BUILDING A CASE FOR SUSTAINABLE MANAGEMENT OF PRIVATE WOODLANDS

CASE STUDY: MACK WILLIAMS 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 Mack Williams Woodlot Story by Mack Williams (deceased)

In 1946, at age 22, I purchased a 100-acre property on top of the Oro Moraine, north of Barrie. It is on dry sandy soil and is strewn with many stones and boulders. When exposed it is subject to wind and water erosion. Mostly it is gently rolling, except in one corner where it slopes steeply into a gully. Since 1946 it has been transformed from a semi-abandoned farm to a thriving young forest.

It had been a farm between 1870 and 1938. It was operated under several handicaps: dry sandy land, fields strewn with large stones, severe droughts, water supply not enough to support the farm family and their livestock during droughts, and the Great Depression of the 1930's. The family moved away, then neighbours pastured it off and on, the barn and house were rented.

My story, beginning in 1946, in several ways is unlikely to be repeated nowadays. The purchase price was $1,800, complete with farm buildings, which were later removed. Over the next 15 years sales of Christmas trees more than recovered the property purchase price and the taxes over that time. Tree seedlings were readily available from the provincial nursery at Midhurst, about 15 km away; without charge at first, then inexpensively for some time after. Planting was done entirely by myself, my parents, brother and sister-in-law, so there was no financial outlay. Some years earlier, when my parents did a

major planting, planters felt they were well paid at $2 per day.

There were, and still are, two parcels of hardwood forest, together about 20 acres; likely around 60 years old in 1946. Dense maple regeneration was taking place in several parts of the property.

Planting began in 1946, and was mostly red and white pine, white spruce and Scots pine, and a smaller amount of European larch. By 1955 the place was largely forested. The farm field layout was retained, the fields, two hardwood parcels and central lane now make up 10 compartments, which are split into 30 subcompartments, based on species and age makeup. A trail system made up mainly of the central laneway and the various routes to farm fields and the two hardwood stands have since provided ready access to most of the property, for work or for enjoyment.

Several acres of Scots pine, along with some white spruce and red pine plantations, provided Christmas trees between 1953 and 1962. Afterwards there were many residual Scots pine. Over time most of them were removed and the areas replanted to other species. In one area the trees were too large for this approach, so most were girdled, and that area is now a maple sapling stand.

After various changes like thinnings that altered species mix, and replacement of Scots pine, the property is now made up of: maturing hardwood 20%, hardwood sapling 17%, red pine plantation 36%, white pine plantation 7%, white spruce and mixed plantation 18%, roads, etc., 2%.

Apart from Christmas tree production in the early years, little happened on the property until 1978. I lived, then and now, in Toronto, 120 km. from the property. At that time, with a young family and a job that often took me away from home, I had little time or energy for the various improvements I'd have liked to make. But meanwhile my growing trees were gradually transforming the place.

In 1978 my red pine plantations, then 25 to 32 years old, had their first thinning. Every 3rd or 4th row was removed to provide access to the stands for future thinnings, and to give remaining trees more growing room. The trees were still small and low in value; luckily there was a pulpwood market for the thinnings.

The hardwood stands were also thinned in 1978 for the first time during my ownership. There were sawlogs, and a fair amount of firewood, from tops of sawlog trees, and from trees not of sawlog quality.

Over the years my objectives remain much the same, though the emphasis has shifted somewhat. First it was the rehabilitation of sandy farmland. Then it was to produce income from Christmas trees and then timber, and provide modest wildlife habitat (this potential is limited by absence of water). More recently it is to develop the trail system for recreation, education, forest management, and security.

During the 1980's the red pine plantations were thinned again, and the white pine thinned for the first time. Most of this went for pulpwood and to a sawmill that specialized in using wood from plantation thinnings. In 1995 the red and white pine were thinned again, and other plantations for the first time. By then the trees were larger and the thinnings mostly sawlogs.

That thinning generated much economic activity. At least two loggers earned their living there for several months. Operating and maintaining all that equipment must have been important to the economy, likewise the large trucks that took away the logs, and the sawmill where they went. There was also the consulting technician whose skill in selecting and marking the trees to be cut are vital to the future of the stands.

In 1995 the hardwood stands were thinned for the second time, and quite a number of sawlogs and a volume of fuelwood from tops and from low quality trees were taken.

In 2004 the plantations were thinned again. Larger trees again meant much higher wood quality and quantity. Loggers worked there for four months, mostly with modern logging machinery. This time the products included poles (some 50 feet long), sawlogs, pulpwood and log house material.

For each thinning standing timber was sold, with qualified tree markers marking the trees to be taken and offering them for bid. The entire operation was conducted by the purchaser, under a contract that set a time limit and protected the property from needless damage or mess, and from taking of unmarked trees.

As I age I relax on the property much more than ever before, with a folding chair at various points on the

trails. I may read, or just enjoy what Mother Nature has been doing. It is exciting to see, within my adult lifetime, a transition from an open, windswept eroding sandy landscape, to plantations up to 59 years old, some with dense sugar maple understory. I have seen quality logs from trees planted by myself and by family members. I see it becoming a sheltered place of peace and refuge from a hectic world. I am aware of gradual changes happening in the soil. I marvel at the contribution I am sure it is making to quality of air and ground water. I dream that it may become a place for teaching health, biological and artistic subjects. I can see the potential growth that lies ahead, including both the maple syrup and timber potential of the hardwood parcels. I can also see much work I could have done, had I had more time and energy, to make the stands even better. I can see other courses of action I could have taken, with equally exciting results.

I marvel that Canada is a nation of trees and forests, an ecological, economic, social and spiritual treasure. I wish more Canadians could share this awareness and appreciation. I wish more landowners could have similar dreams and the energy and skills to make them happen. I wish that society might recognize how much it benefits from such a forest, perhaps much more than the individual owners, and how it might benefit greatly from offering realistic support to those engaged in private land forestry. And I would hope that landowners everywhere will understand that it is never too early or too late to start.

2012 Update

Mack passed away January 11, 2011 at 87 years of age. The Williams family continues to maintain the 100 acre property. There is an 80-acre conservation easement in partnership with the Couchiching Conservancy which allows ongoing forest management.

Mack with a vigourous oak that he planted.

Is This Forest Being Managed in a Sustainable Way?

Mack Williams' early objective, restoration of marginal land, has certainly been achieved with the development of hardwood regeneration on 20 acres, plus 60 acres of well established maturing plantation up to 60 years old, with a slowly rejuvenating forest floor and organic layer, on what in 1946 was infertile sandy land, and a changing microclimate. All forest harvest operations have been carried out under the guidance and supervision of forestry professionals, initially Ontario Ministry of Natural Resources staff and more recently forest consultants. This guidance is supplemented by the owner's own interest, knowledge and skills allows us a high level of confidence in assuming the forests are being managed in a sustainable fashion.

As coniferous plantations approach maturity, managers must also consider how the next crop will be established. In some cases replanting will be required, starting the cycle all over again. More commonly, if a seed source of native hardwoods is present, a hardwood understorey becomes naturally established, often encouraged by the routine thinnings that occur in a well managed plantation.

Inventories were carried out throughout the Williams property in 2004. Figure 1 shows the stand structure from an area of white pine plantation on the property, showing both pine trees and established hardwood regeneration. The results can be seen in the adjacent stand structure chart (Figure 1).

The "Recommended" curve in Figure 1 represents the ideal size class distribution for an all age upland tolerant hardwood forest being managed under a single tree selection system. 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 hardwood stand, i.e. many trees in the smaller size classes and progressively fewer as size increases.

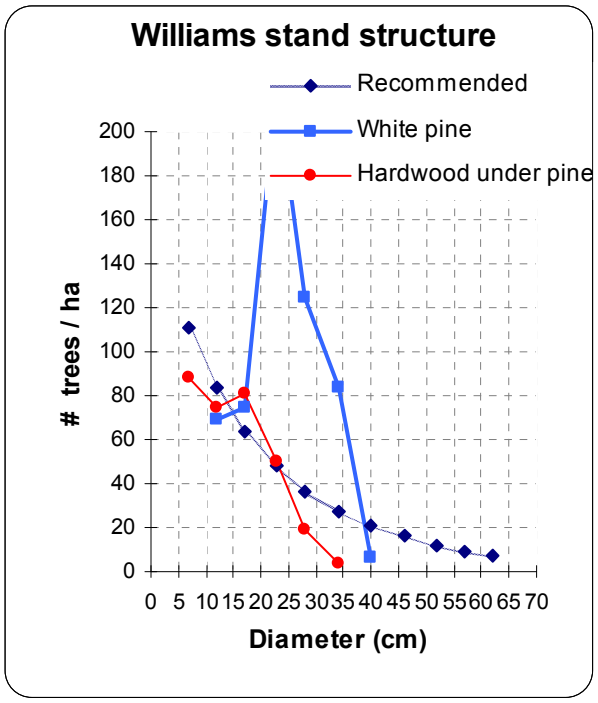

Figure 1.

The pine stand shows up as would be expected, an even aged stand with most trees in a narrow range of diameters, i.e. between 20 and 35 cm. It is interesting to note that the curve representing the hardwood understorey is already close to the "Recommended" curve for a hardwood stand in the smaller size classes. It seems reasonable to predict that as further pine thinnings occur, this stand will naturally convert to an upland hardwood forest.

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

The objective of this economic analysis was to compare historical returns from the Williams 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 Williams case, this went back to 1977. 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.

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.

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.

The Williams Woodlot

Background information on the Williams forest is found in Table 1. As noted in Part One, when the farm was purchased in 1946 much of it was abandoned agricultural fields that were gradually reforested between 1946 and 1955. Sixty acres of the 100 are in plantation. Approximately 17 acres were young hardwood bush (60 years old or less). Thinning operations began in the late 1970's in both the hardwoods and coniferous plantation areas.

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.

Comparison of Returns

The total earnings of all sources of income from the Williams woodlot were determined on a per acre basis over the last 36 years (1975-2010). Table 2 illustrates that Williams has generated $1,318 per acre (NPV) of profit from timber sales at a 5% discount rate. Annual values are added to simplify comparison to other cases.

Over the same period, the agriculture rotation generated a net profit of $1,781 per acre. The present value of revenue in the agriculture rotation was $21,999 and of costs was $20,218 at the 5% discount rate. (Table 3). The Central crop Model was used in this location due to the poor quality of the soils. (Canada Land Inventory agricultural classes 6 and 7).

The economic analysis indicates Williams has generated a total (in present value) of $137,078 in revenue from timber sales, while costs were about $5,233, resulting in a profit of $131,845 at the 5% discount rate. See Table 4.

Profit per acre from the 37 acres of hardwood woodlot totaled $308 per acre (sales were only made from 20 of the 37 acres), while profit per acre from coniferous plantations on the remainder of the property totaled $1,011 per acre.

While in this instance returns from the woodlot property do not compare as favourably with projected returns from agriculture, a few additional factors should be considered. First, the Williams plantation was established on former farm land that was abandoned because the coarse textured, stony soil was not productive for agriculture. Secondly, the results highlight the fact that the stage of maturity and state of management of the woodlot, has significant impact on how well woodlot returns can compare with those from agriculture. Both the plantation and hardwood forest on the Williams property are relatively young and are now likely moving into a period where quality of products harvested and subsequent returns should increase. It may be that if sales from this property continue to be monitored, returns from the woodlot could start to compare more favourably to those from agriculture. The long establishment period for plantation properties before returns are generated make it unlikely that returns from tree plantations can compare well with those from agricultural crops. However, often plantations are established on land that is marginal for agriculture for a variety of reasons, which of course further complicates the comparison, as it is unlikely that these areas could generate the level of net returns estimated by the crop rotation model.

Summary

The results of this analysis indicate that Williams was able to generate less 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 135% of the timber value.

Table 1 The Williams Forest Property Description

Land use	Description	Hectares (acres)
Hardwood Forest	Mature Hardwood	8.1 (20)
Hardwood Forest	Young Hardwood	6.9 (17)
Plantation	Red Pine Plantation	14.6 (36)
Plantation	White Spruce Plantation	2.4 (6)
Plantation	White Pine Plantation	2.8 (7)
Plantation	Mixed Plantation	4.9 (12)
Open	Roads and Landing	0.8 (2)

Table 2. Net Present Value Summary of All Sources of Income (1975 - 2010) from the Williams Woodlot at the 5% Discount Rate.

Source of Income	NPV ($/acre)	NPV ($/acre/year)
Timber Sales	1,318	37
Average Crop Rotation	1,781	50
Difference	**-463**	**-13**

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. (100 acre woodlot).

Year of Harvest	Volume Harvested *(i)*	Actual Revenue *(ii)*	Actual Costs *(iii)*	PV of Revenue	PV of Costs	NPV	NPV/Acre
Hardwood							
1977	26,000	2,100	0	10,507	0	10,507	105
1995	19,700	10,200	440	21,205	915	20,290	203
Conifer							
1979	240	1,669	0	7,574	0	7,574	76
1984	153	1,302	0	4,629	0	4,629	46
1989	167	2,660	0	7,411	0	7,411	74
1995	447	18,500	1,000	38,460	2,079	36,381	364
2002	366		1,516	0	2,240	-2,240	-22
2004		35,290	0	47,292	0	47,292	473
Total (1975 -2010)		**71,721**	**2,956**	**137,078**	**5,233**	**131,845**	**1,318**

(i) foot board measure (fbm) for hardwood and cords for conifer.

(ii) All revenue has been from sale of standing trees which were harvested by purchasers at their expense. Some value for fuelwood is included in the 1995 hardwood timber sale.

(iii) In all the harvests prior to 1995 the Williams did not incur any costs as marking was done through Ministry of Natural Resource programs. Since 1995 + the main costs were for marking trees for cutting and for site visits during logging. Costs in 2002 was for marking with harvest in 2004.

Costs for establishment of the plantations are not available. Most planting was done by family. Trees were free. From 1952 to 1962 Mack operated a cut-your-own Christmas tree operation with a net revenue worth $7,500. This was not included in the calculations.

Acknowledgments:
This case was prepared by Terry Schwan and Steve Bowers in 2006 and updated in 2012. Economic analysis carried out by Cher Brethour formerly of the George Morris Centre. Photos by Terry Schwan. Field work assistance from Kevin Reese.
Financial and /or in-kind support provided by Huron Stewardship Council, George Morris Centre, Huron Perth Chapter of the Ontario Woodlot Association, Maitland Watershed Partnership Initiative, Ontario Ministry of Natural Resources and Ontario Stewardship Opportunity Fund.

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