BUILDING A CASE FOR SUSTAINABLE MANAGEMENT OF PRIVATE WOODLANDS

CASE STUDY: BARRIE WOODLOT

What factors motivate private woodland owners to manage their woodlots sustainably? For some it is personal interest or stewardship ethic, while others may be more influenced by potential for economic returns.

This is one of several case studies profiling woodland owners who have not only demonstrated long-term stewardship of their forests, but have also documented financial returns over the years. The case studies have been undertaken, in part, to investigate if economic returns from woodlots can compare favourably with those from agriculture. Returns from these managed forests (mostly from timber sales but possibly including other activities such as production of maple syrup) have been compared to the income from agricultural crops on comparable land over the same period.

It is hoped these case studies will provide incentive for woodlot owners to manage their woodlots responsibly, either by demonstrating the potential for enhanced long-term financial returns or through the example of responsible stewardship provided by the woodland owners profiled in the case studies.

We appreciate the assistance of the woodland owners who have so generously shared their stories with us.

Part One: The George and Sandy Barrie Woodlot Story

by Keith Roulston, Publisher, the Rural voice

George Barrie and his son Sandy, grow the usual southern Ontario crops of corn, soybeans and wheat and raise some livestock on their 250-acre Cambridge-area farm but the best profit per acre, George says, comes from their 45 acre hardwood woodlot. The Barries sell firewood in the fall, make maple syrup in the spring and cut small lots of timber during the winter and produce more return from their trees than their cleared land.

The farm sits on Dumfries loam soil that is somewhat gravelly. Maples grow well on it. The soil is prone to drought Sandy says and the last few years (early 2000's) both crops and trees have been affected by dry weather. Besides the hardwood forest, a 12-acre area of fragile soil was reforested with red pine and black walnuts in 1968. Another three acres of fragile land was reforested with black locust as a nurse crop for black walnut under the National Soil Conservation Program in 1992.

The 1968 reforestation was carried out under the Woodlot Improvement Act Program, which, George says, changed his whole thinking about his woodlot. Under that act the Ministry of Natural Resources offered the expertise of professional foresters to help manage woodlots, a new concept for nearly all

farmers at the time. The MNR used part of the Barrie woodlot as a demonstration area, installing some permanent logging trails in the bush.

"It got us interested in what we had there," George says, and the first thing he realized was that his woodlot was too dense to allow optimum growth. Forest technicians developed a thinning plan and the Barries, with their own firewood business, worked away at it each winter.

For the Barries, the number one management objective for their woodlot is income. There are three main sources of income; sawlogs, fuelwood and maple syrup. Their maple syrup operation has about 1,100 taps with most of the syrup being sold right at the door, though they also sell their own and some purchased maple syrup at the Cambridge farmers' market each spring. They began producing syrup in 1987. "Had we known what hard maple was going to do since then (in timber prices) I think maybe we would have questioned drilling holes in the trees," Sandy says with a wry smile. Only about a third of the woodlot has been tapped to take advantage of the hills in this area to make flow through the pipelines easier.

Income from maple syrup, like so many areas of farming, is dependent on weather. Both the amount of syrup and the quality can be affected if the perfect conditions of warm days and cold nights don't arrive on time. With 22 taps per acre, at an industry-average estimated yield at 8 litres per tap and a $5 profit per litre, they average $88 profit per acre.

For many years, they hosted paid school tours to show children how maple syrup is made both in the bush and the sugar house. "How often do you have the opportunity to educate your future consumers" Sandy says. In future when those children, their parents or their teachers, think of maple syrup, "they'll think of us and they'll know how to get here."

Most of the time the Barries do their own logging. Usually they cut and skid their own trees. Using their tractor they skid the logs to the barnyard then timber buyers are invited to bid. It's labour intensive and it's risky. You need to be safety conscious. That's why not everybody's in it. A few times when they've had a large cut they've called for competitive bids after having the trees marked. But most farms have the necessary equipment. You have a tractor and a front-end loader, a chain saw and a wood splitter and a pickup truck for deliveries."

"Because we have a firewood market, we can pretty well harvest trees one at a time, harvest the logs and clean up the tops for firewood," George says. "It's pretty well an annual process that we have logs to sell and firewood." Over the last 10 years they have had timber sales of $109,000 from their 45-acre woodlot for about $240 annual income per acre (present value).

George's advice for any woodlot owner is to hire a consultant to help decide which trees should be cut and to get competitive bids. As an example he points to 50 trees they offered for sale in 2001 with the resulting bids ranging from a low of $24,600 to a high of $38,570. The few dollars spent on a consultant could bring a huge return.

They sell 150-200 face cords of wood a year. "It's directly proportional to the amount of work we want to do," Sandy says. "There is no end to the market. We've yet to satisfy the market for firewood. There are lots of people who want to buy wood but there are few people who want to cut firewood." The vast majority of buyers are what Sandy calls "recreational burners" who want to have a fire in a fireplace or stove but not heat with wood. Firewood sales have averaged $60 per acre over that 10-year period. "All sources of income from the hardwood woodlot add up to $416 per acre per year", George says.

There are low input costs for the woodlot, unlike the cash crops. Trees reseed themselves and don't need to be cultivated, fertilized or sprayed with pesticides. The family does their own labour. "Working in the woodlot is not time-critical," George says. "Unlike field crops where there is a narrow window for planting or harvest, you can do your bush work when you have time. From early November to March you can work whenever you have time".

An added advantage from the woodlot is that prices remain more stable than for field crops such as soybeans. "You know Brazil isn't going to flood the market for firewood," Sandy smiles. "We basically set our price." There's also more flexibility in deciding when to sell. Unlike livestock that must go to market when it's ready no matter the price, trees can be left to grow another year or two if prices aren't favourable.

Another management objective for the Barries is wood products for their own use. Much of the wood

for renovations in the barn over the years, from timbers to siding, has come from lumber sawn from their own trees.

Environmental protection is also a management objective. The woodlots are all designated environmentally sensitive protected areas by the Region of Waterloo so woodlots produce income on land that couldn't be used for cropping practices. Wildlife is abundant in the area with deer, wild turkey and coyotes. A bird inventory taken by the Canadian Wildlife Service recorded wood thrush, rose-breasted grosbeaks and scarlet tanager, among others..

The Grand Valley Hiking Trail also goes through the woodlot. The Barries have had very few problems with hikers and skiers on the trails. They also allow hunters for deer and wild turkeys. The Barrie history of care for their woodlot goes back for many years with George's father William sitting on the county tree commission that existed in those days. Even back then the family had a firewood business and George remembers helping deliver firewood to customers in Ayr with his father as a youngster. Fences on the farm were sometimes still the root fences that resulted from stumps being dug out after the land was cleared.

George, and his wife Gwen, have developed a greater appreciation of his woodlot over the last 35 years. "Trees are a crop," he says. "You have to have a long-term outlook but I'm kind of amazed at the income we're getting from the woodlot," George says. "I never suspected there was that much in it." It has taken a long time to get the woodlot to the point where it is producing at an optimum level, he says, but looking at their returns he thinks that if a person had 150 acres of woodlot producing at this level it could be his sole enterprise. There are many good reasons to grow trees but in the end the bottom line is one of the best for the Barries. Over the years the return on an investment in a good woodlot will out-pace mutual funds, Sandy concludes.

2012 Update

In 2007 George and Sandy sold their farm to Brian Houston and family. Brian is continuing with the maple syrup and fuelwood operations. Market conditions and forest stocking will help determine the next sawlog harvest.

Is This Forest Being Managed in a Sustainable Way?

It has been asked if the forests profiled in these case studies are being managed sustainably, or if the growing stock may have been sacrificed in the interest of short term economic gain. In an effort to answer this question an inventory was carried out in several of the case study sites and the data compared to the recommended stand structure diagram for tolerant hardwoods in Site region 6E (which includes much of the area where these case studies are located). The stand structure diagram (see "Recommended" curve in Figure 1) represents the ideal size class distribution in an all age forest being managed under a single tree selection system, as is recommended for upland tolerant hardwood forests such as the one represented in this case study. The "y" axis represents the number of trees per unit of area, while the "x" axis represents the diameter at breast height (dbh) of the trees. The resulting curve, often referred to as a "Reverse J" curve, is representative of trees found in a well managed stand, i.e. many trees in the smaller size classes and progressively fewer as size increases. When the stand structure of the Barrie woodlot is compared to the recommended distribution there are some minor differences (i.e. a deficit of trees from 10 to 25cm and a surplus from 45 to 55 cm), but on the whole the Barrie structure compares quite favourably with that recommended, allowing us to conclude that the forest is in a reasonably good state of management.

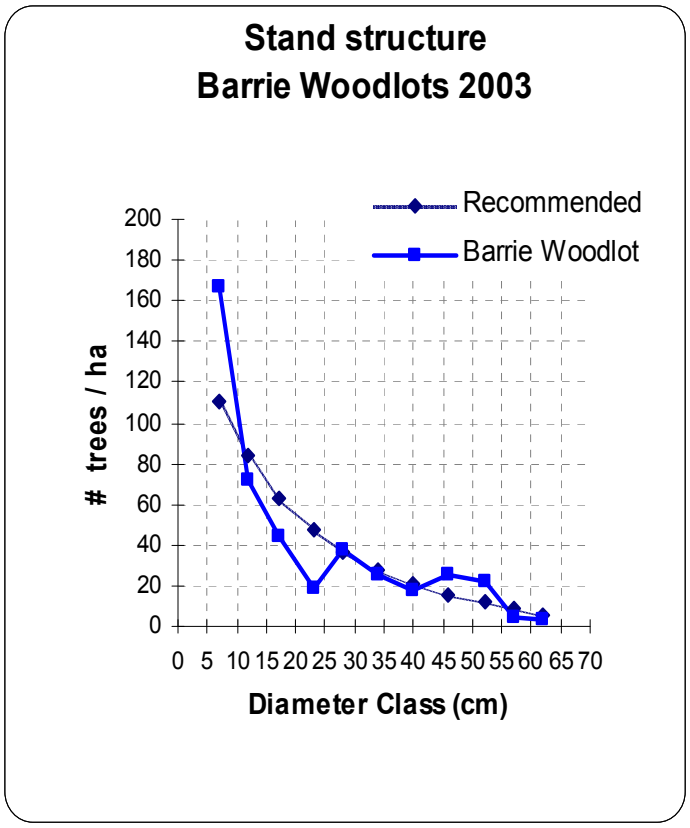

Figure 1.

Part Two: Economic Comparison of Woodlot and Crop Production for the Barrie Case Study

The objective of this economic analysis was to compare historical returns from the Barrie woodlot to that from agricultural crops on comparable land over the same period. In order to make the comparison, a crop rotation was selected that would have likely been used in this area (see Crop Production Model description). Using historical returns for these crops a Net Present Value (NPV) calculation was used to estimate the returns in 2010 terms (see Net Present Value description).

Economic information for the woodlot was obtained through a personal interview with the landowner. Actual revenue and costs were collected for each forest operation for which data was available. In the Barrie case, this went back to 1967. A Present Value calculation was used to estimate the equivalent 2010 value for revenue and costs from the woodlots. Then a NPV or profit was calculated.

The NPV was then calculated on a per acre basis and summed over the time period since 1975 in order to compare returns from the woodlots to that from agricultural land.

This analysis does not attempt to place a monetary value on the many other woodlot benefits such as site protection, contributions to water quality or groundwater recharge, opportunities for recreational use, etc. It is typically more difficult to place a dollar value on these benefits, although in some locations landowners are charging for access or leasing hunting and fishing rights.

Net Present Value

Typically sales from agricultural crops are made on an annual basis, while sales from woodlots are made only periodically. In order to assess them in a comparable way, a Net Present Value (NPV) calculation is done to estimate the value sales would have at a fixed future date (for these case studies 2010 was used). To convert past values to the present, the NPV calculation assumes that the profit (or margin) from sales is invested and compounded (i.e. the interest is added to the total investment annually) until the date that is to be used for the comparison. A 5% return was the most realistic and is reflected in most of the tables. However calculations for 2, 4, 6, 7.5 and 10% were also used.

Crop Production Model

Representative crop models were developed by region for typical crop rotations in Ontario using corn, soybeans & 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 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. (Fixed costs do not include land rent or interest on land.)

Historic crop enterprise budgets were not readily available for all the required years. For the years that data was not available, values were estimated by averaging the total costs. To accommodate changes in reporting of crop enterprise budgets over the years, estimates using linear trends and averages based on the available historic numbers were determined. The earliest crop budgets go back to 1975.

Crop returns are cyclical in nature, based on crop rotations. To mitigate the effect that a given crop rotation cycle would have on the end results, the crop model was evaluated assuming the rotation planted 1/3 to corn, 1/3 to soybean and 1/3 to wheat annually. The present value of the rotation was used for the purpose of comparison with the woodlot per acre revenue.

The Barrie Farm

Background information on the farm and forest is found in Table 1. Only Woodlot W1 and W3 are used for forest products (timber and fuelwood sales, as well as up to 1,100 taps for maple syrup production) and are used for the economic analysis. The plantations (W2) are not currently used for timber production. There are 185 acres of cropland (corn, soybeans, wheat, and some hay) and approximately 50 beef cattle that overwinter. Between 1962 and 1997, there was a beef feedlot with capacity for 200 cattle.

Comparison of Returns

The total earnings of all sources of income from the Barrie's woodlots were determined on a per acre basis over the last 36 years (1975-2010). Table 2 illustrates that the Barrie's have generated $8,866 per acre (NPV) for the combined profit from timber, fuel wood and maple syrup sales at a 5% discount rate. Annual values are added to simplify comparison to other cases.

Over the same period, the agriculture rotation generated $4,979 per acre. The present value of revenue in the agriculture rotation was $25,214 and of costs was $20,235 for a net profit of $4,979 at the 5% discount rate. (Table 3).

The woodlot analysis indicates the Barrie's have generated a total (in present value) of $217,624 in revenue from timber sales, while costs were about $12,263, resulting in a profit of $205,361 at the 5% discount rate. The Barrie's have 45 acres of woodland that were used in these calculations, so their total NPV was $4,564 per acre in timber sales. The Barrie's also generated $1,275 per acre in fuel wood sales since 1994 and $3,207 per acre in maple syrup sales since 1987. See Tables 4, 5 and 6.

Summary

The results of this analysis indicate that the Barrie's were able to generate substantially more net revenue per acre from 1975 to 2010 with woodlot management than a typical crop rotation of corn, soybeans and wheat in western Ontario. The crop rotation NPV per acre is 68 % of the timber and fuelwood. When maple syrup is included the agriculture value is 43% of total woodland profits.

Table 1. The Barrie Farm Land Use and Forest Description.

	Land use	**Description**	**Hectares (acres)**
W1	Forest	Sugar maple 90%, Black cherry 5%, minor components of white ash, red oak, beech and white pine; rolling terrain with large central drumlin – sandy loam to loam soils	12.15 (30)
W2	Plantation	Planted with 12,000 red pine, 1,000 black walnut in 1970; Area retired under National Soil Conservation Program; planted in 1992; 1,300 black walnut, 1,300 black locust	4.86 (12) 1.2 (3)
W3	Forest	Sugar maple 84%, red maple 10%, minor components of cherry, beech, white pine ,ash, basswood; flat terrain with sandy loam to loam soils.	6.1 (15)
	Agriculture	Including farmstead, and 1 ha wetland	75.7 (187)

Table 2. Net Present Value Summary of all Sources of Income (1975 - 2010) from the Barrie Woodlot at the 5% discount rate.

Source of Income	**NPV ($/acre)**	**NPV ($/acre/ year)**	Years of data available
Timber Sales	4,564	127	36
Fuelwood Sales	1,275	75	17
Maple Syrup Sales	3,027	121	25
Woodlot Total	**8,866**	**323**	
Average Crop Rotation	4,979	138	36
Difference	**3,887**	**185**	

NPV ($/acre/year) is calculated based on years of data available not the entire 36 years. If crop rotation data was done comparably the result would be lower than 138 **NPV ($/acre/year).**

Table 3. Revenue, Cost, Present Value (PV) and Net Present Value (NPV) in dollars of Corn, Soybeans and Wheat Rotation using Western Crop Model at 5% discount rate.

Year of Harvest	Actual Revenue/ Acre	Actual Cost/ Acre	PV Revenue/ Acre	PV Costs/Acre	NPV/Acre
1975	170	151	935	834	102
1976	148	155	777	814	-37
1977	175	161	876	803	73
1978	188	166	895	793	102
1979	229	175	1,038	794	244
1980	281	169	1,215	732	484
1981	243	184	1,000	756	244
1982	219	203	858	795	63
1983	293	201	1,093	751	342
1984	269	212	957	754	203
1985	250	220	846	745	101
1986	200	213	646	688	-42
1987	285	209	875	641	234
1988	258	203	756	595	161
1989	233	230	649	640	9
1990	241	210	639	556	82
1991	253	205	640	517	123
1992	210	215	505	517	-12
1993	279	225	640	516	124
1994	298	229	651	499	152
1995	442	232	919	483	436
1996	337	239	667	474	193
1997	335	246	632	464	168
1998	282	253	506	455	51
1999	310	243	531	416	115
2000	268	254	436	414	22
2001	267	256	414	397	17
2002	373	251	552	372	180
2003	367	270	517	380	136
2004	314	291	421	390	31
2005	303	307	387	392	-5
2006	385	313	468	380	88
2007	480	313	555	362	193
2008	581	333	640	367	273
2009	427	380	448	399	49
2010	630	349	630	349	280
Total	**10,822**	**8,467**	**25,214**	**20,235**	**4,979**

Using data from the historical crop enterprise budgets we calculated the total revenue and costs per acre for each of the harvest years of the crop rotation. The NPV revenue and costs per acre were determined for each crop rotation. The present value costs were subtracted from revenue to determine the NPV (margin) per acre. The crop rotation assumes that the corn, soybean and wheat rotation is based in western Ontario and uses values from that area. Discount rates were calculated for 2%, 4%, 5%, 6%, 7.5% and 10%. Only the 5% rate is shown here.

Table 4. Revenue, Cost, Present Value (PV) and Net Present Value (NPV) in dollars of Timber Sales at 5% discount rate (45 acre - woodlot).

Year of Harvest	Volume Harvested (fbm) *(i)*	Actual Revenue	Actual Costs *(ii)*	PV of Revenue	PV of Costs	NPV	NPV/Acre
1967 *(iii)*	14,200	650	0	5,297	0	5,297	118
1977	35,952	3,300	0	16,511	0	16,511	367
1988	30,441	10,000	0	29,253	0	29,253	650
1994	4,032	5,380	403	11,744	880	10,864	241
1995	914	886	91	1,842	190	1,652	37
1999	25,187	14,030	2,519	23,996	4,308	19,688	438
2000	21,500	18,245	2,150	29,719	3,502	26,217	583
2001	12,735	12,052	1,274	18,697	1,976	16,721	372
2002	32,500	38,570	0	56,985	0	56,985	1,266
2003	16,900	19,700	1,000	27,720	1,407	26,313	585
2007	unk	1,000	0	1,158	0	1,158	26
Total (1977 -2010)		**123,163**	**7,437**	**217,624**	**12,263**	**205,361**	**4,564**

(i) (fbm) foot board measure (board feet)
(ii) In the harvest of 1967, 1977, 1988, 2002, and 2003 for the W1 woodlot, a logger completed the harvest. Therefore, the Barrie's did not incur costs for the harvest of sawlogs in these years. In addition, no costs were incurred for marking and planning harvests in 1967, 1977 and 1988, as they were done through Ministry of Natural Resources programs.
(iii) Crop enterprise data is not available prior to 1975. Since the 1967 harvest contributes little to the overall margin per acre, the analysis has been adjusted to assume that the first harvest occurred in 1977. This allows for a more representative comparison between the woodlot and crop rotation models.

Table 5. Revenue, Cost, Present Value (PV) and Net Present Value (NPV) in dollars of Fuel Wood Sales at 5% discount rate (45 acre - woodlot**).**

Year of Harvest	Volume Harvested (face cords)	Actual Revenue	Actual Costs	PV of Revenue	PV of Costs	NPV	NPV/Acre
1994	21	1,470	735	3,209	1,604	1,604	36
1995	20	1,400	699	2,910	1,453	1,457	32
1999	132	9,240	4,620	15,804	7,902	7,902	176
2000	113	7,910	3,955	12,885	6,442	6,442	143
2001	67	4,690	2,345	7,276	3,638	3,638	81
2002	170	11,900	5,950	17,582	8,791	8,791	195
2003	165	11,550	5,774	16,252	8,125	8,127	181
2004	108	4,125	2,000	5,528	2,680	2,848	63
2005	146	4,561	2,000	5,821	2,553	3,269	73
2006	128	3,579	2,000	4,350	2,431	1,919	43
2007	80	6,400	3,760	7,409	4,353	3,056	68
2008	80	6,400	3,760	7,056	4,145	2,911	65
2009	80	6,400	3,760	6,720	3,948	2,772	62
2010	80	6,400	3,760	6,400	3,760	2,640	59
Total (1994 -2010)		**86,025**	**45,118**	**119,201**	**61,825**	**57,376**	**1,275**

Fuelwood sales have been occurring since George Barrie can remember. Values are not available before 1994.
Fuel wood values for 2007 are estimated.

Table 6. Revenue, Cost, Present Value (PV) and Net Present Value (NPV) in dollars of Maple Syrup Sales at 5% discount rate (45 acre - woodlot).

Year of Harvest	Volume produced (litres)	Net sales (*i*)	Actual Costs	PV of Revenue	PV of Costs	NPV	NPV/Acre
1986			15,000 (*ii*)		48,376	-48,376	-1,075
1987	1,162	5,810		17,846		17,846	397
1988	1,046	5,230		15,299		15,299	340
1989	880	4,400		12,258		12,258	272
1990	880	4,400		11,675		11,675	259
1991	880	4,400		11,119		11,119	247
1992	880	4,400		10,589		10,589	235
1993	880	4,400		10,085		10,085	224
1994	896	4,480		9,779		9,779	217
1995	896	4,480		9,314		9,314	207
1996	896	4,480		8,870		8,870	197
1997	841	4,205		7,929		7,929	176
1998	840	4,200		7,543		7,543	168
1999	553	2,765		4,729		4,729	105
2000	711	3,555		5,791		5,791	129
2001	898	4,490		6,965		6,965	155
2002	880	4,400		6,501		6,501	144
2003		4,000		5,628		5,628	125
2004	620	3,100		4,154		4,154	92
2005	620	3,100		3,956		3,956	88
2006	620	3,100		3,768		3,768	84
2007		3,100		3,589		3,589	80
2008	800	12,800	8,400	14,112	9,261	4,851	108
2009	600	9,600	8,100	10,080	8,505	1,575	35
2010	550	8,800	8,025	8,800	8,025	775	17
Total - 1987-2010				**210,379**	**74,167**	**136,211**	**3,027**

(i) breakdown of costs and revenues were not available until 2008
(ii) estimated cost of establishing operation
Mean production was 0.8 litres per tap ranging from 0.5 to 1.3 litres per tap.
Over the years, glass containers were most often used.

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If you have comments on this document, please forward them to:
Terry Schwan (519) 826-4933 terry.schwan@ontario.ca