BUILDING A CASE FOR SUSTAINABLE MANAGEMENT OF PRIVATE WOODLANDS

CASE STUDY: GEORGE AND SANDY 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 Barrie Woodlot Story

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 gravely. Maples grow well on it. The light soil is prone to drought and Sandy says over the last few years 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 walnut 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 of 0.8 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 $108,000 from their 45-acre woodlot for about $216 annual income per acre (not compounded to 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, he says.

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 $26 per acre over that 10-year period. All sources of income from the hardwood woodlot add up to $330 per acre per year (i.e. $88 + $216 + $26) (not compounded to present value).

There are low input costs for the woodlot, unlike the cashcrops. 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 from early November to March, 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 controlled access 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, who farms with his wife Gwen, has 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.

Sandy and George Barrie enjoy a fall afternoon in their woodlot.

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.

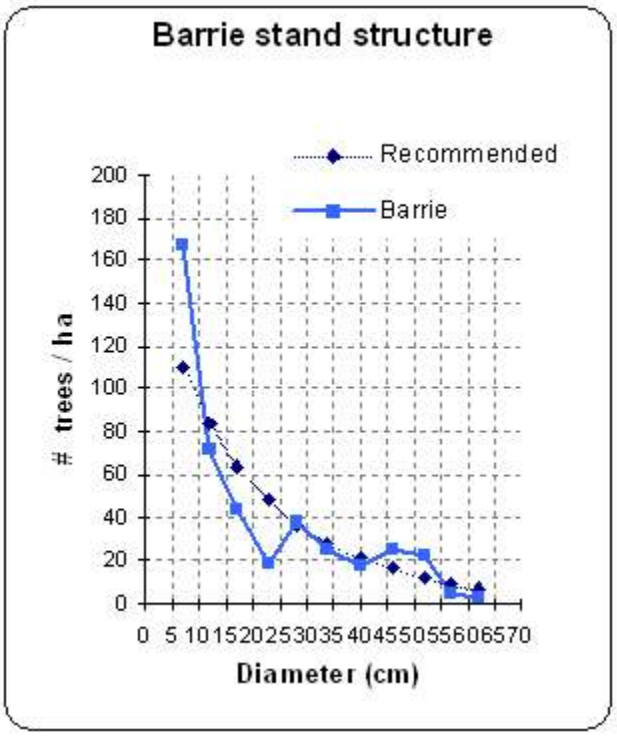

Figure 1

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 woodlots 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 2003 dollars (see Net Present Value description). The NPV of returns from woodlots and the crop production model are listed in Table 1.

Economic information for the woodlot was obtained through a personal interview with the landowners. Actual revenue and costs were collected for each forest operation for which data was available (In the Barrie case this stretched back to 1967). Profits (or margin) were determined (revenue minus costs), then a Net Present Value calculation was used to estimate a 2003 value for returns from the woodlots.

The NPV of returns were then calculated on a per acre basis and summed over the time period since 1977 (crop budgets were only available back to 1976) in order to compare returns from the woodlots to that from agricultural land.

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 compare them in a way that is economically valid, a Net Present Value (NPV) calculation is done to estimate the value sales would have at a future date (for this case study 2003 was used). 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 felt to be most realistic and is reflected in most of the tables, however calculations for 7.5% and 10% were also used and are mentioned periodically as well.

The Barrie Farm
Background information on the farm and forest is found in Table 2. Only Woodlot W1 and W3 are used for forest products (timber and fuelwood sales, as well as 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 are185 acres of cropland (corn, soybeans, wheat, and some hay) and approximately 50 beef cattle that over-winter. Between 1962 and 1997, there was a beef feedlot with capacity for 200 cattle.

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.

Crop yields and prices are cyclical in nature, so the order of the crop rotation would have an impact 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.

Comparison of Returns

The economic analysis indicates the Barrie's have generated a total (in present value terms) of $153,838 in revenue from timber sales, while costs were about $8,715, resulting in a margin of $145,123. The Barrie's have 45 acres of woodland that were used in these calculations, so their total earnings were $3,225/acre. The Barrie's also generated $599/acre in fuel wood sales since 1994 and $2,468/acre in maple syrup sales since 1987. (All values in 2003 dollars and a 5% compound rate.)

Following analysis of all sources of income from the Barrie's woodlots, the total earnings were determined on a per acre basis over the last 27 years (1977-2003). Table 1 illustrates that the Barrie's have generated between $6,292 and $9,284 per acre for the combined revenue from timber, fuel wood and maple syrup sales depending on the compound rate applied. The agriculture rotation generated between $2,927 and $6,238 per acre.

Summary

The results of this analysis indicate that the Barrie's were able to generate substantially more revenue per acre from 1977-2003 with woodlot management than a typical crop rotation of corn, soybeans and wheat in western Ontario. At the various compound rates the difference between woodlot management and crop rotation ranged from $3,365 (115% higher for woodlot) to $3,046 (49% higher for woodlot) more in profit per acre. See the tables below for a summary of the data.

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.

Table 1: Summary of All Sources of Income (1977 - 2003) From the Barrie Woodlot (Present Value, $/acre)

Source of Income	5%	7.5%	10%
Timber Sales	$ 3,225	$ 3,781	$ 4,599
Fuelwood Sales	$ 599	$ 636	$ 676
Maple Syrup Sales	$ 2,468	$ 3,137	$ 4,008
Woodlot Total	**$ 6,292**	**$ 7,555**	**$ 9,284**
Average Crop Rotation	$ 2,927	$ 4,226	$ 6,238
Difference	**$ 3,365**	**$ 3,328**	**$ 3,046**

Note: columns may not sum correctly due to rounding

Table 2: 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 3: Present Value of Corn, Soybeans and Wheat Rotation (at 5% rate) *(i)*

Year of Harvest	Actual Revenue/Acre	Actual Cost/Acre	Present Value Revenue/Acre	Present Value Costs/Acre	Margin/Acre
1977	175.18	153.86	622.90	547.09	75.81
1978	187.82	156.95	636.02	531.48	104.54
1979	228.78	162.85	737.84	525.20	212.65
1980	281.23	169.27	863.81	519.92	343.89
1981	243.06	183.77	711.02	537.58	173.44
1982	218.76	202.77	609.46	564.91	44.55
1983	292.75	201.11	776.75	533.59	243.16
1984	269.18	211.98	680.21	535.67	144.54
1985	249.87	220.01	601.34	529.49	71.85
1986	200.38	213.42	459.27	489.17	-29.89
1987	284.95	208.84	622.02	455.87	166.15
1988	258.38	203.48	537.14	423.02	114.12
1989	232.78	229.67	460.89	454.72	6.17
1990	240.71	209.62	453.89	395.28	58.61
1991	253.37	204.77	455.01	367.74	87.27
1992	209.88	214.90	358.96	367.55	-8.59
1993	279.24	225.03	454.85	366.54	88.31
1994	298.29	228.72	462.75	354.81	107.93
1995	441.77	232.41	652.70	343.37	309.33
1996	336.96	239.27	474.14	336.68	137.46
1997	335.22	246.14	449.22	329.85	119.38
1998	281.97	253.17	359.88	323.11	36.77
1999	310.15	243.24	376.99	295.66	81.34
2000	267.59	254.03	309.77	294.07	15.70
2001	266.90	256.12	294.26	282.38	11.88
2002	373.39	251.46	392.06	264.03	128.03
2003	352.94	270.33	352.94	270.33	82.60
Total					**$ 2,926.99**

Note: columns may not sum correctly due to rounding

(i) Using data from the historical crop enterprise budgets it was possible to calculate the total revenue and costs per acre for each of the harvest years of the crop rotation. The crop rotation assumes that the corn, soybean and wheat rotation is based in western Ontario and uses values from that area. Using the 5%, 7.5% and 10% compound rate, 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. As identified in the table above, the total margin for the crop rotation over the 27 year time period from 1977 to 2003 (expressed in 2003 dollars, using a compound interest rate of 5%) was $2,927 per acre. For 7.5% and 10% compound rates, net present values were $4,227 and $6,238 per acre respectively.

Table 4: Present Value of Timber Sales (at 5% rate) (45 acres - woodlots W1 & W3)

Year of Harvest	Volume Harvested (fbm) *(ii)*	Actual Revenue	Actual Costs *(iii)*	Present Value of Revenue	Present Value of Costs	Present Value of Margin	Present Value Margin/Acre
1967 *(iv)*	14200	650	0	3764	0	3764	83
1977	35,952	3300	0	11733	0	11733	260
1988	30,441	10000	0	20789	0	20789	461
1994	4032	5380	403	8346	625	7720	171
1995	914	886	91	1309	135	1173	26
1999	25187	14030	2518	17053	3061	13992	310
2000	21500	18245	2150	21120	2488	18631	414
2001	12735	12052	1273	13287	1404	11883	264
2002	32500	38570	0	40498	0	40498	899
2003	16900	19700	1000	19700	1000	18700	415
Total (1977 - 2003)	180,161			**$ 153,838**	**$ 8,715**	**$ 145,123**	**$ 3,225**

Note: columns may not sum correctly due to rounding

(ii) (fbm) foot board measure (board feet)

(iii) 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.

(iv) Crop enterprise data is not available prior to 1976. 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: Present Value of Fuel Wood Sales *(v)* **(at 5% rate)** (45 acres - woodlots W1 & W3)

Year of Harvest	Volume Harvested (face cords)	Actual Revenue	Actual Costs	Present Value of Revenue	Present Value of Costs	Present Value of Margin	Present Value Margin/Acre
1994	21	1470	735	2280	1140	1140	25
1995	20	1400	699	2068	1032	1035	23
1999	132	9240	4620	11231	5615	5615	124
2000	113	7910	3955	9156	4578	4578	101
2001	67	4690	2345	5170	2585	2585	57
2002	170	11900	5950	12495	6247	6247	138
2003	165	11550	5774	11550	5774	5776	128
Total				**$ 53,953**	**$ 26,974**	**$ 26,979**	**$ 599**

Note: columns may not sum correctly due to rounding

(v) Fuelwood sales have been occurring since George Barrie can remember. Values are not available before 1994.

Table 6: Present Value of Maple Syrup Sales (at 5% rate) (45 acres - woodlots W1 & W3)

Year of Harvest	Volume Produced (litres)	Mean Net Sales	Present Value Margin	Present Value Margin/Acre
1987	1162	5810	12682	281
1988	1046	5230	10872	241
1989	880	4400	8711	193
1990	880	4400	8296	184
1991	880	4400	7901	175
1992	880	4400	7525	167
1993	880	4400	7167	159
1994	896	4480	6949	154
1995	896	4480	6619	147
1996	896	4480	6303	140
1997	841	4205	5635	125
1998	840	4200	5360	119
1999	553	2765	3360	74
2000	711	3555	4115	91
2001	898	4490	4950	110
2002	880	4400	4620	102
Total			**$ 111,072**	**$ 2,468**

Note: columns may not sum correctly due to rounding

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