to identify a number of probable technical and business risks that should be considered in a more detailed pre-feasibility analysis of the proposed facility. These will include, in no particular order of priority:

- changes in foreign exchange values that may affect profitability of the facility
- changes in relative values of other forms of energy, (e.g. oil prices) that may make outputs from the facility relatively more or less valuable in the marketplace
- changes in policy by external parties that could make it more or less difficult to sell some outputs, such as electricity, to transmission/distribution grids or utilities
- failure of technology to perform as anticipated
- essential licensing arrangements cannot be successfully negotiated
- climate changes or other events that affect growing cycles of plantation biomass crops
- lack of success in recruiting appropriately skilled workers
- lack of success attracting adequate amounts of investment capital needed to support early stage implementation of the concept and
- unanticipated increases in demand for fibre resulting from unrelated developments elsewhere, (e.g. annual allowable cut policy changes introduced in Québec), that reduce available supply or increase the relative price of needed fibre.

CONCLUSIONS AND RECOMMENDATIONS

The level of analysis possible within the scope of this assignment does not support development of detailed conclusions and recommendations. However, we can offer the following preliminary observations which we hope can help guide the Eastern Ontario Model Forest and its partners in furthering development of the bio-refinery initiative.

- These potential developments are being considered and discussed within a changing policy and business environment.
    - Oil prices are at record high levels and look very much like they will remain at current or higher levels, thereby enhancing the relative value of green fuels such as ethanol.
    - Supplies of electricity may be significantly constrained in Ontario, (and other neighbouring jurisdictions) in the near future, thereby making plantation biomass and ethanol extracted from renewable forest resources increasingly attractive as a basis for generating needed incremental supplies of electricity.
    - The Government of Canada has signed the Kyoto Protocol, thereby committing to reductions in greenhouse gases. Development of significant-sized, renewable sources of clean fuels, like ethanol, could represent an attractive opportunity for the federal opportunity to accelerate achievement of Kyoto targets.
    - The United States government, while not a Kyoto signatory, is nonetheless interested in enhancing security of energy supply. The St. Lawrence forest basin straddles the Canadian-US border and will likely be regarded as “domestic,” even if bio-refinery facilities are located in Canadian communities, thereby opening up possibilities of enhanced cross-border cooperation, funding, technology transfer and the like.
- The bio-refinery concept has been developed for industry and forest environments that are similar to the situation facing Eastern Ontario and Cornwall. Nonetheless, the technologies inherent in the concept are new and need further testing and analysis before moving forward towards development and implementation. Therefore, we recommend that a more detailed assessment of the economic, business, and technical feasibility of the concept be undertaken at the earliest possible opportunity and that the EOMF and its partners be prepared to move from conclusion of that feasibility evaluation to development and implementation of a pilot scale project.

  We have also concluded from our analysis, that considerable indirect economic and community development benefits can be expected to occur in the areas, which proceed with the earliest industrial-scale development of this concept. In other words, by hosting the first successful bio-refinery, Eastern Ontario can expect to attract engineers, researchers and equipment manufacturers who will all want to locate near such a facility because it will be a very significant engine for further economic growth, both locally and through increased exports.

Thus, there is some urgency and significant gains to be realised by moving forward quickly with next stage evaluation and pilot development of the bio-refinery concept.

- As noted in earlier sections of this document, there are significant opportunities to develop other wood / forest products businesses that would be either directly or indirectly interconnected with the bio-refinery. These businesses could include the proposed wood products manufacturing complex near Prescott, biomass plantations, other chemical or plastics processing facilities, and electricity generating plants. Development of such businesses could create interdependencies between operations that could create new opportunities or new risks. These will need to be more fully analysed and understood.

  There is also some urgency to proceeding with further feasibility assessment of these interconnected opportunities.

- If Eastern Ontario can establish a leadership position in successful development of such an environmentally-beneficial, interconnected industrial complex, other engineers, researchers, equipment manufacturers and the like will want to establish operations in the area.

  The complex can therefore function as the nucleus of sustainable, biomass-based industrial cluster.

All of these factors potentially create significant opportunity for development of a bio-refinery facility in Eastern Ontario. Similarly, these factors could spur other jurisdictions to pursue similar opportunities. Being first, or one of the first, to implement such a concept could offer significant advantages to the jurisdiction or community seizing such an opportunity because the first such facility can be expected to establish the “standard” approach to the concept and, as such, will attract equipment manufacturers, processors of the chemical outputs and so on. The growth acceleration to be derived from being “first to market” with this concept will be significant.

CHAPTER THREE "CLOSER EXAMINATION OF ECONOMIC, SOCIAL AND ECOLOGICAL IMPACTS" BY LAURIE GRAVELINES

Chapter Three describes the economic, social, and ecological threats facing communities within the United Counties of Stormont, Dundas & Glengarry and resulting from restructuring of Domtar's Cornwall, Ontario pulp and paper facility.

This chapter is structured in three parts:

1. summary of the findings of the series of meetings and expert roundtables
2. description of the economic impact of the restructuring and
3. documentation and analysis of the "wood shed" serving the Domtar mill in terms of:
    a. its economic impact
    b. the implementation of sustainable forest management
    c. attitudes towards potential future developments and
    d. the underlying land use patterns.

But first some background.

BACKGROUND

The structure of the forest products market place and its product chain include:

Forest nurseries: Forest nurseries provide the growing stock for forest plantations; the premiere nursery in Eastern Ontario is Ferguson Forest Station in North Grenville

Forest owner: Forest owners provide standing timber to the forest product chain. In contrast to the northern boreal forests, forest ownership in the Cornwall mill's supply woodshed has a very large component of independent private woodlots and woodlands owned directly by Domtar. Some Ontario provincial Crown lands are also affected.

Contract loggers: Independent contract loggers make contractual arrangements with woodlot owners for access and the logging of the woodlots. Contract loggers sell pulpwood and/or chips to the mills, sometimes through brokers and sometimes through direct arrangements.

Other primary processors: Other forest products processors sell residuals to the pulp mill as a pulp furnish. A simple example would be chips produced as a by-product by sawmills, and/or flailings from other operations.

Secondary processors: Secondary processing facilities are seen as the top of the value added chain within the traditional forest products industry. The pulp and paper mill would be a secondary processor.

The restructuring of the Cornwall mill would impact each of these elements of the industrial product chain.

IMPACT OF THE CLOSURE OF THE PULP MILL

At the heart of the restructuring and the concerns that led to this study was the suspension of production at the pulp mill, leading directly to the suspension of Domtar Cornwall's participation in the market for chips and roundwood. This, in turn, had immediate and direct impacts on contract loggers and woodland owners. The overview of the economic impact on the local economy will be presented below.[5]

Framing the Issue

The SocioEconomic Impact Model (SEIM) is used to estimate the economic impact of the mill restructuring on the Ontario economy. This model was initially developed for use by the Ontario Ministry of Natural Resources for use in its forest management program to estimate socioeconomic effects associated with changes in wood flow.

SEIM traces how a dollar spent on an activity such as producing pulp, circulates and re-circulates within the economy, multiplying the effects of the original expenditure on overall economic activity. This process is called the economic multiplier effect. It operates at several levels.

Initial expenditures on wages and materials are generally referred to as the direct costs and their effects on the economy are referred to as the initial or direct effect. Wages and salaries associated with the purchase of the initial materials are also included in the direct effects. This means that jobs may be directly affected off-site, perhaps in other districts and regions, depending on where the materials are produced.

Subsequent purchases by suppliers of materials and services to sustain the original and derivative expenditures are called indirect effects. Induced effects emerge when workers in the sectors stimulated by initial and indirect expenditures spend their additional incomes on consumer goods and services.

The circulation and recirculation of impacts are based on the economic circumstances of the local areas for which SEIM has been customized, in this case, the MNR District of Kemptville. This is because SEIM was developed for use by the Ministry of Natural Resources; its geographic resolution reflects the ministry's management structure: district, region and province. As such, customized multipliers are calculated internally within the model, they are not imported into the model as externally determined inputs.

[5] Economic impacts at the provincial level may be offset to some extent if the Cornwall mill receives pulp manufactured at other mills in Ontario, resulting in increased levels of production at the source pup mill. It is expected that the Cornwall paper mill will source at least some of its pulp requirement from Domtar's Espanola mill (75 km west of Sudbury, Ontario.) For example in its corporate-wide rationalization of pulp production, output from the Espanola mill may or may not have been affected. The fact that it is directed to the Cornwall facility, may, from a provincial perspective, simply be coincidental. In any event, before economic losses in Cornwall are netted for production in Espanola, much more information about Domtar's strategic plans would be required.

Economic impact is measured using a number of indicators, each indicator measuring a different aspect of the impact. Total sales include the total turnover of goods and services sold by businesses to sustain the activity's operations. The limitation of this measure is that by including the sales of both inputs and outputs, it double counts the amount of economic activity. For example if pulpwood is sold to a pulp mill, both the value of sales by the loggers and the value of sales by the pulp mill *would be added together*.

In contrast, "value added" avoids double counting of products sold during the accounting period by including only final goods. For instance, only the value of the pulp is included, whereas the supplies that go into supporting the logging activity do not appear separately. Total value added at the national scale is the equivalent of gross national product. It may be calculated by adding wages, interest, rent and profit or by subtracting the total cost of purchased inputs from revenues.

The SEIM-derived economic impacts associated with the suspension of the pulp mill are presented in Table 1. Logging impacts were excluded from this SEIM run because the impact on the logging contractor industry is, as yet, uncertain. Results are presented separately for the Kemptville District and the MNR's South-central Region.

The suspension of the pulp mill will result in the direct loss of 404 person years of employment within the Kemptville District. Due partly to the highly skilled and paid positions that will be lost at the pulp mill, an addition thousand or so jobs will also be lost in the district. The total number of jobs affected is 2.7% of the number of people in Stormont, Dundas and Glengarry that reported earned income in the 2001 Census of Canada. The reduced level of economic activity will also lead to an overall loss of $83,153 thousand in the GNP[6] of the district economy. This was equivalent to 2.9% of the county's total earned income reported in the 2001 Census of Canada.

To put this in perspective, if the Ontario economy suffered such an absolute decline in its GNP, it would be considered a major recession.

The impacts within the entire South-central Region reflect the extensive linkages between economic activity in the Kemptville District and material suppliers in the rest of the region. Direct impact of the pulp mill closure will result in a direct loss of 540 jobs in the region. With the multiplier effect, total job losses will be in the order of 1,758 spread across the region. In total, the value of the regional economy, as measured by value added will contract by $130,670 thousand or over $130 million. By being spread throughout the much larger economy of southern Ontario, the impacts will be diluted.

[6] Actually we are measuring the reduction in the value added. More familiar is the Gross National Product (GNP) which is the value of value added at the national level. We use the term GNP to more easily communicate the concept.

Table 1. Economic Impact of Pulp Mill Suspension, dollars are in thousands

	Kemptville District		South-central Region	
	Direct	Total	Direct	Total
Value Added	-$21,787	-$83,153	-$57,518	-$130,670
Total Sales	-$57,059	-$184,942	-$144,200	-$291,576
Employment (person years)	-404	-1,384	-540	-1,758
Wages and Salaries	---	---	-$34,374	-$77,312

Another measure of impact is the amount of tax revenue generated by the operations of a sector. Tax revenues associated with different activity levels measure the relationship of government to the economy. Since more than one level of government collects taxes (and each level collects an assortment of different taxes), federal, provincial and local tax impacts are itemized separately. Tax receipts effects are summarized in Table 2.

Table 2. Tax Revenue Decreases with Pulp Mill Suspension (thousands of dollars)

	Federal	Provincial	Local	Total
Personal Income Tax	-20,012	-9,803	0	-29,815
Provincial Sales Tax	0	-5,802	0	-5,802
Goods & Services Tax	-4,647	0	0	-4,647
Other Taxes	-4,126	-3,490	-4,128	-11,744
Total	-28,785	-19,095	-4,128	-52,008

Annual personal income tax receipts are most affected by the pulp mill suspension: the federal treasury sees a reduction of just over $20 millions while the provincial treasury losses are almost $10 millions. Between the Goods and Services Tax and provincial sales taxes, government receipts drop another $10 million.

In summary, the suspension of the pulp mill operations will have a significant, negative, direct impact on the local economy.

EXPERT MEETINGS AND ROUNDTABLE SERIES

On January 21st 2005

The initial round of discussions culminated in a discussion of the ramifications and consequences of the Domtar announcement and the scoping out of action plans for the Eastern Ontario Model Forest, the Stewardship Councils and the Ontario Ministry of Natural Resources. Observations and expectations focused on the industry in eastern Ontario and included the following[7].

Expectations/worries regarding immediate forest sustainability and socio-economic impacts are:

immediate effect on price of pulp

[7] This section draws heavily on the actual record of the meeting.

Crown and private land in Kemptville District will likely be most affected. Markets for Crown wood supply from the Ottawa Valley Forest may be picked up by Smurfit-Stone in Portage-du-Fort as they are an associate member of the Ottawa Valley Forest Inc. and utilize poplar, birch and tolerant hardwoods
for Lanark County and areas of eastern Ontario outside the Area of the Undertaking[8]: poplar will not likely be harvested and there will be a limited market for low grade tolerant hardwood material
possible increase in firewood sales
marginal stands may not be harvested at all
trees will be left standing or there will be increased cost to have them felled to accomplish silvicultural objectives in forest management plans. Amendments to Forest Management Plans may be requested to allow continued operations if CFSA standards cannot be met
increased high-grading may occur after years of working to improve practices to reduce high-grading
lack of pulp market may put some operators out of business. Job loss may be more significant in this area since more cut and skid crews remain and level of mechanization is low
sawmill chips may be difficult to market and therefore there is potential that sawmills may have to shut down due to Ontario Ministry of the Environment restrictions on residue ("waste")
base of knowledge, setting a good example and operational experience will be gone and Ferguson Forest Station near Kemptville will be affected. Domtar currently accounts for 10% of their sales, planting 100,000 trees per year on private land (Domtar owns 3500 ha of freehold forest).

Questions about the long-term effects include:

if Domtar makes a decision to reopen their "wood room," the long-term availability of supply will be in jeopardy if operators have established new markets in the meantime
integrity of natural heritage values may be compromised if Domtar lands are sold. These lands have been for sale. It is important that opportunities are sought to retain these lands in a natural state
the future of Domtar's patent lands in Canada
the integrity of the certification program on private lands will be in jeopardy. Domtar acted as a model which influenced Sustainable Forest Licenses and private landowners; there was intent to expand. The premiums Domtar contributed for certified wood to a central fund towards FSC certification is now gone
the ethanol plant being planned in Cornwall may now have more impact on the landscape. A survey indicated that 40% of area farms sold wood products from their woodlots since farmers were looking to supplement income during hardship
there may now be increased incentive to convert forest to agricultural lands due to this emerging market with the ethanol plant. [editors' note: this will be explored fully in the final chapter of this report.] The United Counties of Stormont, Dundas & Glengarry already have the lowest percentage of forest cover in the Eastern Ontario Model Forest area. There are only a small percentage of the woodlot owners that take advantage of Managed Forest Tax Incentive Program in the Renfrew and Lanark Counties. A loss of forested land base is counter to the government's priority to maintain green spaces and
possible loss of valuable Domtar data once forestry staff have gone i.e. growth and yield information; private land forest inventory (possible asset for Private Land Wood Supply Study

[8] The area covered by the Environmental Assessment

linked to Provincial Wood Supply Strategy); and genetic poplar clone trial information; values data (e.g. nesting sites).

As stewards of the forest:

Domtar provided operator training and guidance and subsequent protection of values. There is an anticipated loss of logger expertise
Domtar freehold is open to public access to support recreational activities including trails and assigned areas of exclusive use (leases) on $^{2}/_{3}$ of their lands that generate income to cover cost of taxes
Domtar is currently involved in the following Partnerships (may not be a complete list):

- Shareholder in Mazinaw-Lanark and Ottawa Valley Forest SFL's
- Eastern Ontario Model Forest
- Resource Stewardship S. D. & G Council
- Friends of Apple Hill Forest Centre
- Finch Trail Demonstration
- Envirothon (school program)
- Diamonds Land Trust (to conserve significant Domtar owned forest)
- Woodlot Conferences / Workshops / Fairs
- Raison Region Conservation Authority Natural Heritage Strategy and
- United Counties of Stormont, Dundas & Glengarry (SD&G) – helping South Nation Conservation Authority with a forest management plan

In summary, the January 21, 2005 meeting began the discussions of market viability, Forest Management Plans, future of certified forest products, viability and capacity for contract logging, supplying of chips and flailings and the alternative uses for the newly available furnish.

And on February 2, 2005

February 2nd meeting issue focused on two principle topics:

1. the need to better document the impact of the shut down of the pulp mill and share this information in order to develop mitigating strategies. Mitigative strategies included the search for alternative value-added opportunities such as bio-energy developments and
2. the impact on private land forestry needed to be better understood. Private lands included Domtar's future relationship with participants in its Forestry Program, Domtar's freehold forestlands and the position of contract loggers.

The decision was made to broaden the dialogue further on the February 17th session.

Then on February 17, 2005 a focus on sustainable management and certification

The roundtable discussions were broadened to include Raisin River Conservation Authority, the South Nation Conservation Authority, the Resource Stewardship S.D.&G. Council, the Kemptville District office of the Ontario Ministry of Natural Resources, and the Eastern Ontario Model Forest. Invited, but unable to attend were the Ontario Woodlot Association, the Ontario Forestry Association and the Mohawk Council of Akwesasne, Department of the Environment.

Note: Domtar entered into 90 plantation tree farm agreements with private woodlot owners. Domtar owns the trees in the plantation and pays the woodlot owner an annual lease fee. Each agreement lasts for 15 years with the agreements staggered over the period. The Cornwall restructuring has thrown the future of these plantations into question.

Domtar also has an additional 200 or so private woodlots in its private woodlot development program. Ownership of the standing timber resides with the landowner. Domtar provides expertise for managing the forest. Also Domtar would hire tree markers when required and engage and supervise contract loggers for the landowner. Stumpage remains with the property owner. Contractually, these arrangements are more casual than the tree farm agreements. Through this program Domtar was laying the groundwork for a high quality forest resource for future use.

The goals of this meeting were to:
"ensure continued sustainable management of private forests currently under the Domtar Program" and
develop a transition option to Domtar before the restructuring.

Conclusions and recommendations were as follows.

1. The agencies should work together in a partnership.
2. Resource Stewardship S.D.&G. Council should act as the point of contact with woodlot owners.
3. Domtar should inform its agreement holders.
4. Domtar would transfer file information to the Resource Stewardship S.D.&G. Council in support of the council's role as the primary contact.
5. On site work would be coordinated between the Council and the South Nation and the Raisin Region Conservation Authorities. A funding formula would be worked out
6. Properties would be monitored for compliance with sustainable forest management practices.
7. The Eastern Ontario Model Forest would work with all partners to ensure the integrity of the forest certification status.
8. Domtar would deal with legal and other contractual obligations remaining from its original program.

WOOD SUPPLY

Mills in southeastern Ontario draw their wood supply from eastern Ontario, western Quebec, and northern New York. The forested lands in eastern Ontario are, from an industrial perspective, integrated into this regional wood shed. Much of the forested lands available for industrial use in these areas are privately owned with ownership scattered among a large number of landowners. As such, the sort of forest inventory and sustained yield calculation that are calculated for Planned Forest Management Area of Ontario, are either not done for these areas, or they are proprietary information.

In short, there is no readily available estimate of the wood supply in the region.

N.B. In the absence of a readily available independent regional wood supply analysis, we will focus on the Domtar "woodshed" as it was before the restructuring announcement. This is, after all, the wood fibre that has been released back into the market place.

Domtar's Woodshed

Before the restructuring, Domtar's Cornwall pulp mill drew almost three quarters of its wood supply from New York, about a quarter from Ontario, and the rest from Quebec.

Over the six-year period ending in 2004, 40% of the wood was received as pulpwood, 44% as flailings, and 16% in the form of sawmill chips. 19% of the wood was sourced from Domtar-controlled forested lands and only 5.5% from Ontario Sustainable Forest Licence forests. On average 69% of the wood was sourced from New York lands, just under 26% from Ontario lands – private and Crown – and less than 5% from Quebec sources. Table 4 provides the annual profile for the distribution of wood by each of the three jurisdictions.

Table 3. Fibre Input by Source, Cornwall Mill, 1999 – 2004, cubic metres

	1999	2000	2001	2002	2003	2004
Pulpwood						
Domtar/Crown						
PLF	6,660	5,040	4,271	3,406	2,095	5,222
DII	39,060	34,020	29,745	8,519	12,868	14,380
SFL	23,760	36,900	14,747	14,947	16,013	34,425
Total	69,480	75,960	48,764	26,872	30,976	54,027
Private						
ON	68,040	78,120	59,846	44,219	32,278	45,700
PQ	360	1,800	718	0	315	3,820
NY	30,600	28,440	51,368	64,705	76,493	141,116
Total	99,000	108,360	111,933	108,923	109,085	190,636
Total Pulpwood	*168,480*	*184,320*	*160,697*	*135,796*	*140,062*	*244,663*
Flail Chips						
Domtar						
PLF	5,580	3,060	7,474	0	5,652	3,263
DII	12,600	0	18,783	47,398	44,998	31,171
Total	18,180	3,060	26,257	47,398	50,650	34,434
Private						
ON	180	360	0	2,745	6,255	10,418
NY	139,500	168,660	174,134	158,303	147,929	138,733
Total	139,680	169,020	174,134	161,048	154,184	149,152
Total Flail chips	*157,860*	*172,080*	*200,390*	*208,445*	*204,835*	*183,586*
Sawmill Chips						
ON	24,840	24,120	18,221	19,645	19,107	16,483
PQ	18,900	21,240	14,251	24,241	19,350	17,266
NY	28,260	30,060	30,299	31,153	24,845	12,886
Total	*72,000*	*75,420*	*62,771*	*75,038*	*63,302*	*46,634*
Total Chips	229,860	247,500	263,162	283,484	268,137	230,220
Total	398,340	431,820	423,859	419,279	408,199	474,883

Explanation of terms and abbreviations:

PLF Private Land Forestry Program established by Domtar in Ontario
DII Domtar Freehold Lands primarily in New York State and now owned by Lyme Timber Company, The Nature Convservancy and New York State
SFL Sustainable Forestry License in Ontario

Private represents wood purchased from private land in Ontario, Province of Quebec, and New York State
Flail chips are produced onsite in the forest, whereas sawmill chips are produced from material remaining from saw of logs

Table 4. Distribution of Cornwall Mill's Woodshed, by jurisdiction

	1999	2000	2001	2002	2003	2004	Average
Ontario	32.4%	34.2%	24.7%	20.3%	19.9%	24.3%	25.9%
Quebec	4.8%	5.3%	3.5%	5.8%	4.8%	4.4%	4.8%
New York	62.8%	60.5%	71.8%	74.0%	75.2%	71.2%	69.3%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Ontario Sustainable Forestry Licenses

Ontario Sustainable Forest Licenses provided a small amount of timber to the Cornwall mill. The timber originated from two SFLs – the Mazinaw-Lanark Forest and the Ottawa Valley Forest. In each case the Cornwall-destined wood accounted for a relatively small share of the management unit's available timber supply: 11% for Mazinaw-Lanark and 3% for the Ottawa Valley Forest.

Table 5. Wood Sourced from Ontario SFLs (cubic metres)

Species Group	1999	2000	2001	2002	2003	Average 1998-2003
Mazinaw-Lanark Forest						
White Birch	297	570	477	615	578	508
Poplar	2,081	2,842	2,242	1,371	1,410	1,989
Tolerant Hwd	8,317	9,995	13,517	3,529	4,155	7,903
Sub-total	10,695	13,407	16,237	5,515	6,144	10,400
Ottawa Valley Forest						
White Birch	1,301	614	1,961	1,226	894	1,199
Poplar	141	862	6,881	1,338	1,383	2,120
Tolerant Hwd	7,073	10,505	8,229	3,968	1,639	6,581
Sub-total	8,515	11,981	17,071	6,532	3,916	9,900
Total	19,210	25,387	33,387	12,047	10,060	20,300

Sustainable Forest Licences are generally issued for a term of twenty years with five year review periods. The SFL holder has the right to harvest all species of trees found in a licensed area. These rights are conveyed by way of Section 26 of the Crown Forest Sustainability Act and are transferable with the written consent of the Minister.

The SFL company is responsible for specified forest management activities on the SFL area. Responsibilities include forest management planning; gathering forest information for the Crown; conducting operations in accordance with the Crown's "Forest Operations and Silviculture Manual," which includes constructing forest roads that serve the public at large, regenerating the forest and compliance planning and monitoring.

The Mazinaw-Lanark Sustainable Forest License (Number 542621) was signed on October 30, 2002 by Mazinaw-Lanark Forest Inc. of Cloyne Ontario. It was amended May 22, 2003. The SFL is intended to provide timber to the following existing forest resource processing facilities of the shareholders or associated with the shareholders of the Mazinaw-Lanark Forest Inc:

Domtar Inc. located at Cornwall
Norampac Inc. located at Trenton
Lavern Heideman & Sons Limited located at Eganville
Dament & Charles Lumber Mfg. Ltd. and Herb. Shaw and Sons Limited located at Pembroke
George Stein Limited located at Palmer Rapids
Gulick Forest Products Ltd. located at Palmer Rapids
O.E. Rothwell Lumber Co. Ltd. located at Lanark and
M.J. Umpherson Lumber Co. Ltd. Located at Lanark

In addition, the SFL company must make available for sale on the open market during the five-year term of each forest management plan:

41% of the sawlog and veneer-quality log component of the harvest, to a maximum of 62,500 cubic metres, and
13% of the pulpwood component of the harvest from the Forest, to a maximum of 23,700 cubic metres,

Ottawa Valley Forest Inc. of Pembroke, Ontario holds the Ottawa Valley Sustainable Forest Licence (Number 542529). It was signed April 14, 1999 and amended May 22, 2003. Under it, the harvest is to provide a wood supply to:

Ben Hokum and Son Limited of Killaloe
724583 Ontario Ltd.
Shaw Lumber of Pembroke
Commonwealth Plywood Co. Ltd. of Pembroke
Gulick Forest Products Limited of Palmer Rapids
Thomas J. Neuman Limited of Palmer Rapids
Murray Bros. Logging Company Limited of Madawaska
Temple Pembroke Inc. and
Domtar Inc. of Cornwall and Trenton.

The SFL company must make available up to 3,800 cubic metres of non-veneer poplar volume annually for Grant Forest Products Inc. in Englehart. In addition, the company must also make available on the open market:

10% of the sawlog and veneer quality log component of the harvest, to a maximum of 63,000 cubic metres and
72% of the pulpwood component of the harvest, to a maximum of 330,000 cubic metres.

The forest management plans for each SFL is currently under preparation for implementation in 2006.

Private Woodlot Supply

Over 1999 through 2004, Domtar's Cornwall mill purchased 87,000 cubic metres of wood from Ontario sources. This represented one fifth of its wood supply.

Through two programs, Domtar took direct action to assist eastern Ontario private woodlots. In the Tree Farm Program, Domtar entered formal contracts with private landowners to cultivate hybrid poplar plantations. As of April 1, 2002 there were 90 such agreements covering 956 hectares. Tree Farm Agreements were for a 15 year term with Domtar paying the land owner an annual lease fee. As well, the land owner collected the stumpage when the plantation was to be harvested. Domtar estimates that the cost of this wood amounted to $2 to $5/odmt depending on the plantation's actual business circumstances. Between 1999 and 2004, Domtar purchased an average of just under 9,000 cubic metres, or 2% of its wood supply under the Tree Farm Program.

The second program was the Woodlot Development Program and provided a mechanism for Domtar to provide advice to private wood lot owners within a 100 kilometer radius of the mill, regarding forest management. This program involved 237 participants with a total of 2,966 hectares of hardwoods.

Domtar provided direct assistance to the woodlot owner in the preparation of detailed forest management plans that would allow the landowner to apply for Management Forest Tax Program assistance offered by the Ontario government. Domtar also provided assistance with tree marking and accessing reputable contract loggers when harvesting was warranted under the management plan. Under this program, the land owner retained ownership of the standing stock and the stumpage value.

In recent years it is becoming increasingly important for wood to be managed according to forest sustainability principles; this fact can be substantiated. Substantiation can occur when the forest is accredited by an independent agency with established and transparent set of guidelines. Domtar has assisted private woodlot owners with gaining certification through the Forest Stewardship Council. The certifying and FSC-accredited agent is SmartWood. The Eastern Ontario Model Forest also maintains this certification.

Maintaining certification requires an annual audit and membership fee. In combination with all forest-sourced wood[9] purchased in Ontario, this represented an average of 58,000 cubic metres, or 13% of the Cornwall mill's consumption.

Private Woodlot Characteristics

There have been no available studies of Ontario private woodlot owners who manage their woodlot primarily for industrial timber. The primary source of information regarding Ontario woodlots is based on a 2001 survey conducted by Environics Research Group[10] with a variety

[9] Includes roundwood and flailings. Does not include sawmill chips.
[10] Survey of Rural Landowners in Ontario, Phase 2, Attitudes and Behaviours Regarding Land Stewardship.

of sponsors including the Eastern Ontario Model Forest[11] and the Ontario Ministry of Natural Resources' Climate Change and Ice Storm Initiatives.

1,215 Ontario rural landowners were surveyed. They included farming and non-farming properties in Ontario having been identified from Ontario tax rolls. 95% of the properties were family owned, and it was the primary residence for 76% of the respondents. 74% had treed areas with an average size of 11 acres. 6% of respondents said that their land generates incomes from logging activities.

Findings include:
94% of small landowners expressed some understanding of sustainable forest management they are aware of the role of forests in climate change
9% reported that there were timber activities occurring on their land
landowner or farmer associations and conservation authorities are perceived as the most credible sources of information on land management
a large majority of landowners are keen on receiving information through brochures and manuals
41 % of rural landowners understands stewardship as the voluntary conservation of the natural environment, 25% believes the term refers to keeping one's land economically viable and 25 % believes it is the combination of both
landowners with small parcels of land, those whose income is less or not at all dependent on their land, and those that are better educated see stewardship as the voluntary conservation of the natural environment
landowners that choose trees for planting on their own land say health and species of trees are very important considerations and price of trees is somewhat important
landowners are sensitive to the importance of planting trees that are native to their regions
landowners would respond to monetary incentives to encourage them to plant trees
landowners are open to spending money on conservation but economic considerations are nonetheless important to them. The greatest two obstacles keeping landowners from doing more to conserve wetlands or forests is needing the land for other uses and the money it costs
landowners are not interested in entering into long-term agreements with agencies to oversee management of their forests
landowners prefer education initiatives to being regulated and believe very strongly in property rights especially in eastern Ontario
There is low level participation in specific land management programs. For example:
Farm tax Incentive Program – 29%
Managed Forest Tax Incentive Program – 10%
Wetlands Habitat Fund or Ducks Unlimited Programs – 8%
Conservation Land Tax Incentive Program – 7%[12]

Total Ontario Sourced Wood Input

[11] Of the 1.5 million hectares covered by the EOMF 35% is forested and 88% of these woodlands are privately owned.
[12] Editor's note: In order to be eligible for CLTIP, the land must be identified by OMNR as having significant values e.g. be a provincially significant woodland or an "ansi" (area of natural and scientific interest)

Domtar sourced approximately one quarter of its wood fibre from Ontario suppliers over the last six years. Almost two thirds of this amount was purchased from the private land forest sector, which included the Tree Farm Program participants, and it mostly was harvested as roundwood (59,150 cubic metres), with a relatively small amount harvested as flailings (7,498 cubic metres).

Table 6. Ontario Sourced Wood, cubic metres

	1999	2000	2001	2002	2003	2004	Average	Share
Pulpwood -SFL	23,760	36,900	14,747	14,947	16,013	34,425	23,465	5.5%
Pulpwood -PLF	74,700	83,160	64,118	47,624	34,373	50,922	59,150	13.9%
Flailings	5,760	3,420	7,474	2,745	11,907	13,682	7,498	1.8%
Sawmill Chips	24,840	24,120	18,221	19,645	19,107	16,483	20,403	4.8%
Ontario Sourced	129,060	147,600	104,560	84,962	81,400	115,511	110,516	25.9%

As discussed above, SFLs provided just under 6% of the Cornwall mill's wood requirements.

The final class of supplier of Ontario wood fibre to the Cornwall mill was sawmills, sending chips to the mill. This averaged 20,000 cubic metres per year, or slightly less than 5% of the Cornwall wood requirement.

Species Composition of Mill Consumption

The species distribution for mill consumption from 1994 to 1999 is presented in Table 5. High density species dominate the furnish composition with maples well over half of the wood input. The two low density species, poplar and basswood, contribute less than 15% to the wood furnish for the pulp mill.

Table 7. Pulp Mill Consumption by Species

Average Species Distribution 1994-1999	
Soft Maple	28.8%
Hard Maple	26.5%
Poplar	12.6%
Beech	12.0%
Ash	4.3%
Cherry	4.2%
Oak	3.5%
White Birch	3.0%
Yellow Birch	2.2%
Basswood	1.9%
Hickory	0.4%
Elm	0.4%
Butternut	0.1%
Ironwood	0.1%
Willow	negligible

Wood Supply Developments

Since the beginning of 2005 there have been two major developments that affect the wood supply in the region.

First, Domtar announced the sale of its New York private woodlands on January 4th 2005. Domtar sold 42,249 hectares of timberlands in upstate New York to the Lyme Timber Company of Hanover, New Hampshire and The Nature Conservancy. The purchase price was US $23.7 million. The decision to sell the New York Adirondack Timberland was taken once Domtar determined that the property no longer met its strategic land ownership goals for its core paper manufacturing business.

Second, the Government of Québec had decided to make dramatic reductions in the allowable harvest on provincial lands. The Québec report states:

> *"Quebec, which accounts for 25 per cent of Canadian lumber shipments to the United States, plans to cut forestry harvests by one-fifth over three years, a move that an industry group said may cost more than 10,000 people their jobs. The reductions on spruce, pine and fir would take effect April 1, Natural Resources Minister Pierre Corbeil said. A government study said in December that Quebec's forests are over harvested. The proposal, introduced in the provincial legislature yesterday, may hurt companies including Abitibi-Consolidated Inc., Domtar Inc., Tembec Inc. and their subcontractors. According to the Quebec Forest Industry Council, a provincial trade group, sawmills and forestry operations employ about 56,000 people across the province. Michel Vincent, an economist with the trade group, said the job-loss estimate of at least 10,000 doesn't take into account potential cutbacks at pulp and paper producers"*[13]

Each of these announcements reduces the available wood supply for the Cornwall area as compared to mid-2004.

Domtar officials estimate that before the restructuring, there were another one million cubic metres of unused wood fibre within economic reach of the mill. A large portion of this amount was within economic reach of the Cornwall mill but was scattered amongst a large number of private land owners.

Domtar's Wood Suppliers

On average, the Cornwall mill required 425,000 cubic metres of wood input per year.

Domtar's principle wood supplier, which was based in New York, provided almost one-half of the mill's demand. The top five suppliers provide 60% of the mill's requirements and they are all New York companies. The next five largest contract wood suppliers provide 8% of the mill's requirements. Two are Ontario suppliers. The balance of the wood supply is provided by close to a hundred companies.

The average cost of wood delivered to the mill is $90/odmt.[14] The generic/average expenditure profile for the delivered wood products is as follows:

[13] Source: Globe and Mail, Saturday March 19 2005, p.B6
[14] The general conversion factor used by Domtar is 1 odmt = 1.8 cubic metres.

Stumpage: $12.75 to $14.75/odmt
Harvesting: $45/odmt
Loading: $5/odmt
Delivery: $26/odmt

Stumpage costs are related to distance, with closer (near) wood commanding higher stumpage values than further wood. This reflects what would normally be predicted by theory: stumpage reflects a residual value after all transformation costs are covered, thus further wood, with higher transportation costs, would lead to lower stumpage values at the mill. The largest cost item for delivered wood is fuel, not labour, with fuel being consumed at all the harvesting, loading, and delivery stages of production.

Wood supply was discussed above in an inventory sense. As an economic and business concept, wood supply treats delivered wood as a variable, a variable that depends on the price offered. It is the relationship between price and volume delivered: a lower price will attract less wood, a higher price will attract more wood, and vice versa. In addition, the profitability of the delivered wood would determine how much investment is attracted into the industry, at either the contractor level or the woodlot owner level.

Based on actual experience over the last few years, we know that an offered delivered price of $90/oven dried metric tonne (odmt) will attract approximately 450,000 cubic metres to mill at Cornwall. It follows that a lower offer price will attract less wood, either the wood would be delivered to alternative markets or it will simply be left on the stump waiting for a more profitable time to be harvested. It also means that if there is harvestable timber within economic reach of Cornwall, that it would require a higher delivered price to realize it as a harvested and delivered commodity.

WOOD DEMAND

The restructuring of the Cornwall mill has resulted in an immediate release of approximately 450,000 cubic metres into the market place on an annual basis. Principle alternative markets for the wood included the Fraser Thurso Pulp Operation that produces 245,000 tons of bleached hardwood kraft pulp and the Stone mill in Fort Coulonge. The expectation was that wood prices would decrease in view of the released supply.

Despite efforts to reduce the price, neither price nor volume has suffered. Three factors may be contributing to this unexpected development.

First, there is a belief that contract loggers are the economic bottleneck in the flow of timber from the forest to the mill. During the 1990s, mills squeezed contractors in order to get through the economic cycle. It is thought that this had the effect of encouraging established operators to leave the business, to discourage new operators from entering the business, and to undermine the financial ability of surviving operators to make significant investment in new and more productive technologies.

Second, the announcement by the Quebec government that the allowable harvest from forests owned by the province would be dramatically decreased over the next five years may have Quebec mills making precautionary investments in the access to private land harvest rights in

Ontario and perhaps New York. This can take many forms, one of which would be to build a responsible relationship with independent contractors.

Third, new industrial capacity is being planned on the New York side of the region. On March 1, 2005 Ainsworth Lumber announced it had signed a letter of intent with Chatham Forest Products Inc. to purchase a proposed oriented strand board mill project based in Lisbon, New York. Such a development would provide a significant market to take up whatever remaining slack there may be in the wood market.

In view of the developing demand-supply relationship in the regional wood market, it would be prudent to assume that wood prices will not decline and that volumes will be maintained.

CHAPTER FOUR:
DIGITIZING STORMONT, DUNDAS, AND GLENGARRY FOREST RESOURCE INVENTORY

BY GREG MOFFATT AND MARK ROWSELL

INTRODUCTION

Forest resource inventory, or FRI, is a spatially explicit data product representing land cover from a forestry perspective. It maps the boundaries of forested areas, as well as the internal stand boundaries. It contains numerous attributes describing the tree species (and the proportions thereof), as well as the age (or year of stand establishment), height, stocking, canopy closure, site class, and more. FRI is developed through careful interpretation of aerial photography, combined with field checks.

Traditionally, FRI has been used to determine the location and approximate the quantity of merchantable timber and to plan forestry operations. However, with the current emphasis on forest and land use planning for a great variety of timber and non-timber values, the uses for FRI have extended well beyond its initial intentions. Diverse applications such as wildlife habitat assessment, insect and disease monitoring and prediction, modeling the impacts of acid rain, evaluation of forests carbon sequestration, identifying marginal land for planting programs are all facilitated by the presence of a forest resource inventory.

Figure 1. The area of the undertaking, where the majority of forest management activity occurs in Ontario. (Source: State of the Forest Report 2001, OMNR)

In Ontario, the area in which the majority of forest management occurs (defined as the "area of the undertaking" in Natural Resources Class Environmental Assessment for Timber Management EA-87-02, Figure 1) receives most of the attention for forest resource inventory. In the area of the undertaking, the re-inventory cycle for FRI is presently about seven years.

Below this area, in the more agricultural and developed land of southern and eastern Ontario, maintaining a current forest inventory becomes less of a priority for the MNR. In eastern Ontario, for example, the last inventory that exists in digital format and covers the entire region dates from 1978.

Panchromatic aerial photography, acquired by the Ministry of Natural Resources in 1991, exists for eastern Ontario in the form of hard-copy prints, and in the counties of Lanark and Stormont, Dundas, and Glengarry (SD&G), the photos have been typed. Typed photography (Figure 2) has been marked with forest stand boundaries and attribute information. Lanark County has gone a step further to digitize the 1991 FRI, however, in SD&G these prints are of limited use to planners and analysts, since they are not in a digital form that can be used in a geographic information system (GIS). Therein lies the need that has been addressed through this project—a need to create, from digital and hard-copy FRI photographs, a digital FRI data layer for the forested areas of Stormont, Dundas, and Glengarry.

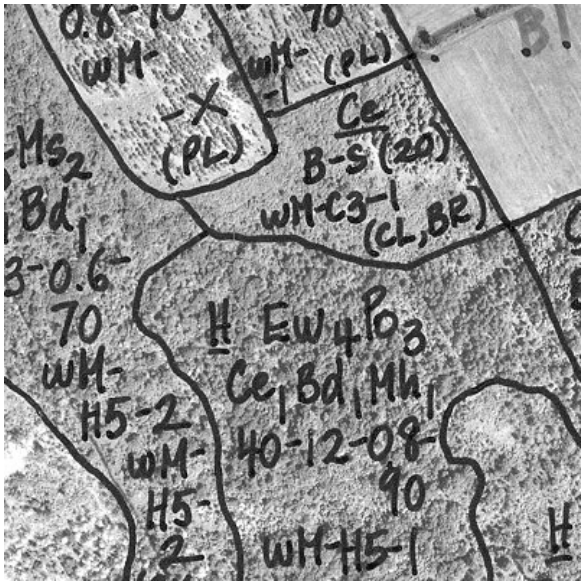


Figure 2. An example of the 1991 scanned FRI photography. Stand boundaries have been drawn on the photo, and typing (indicating species composition, etc.) marked within each polygon.

GOALS AND OBJECTIVES

On March 9, 2005, Domtar Inc., the largest forest-sector employer in eastern Ontario, closed down a significant part of its operations at its Cornwall site due primarily to unfavourable market conditions driven by the weak U.S. dollar.

At the same time, Domtar also announced that it would be suspending its private woodlot program, which provided management assistance to woodlot owners in exchange for a sustainable supply of wood fibre from these woodlots to the Cornwall mill. Domtar's efforts on private lands included a heavy emphasis on sustainable forestry, and with the suspension of this program there now exists a potential for significant changes to the landscape. The overall goal of this project, then, was to create an accurate picture of the forested landscape in SD&G so that we can identify and evaluate those landscape-level changes.

The particular objectives of this project were threefold:

- To gather and compile previously scanned and rectified (or georeferenced) photography from a variety of sources,
- To scan and rectify photography not found in the above exercise, and
- To digitize the FRI stand boundaries and attributes into a GIS-ready digital data set.

METHODOLOGY

Study area

The project focused on the United Counties of Stormont, Dundas, and Glengarry (SD&G), an upper-tier municipality in eastern Ontario that borders on Quebec to the east, and the St. Lawrence River to the south. The forest cover in SD&G is concentrated more in the eastern half of the counties, and exhibits a distinct striated pattern, owing to the low, long ridges of moraine that are characteristic of the Glengarry Till Plain (Figure 3).

Since the entire area of SD&G could not be addressed in this project due to budget constraints, priority for the project was assigned first to the immediate Cornwall area, and then radiating

outwards, as shown in Figure 4. The 1991 aerial photography is represented in the figure by dots on the map (each photo actually covers approximately 4 km). Within the first 25 km around Cornwall, (considered the highest priority), there were 507 images. Within the next 10 km there were an additional 536 images. The remainder of SD&G was covered by an additional 1137 images.

Figure 3. The United Counties of Stormont, Dundas & Glengarry. Most of the forested land lies in the Glengarry Till Plain, characterized by a striated forest pattern.

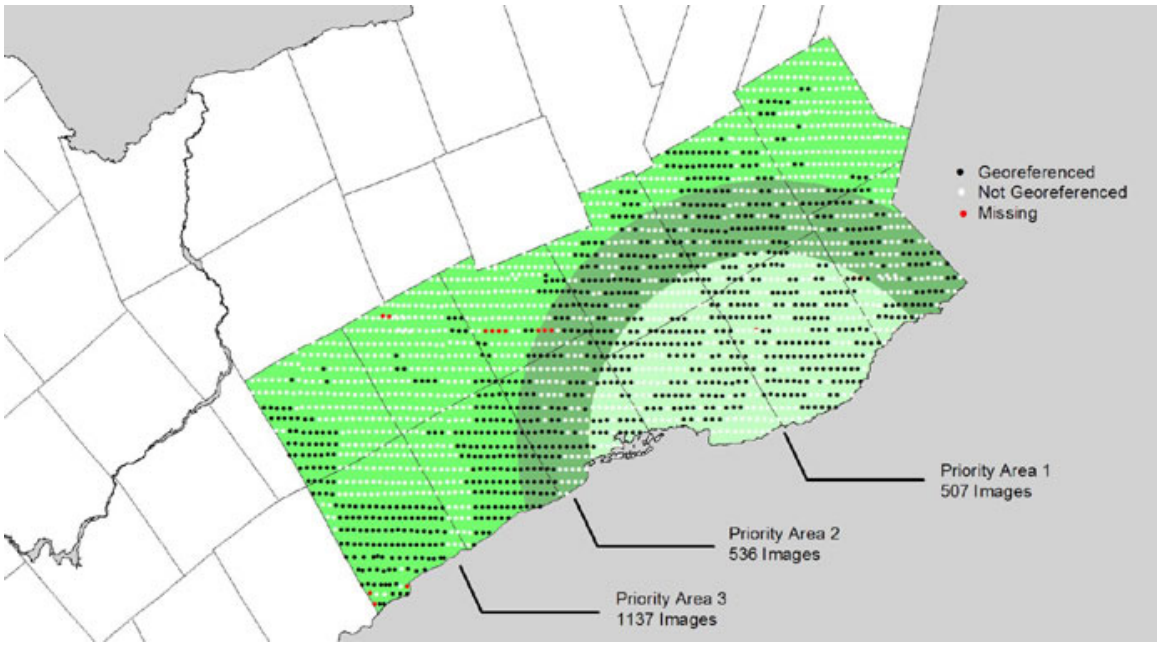


Figure 4. Priority areas for this project radiate outwards from Cornwall.

Compilation of photography

In order to digitize the interpreted FRI boundaries, the typed photos must be in digital form (*i.e.* scanned), and georeferenced, so that they line up with other GIS data layers. The process of georeferencing an image is also referred to as *rectification*, or, when factoring terrain elevation into the algorithm for even more accuracy, *orthorectification*.

A large amount of effort in scanning and georeferencing the FRI photography in SD&G has already been made by organizations in the area. The Eastern Ontario Model Forest, Raisin Region Conservation Authority, Domtar, and the United Counties of SD&G had all previously scanned, and/or georeferenced FRI photography for other purposes, so it became a part of this project to bring those data together. Figure 4, above, shows the state of the existing photography as georeferenced, not georeferenced, and missing (not yet scanned).

Of the nearly 2200 photos covering SD&G, 98% had been previously scanned, and 54% had been previously georeferenced. Making use of this work introduced a much greater efficiency into this project, and allowed a greater proportion of project funds to be used for the creation of the data layer, rather than for preparatory tasks such as scanning and georeferencing.

The existing digital and/or georeferenced photography was collected from various sources and organized by priority area around Cornwall. The photography were all received in the Universal Transverse Mercator (UTM) projection, however they were based on two different datum models, the North American Datum (NAD) 27, and NAD 83. In order to impose consistency among the digital photos, and since the majority of the photos were UTM NAD 27, the remaining NAD 83 photos were transformed to UTM NAD 27. The final FRI data layer can be projected and transformed into any needed projection and datum once complete.

Preparation of base data

Georeferencing the remaining photos required base data. In the process of rectification, identifiable points in each air photo (such as street intersections or the corners of large buildings) are matched to their counterparts in one or more GIS data layers using specialized software. By specifying a number of these matches (called *control points*), the air photo is "tied" to the GIS data.

The software then performs a transformation on the image, scaling, rotating, and stretching the image so that it lines up with all of the control points. The result of the process is an image that uses a real-world coordinate system (UTM NAD 27), and matches well with other GIS data layers.

To prepare the GIS data layers that were used to georeference FRI photos, a small set of MNR NRVIS layers (roads, railways, streams, water, utility lines, miscellaneous lines, building footprints, and building points) were transformed to the NAD 27 datum and clipped to the extent of SD&G.

Digitizing and attribution

For the bulk of the project work, Dendron Resource Surveys Inc., Ottawa, was retained. All of the existing digital and/or georeferenced photography were provided to Dendron, along with the base data used to rectify non-georeferenced photography. As well, hard copies of the typed photos were delivered.

Dendron was instructed to provide an FRI data layer digitized from the georeferenced FRI photography. If a photo was not previously georeferenced, they were to perform the rectification using the base data provided. If a photo was not available in digital form, they were to scan and georeference the photo. They were also instructed to, following completion of the project, provide any photos that they had scanned or georeferenced.

Linework from the photos was digitized on-screen at Dendron, and attributes were assigned to the digitized polygons by referring to the hard copy photos. Seven technicians were hired by the contractor to digitize linework, attribute the data, and georeference photos.

RESULTS

The following results were generated through this project:

All available digital and georeferenced 1991 FRI photos were compiled and standardized to UTM NAD 27

Any photos within approximately 40 km of the City of Cornwall that were not either scanned or rectified previously were scanned and/or georeferenced to UTM NAD 27

A 1991 digital FRI data layer (see example, Figure 5) was created for a radius of approximately 40 km around Cornwall, corresponding to Priority Areas 1 and 2 (as defined in Figure 4).

This layer was generated from over 900 individual photos, and represents 62% of the wooded area in SD&G.

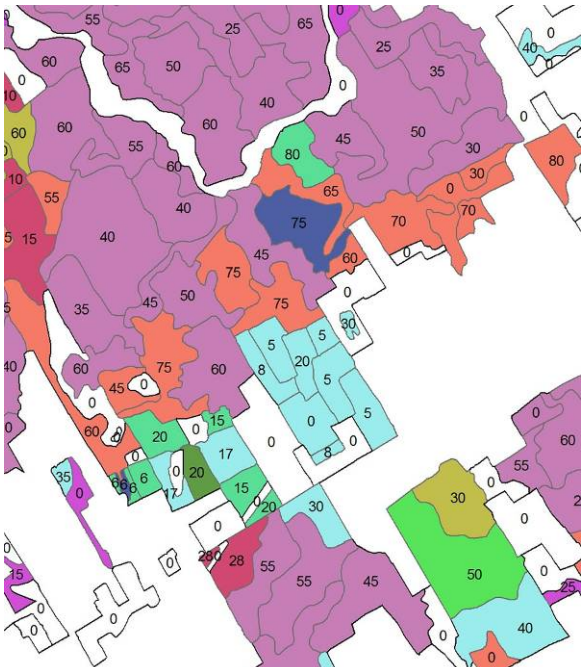


Figure 5. A sample of the 1991 SD&G FRI data from the Cornwall area. Colours represent different working groups, and stand age is shown within each stand.

Attributes contained within the layer include:

Stand area
Working group
Species composition
Stand age
Height
Stocking
Canopy closure
Soil moisture class
Site class

RECOMMENDATIONS FOR THE FUTURE

A central tenet of the Naturalized Knowledge System extending from the Mohawk Nation of Akwesasne, whose international territory centers around Cornwall, is that knowledge is powerful only when it is shared. Borrowing on that thought, an important "next step" for this project is to ensure that the availability of the data created through this project is known throughout the region. The FRI data layer produced here was the result of the efforts of many, finally brought together through this project. Those organizations and people—in fact, all who are concerned with the sustainability of forests and communities in eastern Ontario—should enjoy the data produced here.

As well, this philosophy should apply to any studies or derivatives of the data, so that they can, in turn be used to catalyze other projects. This may also serve to reduce or eliminate duplication of efforts, and to emphasize knowledge gaps.

The second recommendation stemming from this project is that the remainder of the 1991 photos in SD&G be digitized. A little under half of the photos in the county were processed in this project, covering about 62% of the wooded area. However, some large forest patches in the former townships of Kenyon, Roxborough, and Williamsburgh—and elsewhere—were not covered. And, of course, a data layer that conforms to some administrative boundary would be preferred over one whose boundary is quite arbitrary, as this one is.

In addition, it will be important to update this data layer at some time in the future in order to portray changes and trends, and it may be necessary to call once again on our partners in the area for their assistance in the undertaking. In fact, the MNR acquired colour infra-red (CIR) photography for eastern Ontario in 2001, and already a number of cooperating organizations have made great headway in scanning and georeferencing these images. These photos could be used to produce a 2001 FRI layer. Since it sets up a historical record of changes in the forest, in addition to being a "snapshot in time," the value of a 2001 FRI would be enormous. This project, in fact, may serve as an excellent model should the 2001 CIR photography be typed and digitized.

CONCLUSION

Two major deliverables have been achieved through this project. The first, the collection and compilation of digital and georeferenced 1991 FRI photography from several organizations in eastern Ontario was a major achievement in itself, and is a credit to the cooperative nature of groups in this region. Any available digital or georeferenced photography within SD&G was brought together, and the remainder of the photos within about 40 km of the City of Cornwall has been georeferenced through this project.

The second achievement of this project was the creation of a seamless, GIS-ready forest resource inventory; more current than what had previously existed for the area by nearly 15 years. This FRI layer can be analyzed and mapped according to a host of different attributes, and will provide not only for the ability to evaluate, model, and predict changes to the landscape resulting from the changes in the forest industry in this region, but it also gives all organizations in the region an improved ability to model habitat, identify potential old-growth forest stands, target tree planting programs and conduct a host of other exercises that were either impossible, less accurate, or more difficult without this data layer (Figure 6).

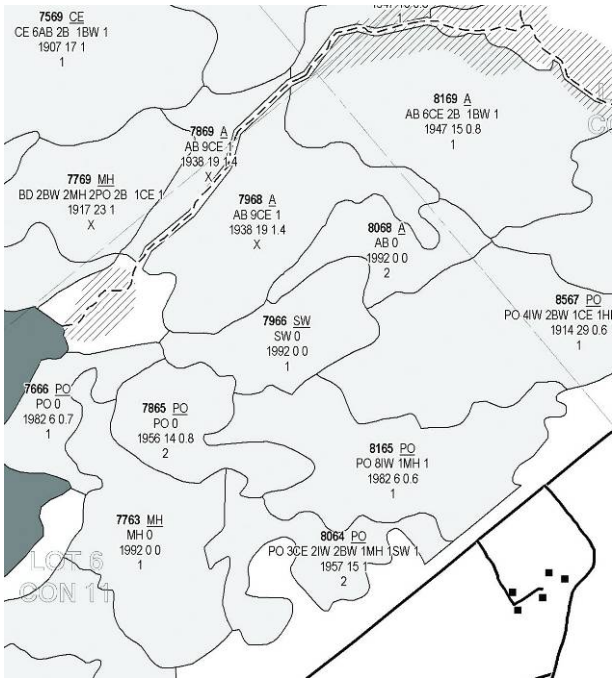


Figure 6. An example of a FRI map produced by the EOMF Mapping and Information Group to support the EOMF's Forest Certification Project.

It's clear that forest resource inventory is required outside of the realm of industrial forest management, particularly in our "settled landscape." The range of values provided by the forest in such a landscape extend well beyond timber and wood products, and a detailed knowledge of the forest is critical to providing these values, and to ensuring that they are available to the residents of Stormont, Dundas, and Glengarry for generations to come.

CHAPTER FIVE: BUILDING A CASE FOR SUSTAINABLE MANAGEMENT OF PRIVATE WOODLANDS
BY CHER BRETHOUR AND TERI-LYN MOORE

INTRODUCTION AND BACKGROUND

Local forests and woodlots are a central feature of rural Ontario. A Forest Health Study completed by the Maitland Watershed Partnership Initiative has illustrated a number of factors impacting on health of local forests (e.g. residual stocking, size class distribution, species diversity, logging damage, etc.). There are a number of reasons these issues are impacting on local forests, including a lack of landowner awareness of proper management practices, a relative lack of landowner interest in their forests and high demand for resources like timber.

The case study concept was suggested in a brainstorming exercise with participants from varied backgrounds (logging, woodlot association, agency, farm organizations, and consultants). It was felt that profiling local examples of responsible long term management efforts and illustrating actual returns from these woodlands could help to encourage landowners to realize the potential of the forested parts of their properties and stimulate more interest in managing them appropriately.

While demonstration sites have been utilized through a variety of projects over the years, to our knowledge, very few case studies illustrating long-term economics have been developed.

Purpose and Objectives

The purpose for "Building a Case for Sustainable Management of Private Woodlots" is to promote responsible management of privately owned forests in southern Ontario. The purpose of this study is to develop individual cases and conduct the economic analysis for each of them. The economic analysis estimates the net present value of the private woodlot returns and compares them to the returns for alternative land uses, such as agriculture.

The specific objectives of this project are:

- To develop a series of case studies through interviews and data collection.
- To estimate the net present value (NPV) of historic revenue from the woodlots selected for these cases, including an estimate of the recreational value from the woodlot (where revenue was obtained).
- To estimate the opportunity cost (earnings) that could have been derived for the tract of land under an agricultural crop rotation.
  .
- To compare future (Van Sleuwen Case Study) and historical land returns under the woodlot and crop rotation scenarios.

PROCEDURES AND METHODS

Section 2.0 describes the procedures and methods that were used to complete the objectives outlined in the section above.

Establishing Private Woodlot Cases

An interview process was used to obtain all the required information for the woodlot economic models. The George Morris Centre worked in conjunction with the MNR to develop a structured questionnaire to obtain the necessary information for the economic analysis. The questions were designed to collect data for each of the variables required to complete the economic analysis. The variables are listed in the table below and the questionnaire is in Appendix A.

Variables required for the economic analysis include:

Timber Sales	Fuel Wood Sales	Maple Syrup Sales	Recreation
- year of harvest	- year of harvest - acres harvested	- year of harvest - acres harvested (number of taps)	- number of hikers (on average) that hike in their woodlot per year
- acres harvested	- number of trees harvested	- total harvest costs	- How long the hiking trail had been established (i.e., how many years)
- number of trees harvested	- total harvest costs (labour, machinery, fuel and equipment)	- volume produced	- The number of hunters (on average) and how long they had been hunting in their woodlot per year
- sale volume	- face cords produced	- value of sales	- dollar amount to lease the land for recreational purposes
- stumpage and sale value	- prices		
- harvest costs			

The Resource Stewardship S.D.& G. Council conducted the case study selection, communication with a local forestry consultant and interviews to collect the data for this economic evaluation.

Developing a Net Present Value Model

Net Present Value Woodlot Model

In each case study, an economic assessment of the forest manager's margins during the time period that information was available was evaluated. The margin was calculated by subtracting the revenue from the total costs for each of the sources of income (timber, fuel wood, maple

syrup and the estimated recreation value). The model then estimated the net present value (NPV) of the margins over the time period.

To estimate the net present value, an interest rate was selected for compounding. Selecting a single compound rate for the net present value calculations in this analysis was difficult because the interest rate fluctuated substantially over the 30 years in question. To address this issue, the analysis was conducted using three different scenarios: 5%, 7.5% and 10% to identify the statistical variance (of margins) between the three rates. In practice, 5% is the most commonly used rate and is what is expressed throughout this document (7.5% and 10% results are in Appendix B). Although 10% is high and uncommon for this type of analysis, it was deemed relevant do to the high interest rates in the 1980's - part of our case study sample years.

Using the data provided from the case study interviews, it was possible to calculate the 'actual' total revenue and costs for each of the years there was a timber or fuel wood harvest, maple syrup was produced. An estimated recreation value was included in the estimates, although the revenue was not realized for the case studies (refer to section 2.3 below). Using the 5%, 7.5% and 10% compound rate, the present value revenue and costs were determined for each source of income over the period in which revenue was generated.

To estimate the NPV of gross margin on a per acre basis, the values were divided by the total acreage allocated to woodlot. The per acre values from all the revenue sources produced from the woodlot(s) were then summed to determine the total earnings (per acre) over the time period.

All results from the cases study analyses are expressed in 2004 dollars. It should be noted that this analysis does not take into account full cost accounting for the tax treatment of costs and revenues. Thus, this analysis does not take into account any applicable tax deductions.

Each of the cases was compared to a representative crop production model to assess the potential revenue from an alternative land use.

Net Present Value Crop Model

A representative crop model was developed for a typical crop rotation in Ontario using corn, soybeans and wheat. The representative farm model was based on crop enterprise budgets developed by the Ontario government, which reflect industry average costs and returns. Both variable and fixed[15] costs were used in the calculations. Although fixed costs do not change with changes in acreage, overall fixed costs, including depreciation, must be covered to maintain long-term profitability.

A representative crop model was developed for a typical crop rotation of corn, soybeans and wheat in Ontario. The representative farm model was based on crop enterprise budgets developed by the Ontario government (over the last thirty years), which reflect industry average costs and returns (Appendix C).

Historic crop enterprise budgets were not readily available for all the required case years for this analysis. However, it was possible to obtain crop enterprise budgets from 1976 forward

[15] The fixed costs do not include land rent or interest on land.

(Appendix C), with the exception of a few years[16]. Depending on the year of first woodlot revenue in the 1970's, the crop rotation model was adjusted to start in the corresponding year.

For the years that data was not available, values were estimated by averaging the total costs. For example, if the missing data was in 1994, the average of the total costs for 1993 and 1995 was the estimated value used for the 1994 data point. Because there was no data prior to 1980 for wheat and corn, 1980 total costs were used for each of the years prior.

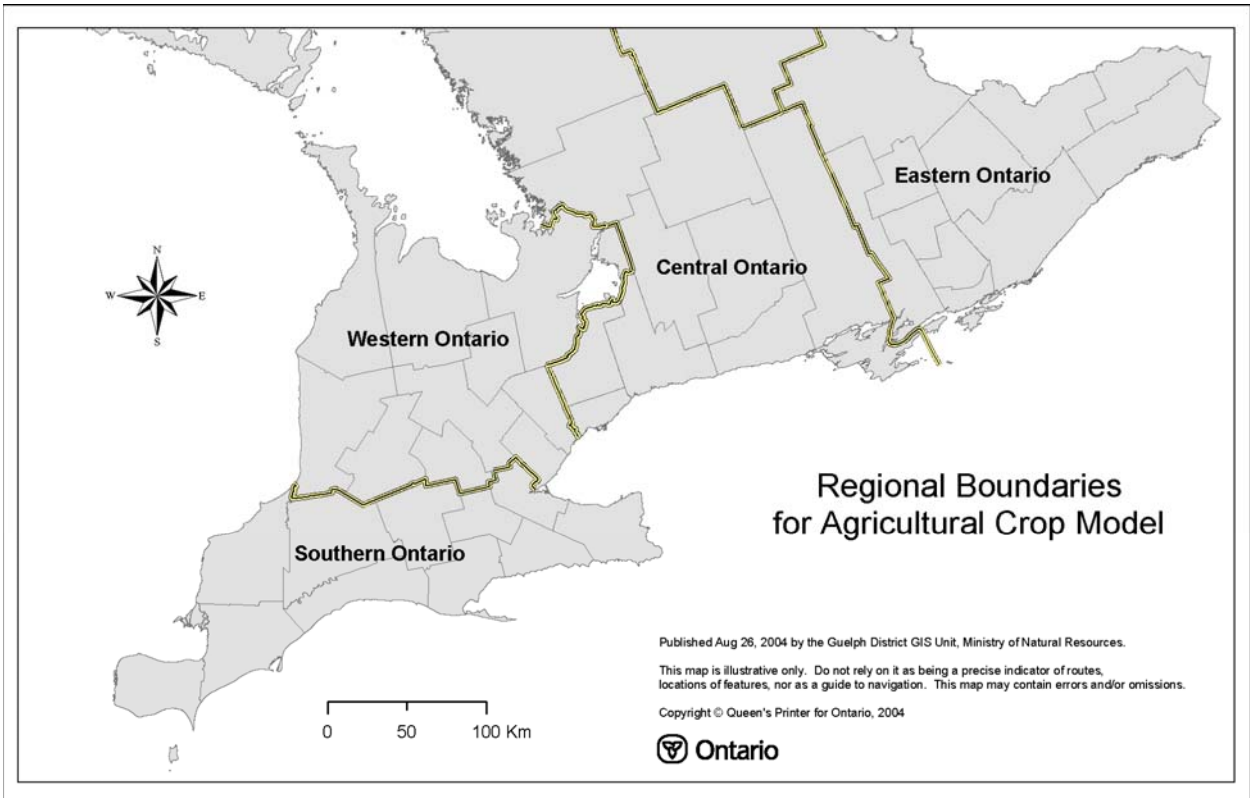
An important caveat to this analysis relates specifically to the crop enterprise budgets. Over time there have been changes to how the crop enterprise budgets were reported. For example, in various years, budget line items such as custom work, storage, drying, trucking and/or consulting were not always accounted for. To accommodate for these changes, estimates using linear trends and averages based on the available historic numbers were determined. These values have been included in Appendix C as 'estimated variable costs'.

Crop yields and prices are cyclical in nature, so given that the evaluation used historic data, the order of the crop rotation would have an impact on the end results. For example, the price spike (due to shortage in supply) for corn and soybeans in 1995 and 1996 respectively (Revenue table in Appendix C), would make a difference on the total gross margin per acre, depending on the crop that was grown in 1995 and 1996. For this reason, the crop model was evaluated assuming the rotation planted 1/3 to corn, 1/3 to soybean and 1/3 to wheat. The present value of the rotation was used for the purpose of comparison with the woodlot per acre revenue.

There are also considerable regional variations for crop yields (refer to Appendix C for yield data by region) across Ontario. To resolve some of the variation, the crop models were developed for each of the regions in Ontario (southern, western, central and eastern). The map below in Figure 2.1 illustrates the counties by region within Ontario. Depending on the location of the woodlot cases, the appropriate regional crop model was used for comparison. In this case study a corn, soybean wheat model was used.

[16] There were three years of missing data for soybeans and seven years for corn and wheat. The missing years have been italicized in Appendix C.

Figure 2.1 Regional Boundaries



Using the data from the enterprise budgets it was possible to calculate the total revenue and costs per acre for each of the harvest years of the crop rotation. Using the 5%, 7.5% and 10% compound rate, the present value revenue and costs (per acre) were determined for each crop rotation. The present value costs were subtracted from the revenue to determine the present value gross margin per acre.

Table 2.1 below is a summary of the results of the crop rotations evaluated at a 5%, 7.5% and 10%, for the province and each region of Ontario. The average NPV margin/acre is highest for the crop rotation in southern Ontario, as the growing conditions are best for a corn, soybeans and wheat rotation. It is also clear from the table that Central and Eastern Ontario are not as profitable growing a corn, soybean and wheat crop rotation.

Table 2.1 Present Value of Crop Rotation Margins at 5%, 7.5% and 10% Assuming Regional and Provincial Yield Estimates (1977-2003)

Average Crop Rotation	NPV Margin ($'s)/acre		
	5%	**7.5%**	**10%**
Southern Ontario	$ 3,667.35	$ 5,420.95	$ 8,166.72
Western Ontario	$ 2,926.99	$ 4,226.53	$ 6,238.18
Central Ontario	$ 1,167.80	$ 1,759.59	$ 2,713.91
Eastern Ontario	$ 1,487.58	$ 2,086.70	$ 3,007.57
Province	$ 3,285.67	$ 4,858.45	$ 7,329.09

Economic Literature Review for Recreation

Domtar Inc. currently leases wooded areas in Eastern Ontario for recreational use. This recreational use includes, but is not necessarily limited to, hunting, hiking and personal enjoyment. The $7/acre/year lease rate was used to estimate the potential revenue from recreation for the case studies in Eastern Ontario.

An economic literature review was also conducted to estimate the monetary value of recreational benefits during the use of private woodlots. Results from the literature review can be found in Appendix E.

Assessment of Agricultural versus Woodlot Private Production

The results from the woodlot and crop rotation iterations are compared to determine the more viable use of land.

CASE STUDIES RESULTS

Section 3.0 is a description of the case study results. Specifically, the section provides a backgrounder on the case, discusses the economic assessment of the woodlot, including any recreational values, describes the representative crop model results for the case study area and concludes with a comparison of the net present values of both the woodlot and the alternative land use.

CASE 1: PETER VAN SLEUWEN

The Van Sleuwen property consists of three woodlots on two separate land parcels in Lancaster, Eastern Ontario. The total area of land devoted to woodlots is 44.89 acres.

Economic Analysis of Van Sleuwen Case

The analysis for the Van Sleuwen Case has been modified from the methods above to reflect the woodlot owner's interest in converting a specific woodlot on his property to crop production. The economic analysis for this case estimates whether clear cutting a 28.47 acre woodlot for crop production (corn/soybeans/wheat) is a viable option. The analysis estimates the present value (using a 5% discount rate) of the woodlot and crop production for the years 2005 to 2021.

Van Sleuwen Land Use and Forest Description

Land Use	Description	Hectares (Acres)
Timber	Mixed hardwoods	11.52 (28.47)

The following assumptions and data[17] were used for the evaluations:

Woodlot Assumptions:

- There will be two additional timber harvests in the years 2006 and 2021.
  - Estimated value of the 2006 harvest is $190/acre.
  - Estimated value of the 2021 harvest is $354/acre.
- Recreational value received from the woodlot
  - Based on Domtar's estimates of a recreational value of $7/acre/year.

Crop Rotation Assumptions:

- Ten year historic average used for the CSW revenue and cost estimates.
- Estimated costs to clear the land included stumping and windrowing, burning windrows, stone removal and cost of tile/drainage. All costs are in 2005 dollars and estimated on a per acre basis (based on a total area of 28.47 acres). Refer to the table below.
- Revenue generated from the timber was subtracted from the clear-cutting costs for a net cost of clearing the land on a per acre basis in 2005 dollars. Refer to the table below.

[17] Source of data: Peter Wensink, LORAX Forestry Management and Consulting

Estimated Costs and Revenue to Prepare the Land for Crop Production, 2005

Costs	**$/acre**
Stumping and windrowing	$1,100
Burning windrows (same time required to burn one windrow or 4 windrows)	$1,500
Stone and debris removal	$300
Cost of tile drainage	$650
Total Costs	*$3,550*
Revenue from clear cutting woodlot (approximately 986 cords)	*$924*
Net Costs	*$2,626*

Source of Cost Estimates:
The cost estimates for stumping and windrowing, burning windrows and stone and debris removal came from personal communication with Allen Crites Excavation Ltd. Maxville, Allan Leduc (landowner and excavator owner/operator) Moose Creek and AGRO-DRAIN.
The cost of tile drainage came from personal communication with Allan Leduc and AGRO-DRAIN.

Woodlot Model Results for Van Sleuwen Case

The economic analysis conducted for the Van Sleuwen case illustrates that between the periods of 2006 and 2021 the Van Sleuwens could generate a total of approximately $9,777 in gross margin (revenue minus costs) from timber sales on the 28.47 acres of woodlot (in 2005 dollars, assuming a 5% discount rate). Given the total acres allocated to the woodlot, the Van Sleuwen's total earnings would be approximately $343/acre (between 2006 and 2021) in 2005 dollars assuming a 5% discount rate.

Present Value of Timber Sales, Evaluated at 5%

Year of Harvest	Woodlot Acreage	Estimated Gross Margin	Present Value of Margins	Present Value Margin/Acre
2006	28.47	5,418	5,160	181
2021	28.47	10,078	4,617	162
Total – 2005-2021		***$15,496***	***$9,777***	***$343***

Value of Recreational Land for the Van Sleuwen Case

If the Van Sleuwens could obtain the lease rate of $7/acre/year for recreational use (Domtar Inc), with 28.47 acres in 2005, the recreational value of the Van Sleuwen woodlot would be $199. Between the years 2005 and 2021, the Van Sleuwens could realize an additional profit of $2,359 or $83/acre from recreation, assuming a 5% discount rate (refer to the Table below).

Year of Harvest	Woodlot Acreage	Estimated Gross Margin	Present Value of Margins	Present Value Margin/Acre
2005	28.47	199.29	199.29	7.00
2006	28.47	199.29	189.80	6.67
2007	28.47	199.29	180.76	6.35
2008	28.47	199.29	172.15	6.05
2009	28.47	199.29	163.96	5.76
2010	28.47	199.29	156.15	5.48
2011	28.47	199.29	148.71	5.22
2012	28.47	199.29	141.63	4.97
2013	28.47	199.29	134.89	4.74
2014	28.47	199.29	128.46	4.51
2015	28.47	199.29	122.35	4.30
2016	28.47	199.29	116.52	4.09
2017	28.47	199.29	110.97	3.90
2018	28.47	199.29	105.69	3.71
2019	28.47	199.29	100.65	3.54
2020	28.47	199.29	95.86	3.37
2021	28.47	199.29	91.30	3.21
Total – 2005-2021		***$3,388***	**$2,359.15**	**$82.86**

Summary of All Sources of Income (Present Value $/acre) from the Van Sleuwen Woodlot

Source of Income	5%	7.5%	10%
Timber Sales	$343.41	$288.32	$250.00
Recreational Value	$ 82.86	$70.99	$61.77
TOTAL ($/acre)	***$426.27***	***$359.31***	***$311.77***

Crop Model Results for Van Sleuwen Case

The Van Sleuwens are interested in clear cutting one of their woodlots for the purpose of crop production. As indicated, the woodlot is located in Lancaster, Ontario. The crop rotation analysis assumes that the corn, soybeans and wheat rotation is based in eastern Ontario.

The table below illustrates the stream of revenue and costs associated with production of a corn, soybeans and wheat rotation from 2005 to 2021. The model estimates the CSW gross margin using a ten year historic average for revenue ($306.97/acre) and costs ($253.98/acre).

If the woodlot is cleared for the purpose of corn, soybeans and wheat production, the net costs (i.e., the costs to clear the woodlot minus the revenue obtained from the timber) must be taken into account for the production of the crop rotation. The net costs from clearing the woodlot were estimated at $2,626/acre ($3,550/acre in costs to clear the lot minus $924/acre in revenue obtained from the timber), in addition to the costs of production for the CSW rotation (253.98), for a total cost of $2879.98/acre for the 2005 crop production.

The table below provides a more detailed illustration of the crop rotation iterations evaluated at a 5% discount rate. As identified, the average for the crop rotation, which includes the costs of clear cutting the woodlot to prepare it for crop use, was $2,000.

Present Value of Corn, Soybeans and Wheat (CSW) Rotation Evaluated at 5% (Eastern Region of Ontario)

Year of Harvest	Actual Revenue/Acre	Actual Costs/Acre	Present Value Revenue/Acre	Present Value Costs/Acre	Margin/Acre
2005	306.97	2879.98	307.0	2879.98	-2573.01
2006	306.97	253.98	292.4	241.9	50.5
2007	306.97	253.98	278.4	230.4	48.1
2008	306.97	253.98	265.2	219.4	45.8
2009	306.97	253.98	252.5	208.9	43.6
2010	306.97	253.98	240.5	199.0	41.5
2011	306.97	253.98	229.1	189.5	39.5
2012	306.97	253.98	218.2	180.5	37.7
2013	306.97	253.98	207.8	171.9	35.9
2014	306.97	253.98	197.9	163.7	34.2
2015	306.97	253.98	188.5	155.9	32.5
2016	306.97	253.98	179.5	148.5	31.0
2017	306.97	253.98	170.9	141.4	29.5
2018	306.97	253.98	162.8	134.7	28.1
2019	306.97	253.98	155.0	128.3	26.8
2020	306.97	253.98	147.7	122.2	25.5
2021	306.97	253.98	140.6	116.4	24.3
TOTAL					***$-1998.7***

Economic Comparison of Woodlot and Crop Production for Van Sleuwen Case (2205-2021)

The conclusion of this analysis is a comparison of the present values of both the woodlot and the alternative land use (crop production in eastern Ontario) from 2005-2021 presented in the table below.

Economic Comparison of Woodlot and Crop Production Margin (2005 dollars) for Van Sleuwen Case (2005-2021)

	PV Margin ($'s)/acre **5%**
Woodlot	$343
Recreation	$82.86
Average Crop Rotation (includes costs to clear the land)	$(1,998.7)
Difference (woodlot – CSW)	$ 2,425

The results of this analysis indicate that the costs of clearing the land far out way the benefits that would be obtained from a corn, soybeans, wheat rotation. If the land could be cleared at no cost, the ten year average crop rotation would generate $201/acre ($627/acre assuming 5% discount rate) more present value margin than the woodlot production between the years 2005 and 2021. The caveat of this analysis is that the volatility and risk of crop production are assumed away by using a ten year historic average.

CASE 2: MERLE AND ROBERT HAVERSTOCK

The Haverstock woodlot consists of two parcels of land with a total acreage of 127.26, located in Lancaster, Eastern Ontario. The table below identifies the breakdown of acres by woodlot.

Haverstock Land Use and Forest Description

Land Use	Description	Hectares (Acres)
Timber	WMA 134 – Mixed hardwood	13.8 (34.1)
Timber	WMA 55 – Mixed hardwood	37.7 (93.16)
Total		51.5 (127.26)

Economic Analysis of Haverstock Case

For the purpose of this analysis, the gross margin calculations were conducted for the following:

- Timber sales
- Recreational value (estimated not realized)

Using the economic data collected in the Haverstock interviews, the net present value of all sources of earnings from the woodlots was assessed. To understand the opportunity cost of the woodlot, a corn, soybean, wheat rotation in eastern Ontario was simulated for comparison.

The purpose of this exercise was to compare the results to crop production during the span of years when the woodlots were harvested.

The economic analysis conducted for the Haverstock case illustrates that between the periods of 1988 to 2004, the Haverstock's generated a total of approximately $41,586 in revenue from timber sales on both parcels of land (in 2004 dollars, assuming a 5% compound rate). There were no costs incurred for the harvests as all costs were incurred by Domtar Inc.'s Woodlot Management Agreement program. Given the total 127.26 acres allocated to the two woodlots, the Haverstock's total timber earnings were approximately $326.78/acre (between 1988 and 2004), assuming a 5% compound rate. The results using 7.5% and 10% equated to $410/acre and $521/acre respectively (see Appendix B for the complete tables).

Present Value of Timber Sales, Evaluated at 5%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs[18]	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
WMA 134							
1988	127.26	4583.64	0	5850.02	0	5850.02	45.97
1999	127.26	4245.09	0	9266.50	0	9266.50	72.82
WMA 55							
1988	127.26	7786.94	0	7803.38	0	7803.38	61.32
1999	127.26	3574.82	0	9201.03	0	9201.03	72.30
2000	127.26	7209.25	0	9465.07	0	9465.07	74.38
Total – 1988-2004		***$27,399.74***	**0**	***$41,586.01***	***0***	***$41,586.01***	***$326.78***

Economic Value of Recreation on the Haverstock Woodlot

If the Haverstock's could have obtained the lease rate of $7/acre/year for recreational use (Domtar Inc) for their woodlots between the years 1988 and 2004, the Haverstock's could have realized additional revenue of $23,019 ($181/acre, assuming a 5% interest rate). The estimated recreational values for the two woodlots are summarized in the table below.

Present Value of Recreation, Evaluated at 5%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1988	127.26	890.82	0	1,944.55	0	1,944.55	15.28
1989	127.26	890.82	0	1,851.95	0	1,851.95	14.55
1990	127.26	890.82	0	1,763.76	0	1,763.76	13.86
1991	127.26	890.82	0	1,679.77	0	1,679.77	13.20
1992	127.26	890.82	0	1,599.78	0	1,599.78	12.57
1993	127.26	890.82	0	1,523.60	0	1,523.60	11.97
1994	127.26	890.82	0	1,451.05	0	1,451.05	11.40
1995	127.26	890.82	0	1,381.95	0	1,381.95	10.86
1996	127.26	890.82	0	1,316.15	0	1,316.15	10.34
1997	127.26	890.82	0	1,253.47	0	1,253.47	9.85
1998	127.26	890.82	0	1,193.78	0	1,193.78	9.38
1999	127.26	890.82	0	1,136.94	0	1,136.94	8.93
2000	127.26	890.82	0	1,082.80	0	1,082.80	8.51
2001	127.26	890.82	0	1,031.24	0	1,031.24	8.10
2002	127.26	890.82	0	982.13	0	982.13	7.72
2003	127.26	890.82	0	935.36	0	935.36	7.35
2004	127.26	890.82	0	890.82	0	890.82	7.00
Total – 1988-2004				***23,019.12***	***0***	***23,019.12***	***180.88***

[18] There were no costs incurred as all harvest costs were covered by Domtar Inc's Woodlot Management Agreement program.

Summary of All Sources of Income from the Haverstock Woodlots

Given the analysis of income from the Haverstock woodlots, it is possible to determine the total earnings on a per acre basis, between 1986 and 1998. The table below illustrates that on a per acre basis, the Haverstock's generated between $508 and $747, depending on the compound rate used.

Summary of All Sources of Income (Present Value $/acre) from the Haverstock Woodlot

Source of Income	5%	7.5%	10%
Timber Sales	$ 326.78	$ 358.50	$ 463.18
*Recreational Value**	*$ 180.88*	*$ 225.81*	*$ 283.81*
TOTAL ($/acre)	**$ 507.66**	**$ 584.31**	**$ 746.99**

*Estimated present value, income was not realized.

Crop Model Results for Haverstock Case

The Haverstock's have two parcels of land which contain woodlots in Lancaster, Eastern Ontario. The crop rotation analysis assumes that the corn, soybean and wheat rotation is based in eastern Ontario.

The table below provides a more detailed illustration of the crop rotation iterations evaluated at a 5% compound rate (7.5% and 10% calculations for the Haverstock case are provided in the Appendix D at the end of this document).

Present Value of Corn, Soybeans and Wheat Rotation Evaluated at 5% (Eastern Region of Ontario)

Year of Harvest	Actual Revenue/Acre	Actual Costs/Acre	Present Value Revenue/Acre	Present Value Costs/Acre	Margin/Acre
1988	268.52	203.48	586.15	444.17	141.98
1989	233.99	229.67	486.45	477.46	8.99
1990	212.42	209.62	420.59	415.04	5.55
1991	212.97	204.77	401.59	386.13	15.46
1992	213.77	214.90	383.89	385.93	-2.04
1993	262.84	225.03	449.54	384.87	64.67
1994	278.23	228.72	453.21	372.55	80.66
1995	379.41	232.41	588.59	360.54	228.05
1996	356.39	239.27	526.55	353.51	173.04
1997	279.04	246.14	392.64	346.34	46.30
1998	289.15	253.17	387.49	339.27	48.22
1999	280.12	243.24	357.51	310.44	47.07
2000	214.81	254.03	261.11	308.77	-47.67
2001	245.98	256.12	284.75	296.49	-11.74
2002	323.32	251.46	356.46	277.23	79.23
2003	355.64	270.33	373.42	283.85	89.57
2004	345.87	293.67	345.87	293.67	52.20
TOTAL					***$1,019.54***

As identified in the table above, the average for the crop rotation compounded at 5% was $1,019.54; the 7.5% and 10% present values were $1,247.29 and $1,535.66 respectively (refer to Appendix D).

Economic Comparison of Woodlot and Crop Production for Haverstock Case (1988-2004)

The conclusion of this analysis is a comparison of the net present values of both the woodlot and the alternative land use (crop production in eastern Ontario) model from 1988-2004 presented in the table below.

	NPV Margin ($'s)/acre		
	5%	7.5%	10%
Woodlots*	$ 507.66	$ 584.31	$ 746.99
Average Crop Rotation	$ 1,019.54	$ 1,247.29	$ 1,535.66
Difference	$ (511.88)	$ (662.98)	$ (788.67)

*NPV margin/acre includes the estimated value for recreation which was not a realized income.

The results of this analysis indicate that the Haverstock's generated less per acre from 1988-2004 with their woodlot management when compared to a typical crop rotation of corn, soybeans and wheat in eastern Ontario. At the various compound rates the difference between woodlot management and crop rotation ranged from $512 to $789 less profit per acre. Note that this difference includes estimated revenue from recreation that was not actually realized.

CASE 3: C & D OSBOURNE FARMS

Background

The Osbourne woodlot is located in Bainsville, Eastern Ontario, and consists of 37.07 acres. The table below describes the land use for the mixed hardwood woodlot.

Osbourne Land Use and Forest Description

Land Use	Description	Hectares (Acres)
Timber, fuel wood and maple syrup	WMA 133 – Mixed hardwoods	15.01 (37.07)

Economic Analysis of Osbourne Case

For the purpose of this analysis, the gross margin calculations were conducted for the following:

- timber sales
- fuel wood sales
- maple syrup sales and
- recreational value (estimated not realized).

Using the economic data collected in the Osbourne interview, the net present value of all sources of earnings from the woodlots was assessed. To understand the opportunity cost of the woodlot, a corn, soybean, wheat rotation in eastern Ontario was simulated for comparison.

The purpose of this exercise was to compare the results to crop production during the span of years where there was woodlot harvested.

The economic analysis conducted for the Osbourne case illustrates that between the periods of 1984 to 2004, the Osbournes generated a total of approximately $166,606 in revenue from timber, fuel wood sales and maple syrup sales. The timber sales generated a present value margin of $593/acre, while the fuel wood sales contributed $385/acre and the maple syrup sales contributed $1,177/acre (all values are in 2004 dollars, assuming a 5% compound rate). There were no costs incurred for the timber harvests as all costs were incurred by Domtar Inc's Woodlot Management Agreement program.

The Osbournes have a hiking trail in their woodlot that has been established for the last five years. Assuming a lease rate of $7/acre/year for recreational use (Domtar Inc) between the years 2000 and 2004, the economic value for recreation is estimated at $1,433 or $39/acre, assuming a 5% compound rate. The results using 7.5% and 10% equated to $41/acre and $43/acre respectively (see Appendix B for the complete tables).

Present Value of Timber Sales, Evaluated at 5%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs[19]	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1984	37.07	3507	0	17488.71	0	17488.71	471.78
1999	37.07	6591.31	0	4475.92	0	4475.92	120.74
Total – 1984-1999		***$10,098.31***		***$21,964.63***	***0***	***$21,964.63***	***$592.52***

[19] There were no costs incurred as all harvest costs were covered by Domtar Inc's Woodlot Management Agreement program.

Present Value of Fuel Wood, Evaluated at 5%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1984	37.07	1300	900	3,449.29	2,387.97	1061.32	28.63
1985	37.07	1300	900	3,285.04	2,274.26	1010.78	27.27
1986	37.07	1300	900	3,128.61	2,165.96	962.65	25.97
1987	37.07	1300	900	2,979.62	2,062.82	916.81	24.73
1988	37.07	1300	900	2,837.74	1,964.59	873.15	23.55
1989	37.07	1300	900	2,702.61	1,871.04	831.57	22.43
1990	37.07	1300	900	2,573.91	1,781.94	791.97	21.36
1991	37.07	1300	900	2,451.34	1,697.08	754.26	20.35
1992	37.07	1300	900	2,334.61	1,616.27	718.34	19.38
1993	37.07	1300	900	2,223.44	1,539.31	684.14	18.46
1994	37.07	1300	900	2,117.56	1,466.01	651.56	17.58
1995	37.07	1300	900	2,016.73	1,396.20	620.53	16.74
1996	37.07	1300	900	1,920.69	1,329.71	590.98	15.94
1997	37.07	1300	900	1,829.23	1,266.39	562.84	15.18
1998	37.07	1300	900	1,742.12	1,206.09	536.04	14.46
1999	37.07	1300	900	1,659.17	1,148.65	510.51	13.77
2000	37.07	1300	900	1,580.16	1,093.96	486.20	13.12
2001	37.07	1300	900	1,504.91	1,041.86	463.05	12.49
2002	37.07	1300	900	1,433.25	992.25	441.00	11.90
2003	37.07	1300	900	1,365.00	945.00	420.00	11.33
2004	37.07	1300	900	1,300.00	900.00	400.00	10.79
Total – 1988-2004				**46,435.03**	**32,147.33**	**14,287.70**	**385.42**

Present Value of Maple Syrup Sales, Evaluated at 5%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1985	37.07	2970	1650	7,505.04	4,169.47	3,335.57	89.98
1986	37.07	2970	1650	7,147.66	3,970.92	3,176.74	85.70
1987	37.07	2970	1650	6,807.29	3,781.83	3,025.46	81.61
1988	37.07	2970	1650	6,483.14	3,601.74	2,881.39	77.73
1989	37.07	2970	1650	6,174.42	3,430.23	2,744.19	74.03
1990	37.07	2970	1650	5,880.40	3,266.89	2,613.51	70.50
1991	37.07	2970	1650	5,600.38	3,111.32	2,489.06	67.14
1992	37.07	2970	1650	5,333.69	2,963.16	2,370.53	63.95
1993	37.07	2970	1650	5,079.71	2,822.06	2,257.65	60.90
1994	37.07	2970	1650	4,837.82	2,687.68	2,150.14	58.00
1995	37.07	2970	1650	4,607.44	2,559.69	2,047.75	55.24
1996	37.07	2970	1650	4,388.04	2,437.80	1,950.24	52.61
1997	37.07	2970	1650	4,179.09	2,321.72	1,857.37	50.10
1998	37.07	2970	1650	3,980.08	2,211.16	1,768.93	47.72
1999	37.07	2970	1650	3,790.56	2,105.86	1,684.69	45.45
2000	37.07	2970	1650	3,610.05	2,005.59	1,604.47	43.28
2001	37.07	2970	1650	3,438.15	1,910.08	1,528.07	41.22
2002	37.07	2970	1650	3,274.43	1,819.13	1,455.30	39.26
2003	37.07	2970	1650	3,118.50	1,732.50	1,386.00	37.39
2004	37.07	2970	1650	2,970.00	1,650.00	1,320.00	35.61
Total – 1985-2004				**8,205.88**	**54,558.82**	**43,647.06**	**1,177.42**

Present Value of Recreation, Evaluated at 5%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
2000	37.07	259.49	0	315.41	0	315.41	8.51
2001	37.07	259.49	0	300.39	0	300.39	8.10
2002	37.07	259.49	0	286.09	0	286.09	7.72
2003	37.07	259.49	0	272.46	0	272.46	7.35
2004	37.07	259.49	0	259.49	0	259.49	7.00
Total 2000 -2004				**$1,433.85**	***0***	**$1,433.85**	**$38.68**

Summary of All Sources of Income from the Osbourne Woodlot

Given the analysis of income from the Osbourne woodlot, it is possible to determine the total earnings on a per acre basis for all sources of income, including timber sales, fuel wood sales, maple syrup sales and the estimated recreational value, between 1984 and 2004. The table below illustrates that on a per acre basis, the Osbournes generated between $3,061 and $5,675 depending on the compound rate used.

Summary of All Sources of Income (Present Value $/acre) from the Osbourne Woodlot (1984-2004)

Source of Income	5%	7.5%	10%
Timber Sales	$592.52	$891.12	$1,348.56
Fuel Wood Sales	$385.42	$513.11	$690.61
Maple Syrup Sales	$1,177.42	$1,542.01	$2,039.47
*Recreation Value**	*$38.68*	*$40.66*	*$42.74*
TOTAL ($/acre)	***$3,061.25***	***$4,141.40***	***$5,675.26***

*Estimated present value ($/acre) for the five years a hiking trail was in place in the woodlot, as the income was not realized.

Crop Model Results for Osbourne Case

The Osbourne woodlot is located in Bainsville, Eastern Ontario. The crop rotation analysis assumes that the corn, soybean and wheat rotation is based in eastern Ontario.

The table below provides a more detailed illustration of the crop rotation iterations evaluated at the 5% compound rate (7.5% and 10% calculations for the Osbourne case are provided in the Appendix at the end of this document).

Present Value of Corn, Soybeans and Wheat Rotation Evaluated at 5% (Eastern Region of Ontario)

Year of Harvest	Actual Revenue/Acre	Actual Costs/Acre	Present Value Revenue/Acre	Present Value Costs/Acre	Margin/Acre
1984	231.27	211.98	613.64	562.45	51.18
1985	211.89	220.01	535.44	555.97	-20.52
1986	165.72	213.42	398.84	513.62	-114.79
1987	244.40	208.84	560.17	478.66	81.51
1988	268.52	203.48	586.15	444.17	141.98
1989	233.99	229.67	486.45	477.46	8.99
1990	212.42	209.62	420.59	415.04	5.55
1991	212.97	204.77	401.59	386.13	15.46
1992	213.77	214.90	383.89	385.93	-2.04
1993	262.84	225.03	449.54	384.87	64.67
1994	278.23	228.72	453.21	372.55	80.66
1995	379.41	232.41	588.59	360.54	228.05
1996	356.39	239.27	526.55	353.51	173.04
1997	279.04	246.14	392.64	346.34	46.30
1998	289.15	253.17	387.49	339.27	48.22
1999	280.12	243.24	357.51	310.44	47.07
2000	214.81	254.03	261.11	308.77	-47.67
2001	245.98	256.12	284.75	296.49	-11.74
2002	323.32	251.46	356.46	277.23	79.23
2003	355.64	270.33	373.42	283.85	89.57
2004	345.87	293.67	345.87	293.67	52.20
TOTAL					***$1,016.92***

As identified in the table above, the average for the crop rotation compounded at 5% was $1,016; the 7.5% and 10% present values were $1,243 and $1,530 respectively (refer to Appendix C).

Economic Comparison of Woodlot and Crop Production for Osbourne Case (1984-2004)

The conclusion of this analysis is a comparison of the net present values of both the woodlot and the alternative land use (crop production in eastern Ontario) model from 1984-2004 presented in the table below.

	NPV Margin ($'s)/acre		
	5%	7.5%	10%
Woodlots*	$3,061.25	$4,141.40	$5,675.26
Average Crop Rotation	$ 1,017	$ 1,243	$ 1,530
Difference	$ 2,044.33	$ 2,897.99	$ 4,144.94

*NPV margin/acre includes the estimated value for recreation, which was not a realized income.

The results of this analysis indicate that the Osbournes generated more per acre from 1984-2004 with their woodlot management (timber, fuel wood sales, maple syrup sales and recreation) when compared to a typical crop rotation of corn, soybeans and wheat in eastern Ontario. At the various compound rates the difference between woodlot management and crop rotation ranged from $2,044 to $4,145 more profit per acre.

CASE 4: JEAN VILLENEUVE WOODLOT

Background

The Jean Villeneuve woodlot is located in Maxville, Eastern Ontario, and consists of 36.32 acres. The table below describes the land use for the mixed hardwood woodlot.

Villeneuve Land Use and Forest Description

Land Use	Description	Hectares (Acres)
Timber sales, maple syrup	Mixed hardwoods	14.7 (36.32)

Economic Analysis of Villeneuve Case

For the purpose of this analysis, the gross margin calculations were conducted for the following:

- Timber sales
- Maple syrup sales
- Recreational value (estimated not realized)

Using the economic data collected in the Villeneuve interviews, the net present value of all sources of earnings from the woodlot was assessed. To understand the opportunity cost of the woodlot, a corn, soybean, wheat rotation in eastern Ontario was simulated for comparison.

The purpose of this exercise was to compare the results to crop production during the span of years where the woodlot was harvested.

The economic analysis conducted for the Villeneuve case illustrates that between the periods of 1986 to 2004, the Villeneuves generated a total of approximately $112,899 in revenue from timber and maple syrup sales. Given the 36.32 acres allocated to the woodlot, the Villeneuves total timber and maple syrup earnings were approximately $290/acre (between 1986 and 1998) and $1,139/acre (between 1986-2004) respectively, assuming a 5% compound rate. The results using 7.5% and 10% equated to $372/acre and $483/acre respectively (see Appendix B

for the complete tables). There were no costs incurred for the timber harvest as all costs were incurred by Domtar Inc's Woodlot Management Agreement program.

If the Villeneuves could have obtained the lease rate of $7/acre/year for recreational use (Domtar Inc) for their woodlots between the years 1986 and 2004, the Villeneuves could have realized additional revenue of approximately $7,764, or $214/acre, assuming a 5% interest rate). The estimated recreational values for the woodlot are summarized in the table below.

Present Value of Timber Sales, Evaluated at 5%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs[20]	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1986	36.32	$1,508.94	0	$3631.41	0	$3631.41	99.98
1998	36.32	$5,159.68	0	$6914.46	0	$6914.46	190.38
Total – 1986-1998				***$10,545.91***	***0***	***$10,545.91***	***290.36***

Present Value of Maple Syrup Sales, Evaluated at 5%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1986	36.32	3465	2065	8,338.94	4,969.67	3,369.27	92.77
1987	36.32	3465	2065	7,941.84	4,733.02	3,208.83	88.35
1988	36.32	3465	2065	7,563.66	4,507.64	3,056.02	84.14
1989	36.32	3465	2065	7,203.49	4,292.99	2,910.50	80.13
1990	36.32	3465	2065	6,860.46	4,088.56	2,771.90	76.32
1991	36.32	3465	2065	6,533.77	3,893.87	2,639.91	72.68
1992	36.32	3465	2065	6,222.64	3,708.44	2,514.20	69.22
1993	36.32	3465	2065	5,926.33	3,531.85	2,394.48	65.93
1994	36.32	3465	2065	5,644.12	3,363.67	2,280.45	62.79
1995	36.32	3465	2065	5,375.35	3,203.49	2,171.86	59.80
1996	36.32	3465	2065	5,119.38	3,050.95	2,068.44	56.95
1997	36.32	3465	2065	4,875.60	2,905.66	1,969.94	54.24
1998	36.32	3465	2065	4,643.43	2,767.30	1,876.13	51.66
1999	36.32	3465	2065	4,422.32	2,635.52	1,786.79	49.20
2000	36.32	3465	2065	4,211.73	2,510.02	1,701.71	46.85
2001	36.32	3465	2065	4,011.17	2,390.50	1,620.68	44.62
2002	36.32	3465	2065	3,820.16	2,276.66	1,543.50	42.50
2003	36.32	3465	2065	3,638.25	2,168.25	1,470.00	40.47
Total – 1986-2003				**102,352.65**	**60,998.04**	**41,354.61**	**1,138.62**

Present Value of Recreation, Evaluated at 5%

[20] There were no costs incurred as all harvest costs were covered by Domtar Inc's Woodlot Management Agreement program.

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1986	36.32	254.24	0	611.86	0	611.86	16.85
1987	36.32	254.24	0	582.72	0	582.72	16.04
1988	36.32	254.24	0	554.97	0	554.97	15.28
1989	36.32	254.24	0	528.55	0	528.55	14.55
1990	36.32	254.24	0	503.38	0	503.38	13.86
1991	36.32	254.24	0	479.41	0	479.41	13.20
1992	36.32	254.24	0	456.58	0	456.58	12.57
1993	36.32	254.24	0	434.84	0	434.84	11.97
1994	36.32	254.24	0	414.13	0	414.13	11.40
1995	36.32	254.24	0	394.41	0	394.41	10.86
1996	36.32	254.24	0	375.63	0	375.63	10.34
1997	36.32	254.24	0	357.74	0	357.74	9.85
1998	36.32	254.24	0	340.71	0	340.71	9.38
1999	36.32	254.24	0	324.48	0	324.48	8.93
2000	36.32	254.24	0	309.03	0	309.03	8.51
2001	36.32	254.24	0	294.31	0	294.31	8.10
2002	36.32	254.24	0	280.30	0	280.30	7.72
2003	36.32	254.24	0	266.95	0	266.95	7.35
2004	36.32	254.24	0	254.24	0	254.24	7.00
Total – 1986-2004				**7,764.24**	***0***	**7,764.24**	**$ 213.77**

Summary of All Sources of Income from the Villeneuve Woodlots

Given the analysis of income from the Villeneuve woodlots, it is possible to determine the total earnings on a per acre basis, between 1986 and 2004. The table below illustrates that on a per acre basis, the Villeneuves generated between $1,750 and $3,155 depending on the compound rate used. Note that the estimated recreation value was not a realized income, but an estimated value for the woodlot.

Summary of All Sources of Income (Present Value $/acre) from the Villeneuve Woodlot (1986-2004)

Source of Income	5%	7.5%	10%
Timber Sales	$397.56	$586.31	$863.45
Maple Syrup Sales	$1,138.62	$1,478.37	$1,933.45
*Recreation Value**	*$213.77*	*$275.47*	*$358.11*
TOTAL ($/acre)	***$1,749.95***	***$2,340.15***	***$3,155.01***

*Estimated present value, income was not realized.

Crop Model Results for Villeneuve Case

The Villeneuve woodlot is located in Maxville, Eastern Ontario. The crop rotation analysis assumes that the corn, soybean and wheat rotation is based in eastern Ontario.

The table below provides a more detailed illustration of the crop rotation iterations evaluated at the 5% compound rate (7.5% and 10% calculations for the Villeneuve case are provided in the Appendix D at the end of this document).

Present Value of Corn, Soybeans and Wheat Rotation Evaluated at 5% (Eastern Region of Ontario)

Year of Harvest	Actual Revenue/Acre	Actual Costs/Acre	Present Value Revenue/Acre	Present Value Costs/Acre	Margin/Acre
1986	165.72	213.42	398.84	513.62	-114.79
1987	244.40	208.84	560.17	478.66	81.51
1988	268.52	203.48	586.15	444.17	141.98
1989	233.99	229.67	486.45	477.46	8.99
1990	212.42	209.62	420.59	415.04	5.55
1991	212.97	204.77	401.59	386.13	15.46
1992	213.77	214.90	383.89	385.93	-2.04
1993	262.84	225.03	449.54	384.87	64.67
1994	278.23	228.72	453.21	372.55	80.66
1995	379.41	232.41	588.59	360.54	228.05
1996	356.39	239.27	526.55	353.51	173.04
1997	279.04	246.14	392.64	346.34	46.30
1998	289.15	253.17	387.49	339.27	48.22
1999	280.12	243.24	357.51	310.44	47.07
2000	214.81	254.03	261.11	308.77	-47.67
2001	245.98	256.12	284.75	296.49	-11.74
2002	323.32	251.46	356.46	277.23	79.23
2003	355.64	270.33	373.42	283.85	89.57
2004	345.87	293.67	345.87	293.67	52.20
TOTAL					***986.26***

As identified in the table above, the average for the crop rotation compounded at 5% was $986.26; the 7.5% and 10% present values were $1,194 and $1,450 respectively.

Economic Comparison of Woodlot and Crop Production for Villeneuve Case (1986-2004)

The conclusion of this analysis is a comparison of the net present values of both the woodlot and the alternative land use (crop production in eastern Ontario) model from 1986-2004 presented in the table below.

	NPV Margin ($'s)/acre		
	5%	7.5%	10%
Woodlots*	$ 1,749.95	$ 2,340.15	$ 3,155.01
Average Crop Rotation	$ 986.26	$ 1,193.56	$ 1,450.21
Difference	***$ 763.69***	***$ 1,146.59***	***$ 1,704.80***

*NPV margin/acre includes the estimated value for recreation which was not a realized income.

The results of this analysis indicate that the Villeneuves generated more per acre from 1986-2004 with their woodlot management when compared to a typical crop rotation of corn, soybeans and wheat in eastern Ontario. At the various compound rates the difference between woodlot management and crop rotation ranged from $764 to $1,705 more profit per acre. This profit is attributed to the timber and maple syrup sales and the recreational value of the woodlot. Recall that the estimated recreational value of the woodlot was not realized income.

CASE 5: GERRIT AND HARMKE VELEMA

Background

The Gerrit Velema woodlot is located in Avonmore, Eastern Ontario, and consists of 99.25 acres on two separate woodlots. The table below describes the land use for the woodlot.

Velema Land Use and Forest Description

Land Use	Description	Hectares (Acres)
Timber and fuel wood		40.17 (99.25)

Economic Analysis of Velema Case

For the purpose of this analysis, the gross margin calculations were conducted for the following:

- timber sales
- fuel wood (personal consumption)
- Christmas tree sales and
- recreation value (estimated not realized).

Using the economic data collected in the Velema interviews, the net present value of all sources of earnings from the woodlot was assessed. To understand the opportunity cost of the woodlot, a corn, soybean, wheat rotation in eastern Ontario was simulated for comparison.

The purpose of this exercise was to compare the results to crop production during the span of years when the woodlot was harvested.

The economic analysis conducted for the Velema case illustrates that between the periods of 1995 to 2004, the Velemas generated a total of approximately $2,466 in revenue from timber sales. The costs associated with harvesting were incurred by Domtar Inc's Woodlot Management Agreement program (in 2004 dollars, assuming a 5% compound rate). Given the

99.25 acres allocated to the woodlot, the Velema's total earnings were approximately $24.85/acre (between 1995 and 2004), assuming a 5% compound rate. The results using 7.5% and 10% equated to $30.72/acre and $38.37/acre respectively (see Appendix for the complete tables).

Between the years of 2002 to 2004, the Velemas also generated income from Christmas tree sales. During this period, the Velemas generated a total of approximately $12,610 (in 2004 dollars, assuming a 5% compound rate). Given the 99.25 acres that are attributed to the woodlot, the Velema's total earnings from Christmas trees were approximately $127/acre (between 2002 and 2004), assuming a 5% compound rate. The results using 7.5% and 10% equated to $130/acre and $133/acre respectively (see Appendix for the complete tables).

The Velemas used firewood from the lot for personal consumption. The estimated value of the firewood has been included. Between 1995 and 2004, the Velemas could have generated revenue of approximately $1,133 from fire wood sales (in 2004 dollars, assuming a 5% compound rate). Given the 99.25 acres allocated to the woodlot and the harvest costs, the Velema's total value from firewood was approximately $3.44/acre (between 1995 and 2004). The results using 7.5% and 10% equated to $3.54/acre and $3.66/acre (refer to Appendix for complete tables.

If the Velemas could have obtained the lease rate of $7/acre/year for recreational use (Domtar Inc) for their woodlots between the years 1991 and 2004, the Velemas could have realized additional revenue of approximately $13,616, or $137/acre (assuming a 5% interest rate). The estimated recreational values for the woodlot are summarized in the table below. The results using 7.5% and 10% equated to $164/acre and $196/acre (refer to Appendix for complete tables).

Present Value of Timber Sales, Evaluated at 5%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs[21]	Present Value of Margins	Present Value Margin/Acre
1991	99.25	$708.12	0	$1,335.27	0	$1,335.27	$13.45
1995	99.25	$288.84	0	$448.09	0	$448.09	$4.51
2004	99.25	$682.55	0	$682.55	0	$682.55	$6.88
Total – 1991-2004				***$2,465.90***	***0***	***$2,465.90***	***$24.85***

[21] According to the survey filled out by the Velema's, all of the costs were incurred by Domtar Inc's Woodlot Management Agreement program. However, the Case Study and Participant file indicated that there were commercial and pre commercial costs associated with marking the trees. At the moment, this write-up assumes that all costs were incurred by Domtar Inc.

Present Value of Christmas Tree Sales, Evaluated at 5%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
2002	99.25	$4,000	0	$4,410.00	0	$4,410.00	$44.43
2003	99.25	$4,000	0	$4,200.00	0	$4,200.00	$42.32
2004	99.25	$4,000	0	$4,000.00	0	$4,000.00	$40.30
Total – 2002-2004				***$12,610.00***	***0***	***$12,610.00***	***$127.05***

Present Value of Fuel Wood, Evaluated at 5%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1995	99.25	$102	$75	$158.24	$116.35	$41.89	$0.42
2004	99.25	$975	$675	$975	$675	$300	$3.02
Total – 1995-2004				***$1,133.24***	***$791.35***	***$341.89***	***$3.44***

Present Value of Recreation, Evaluated at 5%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1991	99.25	694.75	0	1310.05	0	1310.05	13.20
1992	99.25	694.75	0	1247.67	0	1247.67	12.57
1993	99.25	694.75	0	1188.26	0	1188.26	11.97
1994	99.25	694.75	0	1131.67	0	1131.67	11.40
1995	99.25	694.75	0	1077.79	0	1077.79	10.86
1996	99.25	694.75	0	1026.46	0	1026.46	10.34
1997	99.25	694.75	0	977.58	0	977.58	9.85
1998	99.25	694.75	0	931.03	0	931.03	9.38
1999	99.25	694.75	0	886.70	0	886.70	8.93
2000	99.25	694.75	0	844.47	0	844.47	8.51
2001	99.25	694.75	0	804.26	0	804.26	8.10
2002	99.25	694.75	0	765.96	0	765.96	7.72
2003	99.25	694.75	0	729.49	0	729.49	7.35
2004	99.25	694.75	0	694.75	0	694.75	7.00
Total – 1991-2004				**$13,616.15**	***0***	**$13,616.15**	**$137.19**

Summary of All Sources of Income from the Velema Woodlots

Given the analysis of income from the Velema woodlots, it is possible to determine the total earnings on a per acre basis, between 1991 and 2004. The table below illustrates that on a per acre basis, the Velemas generated between $301 and $380 depending on the compound rate used.

Summary of All Sources of Income (Present Value $/acre) from the Velema Woodlot (1991-2004)

Source of Income	5%	7.5%	10%
Timber Sales	$24.85	$30.72	$38.37
Christmas Tree Sales	$127.05	$130.20	$133.40
Fuel wood	$3.44	$3.54	$3.66
*Recreation**	*$137.19*	*$163.56*	*$195.82*
TOTAL ($/acre)	***$292.53***	***$328.02***	***$371.25***

* Estimate present value, income was not realized

Crop Model Results for Velema Case

The Velema woodlot is located in Avonmore, Eastern Ontario. The crop rotation analysis assumes that the corn, soybean and wheat rotation is based in eastern Ontario.

The table below provides a more detailed illustration of the crop rotation iterations evaluated at the 5% compound rate (7.5% and 10% calculations for the Velema case are provided in the Appendix at the end of this document).

Present Value of Corn, Soybeans and Wheat Rotation Evaluated at 5% (Eastern Region of Ontario)

Year of Harvest	Actual Revenue/Acre	Actual Costs/Acre	Present Value Revenue/Acre	Present Value Costs/Acre	Margin/Acre
1991	212.97	204.77	401.59	386.13	15.46
1992	213.77	214.90	383.89	385.93	-2.04
1993	262.84	225.03	449.54	384.87	64.67
1994	278.23	228.72	453.21	372.55	80.66
1995	379.41	232.41	588.59	360.54	228.05
1996	356.39	239.27	526.55	353.51	173.04
1997	279.04	246.14	392.64	346.34	46.30
1998	289.15	253.17	387.49	339.27	48.22
1999	280.12	243.24	357.51	310.44	47.07
2000	214.81	254.03	261.11	308.77	-47.67
2001	245.98	256.12	284.75	296.49	-11.74
2002	323.32	251.46	356.46	277.23	79.23
2003	355.64	270.33	373.42	283.85	89.57
2004	345.87	293.67	345.87	293.67	52.20
TOTAL					***$ 863.02***

As identified in the table above, the average for the crop rotation compounded at 5% was $863.02; the 7.5% and 10% present values were $1020 and $1208 respectively.

Economic Comparison of Woodlot and Crop Production for Velema Case (1991-2004)

The conclusion of this analysis is a comparison of the net present values of both the woodlot and the alternative land use (crop production in eastern Ontario) model from 1991 – 2004 presented in the table below.

	NPV Margin ($'s)/acre		
	5%	7.5%	10%
Woodlots (Timber, Fuel Wood, Recreation and Christmas Tree sales)	$292.53	$328.02	$371.25
Average Crop Rotation	$863.02	$1019.89	$1208.08
Difference	($570.44)	($691.79)	($836.73)

The results of this analysis indicate that the Velemas generated less per acre from 1991-2004 with their woodlot management when compared to a typical crop rotation of corn, soybeans and wheat in eastern Ontario. At the various compound rates the difference between woodlot management and crop rotation ranged from $570 to $837 less profit per acre. Note that this difference includes estimated revenue from recreation that was not actually realized.

SUMMARY AND CONCLUSIONS

Of the four cases that estimated historic woodlot harvests and crop production, two of the cases generated more revenue from the woodlot. This is largely due to the quality, maturity and the length of time management when compared to the other woodlots. It is important to recognize however, that the estimated value of recreation was not a realized income for the woodlots, but a potential revenue source. As a result, the actual estimated margins may be slightly lower than what is depicted in the document for the woodlots.

In the first case in which the woodlot owner wanted to compare the present value of future woodlot cuts with crop production, the costs of clearing the land far exceeded the value of crop production that could be generated during the time period in question (2005-2021). In addition, the caveat assumed away any volatility and risk associated with crop production by using a ten-year historic average. Thus, crop production may be more or less viable than illustrated. For the purpose of this assessment, maintaining the woodlot for timber production between the years 2005 and 2021 is the more economically viable use of the land.

As a final caveat (as identified in the methods), this analysis does not take into account full cost accounting for the tax treatment of costs and revenues. Thus, this analysis does not take into account any applicable tax deductions.

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APPENDIX A: WOODLOT QUESTIONNAIRE

Background

Name	Mailing Address	Telephone/Fax	Email

County	Township	Lot	Concession

Describe the topography of your farm (woodlot):

Land use and forest description:

	Land Use	Description	Hectares (acres)	

Describe the history of ownership of the property (woodlots and farm):

Management

What are your current farm practices?

What were the past farm practices?

What are your forest management objectives?

Have these objectives changed over time? If yes, how? Why?

What factors have influenced your forest management decisions?

What historical details do you remember of the forest (fire, harvest, pasture, tree planting, insect or disease)?

What has been your involvement with the MNR or CA's?

What is the most exciting part about owning, using, working in the woodlot?

Is there anything you would do differently?

Do you have advice for landowners?

APPENDIX B: PRESENT VALUE CALCULATIONS FOR TIMBER, FUEL WOOD, MAPLE SYRUP SALES AND RECREATIONAL VALUE, EVALUATED AT 7.5% AND 10%

Present Value of Haverstock Timber Sales, Evaluated at 7.5% - 2004 Dollars

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs[22]	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
WMA 134							
1988	127.26	4583.64	0	6580.41	0	6580.41	51.71
1999	127.26	4245.09	0	13502.75	0	13502.75	106.10
WMA 55							
1988	127.26	7786.94	0	11370.76	0	11370.76	89.35
1999	127.26	3574.82	0	10349.81	0	10349.81	81.33
2000	127.26	7209.25	0	10399.22	0	10399.22	81.72
Total – 1988-2004		***$27,399.74***	**0**	***$52,202.95***	***0***	***$52,202.95***	***$410.21***

Present Value of Haverstock Timber Sales, Evaluated at 10% - 2004 Dollars

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs[23]	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
WMA 134							
1988	127.26	4583.64	0	7382.00	0	7382.00	58.01
1999	127.26	4245.09	0	19506.07	0	19506.07	153.28
WMA 55							
1988	127.26	7786.94	0	16426.20	0	16426.20	129.08
1999	127.26	3574.82	0	11610.57	0	11610.57	91.24
2000	127.26	7209.25	0	11400.86	0	11400.86	89.59
Total – 1988-2004		***$27,399.74***	**0**	***$66,325.70***	***0***	***$58,943.70***	***$521.18***

[22] There were no costs incurred as all harvest costs were covered by Domtar Inc's Woodlot Management Agreement program.
[23] There were no costs incurred as all harvest costs were covered by Domtar Inc's Woodlot Management Agreement program.

Present Value of Osbourne Timber Sales, Evaluated at 7.5% - 2004 Dollars

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs[24]	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1986	37.07	3507	0	27998.90	0	27998.90	755.30
1998	37.07	6591.31	0	5034.75	0	5034.75	135.82
Total – 1986-1998		***$10,098.31***		***$33,033.66***	***0***	***$33,033.66***	***$891.12***

Present Value of Osbourne Timber Sales, Evaluated at 10% - 2004 Dollars

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs[25]	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1986	37.07	3507	0	44343.04	0	44343.04	1196.20
1998	37.07	6591.31	0	5648.06	0	5648.06	152.36
Total – 1986-1998		***$10,098.31***		***$49991.10***	***0***	***$49991.10***	***$1348.56***

Present Value of Villeneuve Timber Sales, Evaluated at 7.5% - 2004 Dollars

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs[26]	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1986	36.32	$1508.94	0	$ 5,546.57	0	$ 5,546.57	$152.71
1998	36.32	$5159.68	0	$ 7,962.94	0	$ 7,962.94	$219.24
Total – 1986-1998				**$ 13,509.51**	***0***	**$ 13,509.51**	**$371.96**

Present Value of Villeneuve Timber Sales, Evaluated at 10% - 2004 Dollars

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs[27]	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1986	36.32	$1508.94	0	$ 8,389.58	0	$ 8,389.58	$ 230.99
1998	36.32	$5159.68	0	$ 9,140.69	0	$ 9,140.69	$ 251.67
Total – 1986-1998				**$ 17,530.27**	***0***	**$ 17,530.27**	**$ 482.66**

[24] There were no costs incurred as all harvest costs were covered by Domtar Inc's Woodlot Management Agreement program.
[25] There were no costs incurred as all harvest costs were covered by Domtar Inc's Woodlot Management Agreement program.
[26] All costs were incurred by Domtar Inc's Woodlot Management Agreement program.
[27] All costs were incurred by Domtar Inc's Woodlot Management Agreement program.

Present Value of Velema Timber Sales, Evaluated at 7.5%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs[28]	Present Value of Margins	Present Value Margin/Acre
1991	99.25	$708.12	0	$1,813.08	0	$1,813.08	$18.27
1995	99.25	$288.84	0	$553.78	0	$553.78	$5.58
2004	99.25	$682.55	0	$682.55	0	$682.55	$6.88
Total – 1991-2004				***$3,049.40***	***0***	***$3,049.40***	***$30.72***

Present Value of Velema Timber Sales, Evaluated at 10%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs[29]	Present Value of Margins	Present Value Margin/Acre
1991	99.25	$708.12	0	$2,444.62	0	$2,444.62	$24.63
1995	99.25	$288.84	0	$681.07	0	$681.07	$6.86
2004	99.25	$682.55	0	$682.55	0	$682.55	$6.88
Total – 1991-2004				***$3,808.24***	***0***	***$3,808.24***	***$38.37***

Present Value of Velema Christmas Tree Sales, Evaluated at 7.5%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
2002	99.25	$4,000	0	$4,622.50	0	$4,622.50	$46.57
2003	99.25	$4,000	0	$4,300.00	0	$4,300.00	$43.32
2004	99.25	$4,000	0	$4,000.00	0	$4,000.00	$40.30
Total – 2002-2004				***$12,922.50***	***0***	***$12,922.50***	***$130.20***

[28] According to the survey filled out by the Velema's, all of the costs were incurred by Domtar Inc's Woodlot Management Agreement program. However, the Case Study and Participant file indicated that there were commercial and pre commercial costs associated with marking the trees. At the moment, this write-up assumes that all costs were incurred by Domtar Inc.

[29] According to the survey filled out by the Velema's, all of the costs were incurred by Domtar Inc's Woodlot Management Agreement program. However, the Case Study and Participant file indicated that there were commercial and pre commercial costs associated with marking the trees. At the moment, this write-up assumes that all costs were incurred by Domtar Inc.

Present Value of Velema Christmas Tree Sales, Evaluated at 10%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
2002	99.25	$4,000	0	$4,840.00	0	$4,840.00	$48.77
2003	99.25	$4,000	0	$4,400.00	0	$4,400.00	$44.33
2004	99.25	$4,000	0	$4,000.00	0	$4,000.00	$40.30
Total – 2002-2004				***$13,240.00***	***0***	***$13,240.00***	***$133.40***

Present Value of Osbourne Maple Syrup Sales, Evaluated at 7.5%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1984	37.07	1300	0	0	0	0	0
1985	37.07	1300	1650	7,505.04	4,169.47	5,215.97	140.71
1986	37.07	1300	1650	7,147.66	3,970.92	4,852.06	130.89
1987	37.07	1300	1650	6,807.29	3,781.83	4,513.55	121.76
1988	37.07	1300	1650	6,483.14	3,601.74	4,198.65	113.26
1989	37.07	1300	1650	6,174.42	3,430.23	3,905.72	105.36
1990	37.07	1300	1650	5,880.40	3,266.89	3,633.23	98.01
1991	37.07	1300	1650	5,600.38	3,111.32	3,379.75	91.17
1992	37.07	1300	1650	5,333.69	2,963.16	3,143.95	84.81
1993	37.07	1300	1650	5,079.71	2,822.06	2,924.60	78.89
1994	37.07	1300	1650	4,837.82	2,687.68	2,720.56	73.39
1995	37.07	1300	1650	4,607.44	2,559.69	2,530.76	68.27
1996	37.07	1300	1650	4,388.04	2,437.80	2,354.19	63.51
1997	37.07	1300	1650	4,179.09	2,321.72	2,189.94	59.08
1998	37.07	1300	1650	3,980.08	2,211.16	2,037.16	54.95
1999	37.07	1300	1650	3,790.56	2,105.86	1,895.03	51.12
2000	37.07	1300	1650	3,610.05	2,005.59	1,762.82	47.55
2001	37.07	1300	1650	3,438.15	1,910.08	1,639.83	44.24
2002	37.07	1300	1650	3,274.43	1,819.13	1,525.43	41.15
2003	37.07	1300	1650	3,118.50	1,732.50	1,419.00	38.28
2004	37.07	1300	1650	2,970.00	1,650.00	1,320.00	35.61
Total – 1988-2004				**$ 98,205.88**	**54,558.82**	**$ 57,162.18**	**$ 1,542.01**

Present Value of Osbourne Maple Syrup Sales, Evaluated at 10%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1984	37.07	1300	0	0	0	0	0
1985	37.07	1300	1650	8,164.25	10,091.25	8,073.00	217.78
1986	37.07	1300	1650	6,512.95	9,173.86	7,339.09	197.98
1987	37.07	1300	1650	5,011.78	8,339.88	6,671.90	179.98
1988	37.07	1300	1650	3,647.07	7,581.71	6,065.36	163.62
1989	37.07	1300	1650	2,406.43	6,892.46	5,513.97	148.74
1990	37.07	1300	1650	1,278.57	6,265.87	5,012.70	135.22
1991	37.07	1300	1650	0,253.25	5,696.25	4,557.00	122.93
1992	37.07	1300	1650	9,321.13	5,178.41	4,142.73	111.75
1993	37.07	1300	1650	8,473.76	4,707.64	3,766.11	101.59
1994	37.07	1300	1650	7,703.42	4,279.68	3,423.74	92.36
1995	37.07	1300	1650	7,003.10	3,890.61	3,112.49	83.96
1996	37.07	1300	1650	6,366.46	3,536.92	2,829.54	76.33
1997	37.07	1300	1650	5,787.69	3,215.38	2,572.31	69.39
1998	37.07	1300	1650	5,261.54	2,923.08	2,338.46	63.08
1999	37.07	1300	1650	4,783.21	2,657.34	2,125.87	57.35
2000	37.07	1300	1650	4,348.38	2,415.77	1,932.61	52.13
2001	37.07	1300	1650	3,953.07	2,196.15	1,756.92	47.39
2002	37.07	1300	1650	3,593.70	1,996.50	1,597.20	43.09
2003	37.07	1300	1650	3,267.00	1,815.00	1,452.00	39.17
2004	37.07	1300	1650	2,970.00	1,650.00	1,320.00	35.61
Total – 1988-2004				**170,106.75**	**94,503.75**	**75,603.00**	**$ 2,039.47**

Present Value of Villeneuve Maple Syrup Sales, Evaluated at 7.5%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1986	36.32	3465	2065	12,736.66	7,590.54	5,146.13	141.69
1987	36.32	3465	2065	11,848.06	7,060.96	4,787.09	131.80
1988	36.32	3465	2065	11,021.45	6,568.34	4,453.11	122.61
1989	36.32	3465	2065	10,252.51	6,110.08	4,142.43	114.05
1990	36.32	3465	2065	9,537.22	5,683.80	3,853.42	106.10
1991	36.32	3465	2065	8,871.83	5,287.25	3,584.58	98.69
1992	36.32	3465	2065	8,252.87	4,918.37	3,334.49	91.81
1993	36.32	3465	2065	7,677.08	4,575.23	3,101.85	85.40
1994	36.32	3465	2065	7,141.47	4,256.03	2,885.44	79.45
1995	36.32	3465	2065	6,643.23	3,959.10	2,684.13	73.90
1996	36.32	3465	2065	6,179.75	3,682.88	2,496.87	68.75
1997	36.32	3465	2065	5,748.61	3,425.94	2,322.67	63.95
1998	36.32	3465	2065	5,347.54	3,186.92	2,160.62	59.49
1999	36.32	3465	2065	4,974.46	2,964.57	2,009.88	55.34
2000	36.32	3465	2065	4,627.40	2,757.74	1,869.66	51.48
2001	36.32	3465	2065	4,304.56	2,565.34	1,739.22	47.89
2002	36.32	3465	2065	4,004.24	2,386.37	1,617.88	44.55
2003	36.32	3465	2065	3,724.88	2,219.88	1,505.00	41.44
2004	36.32	0	0	0	0	0	0
Total – 1986-2004				**132,893.81**	**79,199.34**	**53,694.47**	**1,478.37**

Present Value of Villeneuve Maple Syrup Sales, Evaluated at 10%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1986	36.32	3465	2065	19,265.11	11,481.23	7,783.88	214.31
1987	36.32	3465	2065	17,513.74	10,437.48	7,076.26	194.83
1988	36.32	3465	2065	15,921.58	9,488.62	6,432.96	177.12
1989	36.32	3465	2065	14,474.16	8,626.02	5,848.15	161.02
1990	36.32	3465	2065	13,158.33	7,841.83	5,316.50	146.38
1991	36.32	3465	2065	11,962.12	7,128.94	4,833.18	133.07
1992	36.32	3465	2065	10,874.65	6,480.85	4,393.80	120.97
1993	36.32	3465	2065	9,886.05	5,891.69	3,994.36	109.98
1994	36.32	3465	2065	8,987.32	5,356.08	3,631.24	99.98
1995	36.32	3465	2065	8,170.29	4,869.16	3,301.13	90.89
1996	36.32	3465	2065	7,427.54	4,426.51	3,001.02	82.63
1997	36.32	3465	2065	6,752.30	4,024.10	2,728.20	75.12
1998	36.32	3465	2065	6,138.46	3,658.27	2,480.19	68.29
1999	36.32	3465	2065	5,580.42	3,325.70	2,254.71	62.08
2000	36.32	3465	2065	5,073.11	3,023.37	2,049.74	56.44
2001	36.32	3465	2065	4,611.92	2,748.52	1,863.40	51.31
2002	36.32	3465	2065	4,192.65	2,498.65	1,694.00	46.64
2003	36.32	3465	2065	3,811.50	2,271.50	1,540.00	42.40
2004	36.32	0	0	-	-	-	-
Total – 1986-2004				**173,801.25**	**103,578.52**	**70,222.73**	**$ 1,933.45**

Present Value of Osbourne Fuel Wood, Evaluated at 7.5%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1984	37.07	1300	900	5522.21	3,823.07	1699.14	45.84
1985	37.07	1300	900	5136.94	3,556.34	1580.60	42.64
1986	37.07	1300	900	4778.55	3,308.22	1470.32	39.66
1987	37.07	1300	900	4445.16	3,077.42	1367.74	36.90
1988	37.07	1300	900	4135.03	2,862.71	1272.32	34.32
1989	37.07	1300	900	3846.54	2,662.99	1183.55	31.93
1990	37.07	1300	900	3578.18	2,477.20	1100.98	29.70
1991	37.07	1300	900	3328.54	2,304.37	1024.17	27.63
1992	37.07	1300	900	3096.31	2,143.60	952.71	25.70
1993	37.07	1300	900	2880.29	1,994.05	886.24	23.91
1994	37.07	1300	900	2679.34	1,854.93	824.41	22.24
1995	37.07	1300	900	2492.41	1,725.51	766.90	20.69
1996	37.07	1300	900	2318.52	1,605.13	713.39	19.24
1997	37.07	1300	900	2156.76	1,493.14	663.62	17.90
1998	37.07	1300	900	2006.29	1,388.97	617.32	16.65
1999	37.07	1300	900	1866.32	1,292.07	574.25	15.49
2000	37.07	1300	900	1736.11	1,201.92	534.19	14.41
2001	37.07	1300	900	1614.99	1,118.07	496.92	13.40
2002	37.07	1300	900	1502.31	1,040.06	462.25	12.47
2003	37.07	1300	900	1397.50	967.50	430.00	11.60
2004	37.07	1300	900	1300.00	900.00	400.00	10.79
Total – 1988-2004				**$61,818.29**	**$42,797.28**	**$19,021.01**	**$513.11**

Present Value of Osbourne Fuel Wood, Evaluated at 10%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1984	37.07	1300	900	8,745.75	6,054.75	2,691.00	72.59
1985	37.07	1300	900	7,950.68	5,504.32	2,446.36	65.99
1986	37.07	1300	900	7,227.89	5,003.93	2,223.97	59.99
1987	37.07	1300	900	6,570.81	4,549.02	2,021.79	54.54
1988	37.07	1300	900	5,973.46	4,135.48	1,837.99	49.58
1989	37.07	1300	900	5,430.42	3,759.52	1,670.90	45.07
1990	37.07	1300	900	4,936.75	3,417.75	1,519.00	40.98
1991	37.07	1300	900	4,487.95	3,107.04	1,380.91	37.25
1992	37.07	1300	900	4,079.96	2,824.59	1,255.37	33.86
1993	37.07	1300	900	3,709.05	2,567.81	1,141.25	30.79
1994	37.07	1300	900	3,371.87	2,334.37	1,037.50	27.99
1995	37.07	1300	900	3,065.33	2,122.15	943.18	25.44
1996	37.07	1300	900	2,786.67	1,929.23	857.44	23.13
1997	37.07	1300	900	2,533.33	1,753.85	779.49	21.03
1998	37.07	1300	900	2,303.03	1,594.40	708.62	19.12
1999	37.07	1300	900	2,093.66	1,449.46	644.20	17.38
2000	37.07	1300	900	1,903.33	1,317.69	585.64	15.80
2001	37.07	1300	900	1,730.30	1,197.90	532.40	14.36
2002	37.07	1300	900	1,573.00	1,089.00	484.00	13.06
2003	37.07	1300	900	1,430.00	990.00	440.00	11.87
2004	37.07	1300	900	1,300.00	900.00	400.00	10.79
Total – 1988-2004				**$ 83,203.25**	**$ 57,602.25**	**$ 25,601.00**	**$ 690.61**

Present Value of Velema Fuel Wood, Evaluated at 7.5%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1995	99.25	$102	$75	$195.56	$143.79	$51.77	$0.52
2004	99.25	$975	$675	$975.00	$675.00	$300	$3.02
Total – 1995-2004				**$1170.56**	**$818.79**	**$351.77**	**$3.54**

Present Value of Velema Fuel Wood, Evaluated at 10%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1995	99.25	$102	$75	$240.51	$176.85	$63.66	$0.64
2004	99.25	$975	$675	$975.00	$675.00	$300.00	$3.02
Total – 1995-2004				***$1,215.51***	**$851.85**	**$363.66**	**$3.66**

Present Value of Haverstock Recreation, Evaluated at 7.5%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs[30]	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1988	127.26	890.82	0	2,833.51	0	2,833.51	22.27
1989	127.26	890.82	0	2,635.83	0	2,635.83	20.71
1990	127.26	890.82	0	2,451.93	0	2,451.93	19.27
1991	127.26	890.82	0	2,280.87	0	2,280.87	17.92
1992	127.26	890.82	0	2,121.74	0	2,121.74	16.67
1993	127.26	890.82	0	1,973.71	0	1,973.71	15.51
1994	127.26	890.82	0	1,836.01	0	1,836.01	14.43
1995	127.26	890.82	0	1,707.91	0	1,707.91	13.42
1996	127.26	890.82	0	1,588.76	0	1,588.76	12.48
1997	127.26	890.82	0	1,477.91	0	1,477.91	11.61
1998	127.26	890.82	0	1,374.80	0	1,374.80	10.80
1999	127.26	890.82	0	1,278.89	0	1,278.89	10.05
2000	127.26	890.82	0	1,189.66	0	1,189.66	9.35
2001	127.26	890.82	0	1,106.66	0	1,106.66	8.70
2002	127.26	890.82	0	1,029.45	0	1,029.45	8.09
2003	127.26	890.82	0	957.63	0	957.63	7.53
2004	127.26	890.82	0	890.82	0	890.82	7.00
Total – 1988-2004				**28,736.10**	***0***	**28,736.10**	**$225.81**

[30] There were no costs incurred as all harvest costs were covered by Domtar Inc's Woodlot Management Agreement program.

Present Value of Haverstock Recreation, Evaluated at 10%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs[31]	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1988	127.26	890.82	0	4,093.29	0	4,093.29	32.16
1989	127.26	890.82	0	3,721.18	0	3,721.18	29.24
1990	127.26	890.82	0	3,382.89	0	3,382.89	26.58
1991	127.26	890.82	0	3,075.35	0	3,075.35	24.17
1992	127.26	890.82	0	2,795.77	0	2,795.77	21.97
1993	127.26	890.82	0	2,541.61	0	2,541.61	19.97
1994	127.26	890.82	0	2,310.56	0	2,310.56	18.16
1995	127.26	890.82	0	2,100.51	0	2,100.51	16.51
1996	127.26	890.82	0	1,909.55	0	1,909.55	15.01
1997	127.26	890.82	0	1,735.96	0	1,735.96	13.64
1998	127.26	890.82	0	1,578.14	0	1,578.14	12.40
1999	127.26	890.82	0	1,434.67	0	1,434.67	11.27
2000	127.26	890.82	0	1,304.25	0	1,304.25	10.25
2001	127.26	890.82	0	1,185.68	0	1,185.68	9.32
2002	127.26	890.82	0	1,077.89	0	1,077.89	8.47
2003	127.26	890.82	0	979.90	0	979.90	7.70
2004	127.26	890.82	0	890.82	0	890.82	7.00
Total – 1988-2004				**36,118.03**	***0***	**36,118.03**	**$ 283.81**

Present Value of Osbourne Recreation, Evaluated at 7.5%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
2000	37.07	259.49	0	346.54	0	346.54	9.35
2001	37.07	259.49	0	322.36	0	322.36	8.70
2002	37.07	259.49	0	299.87	0	299.87	8.09
2003	37.07	259.49	0	278.95	0	278.95	7.53
2004	37.07	259.49	0	259.49	0	259.49	7.00
Total – 1988-2004				**$ 1,507.22**	***0***	**$ 1,507.22**	**$40.66**

[31] There were no costs incurred as all harvest costs were covered by Domtar Inc's Woodlot Management Agreement program.

Present Value of Osbourne Recreation, Evaluated at 10%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
2000	37.07	259.49	0	379.92	0	379.92	10.25
2001	37.07	259.49	0	345.38	0	345.38	9.32
2002	37.07	259.49	0	313.98	0	313.98	8.47
2003	37.07	259.49	0	285.44	0	285.44	7.70
2004	37.07	259.49	0	259.49	0	259.49	7.00
Total – 1988-2004				**$ 1,584.21**	***0***	**$ 1,584.21**	**$ 42.74**

Present Value of Villeneuve Recreation, Evaluated at 7.5%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1986	36.32	254.24	0	934.54	0	934.54	25.73
1987	36.32	254.24	0	869.34	0	869.34	23.94
1988	36.32	254.24	0	808.68	0	808.68	22.27
1989	36.32	254.24	0	752.26	0	752.26	20.71
1990	36.32	254.24	0	699.78	0	699.78	19.27
1991	36.32	254.24	0	650.96	0	650.96	17.92
1992	36.32	254.24	0	605.54	0	605.54	16.67
1993	36.32	254.24	0	563.30	0	563.30	15.51
1994	36.32	254.24	0	524.00	0	524.00	14.43
1995	36.32	254.24	0	487.44	0	487.44	13.42
1996	36.32	254.24	0	453.43	0	453.43	12.48
1997	36.32	254.24	0	421.80	0	421.80	11.61
1998	36.32	254.24	0	392.37	0	392.37	10.80
1999	36.32	254.24	0	364.99	0	364.99	10.05
2000	36.32	254.24	0	339.53	0	339.53	9.35
2001	36.32	254.24	0	315.84	0	315.84	8.70
2002	36.32	254.24	0	293.81	0	293.81	8.09
2003	36.32	254.24	0	273.31	0	273.31	7.53
2004	36.32	254.24	0	254.24	0	254.24	7.00
Total – 1986-2004				**$ 10,005.16**	***0***	**$ 10,005.16**	**$275.47**

Present Value of Villeneuve Recreation, Evaluated at 10%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1986	36.32	254.24	0	1,413.55	0	1,413.55	38.92
1987	36.32	254.24	0	1,285.05	0	1,285.05	35.38
1988	36.32	254.24	0	1,168.23	0	1,168.23	32.16
1989	36.32	254.24	0	1,062.02	0	1,062.02	29.24
1990	36.32	254.24	0	965.48	0	965.48	26.58
1991	36.32	254.24	0	877.71	0	877.71	24.17
1992	36.32	254.24	0	797.91	0	797.91	21.97
1993	36.32	254.24	0	725.38	0	725.38	19.97
1994	36.32	254.24	0	659.43	0	659.43	18.16
1995	36.32	254.24	0	599.48	0	599.48	16.51
1996	36.32	254.24	0	544.99	0	544.99	15.01
1997	36.32	254.24	0	495.44	0	495.44	13.64
1998	36.32	254.24	0	450.40	0	450.40	12.40
1999	36.32	254.24	0	409.46	0	409.46	11.27
2000	36.32	254.24	0	372.23	0	372.23	10.25
2001	36.32	254.24	0	338.39	0	338.39	9.32
2002	36.32	254.24	0	307.63	0	307.63	8.47
2003	36.32	254.24	0	279.66	0	279.66	7.70
2004	36.32	254.24	0	254.24	0	254.24	7.00
Total – 1986-2004				**$ 13,006.69**	***0***	**$ 13,006.69**	**$ 358.11**

Present Value of Velema Recreation, Evaluated at 7.5%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1991	99.25	694.75	0	1778.85	0	1778.85	17.92
1992	99.25	694.75	0	1654.74	0	1654.74	16.67
1993	99.25	694.75	0	1539.29	0	1539.29	15.51
1994	99.25	694.75	0	1431.90	0	1431.90	14.43
1995	99.25	694.75	0	1332.00	0	1332.00	13.42
1996	99.25	694.75	0	1239.07	0	1239.07	12.48
1997	99.25	694.75	0	1152.62	0	1152.62	11.61
1998	99.25	694.75	0	1072.21	0	1072.21	10.80
1999	99.25	694.75	0	997.40	0	997.40	10.05
2000	99.25	694.75	0	927.82	0	927.82	9.35
2001	99.25	694.75	0	863.09	0	863.09	8.70
2002	99.25	694.75	0	802.87	0	802.87	8.09
2003	99.25	694.75	0	746.86	0	746.86	7.53
2004	99.25	694.75	0	694.75	0	694.75	7.00
Total – 2002-2004				**$ 16,233.47**	***0***	**$ 16,233.47**	**$163.56**

Present Value of Velema Recreation, Evaluated at 10%

Year of Harvest	Woodlot Acreage	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs	Present Value of Margins	Present Value Margin/Acre
1991	99.25	694.75	0	2,398.47	0	2,398.47	24.17
1992	99.25	694.75	0	2,180.42	0	2,180.42	21.97
1993	99.25	694.75	0	1,982.20	0	1,982.20	19.97
1994	99.25	694.75	0	1,802.00	0	1,802.00	18.16
1995	99.25	694.75	0	1,638.18	0	1,638.18	16.51
1996	99.25	694.75	0	1,489.26	0	1,489.26	15.01
1997	99.25	694.75	0	1,353.87	0	1,353.87	13.64
1998	99.25	694.75	0	1,230.79	0	1,230.79	12.40
1999	99.25	694.75	0	1,118.90	0	1,118.90	11.27
2000	99.25	694.75	0	1,017.18	0	1,017.18	10.25
2001	99.25	694.75	0	924.71	0	924.71	9.32
2002	99.25	694.75	0	840.65	0	840.65	8.47
2003	99.25	694.75	0	764.23	0	764.23	7.70
2004	99.25	694.75	0	694.75	0	694.75	7.00
Total – 2002-2004				**$ 19,435.62**	***0***	**$ 19,435.62**	**$ 195.82**

APPENDIX C: CROP PRODUCTION MODEL DATA

Corn, Soybeans and Wheat Returns in Ontario, 1976-2003

	CORN			SOYBEANS			WHEAT		
	Price ($/bu)	Yield (bu/acre)	Revenue ($/acre)	Price ($/bu)	Yield (bu/acre)	Revenue ($/acre)	Price ($/bu)	Yield (bu/acre)	Revenue ($/acre)
1977	2.16		192.16	6.53		189.42	3.13		143.97
1978	2.79		223.53	7.65		175.89	4.00		164.03
1979	3.02		262.98	7.13		213.91	4.03		209.45
1980	3.84		326.03	8.52		281.11	4.46		236.56
1981	2.92		262.90	7.18		222.73	4.27		243.55
1982	2.84		278.81	6.80		204.12	3.54		173.36
1983	4.04		363.49	9.33		298.72	4.00		216.04
1984	3.40		313.15	7.54		226.16	4.19		268.24
1985	2.87		272.68	6.72		208.39	3.89		268.54
1986	2.29		226.33	6.29		201.18	2.99		173.64
1987	2.57		313.00	7.18		287.40	4.63		254.47
1988	3.63		279.69	8.46		253.92	4.16		241.51
1989	3.07		282.77	6.61		198.40	3.81		217.18
1990	2.64		285.31	6.26		231.60	3.16		205.21
1991	2.67		333.39	6.18		253.30	3.21		173.42
1992	2.77		238.11	6.83		198.10	2.80		193.42
1993	3.33		358.38	8.14		297.83	3.51		181.51
1994	3.00		356.99	7.43		285.31	3.89		252.58
1995	4.65		571.76	8.79		375.36	5.33		378.20
1996	3.89		414.28	10.07		383.70	4.93		212.90
1997	3.66		404.92	9.17		354.94	3.86		245.79
1998	3.00		350.69	7.59		280.19	3.24		215.05
1999	2.84		371.83	7.16		297.76	3.37		260.87
2000	3.23		327.76	7.08		268.89	2.69		206.12
2001	3.43		378.58	7.32		159.60	3.76		262.53
2002	3.96		494.14	8.49		316.72	4.19		309.31
2003	3.88		473.35	8.71		310.24	3.60		275.22

Price Source: Agricultural Statistics for Ontario; Publication 20; 1966-1997
OMAF Statistics Division; 1998-2003

Corn Yields (bu/acre) by Region in Ontario

Year	Southern	Western	Central	Eastern	Province
1971	81.1	82.7	74.7	80.0	80.9
1972	82.1	71.1	73.7	32.0	76.0
1973	87.9	85.7	79.8	70.2	86.0
1974	74.3	60.1	67.2	53.0	69.6
1975	96.0	92.0	79.0	70.0	92.0
1976	89.0	83.0	74.0	69.0	85.0
1977	102.0	89.0	81.0	67.0	95.0
1978	85.0	80.0	67.0	78.0	82.0
1979	95.0	87.0	82.0	79.0	90.0
1980	99.0	85.0	87.0	83.0	93.0
1981	104.0	90.0	78.0	77.0	95.0
1982	103.0	98.0	86.0	85.0	98.0
1983	101.0	90.0	72.0	74.0	92.0
1984	104.0	92.0	83.0	81.0	96.0
1985	114.0	95.0	79.0	86.0	102.0
1986	112.0	99.0	87.0	75.0	103.0
1987	118.0	122.0	104.0	106.0	117.0
1988	89.0	77.0	74.0	91.0	84.0
1989	117.0	92.0	80.0	102.0	105.0
1990	120.0	108.0	94.0	101.0	112.0
1991	109.0	125.0	80.0	103.0	110.0
1992	107.0	86.0	87.0	88.0	97.0
1993	115.6	107.7	87.8	94.6	108.6
1994	124.5	119.1	104.4	117.9	120.6
1995	117.2	123.0	100.2	114.6	117.1
1996	113.9	106.6	100.5	123.3	112.8
1997	122.1	110.7	87.3	96.7	112.4
1998	137.3	117.0	117.6	132.7	128.8
1999	127.8	130.7	118.0	131.6	128.3
2000	116.0	101.6	94.9	83.3	105.1
2001	104.1	110.4	79.9	97.6	103.1
2002	104.4	124.7	119.6	113.9	113.1
2003	133.0	121.9	112.0	132.0	127.0

Source: OMAF Publication 20, Agricultural Statistics for Ontario; 1970-1995
OMAF Statistics Website: http://www.gov.on.ca/OMAFRA/english/stats/crops/index.html

Soybean Yields (bu/acre) by Region in Ontario

Year	Southern	Western	Central	Eastern	Province
1971	28.1	27.0	27.0	27.0	28.1
1972	29.6	22.2	21.9	21.9	21.9
1973	27.8	27.1	24.7	24.7	24.7
1974	22.6	22.7	15.4	15.4	15.4
1975	30.6	25.0	24.0	24.0	24.0
1976	21.5	17.0	17.0	17.0	17.0
1977	35.5	29.0	29.0	29.0	29.0
1978	27.0	23.0	22.0	20.0	27.0
1979	35.0	30.0	30.0	30.0	35.0
1980	38.0	33.0	33.0	33.0	37.0
1981	33.0	31.0	30.0	30.0	32.0
1982	35.0	30.0	27.0	29.0	35.0
1983	29.0	32.0	25.0	26.0	29.0
1984	34.0	30.0	30.0	31.0	33.0
1985	38.0	31.0	26.0	26.0	37.0
1986	37.0	32.0	32.0	28.0	36.0
1987	42.0	40.0	33.0	32.0	41.0
1988	33.0	30.0	30.0	33.0	32.0
1989	34.0	30.0	29.0	38.0	33.0
1990	40.0	37.0	35.0	38.0	39.0
1991	36.0	41.0	29.0	34.0	36.0
1992	36.0	29.0	26.0	34.0	34.0
1993	39.1	36.6	30.9	38.8	38.1
1994	42.0	38.4	32.3	39.9	40.5
1995	41.9	42.7	34.6	34.9	41.3
1996	36.6	38.1	33.4	41.1	37.0
1997	38.7	38.7	30.0	35.6	38.0
1998	42.5	36.9	39.8	44.5	41.0
1999	40.6	41.6	35.0	41.1	40.5
2000	38.9	38.0	33.3	36.0	38.0
2001	20.9	21.8	16.0	24.3	21.1
2002	32.7	37.3	35.7	32.4	33.9
2003	29.6	35.6	28.0	41.4	31.9

Source: OMAF Publication 20, Agricultural Statistics for Ontario; 1970-1995
OMAF Statistics Website: http://www.gov.on.ca/OMAFRA/english/stats/crops/index.html

NOTES: Southern Region - For data points from 1972 - 1977 regional yield averages were not available. The southern yield is calculated using the average of the following counties: Brant, Elgin, Essex, Haldimand, Kent, Lambton, Middlesex, Niagara, Norfolk and Oxford.

Western Region - Huron County is used as the representative yield for the western region. In 1975 and 1976, no data was provided for Huron County, the "other" yield estimate was used.

Winter Wheat Yields (bu/acre) by Region in Ontario

Year	Southern	Western	Central	Eastern	Province
1971	41.5	41.4	40.5	38.2	41.3
1972	44.3	42.7	40.9	30.7	43.5
1973	38.9	41.5	41.9	30.4	39.5
1974	46.9	45.2	38.2	22.5	45.4
1975	51.0	43.0	44.0	30.0	49.0
1976	49.0	48.0	37.0	24.0	48.0
1977	55.0	46.0	43.0	36.0	52.0
1978	42.0	41.0	39.0	39.0	41.0
1979	53.0	52.0	43.0	42.0	52.0
1980	57.0	53.0	42.0	39.0	54.0
1981	51.0	57.0	45.0	44.0	52.0
1982	40.0	49.0	43.0	42.0	43.0
1983	51.0	54.0	41.0	30.0	50.0
1984	56.0	64.0	49.0	44.0	57.0
1985	68.0	69.0	58.0	55.0	67.0
1986	53.0	58.0	53.0	50.0	54.0
1987	51.0	55.0	51.0	50.0	52.0
1988	55.0	58.0	45.0	47.0	55.0
1989	55.0	57.0	50.0	36.0	55.0
1990	67.0	65.0	46.0	42.0	64.0
1991	52.0	54.0	52.0	48.0	53.0
1992	69.0	69.0	57.0	59.0	68.0
1993	53.7	51.7	48.4	45.0	52.5
1994	64.0	64.9	55.2	47.5	63.4
1995	71.7	70.9	56.1	56.0	69.9
1996	40.7	43.2	42.4	35.8	41.7
1997	61.7	63.6	51.1	40.6	61.1
1998	62.8	66.4	51.7	40.7	62.7
1999	73.1	77.3	59.8	50.9	73.2
2000	76.0	76.5	57.2	44.9	74.3
2001	74.9	69.9	61.5	60.0	71.9
2002	72.4	73.8	65.5	58.1	72.1
2003	78.5	76.5	63.4	53.8	76.3

Source: OMAF Publication 20, Agricultural Statistics for Ontario; 1970-1995
OMAF Statistics Website: http://www.gov.on.ca/OMAFRA/english/stats/crops/index.html

Variable, Fixed and Total Cost of Production for Corn, Soybeans and Wheat, 1976-2003

	CORN				SOYBEANS				WHEAT			
	Variable	Est. Variable	Fixed	Total	Variable	Fixed	Est. Variable	Total	Variable	Est. Variable	Fixed	Total
1977				*225.00*	88.9	13.85	7.00	109.75				*126.84*
1978				*225.00*	95	17	7.00	119.00				*126.84*
1979				*225.00*	109	20.7	7.00	136.70				*126.84*
1980	167.50	15.50	42	225.00	105	41	9.98	155.98	87	8.84	31	126.84
1981	180	15.50	52	247.50	108	45	9.98	162.98	94	8.84	38	140.84
1982	205	15.50	57	277.50	113	49	9.98	171.98	106	8.84	44	158.84
1983	199	15.50	58	272.50	111	49	9.98	169.98	107	8.84	45	160.84
1984				*284.07*	146.31	31.6	5.00	182.91				*168.97*
1985	253.55	4.83	37.25	295.63	150.91	31.4	5.00	187.31	141.25	4.00	31.85	177.10
1986	248.85	4.83	35.9	289.58	151.78	30.9	5.00	187.68	132.55	4.00	26.45	163.00
1987	257.79	4.83	25.62	288.24	149.5	23.2	5.00	177.70	132.2	4.00	24.37	160.57
1988	243.13	4.83	25.7	273.66	151.52	23.24	13.04	187.80	122.25	4.00	22.73	148.98
1989	202		85	287	113	80	5.00	198.00	119		85	204.00
1990	166.3	68.97	45	280.27	84.2	44	52.07	180.27	96.4	29.93	42	168.33
1991	159.4	69.62	45	274.02	89.2	44	52.07	185.27	83.1	29.93	42	155.03
1992				*294.15*				*195.17*				*155.38*
1993	205	63.28	46	314.28	117	36	52.07	205.07	110	13.74	32	155.74
1994				*322.34*				*206.57*				*157.24*
1995	219.5	64.66	46.25	330.41	118.5	37.5	52.07	208.07	111	13.74	34	158.74
1996				*342.26*			52.07	*209.57*				*165.99*
1997	241.5	66.10	46.5	354.10	121	38	52.07	211.07	125	13.74	34.5	173.24
1998	238.55	66.85	46.5	351.90	143.25	38	52.07	233.32	126.05	13.74	34.5	174.29
1999	232.5	67.61	46.5	346.61	136.75	38	52.07	226.82	108.05	13.74	34.5	156.29
2000	236	68.38	46.5	350.88	136.65	38	52.07	226.72	136.25	13.74	34.5	184.49
2001	244.4	69.17	46.5	360.07	138.25	38	52.07	228.32	128.55	13.74	37.7	179.99
2002	229.5	69.97	50.8	350.27	130.25	41.6	52.07	223.92	128.75	13.74	37.7	180.19
2003	313		36	369	154	58	7.00	212.00	162	8.84	68	230.00

Italicized data was not available.

APPENDIX D: CROP PRODUCTION MODEL DATA IN EASTERN ONTARIO

Present Value of Corn, Soybeans and Wheat Rotation in Eastern Ontario Evaluated at 7.5%, 2005 - 2021 (Eastern Region of Ontario) – 2005 Dollars (Van Sleuwen Case)

Year of Harvest	Actual Revenue/Acre	Actual Costs/Acre	Present Value Revenue/Acre	Present Value Costs/Acre	Margin/Acre
2005	306.97	253.98	307.0	254.0	53.0
2006	306.97	253.98	285.6	236.3	49.3
2007	306.97	253.98	265.6	219.8	45.9
2008	306.97	253.98	247.1	204.4	42.7
2009	306.97	253.98	229.9	190.2	39.7
2010	306.97	253.98	213.8	176.9	36.9
2011	306.97	253.98	198.9	164.6	34.3
2012	306.97	253.98	185.0	153.1	31.9
2013	306.97	253.98	172.1	142.4	29.7
2014	306.97	253.98	160.1	132.5	27.6
2015	306.97	253.98	148.9	123.2	25.7
2016	306.97	253.98	138.5	114.6	23.9
2017	306.97	253.98	128.9	106.6	22.2
2018	306.97	253.98	119.9	99.2	20.7
2019	306.97	253.98	111.5	92.3	19.3
2020	306.97	253.98	103.7	85.8	17.9
2021	306.97	253.98	96.5	79.8	16.7
TOTAL					**537.4**

Present Value of Corn, Soybeans and Wheat Rotation in Eastern Ontario Evaluated at 7.5%, 1988 - 2004 (Eastern Region of Ontario) – 2004 Dollars (Haverstock Case)

Year of Harvest	Actual Revenue/Acre	Actual Costs/Acre	Present Value Revenue/Acre	Present Value Costs/Acre	Margin/Acre
1988	268.52	203.48	854.11	647.23	206.88
1989	233.99	229.67	692.36	679.56	12.80
1990	212.42	209.62	584.69	576.98	7.71
1991	212.97	204.77	545.29	524.30	20.99
1992	213.77	214.90	509.14	511.84	-2.70
1993	262.84	225.03	582.34	498.57	83.77
1994	278.23	228.72	573.45	471.39	102.06
1995	379.41	232.41	727.41	445.58	281.84
1996	356.39	239.27	635.62	426.73	208.88
1997	279.04	246.14	462.94	408.35	54.59
1998	289.15	253.17	446.25	390.71	55.54
1999	280.12	243.24	402.14	349.20	52.95
2000	214.81	254.03	286.88	339.25	-52.37
2001	245.98	256.12	305.58	318.18	-12.60
2002	323.32	251.46	373.64	290.59	83.05
2003	355.64	270.33	382.31	290.61	91.70
2004	345.87	293.67	345.87	293.67	52.20
TOTAL					***$1,247.29***

Present Value of Corn, Soybeans and Wheat Rotation Evaluated at 10%, 2005 - 2021 (Eastern Region of Ontario) – 2005 Dollars (Van Sleuwen case)

Year of Harvest	Actual Revenue/Acre	Actual Costs/Acre	Present Value Revenue/Acre	Present Value Costs/Acre	Margin/Acre
2005	306.97	253.98	307.0	254.0	53.0
2006	306.97	253.98	279.1	230.9	48.2
2007	306.97	253.98	253.7	209.9	43.8
2008	306.97	253.98	230.6	190.8	39.8
2009	306.97	253.98	209.7	173.5	36.2
2010	306.97	253.98	190.6	157.7	32.9
2011	306.97	253.98	173.3	143.4	29.9
2012	306.97	253.98	157.5	130.3	27.2
2013	306.97	253.98	143.2	118.5	24.7
2014	306.97	253.98	130.2	107.7	22.5
2015	306.97	253.98	118.4	97.9	20.4
2016	306.97	253.98	107.6	89.0	18.6
2017	306.97	253.98	97.8	80.9	16.9
2018	306.97	253.98	88.9	73.6	15.3
2019	306.97	253.98	80.8	66.9	14.0
2020	306.97	253.98	73.5	60.8	12.7
2021	306.97	253.98	66.8	55.3	11.5
TOTAL					**$67.6**

Present Value of Corn, Soybeans and Wheat Rotation Evaluated at 10%, 1988 to 2004 (Eastern Region of Ontario) – 2004 Dollars (Haverstock Case)

Year of Harvest	Actual Revenue/Acre	Actual Costs/Acre	Present Value Revenue/Acre	Present Value Costs/Acre	Margin/Acre
1988	268.52	203.48	1233.85	934.99	298.86
1989	233.99	229.67	977.45	959.37	18.07
1990	212.42	209.62	806.68	796.04	10.64
1991	212.97	204.77	735.23	706.93	28.31
1992	213.77	214.90	670.89	674.45	-3.56
1993	262.84	225.03	749.90	642.03	107.87
1994	278.23	228.72	721.67	593.23	128.44
1995	379.41	232.41	894.62	548.00	346.62
1996	356.39	239.27	763.96	512.90	251.06
1997	279.04	246.14	543.77	479.65	64.12
1998	289.15	253.17	512.25	448.50	63.75
1999	280.12	243.24	451.13	391.73	59.40
2000	214.81	254.03	314.51	371.92	-57.41
2001	245.98	256.12	327.40	340.90	-13.50
2002	323.32	251.46	391.22	304.26	86.96
2003	355.64	270.33	391.20	297.37	93.83
2004	345.87	293.67	345.87	293.67	52.20
TOTAL					***$1,535.66***

Present Value of Corn, Soybeans and Wheat Rotation in Eastern Ontario Evaluated at 7.5%, 1986 - 2004 (Eastern Region of Ontario) – 2004 Dollars (Villeneuve Case)

Year of Harvest	Actual Revenue/Acre	Actual Costs/Acre	Present Value Revenue/Acre	Present Value Costs/Acre	Margin/Acre
1986	165.72	213.42	609.17	784.49	-175.32
1987	244.40	208.84	835.69	714.09	121.60
1988	268.52	203.48	854.11	647.23	206.88
1989	233.99	229.67	692.36	679.56	12.80
1990	212.42	209.62	584.69	576.98	7.71
1991	212.97	204.77	545.29	524.30	20.99
1992	213.77	214.90	509.14	511.84	-2.70
1993	262.84	225.03	582.34	498.57	83.77
1994	278.23	228.72	573.45	471.39	102.06
1995	379.41	232.41	727.41	445.58	281.84
1996	356.39	239.27	635.62	426.73	208.88
1997	279.04	246.14	462.94	408.35	54.59
1998	289.15	253.17	446.25	390.71	55.54
1999	280.12	243.24	402.14	349.20	52.95
2000	214.81	254.03	286.88	339.25	-52.37
2001	245.98	256.12	305.58	318.18	-12.60
2002	323.32	251.46	373.64	290.59	83.05
2003	355.64	270.33	382.31	290.61	91.70
2004	345.87	293.67	345.87	293.67	52.20
TOTAL					***$1193.56***

Present Value of Corn, Soybeans and Wheat Rotation Evaluated at 10%, 1986 to 2004 (Eastern Region of Ontario) – 2004 Dollars (Villeneuve Case)

Year of Harvest	Actual Revenue/Acre	Actual Costs/Acre	Present Value Revenue/Acre	Present Value Costs/Acre	Margin/Acre
1986	165.72	213.42	921.42	1186.60	-265.19
1987	244.40	208.84	1235.31	1055.56	179.74
1988	268.52	203.48	1233.85	934.99	298.86
1989	233.99	229.67	977.45	959.37	18.07
1990	212.42	209.62	806.68	796.04	10.64
1991	212.97	204.77	735.23	706.93	28.31
1992	213.77	214.90	670.89	674.45	-3.56
1993	262.84	225.03	749.90	642.03	107.87
1994	278.23	228.72	721.67	593.23	128.44
1995	379.41	232.41	894.62	548.00	346.62
1996	356.39	239.27	763.96	512.90	251.06
1997	279.04	246.14	543.77	479.65	64.12
1998	289.15	253.17	512.25	448.50	63.75
1999	280.12	243.24	451.13	391.73	59.40
2000	214.81	254.03	314.51	371.92	-57.41
2001	245.98	256.12	327.40	340.90	-13.50
2002	323.32	251.46	391.22	304.26	86.96
2003	355.64	270.33	391.20	297.37	93.83
2004	345.87	293.67	345.87	293.67	52.20
TOTAL					***$1450.21***

Present Value of Corn, Soybeans and Wheat Rotation in Eastern Ontario Evaluated at 7.5%, 1984 - 2004 (Eastern Region of Ontario) – 2004 Dollars (Osbourne Case)

Year of Harvest	Actual Revenue/Acre	Actual Costs/Acre	Present Value Revenue/Acre	Present Value Costs/Acre	Margin/Acre
1984	231.27	211.98	982.41	900.47	81.94
1985	211.89	220.01	837.29	869.38	-32.09
1986	165.72	213.42	609.17	784.49	-175.32
1987	244.40	208.84	835.69	714.09	121.60
1988	268.52	203.48	854.11	647.23	206.88
1989	233.99	229.67	692.36	679.56	12.80
1990	212.42	209.62	584.69	576.98	7.71
1991	212.97	204.77	545.29	524.30	20.99
1992	213.77	214.90	509.14	511.84	-2.70
1993	262.84	225.03	582.34	498.57	83.77
1994	278.23	228.72	573.45	471.39	102.06
1995	379.41	232.41	727.41	445.58	281.84
1996	356.39	239.27	635.62	426.73	208.88
1997	279.04	246.14	462.94	408.35	54.59
1998	289.15	253.17	446.25	390.71	55.54
1999	280.12	243.24	402.14	349.20	52.95
2000	214.81	254.03	286.88	339.25	-52.37
2001	245.98	256.12	305.58	318.18	-12.60
2002	323.32	251.46	373.64	290.59	83.05
2003	355.64	270.33	382.31	290.61	91.70
2004	345.87	293.67	345.87	293.67	52.20
TOTAL					***$1,243.41***

Present Value of Corn, Soybeans and Wheat Rotation Evaluated at 10%, 1984 to 2004 (Eastern Region of Ontario) – 2004 Dollars (Osbourne Case)

Year of Harvest	Actual Revenue/Acre	Actual Costs/Acre	Present Value Revenue/Acre	Present Value Costs/Acre	Margin/Acre
1984	231.27	211.98	1555.89	1426.11	129.78
1985	211.89	220.01	1295.92	1345.59	-49.67
1986	165.72	213.42	921.42	1186.60	-265.19
1987	244.40	208.84	1235.31	1055.56	179.74
1988	268.52	203.48	1233.85	934.99	298.86
1989	233.99	229.67	977.45	959.37	18.07
1990	212.42	209.62	806.68	796.04	10.64
1991	212.97	204.77	735.23	706.93	28.31
1992	213.77	214.90	670.89	674.45	-3.56
1993	262.84	225.03	749.90	642.03	107.87
1994	278.23	228.72	721.67	593.23	128.44
1995	379.41	232.41	894.62	548.00	346.62
1996	356.39	239.27	763.96	512.90	251.06
1997	279.04	246.14	543.77	479.65	64.12
1998	289.15	253.17	512.25	448.50	63.75
1999	280.12	243.24	451.13	391.73	59.40
2000	214.81	254.03	314.51	371.92	-57.41
2001	245.98	256.12	327.40	340.90	-13.50
2002	323.32	251.46	391.22	304.26	86.96
2003	355.64	270.33	391.20	297.37	93.83
2004	345.87	293.67	345.87	293.67	52.20
TOTAL					***$1530.32***

Present Value of Corn, Soybeans and Wheat Rotation Evaluated at 7.5%, 1991 to 2004 (Eastern Region of Ontario) – 2004 Dollars (Velema Case)

Year of Harvest	Actual Revenue/Acre	Actual Costs/Acre	Present Value Revenue/Acre	Present Value Costs/Acre	Margin/Acre
1991	212.97	204.77	545.29	524.30	20.99
1992	213.77	214.90	509.14	511.84	-2.70
1993	262.84	225.03	582.34	498.57	83.77
1994	278.23	228.72	573.45	471.39	102.06
1995	379.41	232.41	727.41	445.58	281.84
1996	356.39	239.27	635.62	426.73	208.88
1997	279.04	246.14	462.94	408.35	54.59
1998	289.15	253.17	446.25	390.71	55.54
1999	280.12	243.24	402.14	349.20	52.95
2000	214.81	254.03	286.88	339.25	-52.37
2001	245.98	256.12	305.58	318.18	-12.60
2002	323.32	251.46	373.64	290.59	83.05
2003	355.64	270.33	382.31	290.61	91.70
2004	345.87	293.67	345.87	293.67	52.20
TOTAL					***$1019.89***

Present Value of Corn, Soybeans and Wheat Rotation Evaluated at 10%, 1991 to 2004 (Eastern Region of Ontario) – 2004 Dollars (Velema Case)

Year of Harvest	Actual Revenue/Acre	Actual Costs/Acre	Present Value Revenue/Acre	Present Value Costs/Acre	Margin/Acre
1991	212.97	204.77	735.23	706.93	28.31
1992	213.77	214.90	670.89	674.45	-3.56
1993	262.84	225.03	749.90	642.03	107.87
1994	278.23	228.72	721.67	593.23	128.44
1995	379.41	232.41	894.62	548.00	346.62
1996	356.39	239.27	763.96	512.90	251.06
1997	279.04	246.14	543.77	479.65	64.12
1998	289.15	253.17	512.25	448.50	63.75
1999	280.12	243.24	451.13	391.73	59.40
2000	214.81	254.03	314.51	371.92	-57.41
2001	245.98	256.12	327.40	340.90	-13.50
2002	323.32	251.46	391.22	304.26	86.96
2003	355.64	270.33	391.20	297.37	93.83
2004	345.87	293.67	345.87	293.67	52.20
TOTAL					***$1208.08***

APPENDIX E: ECONOMIC VALUE OF ALTERNATIVE LAND USE: RECREATION

An economic literature review was conducted to assess the monetary value of recreational benefits during the use of private woodlots, for example the value of hiking and hunting. This section summarizes the methods used in the literature and discusses the monetary values derived.

A study by Casey, Vukina and Danielson (1995) evaluated the economic value of hiking using the travel cost method[32] to measure the net benefits of recreation services from the Grandfather Mountain Wilderness Preserve (GMWP) in Linville, North Carolina. The net benefit of the recreation services to hikers was measured by calculating the consumer surplus that accrues to hikers at GMWP. The consumer surplus estimate was the dollar value of recreation services (hiking) to an individual hiker. It could also be interpreted as the compensation that would be required to keep the hiker at the same utility level, given the closure of the hiking trails.

Casey et al use revealed preference to estimate the mean consumer surplus. The results from the wage rate model indicate that consumer's value hiking in the GMWP at approximately US$1,206 (C[33]$1,562) per person per year. The mean consumer surplus estimated using the revealed value of time model were more than twice as high as the wage rate model, as consumers valued hiking at an estimated US$2,892 (C$3,746) per person per year.

A study by Boxall et al (1996) estimated the economic value of four forest ecosystems, fire-damaged forests, cut blocks and several park management features for backcountry recreationists in Nopoming Provincial Park in eastern Manitoba. Of particular interest to this study were the results regarding the four ecosystems: jack pine, white spruce, black spruce and aspen.

The analysis used the travel cost random utility model (RUM)[34] to estimate the per trip recreational value of a hectare of forest ecosystem. The RUM was chosen because it allowed

[32] The travel cost method (TCM) recognizes that the full price paid by persons for a good such as a visit to a recreational site is more than just the admission fee. It also includes the costs of traveling to and from the site. Among these travel costs are the opportunity cost of time spent traveling, the operating cost of vehicles used to travel, the costs of accommodations for overnight stays while traveling or visiting, and parking fees at the site. The sum of all of these costs gives the total cost of a visit to the site. This total cost is used as an explanatory variable in place of the admission price (Boardman, 1996).

[33] The exchange rate used in this calculation was obtained from the Bank of Canada website: Can$/US$ Closing Rate for January 22, 2004 of $1.2953.

[34] The random utility model (RUM) has become the preferred way to value quality at recreation sites. This is essentially a site selection model where it is believed that people trade off travel costs and quality when making trip decisions. The RUM is also widely used to in transportation economics to value alternative modes of travel (Sandefur et al., 1996).

direct valuation of forest attributes. The results vary among the four ecosystems and depend on the area evaluated and specific site characteristics. For jack pine, the recreational value of one hectare of jack pine per trip was estimated between $0.24 and $0.001, for white spruce the recreational value per trip per hectare was estimated between $0.025 and $0.06. The results predict, however, that recreationists would pay to avoid black spruce and aspen. The recreational values per trip associated with a hectare of black spruce ranged between ($0.02) and ($0.002) and for a hectare of aspen they were between ($0.021) and ($0.001).

The Canada-British Columbia Partnership Agreement on Forest Resource Development (1995) evaluated the value of wilderness protection and recreation in British Columbia. A province wide mail survey was undertaken in April 1993 to determine provincial residents' views regarding wilderness issues and the values they place on protecting wilderness and participating in wilderness recreation. Designated wilderness areas were defined as roadless, undeveloped natural areas, established and set aside from development by law. Respondents were asked in the form of a referendum like question how much more taxes and fees their household would be willing to pay for a doubling of protected wilderness from 5% to 10% of the land base spread throughout the province. They were asked the same question for the value of tripling the designated wilderness from 5% to 15% of the Province.

It was determined that the willingness to pay to double the protected wilderness land base (from 5% to 10%) was between $108-130, on average, annually per household, in increased taxes and fees. Similarly, to triple the protected wilderness land base (from 5% to 15%), the willingness to pay averaged between $149-156 per household per year, in increased taxes and fees.

Finally, a study by Hailu et al (2000) utilizes the contingent valuation method[35] (in a multi-program valuation format) that allows respondents to choose any combination of three different ecosystem conservation programs. The study involves the valuation of preserving three ecosystems in Alberta. They include: old growth forests, prairie grasslands, and stream ecosystems (in the mountains). These three ecosystems provide habitat to many threatened species, but the three outlined in this paper include woodland caribou, the burrowing owl and bull trout. The programs were described to the respondents and the respondent was allowed to pick any combination of the programs in four different scenarios (the scenarios were constructed from four household tax/price levels for the three different programs). The willingness to pay for each of these programs individually, and for different combinations of the programs, was calculated.

The mean willingness to pay for the woodland conservation program (which is of interest to this report) was estimated at $45.76 per household per year.

The table below summarizes the recreation values estimated for forestry and woodlot use from the four studies reviewed.

[35] The contingent valuation approach relies on surveys to ascertain how much respondents would be willing to pay to preserve the environment, to reduce the amount of man-made injury to it, or to lower the various types of environmental risk posed by modern industrial society (Boardman et al., 1996).

Summary of Woodlot Recreation Values from Literature Review

Study	Method	Results
Casey et al. (1995)	• Travel Cost Method • Mean Consumer Surplus	Wage Rate Model: • $1,206 (US)/person/household Revealed Value of Time: • $2,892 (US)/person/household
Boxall et al. (1996)	• Travel Cost Random Utility • Per Trip Recreational Value	Jack Pine (1 hectare): • $0.24-$0.01 White Spruce (1 hectare): • $0.025-$0.06 Black Spruce (1 hectare): • ($0.02-$0.002) Aspen (1 hectare): • ($0.021-$0.001)
Canada-BC Partnership Agreement on Forest Resource Development (1995)	• Mail Survey • Willingness to Pay	Double Protection: • $108-130 /household/year Triple Protection: • $149-156 /household/year
Hailu et al (2000)	• Contingent Valuation Method • Willingness to Pay	Woodland Program Conservation: • $45.76 /household/year

Consultations were undertaken with various owners and lessees of woodlots, to determine other alternative revenue methods for the use of woodlots, and the estimated revenue received from these uses. Woodlots for the purpose of hunting appear to have a high value. For the sake of anonymity, the names will not be revealed.

A former tour guide for an outfitter profiling waterfowl hunting opportunities revealed that landowners who permitted guided hunts on their property received a percentage of the income from the hunt. Through this agreement, landowners could earn up to $1,000 each autumn. Other advantages of this agreement include a reduced incidence of trespassing and an active effort to manage the local Canadian goose population.

A Sportsman's Club in northern Montana which leases land to hunt waterfowl, deer, turkey and upland game estimated they pay up to US$7.50 (C[36]$9.71) per acre to lease land, which has increased considerably from the US$0.50/acre (C$0.64) they were paying in 1990.

One woodlot owner estimated that he receives over $1,000 annually from deer hunters who use the land for hunting (approximately 150-200 acres). The hunters value this woodlot because of the abundance of deer in the area. Similarly, another woodlot owner estimated that he receives $3,000 annually from a group leasing his land (approximately 50 acres) for camping and fishing purposes.

The table below summarizes the recreational values identified in the paragraphs above.

[36] The exchange rate used in this calculation was obtained from the Bank of Canada website: Can$/US$ Closing Rate for January 22, 2004 of $1.2953.

Summary of Actual Recreational Values Received by Woodlot Owners for Hunting, Camping and Fishing

	Recreation	Value Received
Tour Guide Operator (Canada)	Waterfowl hunting	Landowner Received: $1,000/year
Sportsman's Club (northern Montana)	Waterfowl, deer, turkey and upland game	Landowner Received: C$9.71/acre (to lease)
Landowner with 250 acres (Canada)	Deer hunters	Landowner Received: $1,000/year
Landowner with 50 acres	Camping and Fishing	Landowner Received: $3,000/year

Alternative uses of woodlots, for the purpose of hunting for example, can be an additional revenue source for woodlot owners. These alternative uses need to be accounted for.