

**TIMRET: A Silviculture Investment Return
Software User's Manual**

by

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Abstract

This manual describes a micro-computer software, **TIMRET**, which was developed to aid the forest manager in evaluating profitability of silvicultural investments. Returns from a range of investment alternatives, e.g., forest renewal, cleaning, spacing, thinning, release, fertilization and tree improvements - can be calculated and compared by using any of the following criteria: 1) internal rate of return, 2) present net worth, 3) profitability index and 4) benefit/cost ratio. **TIMRET** calculates returns from treatment costs, and benefits such as increased yield, size premiums, logging cost reductions and product from trees removed by treatment. Examples of these inputs and examples of **TIMRET** software calculations are provided.

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Introduction

In today's increasing complex decision environment, the forest manager needs a simple, quick and interactive "user-friendly" financial analysis software to guide his decisions for evaluating forest management alternatives. **TIMRET**, a recently developed forestry investment analysis software, is a tool intended to meet this need.

Inputs to the program specify management alternatives and discount rates. The former may include; forest fertilization, spacing, thinning, release, tree improvement and wetland drainage. The program can calculate returns for any management practice which brings improved (changed) timber benefits such as increased stem wood yields, log size premiums, logging cost reductions from harvesting bigger trees and products from trees removed by treatments (Appendix 1). The analyst can organize the selected steps (transactions), such as cost and benefits into individual cases (files), that may be saved on disk, retrieved, and modified for further analysis. **TIMRET** enables the analyst to compute cash flow from investments before income taxes for six discount rates. Summary of result can be displayed and viewed on the screen, and/or printed. **TIMRET** can calculate financial returns from one hectare, a stand, or a whole forest. Each case is defined by a series of steps that specify costs and revenues. Net Revenues generated from these steps, and are subsequently used to compute financial returns.

An Example

An example named "TRY01 - white spruce release from trembling aspen" is stored on the DATA DISKETTE provided. Load and run this diskette for demonstration.

Terminology

REVENUES - appear as positive number on display and printouts;

COSTS - appear as negative numbers on display and printouts;

TIMBER YIELD AND DEPLETION - expressed in dollars per hectare (\$/ha). All timber volumes are converted to m³/ha for computing volumes for a stand or forest. The volumes are multiplied by market value of stumpage and entered;

CASH FLOWS - assumed to occur at the beginning of the year. So costs, revenues, occurring in year 1 are discounted for one year.

DATA - Steps describing forest management practices may be specified and entered in any order.

Press <RETURN> or <TAB> key after every entry.

Financial Analyses

The software can compute returns for management scenarios, that include several treatments, or can evaluate profitability of a specific treatment, either for a portion or the whole rotation.

Management Scenario Analyses: Most financial analyses are done to find out the treatment profitability for the stand or entire forest. These analyses provide information needed for evaluating profitability of forest management. In order to analyze various management options, you should specify all management activities or practises from the start

to the end of the rotation. Results of analyses will reflect the returns for the treatment(s) cost and their timing.

Marginal Analyses: determines the effect of specific added treatments to an existing investment. These analyses determine the extent to which extra treatments, such as better site preparation, thinning, or more fertilizer application improve wood yield. Financial returns are based on cash flow differences between a stand that received the extra treatment and the one that did not. Marginal analyses are also useful for comparing competing investments on the same tract of land.

Simple Comparisons: is between a treated and a control, to show if the treatment was profitable.

Starting and Ending Cases: A typical forest investment starts with the establishment of a new stand, but **TIMRET** may begin or end at any specified time. Often, the starting point is a major expenditure or treatment. Analyst should identify the first and last investment activity. Beginning activities include site clearing, site preparation, natural regeneration and planting. Some intermediate treatments such as cleaning, spacing, thinning or fertilizing may be beginning activities for other investments. Ending activities are usually final harvests and timber disposal.

Year Markers: **TIMRET** sets the base year for the investment at the first specified activity. All cash flows are discounted back to this. If an earlier base year is desired add a null activity ($C/B = 0$) to set it.

Entering and Editing Data

Analysis requires three data groups and must be entered to fully identify and define a case. The data entry order is arbitrary. For an example of data input see Appendix 2.

Title: Contains identifying information. To edit, open the title menu and select Edit option.

Costs/Benefits: Specifies management practices, costs, yields, products, prices and timing of treatments. To add to this section, open the costs/benefits menu and select the Add option; to edit, select the Edit option.

Economic Parameters: are discount rates and inflation rate. Default values are provided at the start of every analysis. To modify, open the Economic parameters menu and select the Modify option.

Data error checking is done throughout the data entry and editing process. A BEEP signals that the value you entered is incorrect or is not allowed. Reenter correct data. When entering data, you may use the back-space key to delete the character to the left of the cursor, the delete key to delete the character at the cursor, or the right and left arrow keys to move about the field without changing it. To move to the next field, press the tab or the return key. To move to the previous field press the back tab key.

When editing cost/benefit data, you may move about by pressing the up or down arrow keys. When new information, you may add that below the current value by pressing the down key. To delete a value, scroll (move along) to select the one you want and then open the costs/benefits menu and select the delete option.

Clearing an analysis is done from the File Options menu. If you open the File Options menu and select the Clear Case option all cost/benefit and title information will be deleted and the default discount rates and rate of inflation will be restored. Clearing deletes the case being analysed. If needed later it should be saved. Loading a new case from a disk clears any current information from the memory.

Title Information

Title information is used to identify the case. All entries are free-format text, and may include numbers and letters. Title data is not used in the analysis.

The maximum number of characters allowed for each entry is shown in parentheses.

Title (70): It should be descriptive so that the case can be easily identified later;

Analyst (25): The person doing the analysis;

Date (20): Of the analysis;

Case (8): The file name used for storing the information.

Activity

Specify activities which are expressed in costs and benefits for the investment. The speed and reliability of the analysis depends on how activities are entered and specified. Erroneous specification of activities will produce wrong analyses.

TIMRET checks for obvious entry errors, but cannot check for treatments cost, e.g., \$400/ha for thinning is as valid as \$40/ha.

You may enter up to 100 transactions per case.

Description: This is a 30 character description of the cost/benefit being entered, e.g., market value of increased yield. Enter a description which defines the entire investment cost/benefit and return flow pattern.

Present Value (\$/ha): Enter this value of cost/benefit in units of \$/ha. A cost is entered as a negative number, benefit as a positive number. Because TIMRET allows unrestricted input for the description of the cost/benefit, it cannot determine whether a transaction should be a cost or a benefit; so it is important to enter the present value with the correct sign.

Type: Three options can be selected for input. "Value" indicates that cost/benefit occurs in one year only, "Ann" indicates the cost/benefit occurs on an annual basis; and "Per" indicates that it occurs at regular intervals over a period of time;

First Year (1st Yr); Relative to year 0 in which the cost/benefit occurs. This is a required input for all costs/benefit analysis.

Last Year (Lst Yr); Relative to year 0, in which the cost/benefit occurs. This is only entered by the user for "Ann" and "Per" costs/benefits, costs/benefits for type "One" is set to the same value as the 1st Yr.

Step Year; Is the number of years between each occurrence of the cost/benefit. This is entered only if the cost/benefit is the type "Per". If costs/benefits is the type "One" or "Ann" this field is automatically set to 1.

First, last and step years are expressed as stand age at renewal, treatment and harvest. TIMRET establishes the base year as the earliest year, the year with the smallest number.

Length of investment, i.e., the difference between the first and last year, may not exceed 150 years.

Economic Parameters

Discount Rates are annual rates in percent and may be real or nominal values.

Inflation Rate is the average annual rate in percent expected over the life of the investment. Use an inflation rate of 0% for analyses done in real (or constant) dollar terms.

Discounting: All cash flows are treated as if they occur at the beginning of the year. Therefore, costs and revenues that occur in year 1 are discounted for one year, i.e., to the beginning of year 0.

Cash Flows: Each activity is expanded into one or more cash flows. A cost or revenue amount is calculated for the first year and repeated every step year until the last year. If the first year is the same as the last year, only one cash flow is computed. No cash flows will be computed for years beyond the last specified for the transaction. The extended cash flow amount is computed as follows where N is the number of years from the base year of the activity.

Activity List

A list of input activities is displayed, at all times, on the screen. Seven activities are displayed at once, but the user can scroll through all of them by pressing the **Down** or **Page Down** keys to scroll down the list; or by pressing the **Up** or **Page Up** keys to scroll up the list.

A complete activity list can be printed by opening the cost/benefit menu and selecting the **Print Costs/Benefits**. An example of this printout is in Appendix 4.

Financial Analysis Results

Financial returns are computed (Appendix 4) after opening the financial analysis menu and selecting the **Recalculate** option. Within a few seconds the results will be displayed in the financial analysis section of the screen.

The four financial criteria¹ are shown for the six discount rates selected.

Internal Rate of Return (IRR) is the discount rate which equates discounted costs and revenues. IRR is the return on investment if all immediate revenues are reinvested in the project. IRR is not affected by the discount rate, but is shown in each column for convenience. If the IRR can not be determined then ERR 1, ERR 2 or ERR 3 will be displayed.

Present Net Worth (PNW) is discounted benefits less discounted costs. A positive value indicates return exceeding the discount rate.

Profitability Index (PI) is the present net worth divided by treatment cost; used to rank investment in an order of profitability.

¹For details on criteria for financial evaluation of silvicultural investment forest renewal, and discount rates, see Brealey *et al.* 1986, Brumelle *et al.* 1988, Cassler *et al.* 1984, Fraser *et al.* 1977, Gregersen and Contreras 1979, Gregory 1987, Gunter and Haney 1984, Hawkins and Pearce 1971, Heaps and Pratt 1988. Row *et al.* 1981, Spiro 1984 and Sudgen and Williams 1978.

Benefit/Cost Ratio is the present value of the benefits divided by the present value of the costs. A value greater than 1.0 indicates that the discounted benefits exceed costs.

Solutions to Unique Problems

Too Many Cash Flows: Long investment cases may produce more than 100 cash flows, which must be reduced to conduct the analysis. An excessive number of cash flows can occur from including several annual costs, such as management fees, and leases in the transactions. One solution is to combine similar activities within a year, e.g. all activities with the same tax treatment. Another option is to combine costs or revenues, spread over several years into fewer payments, e.g., instead of annual management fee, apply double amount every second year. This will have only a minor effect on the outcome.

Investment Too Long if it extends beyond 150 years. Although this is unlikely to occur, one solution would be to arbitrarily reduce the investment length to 150 years by compressing cash flows into a shorter period. The present value (after discounting) of costs or revenues, that occur in the distant future is very small, so the effect on the outcome is small. A dollar received in 150 years is worth less than 0.1 cents today after discounting at 5 percent.

Save/Load/Delete

TIMRET allows to save, load, and delete cases from the data disk. This feature allows to save important cases for later use. Deleting cases will clear disk space for new cases.

Saving The Current Case: Open the file options menu and select **Save Case** option. You will need to input a filename. If the case already had a filename then this will be

displayed and you can either save the case under the old name, or you can input a new filename. You can save as many cases on the data disk as space allows.

Retrieving A Case: Open the file options menu and select **Open Case** option. You will need to enter a filename, and provided that this file exists on disk, it will be loaded in memory and displayed on the screen. Loading a case automatically deletes the current case.

Deleting A Case: Open the file options menu and select **Delete Case** option. You will need to enter a filename. You will be asked to verify that you indeed want to delete this file, then the file will be deleted.

Several demonstration cases are provided with the program. Practise loading, saving, and deleting these cases until one is familiar with the process.

Warning

Program Limitations to investments analysis may arise from storage arrays in the program and the available memory. As a precaution, one should make a backup copy of the **TIMRET** disks upon receipt for safe storage. These programs are not copy protected or copyrighted. Do not use the original program and data disks, except to make additional copies.

Always Verify Inputs: Look out for some of the following common errors that can be made when using this program.

- important activities left out, especially costs;
- Errors in data;
- number of years exceeds 150;

- relative year values are not correctly calculated.

Calling for Help

TIMRET was developed at Forestry Canada, Northern Forestry Centre by:

William J. Ondro, (Senior Research Economist, Forestry Canada) developed the original program concept, design, directed the work, and wrote the documentation.

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Case Worksheet

TIMRET: A Silvicultural Investment Return Software

Title Data

Title: _____

Author: _____ (25) Date: _____ (19) Case: _____ (8)

Economic Parameters

Discount Rates: 1 ____ 2 ____ 3 ____ 4 ____ 5 ____ 6 ____ (2 digits)

Inflation Rate: ____ (2 digits)

Costs Benefits

Description: _____ (30) \$/ha: ____ Type: One Ann Per

First Year: ____ Last Year: ____ Step Year: ____

Description: _____ (30) \$/ha: ____ Type: One Ann Per

First Year: ____ Last Year: ____ Step Year: ____

Description: _____ (30) \$/ha: ____ Type: One Ann Per

First Year: ____ Last Year: ____ Step Year: ____

Description: _____ (30) \$/ha: ____ Type: One Ann Per

First Year: ____ Last Year: ____ Step Year: ____

Description: _____ (30) \$/ha: ____ Type: One Ann Per

First Year: ____ Last Year: ____ Step Year: ____

Description: _____ (30) \$/ha: ____ Type: One Ann Per

First Year: ____ Last Year: ____ Step Year: ____

Description: _____ (30) \$/ha: ____ Type: One Ann Per

First Year: ____ Last Year: ____ Step Year: ____

List of Suggested Readings

- Anderson, F.J. 1979. Ontario reforestation policy benefits and costs. *Can. Pub. Policy* 3(1): 336-347.
- Alemdag, I.S.; Honer, T.G. 1973. Relationships between breast-height and stump diameter for eleven tree species from eastern Canada. *Environ. Can., Can. For. Serv., For. Manage. Inst., Ottawa, Ont. Inf. Rep. FMR-X-149*. 14 p.
- Brealey, R.; Myers, S.; Sick, G.; Whaley, R. 1986. *Principles of corporate finance*. McGraw-Hill. New York. 386 p.
- Brumelle, S.L.; Carley, J.S.; Vertinsky, I.B.; Wehrung, D.A. 1988. Evaluating silvicultural investments: An analytical framework. FEPA Research Unit, Univ. Brit. Col., Vancouver, British Columbia, Working Paper 116.
- Buongiorno, J.; Giles, J.K. 1987. *Forest management and economics*. MacMillan Publishing Company Ltd., New York, N.Y.
- Cassler, G.L.; B.L. Anderson; Aplin, R.D. 1984. *Capital investment analysis using discounted cash flows*. Grid Publishing, Inc. Columbus, Ohio.
- Fraser, T.; Tustin, J.R.; Szumidlo, Z. 1977. *Financial evaluation of forestry projects*. New Zealand Forest Service, Wellington, N.S., Inf. Ser. 75.
- Gittinger, J.P. 1982. *Economic analysis of agricultural projects*. 2nd edition. The John Hopkins University Press, Baltimore and London.
- Gregerson, H.M.; Contreras, A.H. 1979. *Economic analysis of forestry projects*. Food and Agric. Organiz. of the United Nations, Rome. FAO Forestry Paper 17.

- Gregory, G.R. 1987. Resource economics for foresters. John Wiley and Sons, New York, N.Y.
- Gunter, J.E.; Haney, H.L. 1984. Essentials of forest investment analysis. Oregon State Univ. Book Stores Inc., Corvallis, Oregon.
- Hawkins, C.J.; Pearce, D.W.. 1971. Capital investment appraisal. The MacMillan Press Ltd. London and Basingstoke.
- Hannula, O. 1971. The effect of average stand diameter on tree length logging cost. Pulp Pap. Mag. Can., 72(2):96-100.
- Heaps, T.; Pratt, B. 1988. The social discount rate for silvicultural investments. FRDA Report prepared for B.C. Ministry of Forests. Victoria, British Columbia.
- Honer, T.G. 1967. Standard volume tables and merchantable conversion factors for the commercial tree species of central and eastern Canada. Can. Dep. For. Rural Dev., For., Inf. Rep. FMR-X-5.
- Johnstone, W.D. 1976. Variable-density yield tables for natural stands of lodgepole pine in Alberta. Fish. Environ. Can., Can. For. Serv., Ottawa, Ont., For. Tech. Rep. 20. 110 p.
- Ondro, W.J.; Constantino, L.F. 1990. Financial returns from fertilizing 70-year-old lodgepole pine near Hinton, Alberta. For. Chron. 66(3): 287-292.
- Ondro, W.J. 1990. Benefits, costs and profitability of precommercial thinning of three lodgepole pine stands in Alberta. For. Can., North. For. Cent., Edmonton, Alta., Unpubl. rep.
- Payandeh, B. 1989. Forestry Investment Decision Model "FIDMEPC". Developed by Forestry Canada, Great Lakes For. Cent., Sault Ste. Marie, Ont., January, 1989.

- Payandeh, B.; Field, J.E. 1985. FIDME: Forestry Investment Decisions Made Easy. Can. For. Serv., Great Lakes For. Cent., Sault Ste. Marie, Ont., Inf. Rep. O-X-364.
- Plonski, W.L. 1960. Normal yield tables. Ont. Dept. Lands and Forests, Toronto, Ont. Timber Series Bull. No. 3.
- Row, C.; Kaiser, H.F.; Sessions, J. 1981. Discount rate for long-term Forest Service Investments. J. For. 179(6):367-369.
- Spiro, P. 1984. Exchange rate risk and the cost of foreign capital. Can. Public Policy. Vol. 10(1):54-65.
- Sudgen, R.; Williams, A.H. 1978. Principles of practical cost-benefit analysis. Oxford University Press.
- Vasievich, J.M.; Frebis, R.; Wiethe, R.W. 1984. Quick Silver. The Forestry Investment Analysis Program, Version 2.0 PC. Developed by U.S. Dep. Agric., For. Serv., the Southeastern Center for Forest Economic Research (SCFER), Triangle Park, North Carolina, U.S.A. November 1984.

APPENDIX 1

MARKET VALUE OF INCREASED WOOD YIELD

Increased wood yield is the difference between total (merchantable) volume in treated and untreated (control) stands at rotation age. Market value of increased yield is the volume of increased wood yield multiplied by the market value of stumpage.

MARKET VALUE OF PRODUCTS FROM TREES REMOVED BY TREATMENT

Trees removed by treatment is the total (merchantable) stem volume used for various products. Their market value is the volume of trees removed multiplied by market value of stumpage.

APPENDIX 2

Table 1. Example of financial data input for wS released from tA at Ws age 50 years.

Description	Cost/Benefit (\$/ha)	Frequency	Age at treatment (harvest)		
			Stand 1st Yr	Last Yr	Step
Treatment Cost	-1060	One	50	50	1
Market Value of Incr. Yield					
Spruce	334	One	100	100	1
Aspen	347	One	100	100	1
Log Size Premium	85	One	100	100	1
Log. Cost Reduction: Convent. Fellerbuncher	880	One	100	100	1
Trees Removed by Treatment					
Spruce	212	One	50	50	1
Aspen	638	One	50	50	1

APPENDIX 3

Table 1. Example of calculation speed for IRR, PNW, PI and B/C ratio for three computerized financial systems and manual calculations.

Study area and location	wS age at treatment (years)	Resid. stand density (trees/ha)		IRR (%)	Calculation speed ¹ (min.)					
		Spruce	Aspen		TIMRET		Quick Silver		Manual calculation	FIDME
Young (15-25-year-old spruce) stands:										
Candle Lake 1	27	170	0	2.14	2:10	4:05	6:15	8:35	90:00	40:00
Candle Lake 2	32	1890	0	3.83	2:05	4:10	6:25	7:55		
Big River	42	2190	0	4.39	1:55	4:00	5:40	6:25		
Big River Nursery	20	840	0	2.09	2:05	3:25	5:05	6:10		
Montreal Lake	27	730	0	3.09	1:45	3:15	5:10	5:50		
Intermediate (50-60-year-old spruce) stands										
Duck Mountain 1	50	1160	940	4.18	2:15	3:40	5:35	7:20		
Duck Mountain 1	50	1030	640	4.07	2:10	3:30	6:20	7:15		
Mature (75-85-year-old spruce) stands										
Sled Lake 1	85	520	300	11.94	2:10	3:20	5:10	6:55		
Sled Lake 2	85	620	240	10.91	1:50	3:05	5:20	7:25		
Divide Reserve 1	75	620	50	7.42	2:05	2:45	5:25	7:15		
Divide Reserve 2	75	630	20	7.44	2:10	2:35	6:40	6:30		

ERR - IRR gives more than one solution, or is incalculable

¹ for four financial criteria; IRR, PNW, PI, and B/C ratio

APPENDIX 4

Table 1. Results of financial analysis for Duck Mountain 1

Discount Rate						
Inflation 0%	3%	4%	5%	6%	8%	10%
IRR	4.20	4.20	4.20	4.20	4.20	4.20
PNW	165.46	21.61	-66.46	-120.64	-174.91	-195.98
PI	-0.16	0.02	-0.06	-0.11	-0.17	-0.18
B/C	1.16	1.02	0.94	0.89	0.83	0.82