BUILDING A CASE FOR SUSTAINABLE MANAGEMENT OF PRIVATE WOODLANDS

CASE STUDY: BOB STALEY 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 RACOONS, RECREATION AND RED OAK LOGS

by Robert N. Staley, B Sc.F., R.P.F.

In 1803, a two hundred acre lot was granted by the Crown to Joseph Durham. It was later sold to Thomas Lewis (Timber Co.) in 1854, to Dr. J. Hunter in 1869 and John Van Nostrand in 1871. The lot was logged for timber (pine and hardwoods) by all of these owners and Hunter and Van Nostrand had sawmills at a site on the east end of the lot and at Vandorf Village respectively.

In 1903, the west 155 acres was purchased by Bette Staley's grandfather, W.D. Richardson, who established a portable sawmill west of the present Staley residence. Pine, cedar and hardwoods were sawn at this time. The lot was then used for farm lumber and firewood until oil took over as heating fuel in the 1940's. It was also used to pasture young cattle for several decades.

Over time, the lot was sub-divided into smaller parcels which were sold, or given to family members. The twenty acre "Staley Woodlot" portion is the only parcel still remaining in the family.

Although there was pasturing and some high grading, the lot has been yielding forest products since 1803.

BACKGROUND INFORMATION

The woodlot is located on Lot 16, Con. V, Town of Whitchurch-Stouffville , Regional Municipality of York. It is within the Greater Toronto Area and on the height of land between the Lake Ontario and Lake Simcoe watersheds – on the landform known as the Oak Ridges Moraine.

Sugar maple, white ash, red oak, basswood, black cherry and eastern hemlock are the dominant species. Secondary species include: white pine, white cedar, white spruce, tamarack, white birch, yellow birch, beech, poplar, ironwood, bitternut hickory, butternut.

The woodlot occurs on interlobate terminal moraine – with soils mainly of Pontypool sand, but with many clay caps and pockets, and underlain with gravel. A cold water stream traverses the property and the swamp soil is muck.

The woodlot is an all-aged forest - with growing stock ranging from regeneration up to mature stems of 26 inches in diameter and 50 feet of clear "stem".

The total property is 20.3 acres and forest types and land use are found in Table 1.

INTENSIVE MANAGEMENT

In 1968, the woodlot consisted of a high percentage of polewood stems mixed with a component of low to medium quality mature and overmature growing stock. The selection harvest cuts in both 1968 and 1978 were aimed at removal of the poor quality stems and less desirable species – in order to upgrade the quality of the woodlot and to concentrate the growth on the best stems of the most valuable species.

A third selection harvest cut in 1990 yielded a very high percentage of high quality material of oak, ash, hard maple, cherry and basswood. A smaller selection cut was carried out in 2007.

From 1976 to 2011 annual stand improvement has been carried out to remove and utilize lower grade small size material for firewood. This supplied the fireplace and the large wood-oil combination furnace at the Staley residence. Some firewood was also sold each year.

The four selection harvest cuts have yielded increasingly better quality trees and thus more valuable sawlogs. These cuts, along with selective annual stand improvement operations have greatly increased the quality and value of residual growing stock.

Selection cuts in 1966, 1977, and 2007 were on the basis of lump-sum stumpage sales for marked timber, while the 1990 cut was sold roadside at a unit price per thousand board feet.

The 1990 cut was operated by R.N. Staley and very good control of felling, skidding and log production was obtained. Assistance in the operation was from Bill Richardson, and from Dave Rose, who owned and very effectively operated the "environmentally friendly" John Deere four-wheel drive farm tractor.

Fuelwood production has been on the basis of cut, split and pile at bush roadside, and a complete system of forest roads makes this, as well as other uses, very feasible. Delivery to residence and to "customers" has been by pick-up truck.

Renewal of the woodlot has been secured through natural regeneration. Maple reproduction has been abundant, white ash very adequate, white oak, cherry, basswood and hemlock have been only fair to poor, but have seeded into many of the openings. Oak will be planted in some of the larger openings to improve species diversity. As cutting continues, the new regeneration will contribute to a better size-class distribution and a better balance of age-classes.

The white pine grove was formerly "wooded pasture" – with natural white pine seedlings under hawthorn and other species. Management activities have included release of trees from competing vegetation, crop tree pruning, an initial non-commercial thinning and further thinning in 1992. The resulting increased growth is now concentrated on the remaining excellent quality white pine stems which range from 6" to 14" in diameter.

Ministry of Natural Resources staff have been most helpful and co-operative and MNR foresters and forest technicians have assisted in the planning, inventory, marking and marketing.

NON-TIMBER VALUES

Mast and den trees have been maintained, young conifers protected, and wildlife food species, such as ironwood, poplar and beech have been retained.

Raccoons, hawks and owls, pileated woodpeckers, deer, blue herons, beaver, ducks and many other species have been viewed and enjoyed.

Biking, hiking, cross-country skiing, nature walks and picture taking have been some of the recreational pursuits in the woodlot. As well as the forest roads and trails, a swamp trail has recently been established.

The woodlot has been utilized for forestry education and many groups have used the area as an outdoor forestry and land use classroom. It has also contributed to maintenance of "unique" forest cover in the Oak Ridges Moraine.

Several springs originate on the property and a tributary of the Holland River crosses through the swamp area. These factors are important in the conservation of water quantity and water quality in the Lake Simcoe watershed.

FUTURE PROSPECTS

At one time the future of the Staley Woodlot was uncertain, due to land use and land development pressures. With the establishment of planning controls on future development on the Oak Ridges Moraine, it appears that intensive management and the production of high value products can continue on the Staley woodlot.

It has demonstrated that upland tolerant hardwood woodlots can be managed on a multiple-use basis to meet a variety of landowner objectives, and also contribute to industrial and societal needs. It has also shown the marvelous ability of a forest to renew itself and has demonstrated the opportunity to increase tree growth and the quality of forest products through the intensive forest management.

UPDATE 2011

Stand improvement through fuelwood production was again carried out from 2009 to 2011. The property was sold in 2011.

Bob Staley beside his fuelwood pile.

Is This Forest Being Managed in a Sustainable Way?

It is reasonable to ask 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.

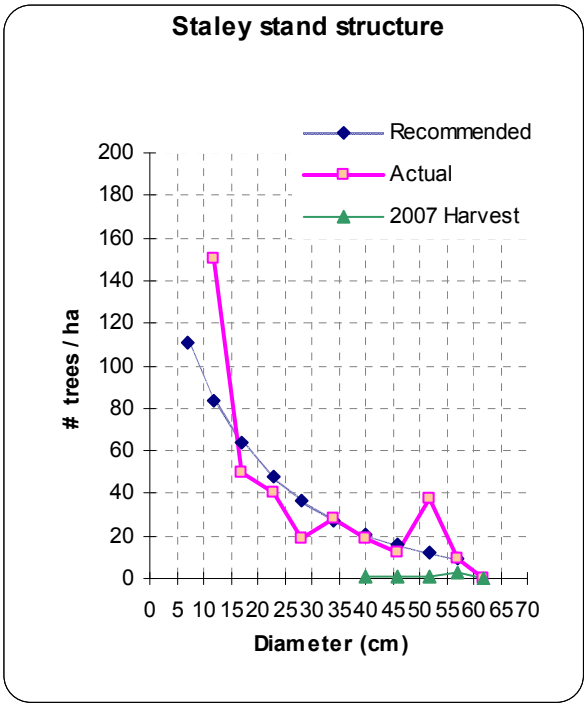

Figure 1.

When the stand structure of the Staley woodlot is compared to the recommended distribution there are some important differences. There is a surplus of trees around the 50 cm size class (about 25 trees per hectare) and a deficit of trees in the 15 to 25 cm classes. The surplus of large trees is likely because there hasn't been a major harvest since 1990. The 2007 harvest was very light and didn't reduce the residual stand significantly. It is likely the next harvest will bring the stand closer to the recommended distribution. Also, Bob Staley's ongoing stand improvement activities during the years he has owned the woodlot have resulted in extremely high-quality trees with a very high proportion that are suitable for veneer.

We can therefore conclude that the forest is in a good state of management and thus is being sustainably managed. This is a great example of how a woodlot can be managed for economic gain in a sustainable way and how these two objectives are mutually compatible. A woodlot owner does not have to choose one over the other.

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

The objective of this economic analysis was to compare historical returns from the Staley 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 Staley 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 Staley Woodlot

Information on the forest types in "The Woodlot" is found in Table 1. There are 8.6 acres of upland hardwood woodlot and 4.4 acres of white pine plantation and poplar stand on a 20 acre property on the Oak Ridges Moraine in York County. The balance of the woodlot is open field and swamp. There is also a house and shed on the property. There have been three large volume harvests in the 8.6 acre woodlot; 1967, 1977 and 1990 and a smaller one in 2007. As a Professional Forester, Bob took particular interest in improving the tree quality in this high-value forest. He also processed the fuelwood and utilized it as a primary source of heat for the house as well as having enough surplus for some annual modest sales.

Comparison of Returns

The total earnings of all sources of income from Bob Staley's woodlot was determined on a per acre basis over the last 36 years (1975-2010). Table 2 illustrates that Staley generated $2,806 per acre (NPV) for the combined profit from timber, and fuelwood sales at a 5% discount rate. Annual values are added to simplify comparison to other cases.

Over the same period, the agriculture rotation from the Central Crop Model generated profit of $1,781 per acre at the 5% discount rate. The present value of revenue in the agriculture rotation was $21,999 and of cost was $20,235. (Table 3).

Table 1. Staley Land Use and Forest Types.

Land Use and Forest	Acres (ha)
Upland tolerant hardwood	8.6 (3.5)
Swamp	4.0 (1.6)
Open field, etc.	3.3 (1.3)
Intolerant hardwood	2.2 (0.9)
White pine grove	2.2 (0.9)
Total	20.3 (8.2)

The woodlot analysis indicates Staley generated a total (in present value terms) of $28,509 in revenue from timber sales, while costs were about $2,653, resulting in a profit of $25,856 at the 5% discount rate. Staley has 13 acres of woodland that were used in these calculations, so their total NPV was $1,989 per acre in timber sales. Staley also generated $817 per acre in fuelwood sales since 1978. See Tables 4 and 5.

Timber sales had potential to be much higher. Staley has an impressive amount of high-quality veneer trees in growing stock. Not included in the calculations is the estimated saving of $800 per year in fuel oil heating costs.

Summary

The results of this analysis indicate that Staley was able to generate substantially more net revenue per acre from 1975-2010 with woodlot management than a typical crop rotation of corn, soybeans and wheat in central Ontario. The crop rotation NPV per acre is 61% of the timber and fuelwood profits.

Typical size and quality of trees in Staley's forest.

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

Source of Income	NPV ($/acre)	NPV ($/acre/year)	Years of data available
Timber Sales	1,989	55	36
Fuelwood Sales	817	25	33
Woodlot Total	2,806	80	
Average Crop Rotation	1,781	49	36
Difference	1,025	31	

NPV ($/acre/year) is calculated based on years of data available not the entire 36 years.

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

Year of Harvest	Actual Revenue/ Acre	Actual Cost/ Acre	PV Revenue/ Acre	PV Costs/ Acre	NPV/Acre
1975	158	151	873	834	39
1976	130	155	684	814	-130
1977	166	161	832	803	29
1978	170	166	812	793	20
1979	212	175	961	794	167
1980	267	169	1,156	732	424
1981	212	184	872	756	116
1982	194	203	759	795	-36
1983	229	201	856	751	106
1984	238	212	846	754	93
1985	209	220	708	745	-37
1986	186	213	601	688	-88
1987	247	209	758	641	116
1988	237	203	692	595	97
1989	209	230	583	640	-56
1990	204	210	542	556	-14
1991	187	205	471	517	-46
1992	193	215	464	517	-53
1993	238	225	545	516	29
1994	256	229	559	499	59
1995	357	232	741	483	258
1996	312	239	618	474	144
1997	264	246	498	464	33
1998	274	253	492	455	37
1999	263	243	450	416	33
2000	232	254	378	414	-36
2001	207	256	322	397	-76
2002	351	251	518	372	147
2003	313	270	440	380	60
2004	287	291	385	390	-5
2005	234	307	299	392	-93
2006	362	298	440	363	77
2007	357	313	413	362	51
2008	469	333	517	367	150
2009	357	380	375	399	-24
2010	539	349	539	349	190
Total	**9,320**	**8,453**	**21,999**	**20,218**	**1,781**

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 central 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(13 acre woodlot).

Year of Harvest	Volume Harvested (fbm) *(i)*	Actual Revenue	Actual Costs *(ii)*	PV of Revenue	PV of Costs	NPV	NPV /Acre
1967	17,811	1,247	0	*10,163*	*0*	*10,163*	*782*
1975	2,000	200	0	1,103	0	1,103	85
1977	13,218	1,084	0	5,423	0	5,423	417
1984	1,040	200	0	711	0	711	55
1990	13,153	3,839	1,000	10,186	2,653	7,533	579
1998*(iii)*	1,324	500	0	898	0	898	69
2007	7,428	8,800	0	10,187	0	10,187	784
Total (1975 - 2010)	**38,163**	**14,623**	**1,000**	**28,509**	**2,653**	**25,856**	**1,989**

Crop enterprise data is not available prior to 1975. The analysis has been adjusted to remove the 1967 harvest. This allows for a more representative comparison between the woodlot and crop rotation models. Harvest in 1967 is not counted in totals to remain consistent with agriculture values.
Costs of fuelwood produced during these harvests is accounted for in Table 5.
Columns may not sum correctly due to rounding

(i) (fbm) foot board measure

(ii) In all harvests, a logger completed the harvest, and bought the logs on a lump-sum basis so payment was the net of his costs. The exception was 1990 when the logs were sold at roadside. Staley incurred no costs at harvest other than for marking and planning harvests since Bob did himself, or were they done through Ministry of Natural Resources programs.

(iii) The 1998 harvest was a cleanup as the result of a tornado.

Footnotes for Table 5
Bob makes fuelwood for his own use and for sale. He mostly sells to friends, so has maintained the same price over many years. Costs have not increased too much over the years. Bob did not cut fuelwood form 2005 to2008.
From 1978 to 1993 he had a wood/fuel oil combo that burned 15 to 16 face cords / year
In 1994 he used a fireplace with insert to heat the house.
For the last 20 years, by burning wood he has saved an estimated $800 / year in fuel oil
His sales range from 10 to 15 face cord/year, so 12 was used.
Bob remembered exact sales for 2003 and 2004. He had documentation for 1990 and 1991. The rest of the figures are all conservative estimate/averages.

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Table 5. Revenue, Cost, Present Value (PV) and Net Present Value (NPV) in dollars of Fuel Wood Sales at 5% discount rate (13 acre woodlot**).**

Year of Harvest	Volume Harvested (face cords)	Actual Revenue	Actual Costs	PV of Revenue	PV of Costs	NPV	NPV /Acre
1978	12	600	504	2,859	2,402	457	35
1979	12	600	504	2,723	2,287	436	34
1980	12	600	504	2,593	2,178	415	32
1981	12	600	504	2,470	2,075	395	30
1982	12	600	504	2,352	1,976	376	29
1983	12	600	504	2,240	1,882	358	28
1984	12	600	504	2,133	1,792	341	26
1985	12	600	504	2,032	1,707	325	25
1986	12	600	504	1,935	1,625	310	24
1987	12	600	504	1,843	1,548	295	23
1988	12	600	504	1,755	1,474	281	22
1989	12	600	504	1,672	1,404	267	21
1990	15	1050	504	2,786	1,337	1449	111
1991	16	1200	504	3,032	1,274	1759	135
1992	12	600	504	1,444	1,213	231	18
1993	12	600	504	1,375	1,155	220	17
1994	12	600	504	1,310	1,100	210	16
1995	12	600	504	1,247	1,048	200	15
1996	12	600	504	1,188	998	190	15
1997	12	600	504	1,131	950	181	14
1998	12	600	504	1,078	905	172	13
1999	12	600	504	1,026	862	164	13
2000	12	600	504	977	821	156	12
2001	12	600	504	931	782	149	11
2002	12	600	504	886	745	142	11
2003	10	600	420	844	591	253	19
2004	10	650	420	871	563	308	24
2009	10	700	420	735	441	294	23
2010	10	700	420	700	420	240	22
Total (1978 - 2010)		**18,700**	**14,280**	**48,169**	**37,554**	**10,615**	**817**