

ACESREDP, Version 2.6

An Allowable Cut Simulation for Red Pine with Thinning Options
Microcomputer Program

User's Manual¹

Dietmar W. Rose²

May 1994

STAFF PAPER SERIES NO. 91

¹ Contribution No. 21,134 of the Minnesota Agricultural Experiment Station.

² Professor, Department of Forest Resources, University of Minnesota, St. Paul, MN 55108.

Table of Contents

	Page
PREFACE	1
INTRODUCTION	2
INSTALLATION OF ACESREDP	3
Using DOS	3
Using SETUP Program	3
PROGRAM INPUTS	5
PROGRAM OUTPUTS	7
INSTRUCTIONS FOR USING ACESREDP	7
Main Menu Options	9
Option 1: Overview	9
Option 2: Technical Reference	11
Option 3: Set Paths Defaults	12
Option 4: Review Yield Tables	13
Suboption 1: Overview	15
Suboption 2: Technical References	16
Suboption 3: Set Paths Defaults	16
Suboption 4: Run Thinning Program	16
Suboption 5: View Yield Tables	24
Suboption 6: Print Yield Tables	24
Suboption 7: View Yield Table Graphs	25
Suboption 8: Leave Program	25
Option 5: Sample Run	26
Option 6: Run ACESREDP	30
Data Entry Options	30
Option 1 (Recall stand data from previously created files)	30
Suboption 1: See the list of filenames	30
Suboption 2: Enter the data filename	31
Suboption 3: Return to MAIN MENU	32
Option 2a: Enter New Stand Data	32
Option 2b: Enter New Run Parameters	37

Table of Contents (continued)

	Page
Main Editing Menu Options	39
Option 1: Edit stand data	39
Option 2: Edit run parameters	42
Option 3: Edit thin parameters	43
Option 4: Perform Calculations	45
Option 5: Return to MAIN Menu	45
Option 7: View ACESREDP Output	45
Option 8: Print ACESREDP Output	46
Option 9: View ACESREDP Graphs	47
Suboption 1: Set Paths Parameters	47
Suboption 2: Enter Plot Data File	48
Suboption 3: Exit REDPGRAF	49
Option 10: Exit ACESREDP	50
REFERENCES	50
APPENDIX I - Sample Stand Data and Run Parameter Files	51
APPENDIX II - Sample Output	53

PREFACE

ACESREDP Version 2.6 is a menu-driven microcomputer program written in Microsoft Professional Basic Version 7.1 for application on the IBM personal computer and its compatibles. These computers must have at least 215K of available RAM to run ACESREDP and the graphing program REDPGRAF called by ACESREDP. REDPGRAF alone requires about 150K RAM. The amount of available RAM is defined as the total amount of RAM in your computer minus the amount allocated to DOS and any utility programs that may be installed. Because the program generates graphics output, it requires a graphics card. A color monitor is preferable to a monochrome display with a graphics card. Finally, it requires DOS (Disk Operating System) version 3.0 or later, and the ACESREDP diskette.

This manual describes how to use ACESREDP, a program which calculates allowable cuts according to various volume control and area control methods and simulates the growth of a specified inventory over time with an allowable cut being implemented at user-specified intervals. The discussion in this manual assumes a basic understanding of computer systems. It is also helpful to be familiar with basic principles of forest regulation and allowable cut determination. Several references are provided with this manual.

The program allows the user to quickly calculate allowable cuts using one of eight volume control methods (including a user defined annual cut) or area control with adjustment for site productivity. The program evaluates the impact of different regulation or allowable cut methods on a forest property in terms of growth, growing stock, and ageclass distribution. Input data required for the program consist of stand data describing current inventories of the covertype for which allowable cuts are to be calculated and a number of run parameters. Stand data or stand parameter inputs created via keyboard input may be permanently saved before logging off to facilitate future analysis with these data and to reduce the time and effort for data entry. Editing options facilitate the future modifications of any of these data for additional analyses. All input statements are checked by the program for correctness. An error message will appear on the screen if the user enters an unacceptable input value. The user can correct the data entry error at this point and proceed with the analysis.

To obtain information about receiving a copy of ACESREDP write to the author at:

Dietmar W. Rose
College of Natural Resources
1530 North Cleveland Avenue
St. Paul, MN 55108
Tel. (612)624-9711

Program protection: It is the user's responsibility to backup the ACESREDP diskette. To do this you should format a new diskette and copy the hidden system files onto it. You should then copy each file on the ACESREDP diskette to the new diskette. Do not use the DISKCOPY or DISKCOMP facilities. Consult your Disk Operating System manual for details. Copies should only be made for backup purposes.

Program updates: Users will be notified of any major changes made to the ACESREDP program. New versions may be obtained by returning the original ACESREDP diskette to the authors. Please send a preaddressed and prestamped envelope with a blank and formatted diskette. Request for modifications of ACESREDP to fit a particular user's need will be handled on an individual case basis.

Disclaimer: Although all software on the ACESREDP diskette has been extensively tested and checked for accuracy and, to the best of the author's knowledge, contains no errors, the author does not accept any responsibility for any errors that do arise. The author would appreciate having any errors or problems brought to his attention.

INTRODUCTION

"The organization and control of the growing stock for a sustained yield of forest products from a specified forest area has traditionally been called forest regulation" (Meyer, Recknagel, Stevenson, and Bartoo 1962). The regulation of a forest property is one of the major tasks practicing foresters face. The primary regulation tool available to managers is the timing and size of timber cuts.

However, evaluating all of the potential alternatives may require many calculations. This process can become very tedious and time consuming. Therefore, microcomputer algorithms have been developed to simplify the task of enumerating the various alternatives. This manual describes the use of one set of algorithms in the form of the Allowable Cut Evaluation Simulator (ACESREDP) software. Input requirements are limited to stand data and various run parameters.

Access to these algorithms or models does not diminish the decision makers need to understand the conceptual basis of allowable cut calculations and the importance of the data inputs required for application of these tools. The user is thus encouraged to study one or more publications that provide a basic introduction to the topic, e.g., Rose and Burk (1980); Meyer et al. (1961); Clutter et al. (1983); Leuschner (1984), Buongiorno and Gilless (1987).

The objectives of this manual are:

1. To describe how ACESREDP is used for allowable cut calculations.
2. To illustrate the various output options of the program through examples.
3. To facilitate data preparation for allowable cut analysis and to support classroom instruction and independent study.

INSTALLATION OF ACESREDP

Using DOS

Before using the ACESREDP disk, make a working copy and label it. The ACESREDP disk is not copy protected, so follow these steps to make a working copy on a diskette:

1. Put your DOS disk in drive A.
2. At the A>, type **FORMAT B:/S** and press <ENTER>.
3. Put a blank working copy disk in drive B.
4. Press any key to continue. When asked if you want to format another disk, type **N** and press <ENTER>, if necessary.
5. Remove your DOS disk from drive A, put the ACESREDP program disk in drive A, type **COPY A:.* B:**, and press <ENTER> to start the copy procedure.

Put the program disk away in a safe place and use the working copy for your applications. You may also use the **COPY** command to transfer all program files to any other drive including a hard disk or utilize the **SETUP** program supplied with ACESREDP.

Using SETUP Program

An installation program **SETUP** on the program diskette can be used also to install the program and all necessary files to any specified hard disk. Simply insert the program diskette in a drive, type <**SETUP**> and follow the simple instructions on the screen. The proper files will be copied to the hard disk. Drive "A" is the default input drive, but the system will determine from which drive the **SETUP** program was activated. The default destination drive and directory is C:\ACESREDP. The **SETUP** program itself will not be saved to the hard disk. The following shows the input screens the user will see during installation:

ACESREDP INSTALLATION PROGRAM
DEFAULT INPUT DRIVE for ACESREDP files: A:\
DEFAULT DESTINATION DRIVE for ACESREDP files: C:\ACESREDP

(1) Change input drive/directory for ACESREDP files...
(2) Change destination drive/directory for ACESREDP files.
(3) Install ACESREDP as specified...
(4) Exit the installation program...

Use Numeric or Arrow Keys to select option
Press <Enter> to execute the option

Enter Drive/Directory String, e.g. C: or C:\FILES: B:

ACESREDP INSTALLATION PROGRAM

NEW INPUT DRIVE for ACESREDP files: B:\
DEFAULT DESTINATION DRIVE for ACESREDP file: C:\ACESREDP

- (1) Change input drive/directory for ACESREDP files...
- (2) Change destination drive/directory for ACESREDP files
- (3) Install ACESREDP as specified...
- (4) Exit the installation program...

Use Numeric or Arrow Keys to select option
Press <Enter> to execute the option

Enter Drive/Directory String, e.g. C: or C:\FILES: D:\ACESREDP

ACESREDP INSTALLATION PROGRAM

NEW INPUT DRIVE for ACESREDP files: A:\
NEW DESTINATION DRIVE for ACESREDP files: D:\ACESREDP

- (1) Change input drive/directory for ACESREDP files...
- (2) Change destination drive/directory for ACESREDP files.
- (3) Install ACESREDP as specified...
- (4) Exit the installation program...

Use Numeric or Arrow Keys to select option
Press <Enter> to execute the option

Copying files to directory:D:\ACESREDP
C:\BC7\FILES\REDPGRAF.EXE
C:\BC7\FILES\ACESREDP.EXE
C:\BC7\FILES\SETUP.EXE
3 File(s) copied
C:\BC7\FILES\ACESPAR.EXP
C:\BC7\FILES\ACEDAT.EXP

ACESREDP program has been successfully installed in drive D:\ACESREDP
Press a key to continue...

ACESREDP INSTALLATION PROGRAM

NEW INPUT DRIVE for ACESREDP files: A:\
NEW DESTINATION DRIVE for ACESREDP files: D:\ACESREDP

- (1) Change input drive/directory for ACESREDP files...
- (2) Change destination drive/directory for ACESREDP files.
- (3) Install ACESREDP as specified...
- (4) Exit the installation program...

Use Numeric or Arrow Keys to select option
Press <Enter> to execute the option

To run ACESREDP, simply type <ACESREDP> from the created directory
Press a key to continue...

PROGRAM INPUTS

ACESREDP can be used to organize and develop allowable cut schedules. Program inputs consist of the following information:

- (1) Stand data required for each stand includes:

acres, age, volume in cu ft, cords or bd ft per acre, and site index.

Additionally, several title lines (1-5 lines, 60 characters/line) can be entered to describe a specific analysis and two parameters need to be specified for the stand data:

- Volume Units: 1 = Cu ft, 2 = Cords, 3 = bd ft
- Covertype Selected: Only red pine currently

- (2) Run parameters including:

- Covertype Selected (only red pine available currently)
- Annual or abbreviated output reports
- Volume Output Units: (Cu ft, cords, or bd ft)
- Ageclass Width: Years
- Rotation: Years
- Minimum Cutting Age: Years
- Growth multiplier (default value 1.0):

the user can carry out sensitivity analyses on growth by entering a different value from the default multiplier. For example, setting the multiplier to 1.1 would increase growth by 10 percent for as long as this parameter was not changed. The user can change this parameter after each simulation period. The program will provide a warning if the multiplier falls outside a specified range.

- Interval to Reevaluate Allowable Cut: Years
- Number of Times to Evaluate Allowable Cut:

The program limits the number depending on the simulation interval chosen.

- Cut Determination Method:

- | | |
|--|------------------------------------|
| 1. Tabular Check | 5. Von Mantel |
| 2. Barnes Method | 6. Hundeshagen |
| 3. Austrian | 7. Hanzlik |
| 4. Chapman | 8. User input of annual volume cut |
| 9. Area control adjusted for site productivity | |

- Adjustment period for Austrian formula

- Cutting Priority:

1 = Decreasing age, 2 = decreasing age and site

- Abbreviated Output: (Yes or No)

Abbreviated output includes summaries of growing stock distributions at each planning interval grouped by a user specified ageclass width and information about allowable cuts as well as the graphical output options; the long output provides additionally individual stand-level information.

- Cubic feet/cord conversion factor (default 79)

- Cubic feet/board foot conversion factor (default 0.158)

The program carries out all internal growth functions and stocking calculations in cubic feet. The yield model projects total cubic foot volumes. When cord or board foot volumes are entered, they are converted to cubic feet before growth and yield functions are activated or stocking calculations are carried out. Thus the user needs to fully understand the impact of entering a specific conversion factor. Conversion factors should reflect the required volume unit on the basis of total cubic foot tree volume. Outputs, therefore, also reflect total tree volumes in the requested unit and may have to be scaled to estimate usable volumes using different conversion factors. The yield table board foot volumes (option 4 in ACESREDP) are board foot volumes in the traditional sense and thus have no relation to the conversion factor that a user would enter. To avoid any problems of interpretation, it is recommended to convert stand inventory volumes into total cubic foot volumes before running ACESREDP.

(2) Thin parameters including:

- Entry Age of Future Regenerated Stands
- Initial Basal Area at Entry Age
- Growth/Thinning Interval
- Thinning Option

Appendix I provides a listing of sample stand data input and run parameter files.

PROGRAM OUTPUTS

After all input data has been entered and the appropriate calculations have been performed by the program, ACESREDP displays the results on the screen, and writes the same output to a user specified disk file. Appendix II shows sample file outputs for both the long and the short output option. Each output includes:

- Stand data and run parameter summaries
- Initial and periodic inventory summary
- Annual cut summary

Plots of major simulation results when volume control methods are simulated can be viewed during a run. ACESREDP writes an output file with extension ".PLT" of the plot data which can be read by a stand-alone program called **REDPGRAF.EXE** to generate the plots. The user thus can generate these plots by simply typing **REDPGRAF** at the system prompt after having left ACESREDP and as long as this file has not been deleted or been overwritten by a new ACESREDP run.

Two additional files with the run name and extensions ".TAB" and ".ASC" are written to the outout directory. The first tracks the performance of the Tabular Check iteration algorithm and is of interest to the program developer for possible improvements in the algorithm and to spot problems of the algorithm converting to a solution. The second file writes some outputs results that the user might find useful for plotting in an external graphing program like Quattro Pro. The file with extension ".PLT" also contains data that the user might want to use for external plotting purposes.

INSTRUCTIONS FOR USING ACESREDP

In this section, the various ACESREDP input screens will be displayed and discussed to provide assistance when entering and/or editing data. The best way to learn how to use ACESREDP, is to follow through a complete session utilizing all key options that are available such as is done below.

The computer needs to be turned on. Place the ACESREDP disk in drive A and close the drive door. The program will then load and start to run automatically. If the computer is on and you see the A> on the screen, type **ACESREDP** and then press the <**ENTER**> key. Do not cover the write protect notch on your working copy disk if you want the program to save data files and write output files to the disk during program operation. If you write protect your working disk, you will need access to another drive to save data and program outputs. To run ACESREDP from a hard disk, you simply type **ACESREDP** from the directory in which the program files reside. The <**ENTER**> key is used to send typed information from the keyboard and the screen (monitor) to the central processing unit of the microcomputer. The <**ENTER**> key must be pressed after typing in the appropriate response to the various data entry prompts within the program. After completing the above step, ACESREDP will display the program title and sofware disclaimer screens:

ACESREDP Version 2.6

ALLOWABLE CUT EVALUATION PROGRAM

Written By

Dietmar W. Rose

Portions Copyright Microsoft Basic 7.1, 1990.
All rights reserved.

Copyright 1993 by Dietmar Rose.

Press any key to continue....

ACESREDP SOFTWARE DISCLAIMER

All the software on the ACESREDP diskette has been extensively tested and checked for accuracy and, to the best of the author's knowledge, contains no errors. However, the author does not provide any guarantees and is not responsible for errors that may arise during the use of this software. Any errors found by the users should be brought to the author's attention in order to incorporate appropriate changes in future versions. Future revisions of ACESREDP will be available by returning the program diskette or a blank diskette and a check for \$15 payable to the author. Please call or write if you have questions. For permission to use or copy this software or obtain ACESREDP updates write to:

Dr. Dietmar W. Rose
1539 12th Terrace NW
New Brighton, Minnesota 55112
Tel. (612)636-7395 or (612)624-9711
E-Mail (Internet): drose@mercury.forestry.umn.edu

Press any key to continue....

Press any key to exit the software disclaimer screen and to display the following MAIN MENU screen:

COPYRIGHT
1993
Dietmar Rose

ACESREDP: ALLOWABLE CUT EVALUATION SIMULATOR
FOR RED PINE WITH THINNING OPTIONS

Version 2.6
April 1994

ACESREDP Main Menu

1. Overview
2. Technical Reference
3. Set default paths
4. Review Red Pine Yield
5. Sample Run
6. Run ACESREDP
7. View ACESREDP Output
8. Print ACESREDP Output
9. View ACESREDP Graphs
10. Exit ACESREDP

Use Numeric or Arrow Keys to select option
Press <Enter> to execute the option

MAIN MENU OPTIONS

Main Menu Option 1 - Overview

This option provides an overview of the ACESREDP program over several screens. After reading an overview screen, press any key to review the next screen. After reading all screens, press any key to return to the MAIN MENU:

ACESREDP USER INFORMATION AND OVERVIEW

ACESREDP is a user-friendly microcomputer program written for the IBM personal computer and IBM compatibles in Microsoft BASIC. These computers should have at least 360K of available RAM memory to run ACESREDP and ACESGRAF. ACESREDP alone can be run with 200K RAM, but does not provide access to the graphical outputs.

ACESREDP calculates allowable cuts for even-aged red pine inventories according to area and several volume control methods. It allows study of the impact on growing stock volumes, growth, and harvest volumes produced when various standard cut determination methods are applied to the forest. It is assumed that the user can divide the forest into a finite number of management units. The stands can be thinned or not. The program is currently dimensioned to handle up to 650 stands. In the simulation, these stands are grown according to a basal area growth model developed by Chen and Rose (see references).

Press any key to continue....

The program simulates only thinned or unthinned red pine in the Lake States. The growth and yield model can be reviewed and individual stand thinning experiments can be carried out.

The user needs to provide the following inputs:

- (A) Rotation age-the harvest age for all stands in regulated forest.
- (B) Minimum cutting age--A warning will be given if stands less than this age are cut.
- (C) Interval (in years) at which allowable cut is reevaluated - The program will cut the forest according to the specified formula with this number of years at which time a revised calculation is done.
- (D) Number of times allowable cut is to be reevaluated at the interval specified above.
- (E) Cut determination method--one of 8 volume allowable cut formulas (including an option for a user specified allowable cut input) or area control with adjustment for site productivity.
- (F) Adjustment period for Austrian allowable cut formula.
- (G) Volume units conversion factors.

Press any key to continue....

Stand information may be entered from

- (1) the keyboard,
- (2) from a previously created file stored on a disk prior to program execution or generated through keyboard input in a previous run.

In each case, data entered for each stand are:

- (1) Acreage of stand
- (2) Age of stand
- (3) Stand volume per acre in cu ft, cords, bd ft or Stand basal area per acre in sq ft.
If volume is entered, basal area is derived from volume and height, if basal area is entered volume is calculated from basal area and height. Height is predicted from age and site index.
- (4) Site index of stand

Press any key to continue....

The order in which the stands are entered is arbitrary. The program will sort the stand inventory according to a user specified cutting priority:

- (1) By decreasing age
- (2) By decreasing age and site index

For further information, users should consult technical references (choice 2 on the MAIN MENU) and textbooks on forest management.

Press any key to continue....

INTEGRATED RED PINE THINNING MODEL FOR SINGLE STANDS OR INVENTORIES

The red pine simulator is a user-friendly microcomputer program written for IBM personal computers and IBM compatibles in Microsoft Professional Basic Version 7.1. This stand-alone program has been integrated in the allowable cut simulation program ACESREDP. Thinning schedules can be for a number of user controlled run parameters. Optimal thinning schedules can be generated also. This result is possible due to a dynamic programming solution to a thinning formulation. These optimal solutions maximize total biological volume production over the planning period. Economic optima cannot be derived, but the user can control parameters that reflect the technical feasibility and, therefore, the economics of thinning. For information on the dynamic programming solution technique and the red pine basal area growth model, the user should consult the technical references (Main menu item 2).

Press any key to continue....

MAIN MENU Option 2 - Technical Reference

This option provides the key reference for the ACESREDP program . After noting the technical reference, press any key to retrun to the MAIN MENU:

ACESREDP TECHNICAL REFERENCES

The three references below provide important background information on forest regulation and the growth and yield model used in the ACESREDP simulation program. These references and a user's manual are shipped with the program when purchased.

Rose, D.W. 1992. Determination of the Allowable Cut - Technical Background Paper to ACESREDP Program. College of Natural Resources, Univ. of Minnesota, 58 pp.

Lime, S.D., Walters, D.K. and A.R. Ek. 1991. GIP: Software for Implementing Stand Level Growth and Yield Equations. The Compiler ((4):36-42.

Walters, D.K. and A.R. Ek. 1993. Whole stand yield and density equations for fourteen forest types in Minnesota. Northern J. of Applied Forestry, 10(2):75-85.

Press any key to continue....

RED PINE THINNING TECHNICAL REFERENCES

The three references below provide important background information on the dynamic programming solution for an optimal thinning sequence for red pine stands:

Chen, C.M., D.W. Rose, and R.A. Leary. 1980. Derivation of optimal stand density over time - A discrete stage, continuous state dynamic programming solution. For. Sci. 26:217-227.

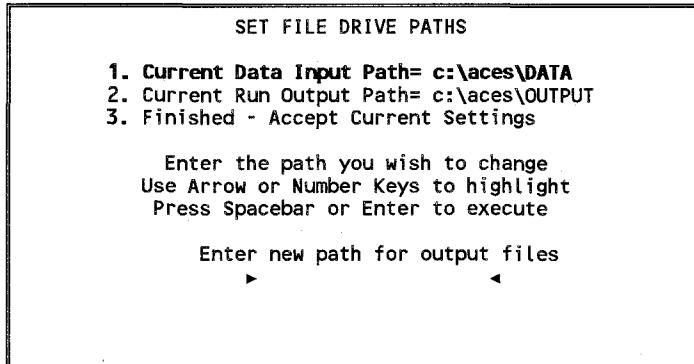
Chen, C.M., D.W. Rose, and R.A. Leary. 1980. How to formulate and solve optimal stand density over time problems for even-aged stands using dynamic programming U.S. For. Serv. Gen. Tech. Rep. NC-56. 17p.

Rose, D.W., C.M. Chen, and R.A. Leary. 1981. Maximum cubic volume production through easily derived optimum thinning schedules. J. For. 79:32-35.

Press any key to continue....

MAIN MENU Option 3 - Set Paths Defaults

This option allows the user to set the directories and paths from where data will be read and where outputs will be stored. The program reads in default values from file "ACESREDP.PTH". When the user changes any path parameters, the new values will be written to this file and will become the default values the next time ACESREDP is being run. When entering on a highlighted item, the program will prompt the user for a new path and retain the old path, if no new value is entered:



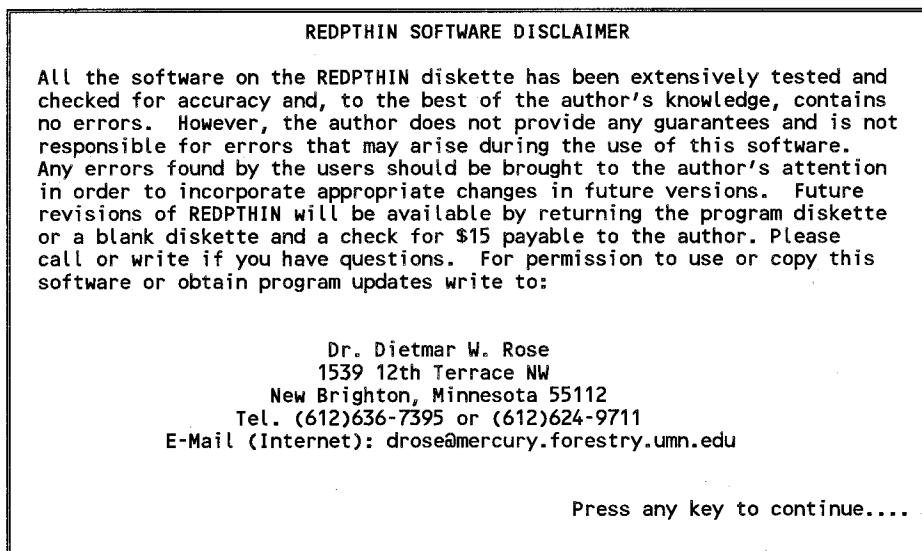
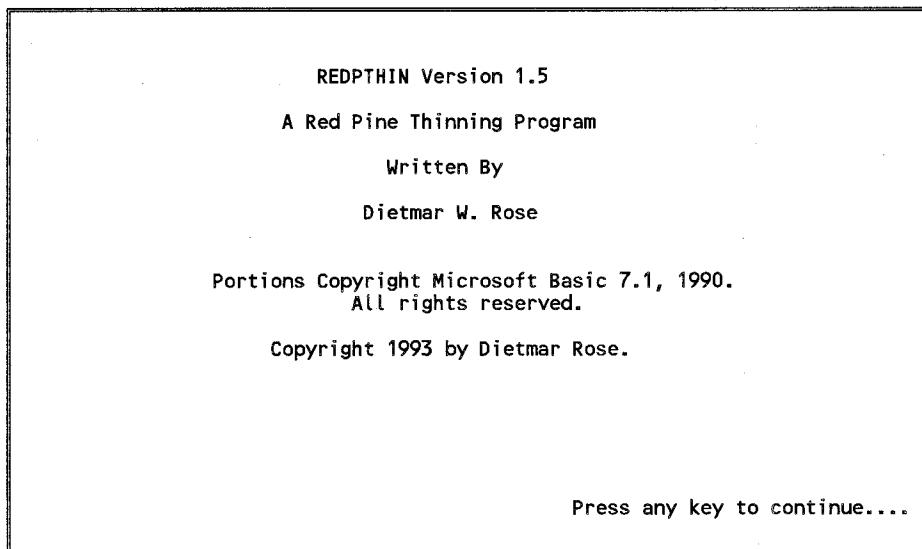
Main Menu Option 4 - Review Red Pine Yield

This option provides the user an opportunity to review the growth and yield model used by ACESREDP. The option activates a computer program, REDPTHIN, that permits the development of optimal thinning schedules for red pine plantations in the Lake States. The optimal schedules maximize total cubic foot volume production for any initial stand condition of age, site, and basal area stocking. These optimal schedules are derived via a special dynamic programming algorithm that the authors have developed (Chen, Rose, and Leary 1980). User specified thinning schedules can be simulated. Optimal biological rotation age and mean annual increment can be derived from the output table.

Timber yields both in terms of quantity and quality depend on management inputs. Among the most important stand decisions are thinning decisions. The latter deal with the intensity and timing of partial timber removal to improve timber growth and/or quality. Derivation of optimal thinning decisions is a complex problem because each thinning decision influences all future thinning options, i.e., the problem is one of deriving an optimal sequence of optimal thinning decisions. Foresters have long been aware of the long-term implications of any given thinning decision. For example, a severe thinning in a young plantation may significantly reduce the range of possible residual densities as the stands gets older. This problem of interrelated decisions can be solved optimally using a technique called dynamic programming (Bellman 1957).

Chen, Rose, and Leary (1980) developed a special dynamic programming algorithm that can derive optimal thinning schedules where the objective function is the maximization of total wood production and where the state variable basal area is continuous, i.e., at each decision stage (age), an infinite number of basal area removal options exist. Rose, Chen, and Leary (1981) demonstrated on an example for red pine how this algorithm could be used to calculate in a number of computational steps an optimal thinning schedule. To facilitate the use of this algorithm for varied initial stand conditions and for various thinning options and constraints, a computer program, REDPTHIN, was developed by the major author which implements this algorithm in a user-friendly microcomputer program in Professional Basic 7.1. This paper provides a description of this program and an application example. The executable version of this program requires a personal computer with DOS 3.0 or higher and about 100K of random access memory (RAM). The program is executed by typing

<REDPTHIN> from the prompt. After the opening screen and software disclaimer screen, the main menu screen provides a number of options:



COPYRIGHT
1993
Dietmar Rose

OPTIMAL THINNING FOR RED PINE

Version 1.5
April 1994

Thinning Main Menu

- 1. Overview
- 2. Technical Reference
- 3. Set Path Defaults
- 4. Run Thinning Program
- 5. View Yield Tables
- 6. Print Yield Tables
- 7. View Yield Table Graphs
- 8. Exit Program

Use Numeric or Arrow Keys to select option
Press <Enter> to execute the option

Suboption 1: Overview

INTEGRATED RED PINE THINNING MODEL FOR SINGLE STANDS OR INVENTORIES

The red pine simulator is a user-friendly microcomputer program written for IBM personal computers and IBM compatibles in Microsoft Professional Basic Version 7.1. This stand-alone program has been integrated in the allowable cut simulation program ACESREDP. Thinning schedules can be for a number of user controlled run parameters. Optimal thinning schedules can be generated also. This result is possible due to a dynamic programming solution to a thinning formulation. These optimal solutions maximize total biological volume production over the planning period. Economic optima cannot be derived, but the user can control parameters that reflect the technical feasibility and, therefore, the economics of thinning. For information on the dynamic programming solution technique and the red pine basal area growth model, the user should consult the technical references (Main menu item 2).

Press any key to continue....

Suboption 2: Technical References

RED PINE THINNING TECHNICAL REFERENCES

The three references below provide important background information on the dynamic programming solution for an optimal thinning sequence for red pine stands:

Chen, C.M., D.W. Rose, and R.A. Leary. 1980. Derivation of optimal stand density over time - A discrete stage, continuous state dynamic programming solution. *For. Sci.* 26:217-227.

Chen, C.M., D.W. Rose, and R.A. Leary. 1980. How to formulate and solve optimal stand density over time problems for even-aged stands using dynamic programming U.S. For. Serv. Gen. Tech. Rep. NC-56. 17p.

Rose, D.W., C.M. Chen, and R.A. Leary. 1981. Maximum cubic volume production through easily derived optimum thinning schedules. *J. For.* 79:32-35.

Press any key to continue....

Suboption 3: Set Path Defaults

This option provides the user with the flexibility to set a path for storing any thinning run results. The default path shown can be changed or accepted as is:

SET FILE DRIVE PATHS

- 1. Current Output Path = C:\ACES\OUTPUT**
- 2. Finished (Accept current settings)**

Enter the path you wish to change
Use Arrow or Number Keys to highlight
Press Spacebar or Enter to execute

Enter new path for output files

Suboption 4: Run Thinning Program

When this option is selected, a screen with the current default settings for a number of run and thinning parameters is displayed. The user can select to accept these parameters or to change any one or more of them before proceeding:

OPTIMAL THINNING SCHEDULES FOR RED PINE
THIS PROGRAM ALLOWS THE MANAGER TO SELECT ANY GROWTH OR
THINNING INTERVAL BETWEEN 1 AND 15 YEARS

CURRENT DEFAULT PARAMETERS FOR THINNING

1. Basal Area Input Unit: sq ft/acre
2. Volume Output Unit: cu ft
3. Site Index Selected: 66 ft at base age 50
4. Initial Age Selected: 20 Year
5. Initial Basal Area Selected: 60 sq ft/acre
6. Ending Age Selected: 120 Years
7. Growth/thinning interval: 10 Years
8. Growth multiplier: 1.00
9. Thin Option: No thinnings

Do you want to change any values?
Yes No

For <Yes>, the program will open an editing screen with all currently set parameters. The user can move the cursor to the line to be changed or simply enter the line number. The input and output units selected are of special importance. The program checks for reasonable ranges of basal area once the input unit has been selected.

Thinning Parameters Editing Menu
Highlight the parameter you wish to edit using the arrow keys.
Press <E> to edit the parameter and <Q> or <ESC> to quit.

1. Basal Area Input Units: sq ft/acre
2. Volume Output Units: cu ft
3. Site Index: 66 ft at base age 50
4. Initial Age: 20 Years
5. Initial BA: 60 sq ft/acre
6. Ending Age: 120 Years
7. Growth/thinning interval: 10 Years
8. Growth multiplier: 1
9. Thin Option 1: No thinnings

Edit Quit

Thinning Parameters Editing Menu
Highlight the parameter you wish to edit using the arrow keys.
Press <E> to edit the parameter and <Q> or <ESC> to quit.

1. Basal Area Input Units: sq ft/acre
2. Volume Output Units: cu ft
3. Site Index: 66 ft at base age 50
4. Initial
5. Initial
6. Ending
7. Growth/
8. Growth
9. Thin Op

Do you want to input basal area in:

1. Sq Ft/Ac
2. Sq M/Ha

Enter corresponding letter from below

Sq Ft/Ac Sq M/Ha

Edit

Quit

Thinning Parameters Editing Menu
Highlight the parameter you wish to edit using the arrow keys.
Press <E> to edit the parameter and <Q> or <ESC> to quit.

1. Basal Area Input Units: sq ft/acre
2. Volume Output Units: cu ft
3. Site Index: 66 ft at base age 50
4. Initial Age: 20 Years
5. Initial
6. Ending
7. Growth/
8. Growth
9. Thin Op

Make sure that site index is in ft
and all basal areas are in sq ft/acre.

Press a key to continue...

Edit

Quit

Thinning Parameters Editing Menu
Highlight the parameter you wish to edit using the arrow keys.
Press <E> to edit the parameter and <Q> or <ESC> to quit.

1. Basal Area Input Units: sq ft/acre
2. Volume Output Units: cu ft
3. Site Index: 66 ft at base age 50
4. Initial Age: 20 Years
5. Initial BA: 60 sq ft/acre
6. Ending Age: 120 Years
7. Growth/thinning interval: 10 Years
8. Growth multiplier: 1
9. Thin option: No thinnings

Do you want to use metric units??
Yes No

Edit

Quit

For <No>, the user gets the option to choose between three output units as shown on the next screen:

Thinning Parameters Editing Menu Highlight the parameter you wish to edit using the arrow keys. Press <E> to edit the parameter and <Q> or <ESC> to quit.		
1. Basal Area Input Units: sq ft/acre 2. Volume Output Units: cu ft 3. Site Index: 66 ft at base age 50 4. Ini 5. Ini Do you want volume output in: 6. End 1. Cu Ft/acre 7. Gro 2. Cords/acre 8. Gro 3. Bd Ft/acre 9. Thi Enter corresponding letter from below		
Cu Ft	Cords	Bd Ft
Edit Quit		

If the <Cords> or <Bd ft> options are chosen, the user is also required to enter a conversion factor from cubic foot to cords and board feet respectively or accepting the default values of 79 and 0.158 respectively by simply hitting the <Enter> key:

Input cu ft/cord conversion (default 79)?
Input cu ft/bd ft conversion (default 0.158)?

When line 9 is selected (currently with the no thinning default), the program will offer the user four different thinning options, each of which in turn will request for different additional parameters:

Thinning Parameters Editing Menu Highlight the parameter you wish to edit using the arrow keys. Press <E> to edit the parameter and <Q> or <ESC> to quit.		
1. Basal Area Input Units: sq ft/acre 2. Volume Output Units: cu ft 3. Site Index: 66 ft at base age 50 4. Initial Age: 20 years 5. Initial BA: 60 sq ft/acre 6. Ending Age: 120 years 7. Growth/thinning interval: 10 years 8. Growth multiplier: 1 9. Thin option: No thinnings		
Edit Quit		

THINNING OPTIONS	
1 = No Thinning	
2 = Thinning to User Specified Basal Area	
3 = Optimal Thinning	
4 = Optimal Thinning with Min. Basal Area Cut Constraint	
 Use Numeric or Arrow Keys to select option Press <Enter> to execute the option	

For options 2-4, the following three additional inputs are requested from the user:

Enter first permissible age for thinning?
Enter last permissible age for thinning?
Enter minimum interval between last thin and final harvest?

In addition, option 4 requires specification of a minimum basal area that would make the thinning operation economically feasible:

Enter minimum cut (sq ft/ac) for thinning?
--

After these various parameters have been entered, the edit screen will display these values which now can further be edited by moving the cursor to the desired parameter or by entering the line number. Most of these parameters do not need any special explanation except the growth multiplier. This parameter allows the user to scale the yield table results by a factor greater or smaller than 1. For example, a factor of 0.8 would scale down all yields by 20 percent. This factor can be used to fine tune the growth model to specific management situations.

Thinning Parameters Editing Menu	
Highlight the parameter you wish to edit using the arrow keys.	
Press <E> to edit the parameter and <Q> or <ESC> to quit.	
<ol style="list-style-type: none"> 1. Basal Area Input Units: sq ft/acre 2. Volume Output Units: cu ft 3. Site Index: 66 ft at base age 50 4. Initial Age: 20 years 5. Initial BA: 60 sq ft/acre 6. Ending Age: 120 years 7. Growth/thinning interval: 10 years 8. Growth multiplier: 1 9. Thin option: Opt. thinnings with min. BA removal 10. First permissible thinning age: 20 years 11. Last permissible thinning age: 100 years 12. Interval between last thin and harvest: 20 years 13. Minimum BA removed in thinning: 40 sq ft/acre 	
Edit	Quit

In the following, outputs from all four thinning options are shown. It is apparent that total volume production is quite sensitive to how various thin parameters are set.

No Thinning Option

RED PINE YIELD TABLE THINNING PARAMETERS

1. Basal Area Input Unit: sq ft/acre
2. Volume Output Unit: cu ft
3. Site Index Selected: 66 ft at base age 50
4. Initial Age Selected: 20 Years
5. Initial Basal Area Selected: 80 sq ft/acre
6. Ending Age Selected: 120 Years
7. Growth/thinning interval: 10 Years
8. Growth multiplier: 1.00
9. Thin Option: No thinnings

Age	Pres	Optimal BA	BA for Vol	BA for BA	Cut	Cum BA	Cut	Hght	CumVol	Cut	MAI	Avg	# of
			Sq Ft per acre			plus BA	in	plus Vol	cu ft	cu ft	inch	Dbh	Trees
20	80	162	111	77	0	80	26.4	887	44.3	5.8	717		
30	157	176	120	56	0	157	40.8	2702	90.1	6.0	666		
40	213	184	127	35	0	213	53.9	4827	120.7	6.4	585		
50	248	187	132	24	0	248	65.4	6820	136.4	6.9	491		
60	272	189	137	17	0	272	75.2	8596	143.3	7.5	406		
70	289	189	141	13	0	289	83.6	10157	145.1	8.2	335		
80	303	188	145	11	0	303	90.6	11525	144.1	8.9	278		
90	314	187	148	9	0	314	96.5	12721	141.3	9.6	231		
100	323	186	151	8	0	323	101.5	13767	137.7	10.3	194		
110	331	185	154	7	0	331	105.5	14683	133.5	11.1	163		
120	339	184	156	7	339	339	108.9	15485	129.0	11.8	137		

Thinning to User-Specified Basal Area

RED PINE YIELD TABLE THINNING PARAMETERS

1. Basal Area Input Unit: sq ft/acre
2. Volume Output Unit: cu ft
3. Site Index Selected: 66 ft at base age 50
4. Initial Age Selected: 20 Years
5. Initial Basal Area Selected: 80 sq ft/acre
6. Ending Age Selected: 120 Years
7. Growth/thinning interval: 10 Years
8. Growth multiplier: 1.00
9. Thin Option: Thinning to user specified BA
10. First permissible thinning age: 30 Years
11. Last permissible thinning age: 100 Years
12. Min. interval: last thin and harvest: 20 Years
13. User specified BA after each thin: 90 sq ft/acre

Age	Pres	Optimal BA	BA for Vol	BA for BA	Cut	Cum BA	Cut	Hght	CumVol	Cut	MAI	Avg	# of
			Sq Ft per acre			plus BA	in	plus Vol	cu ft	cu ft	inch	Dbh	Trees
20	80	162	111	77	0	80	26.4	887	44.3	5.8	717		
30	157	176	120	57	67	157	40.8	1544	51.5	6.0	666		
40	147	184	127	44	57	214	53.9	3196	79.9	6.9	493		
50	134	187	132	36	44	258	65.4	4910	98.2	7.8	376		
60	126	189	137	31	36	294	75.2	6494	108.2	8.7	296		
70	121	189	141	27	31	326	83.6	7959	113.7	9.5	238		
80	117	188	145	24	27	353	90.6	9315	116.4	10.3	194		
90	114	187	148	23	0	377	96.5	11548	128.3	11.2	160		
100	138	186	151	22	0	400	101.5	12784	127.8	11.8	139		
110	160	185	154	21	0	422	105.5	14005	127.3	12.4	121		
120	180	184	156	19	180	443	108.9	15177	126.5	13.1	105		

Optimal Thinning

RED PINE YIELD TABLE THINNING PARAMETERS

1. Basal Area Input Unit: sq ft/acre
2. Volume Output Unit: cu ft
3. Site Index Selected: 66 ft at base age 50
4. Initial Age Selected: 20 Years
5. Initial Basal Area Selected: 80 sq ft/acre
6. Ending Age Selected: 120 Years
7. Growth/thinning interval: 10 Years
8. Growth multiplier: 1.00
9. Thin Option: Optimal thinnings
10. First permissible thinning age: 30 Years
11. Last permissible thinning age: 100 Years
12. Min. interval: last thin and harvest: 20 Years

Age	Pres	Optimal BA	BA	BA Cut	Cum BA	Cut	Hght	CumVol	Cut	MAI	Avg	# of
		BA for Vol	for BA	Growth	plus BA	in	plus Vol	cu ft	cu ft	inch	Dbh	Trees
		--Sq Ft per acre--						ft	cu ft	/ac		
20	80	162	111	77	0	80	26.4	887	44.3	5.8	717	
30	157	176	120	56	0	157	40.8	2702	90.1	6.0	666	
40	213	184	127	41	29	213	53.9	4164	104.1	6.4	585	
50	225	187	132	35	38	255	65.4	5807	116.1	7.1	464	
60	223	189	137	31	34	290	75.2	7666	127.8	7.9	363	
70	220	189	141	28	31	321	83.6	9403	134.3	8.7	289	
80	216	188	145	25	28	349	90.6	11024	137.8	9.6	234	
90	213	187	148	22	0	374	96.5	13601	151.1	10.4	191	
100	235	186	151	19	0	396	101.5	14965	149.7	11.0	165	
110	254	185	154	16	0	414	105.5	16192	147.2	11.7	142	
120	270	184	156	14	270	430	108.9	17286	144.0	12.4	122	

Optimal Thinning with Minimum Basal Area Cut

RED PINE YIELD TABLE THINNING PARAMETERS

1. Basal Area Input Unit: sq ft/acre
2. Volume Output Unit: cu ft
3. Site Index Selected: 66 ft at base age 50
4. Initial Age Selected: 20 Years
5. Initial Basal Area Selected: 80 sq ft/acre
6. Ending Age Selected: 120 Years
7. Growth/thinning interval: 10 Years
8. Growth multiplier: 1.00
9. Thin Option: Opt. thinnings with minimum BA removal
10. First permissible thinning age: 30 Years
11. Last permissible thinning age: 100 Years
12. Min. interval: last thin and harvest: 20 Years
13. Minimum BA removed in thinning: 40 sq ft/acre

Age	Pres	Optimal BA	BA	BA Cut	Cum BA	Cut	Hght	CumVol	Cut	MAI	Avg	# of
		BA for Vol	for BA	Growth	plus BA	in	plus Vol	cu ft	cu ft	inch	Dbh	Trees
		--Sq Ft per acre--						ft	cu ft	/ac		
20	80	162	111	77	0	80	26.4	887	44.3	5.8	717	
30	157	176	120	56	0	157	40.8	2702	90.1	6.0	666	
40	213	184	127	35	0	213	53.9	4827	120.7	6.4	585	
50	248	187	132	35	61	248	65.4	5144	102.9	6.9	491	
60	223	189	137	27	0	284	75.2	8709	145.2	7.9	363	
70	249	189	141	28	61	310	83.6	8300	118.6	8.5	308	
80	216	188	145	23	0	338	90.6	12044	150.6	9.6	234	
90	240	187	148	19	0	361	96.5	13518	150.2	10.2	201	
100	259	186	151	16	0	381	101.5	14835	148.4	10.9	172	
110	275	185	154	14	0	397	105.5	16003	145.5	11.5	147	
120	289	184	156	12	289	411	108.9	17035	142.0	12.2	126	

The table below summarizes some of the results from these four yield tables:

Table 1. Summary of Four Thinning Strategies at End Age 120

Run Option	No Thinning	Thinning to User Specified Basal Area	Optimal Thinning	Optimal Thinning with Minimum Basal Area Removal Requirement
Cumulative Volume Cut including Thinning Volumes (ft ³ /acre)	15,264	14,698	16,723	16,501
Basal Area (ft ² /acre)	334	180	270	289
Avg. Tree DBH (inch)	11.9	13.1	12.4	12.2
No. of Trees/Acre	95	38	70	77

Thinning in most cases produces more total volume than the no-thinning option. An additional benefit are the larger average tree diameters in thinned stands. The average stand diameter is assumed proportionally to site index and age and inversely related to basal area per acre in multiple regression. The number of trees per acre is inversely related to the average diameter and site index:

$$Dbh = -0.66205 + 0.082531x\text{Site Index} + 0.080891x\text{Age} - 0.007816x\text{Basal Area}$$

$$\text{No. of Trees} = 27.995 + 25383 / Dbh^{**2} - 1.0833x\text{Site Index}$$

The program allows the user to save any yield table to create a collection of tables that can be distributed to managers in the field. The user will be prompted for a path and file name to store the yield table as an ASCII file. The default path can be used or a new path can be specified. Any of these yield tables can later be recalled for viewing or printing (see descriptions of these options below).

Do you want to save yield table on a file?
Yes No

Saving Red Pine Thinning Yield Table
Enter path or <ENTER> for default path: C:\ACES\OUTPUT\

Enter data filename, or press only <ENTER> to return

►OPTHINMN◀

If an indicated file name already exists in the selected directory, the program will give a warning message and then allow the user to either override the file with the new information or to enter a new file name.

File C:\ACES\OUTPUT\OPTHINMN.YLD exists.
Do you want to overwrite file.

Yes No

To rename the entered file name, i.e., not to override an existing file, the user would enter <Y>es and be prompted for a new file name.

Enter data filename, or press only <ENTER> to use
default name: C:\REDPTHIN\OUTPUT\OPTHINMN.YLD

► ◄

Suboption 5: View Yield Tables

REDPTHIN OUTPUT FILE CHOICES

1. See the list of filenames.
2. Enter the data filename.
3. Return to the MAIN MENU.

Use Numeric or Arrow Keys to select option
Press <Enter> to execute the option

Enter path or <ENTER> for default path: C:\REDPTHIN\OUTPUT\

-
- (1) NOTHIN.YLD
 - (2) OPTTHINFX.YLD
 - (3) OPTTHIN.YLD
 - (4) OPTHINMN.YLD
- ◀

Select by entering a number or highlight
using cursor and pressing <Enter> or Spacebar

Do you want to view C:\REDPTHIN\OUTPUT\NOTHIN.YLD?
Yes No

REDPTHIN OUTPUT FILE CHOICES

1. See the list of filenames.
2. Enter the data filename.
3. Return to the MAIN MENU.

Use Numeric or Arrow Keys to select option
Press <Enter> to execute the option

Enter path or <ENTER> for default path: C:\REDPTHIN\OUTPUT\

► Enter data filename, or press only <ENTER> to return

►OPTTHIN ◀

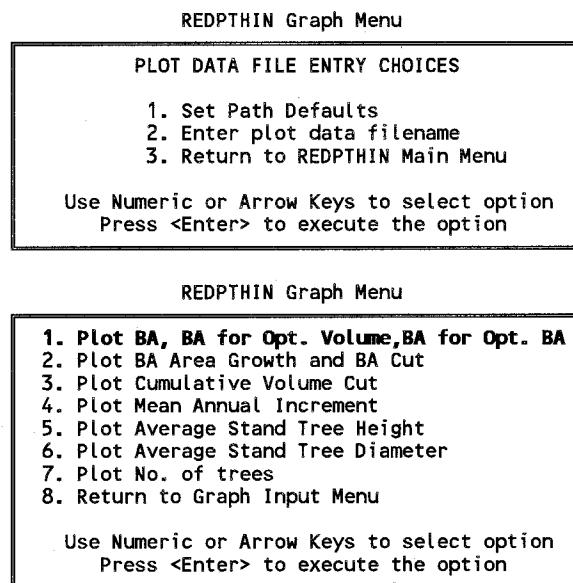
Suboption 6: Print Yield Tables

Do you want to print C:\REDPTHIN\OUTPUT\NOTHIN.YLD?
Yes No

Turn the printer on and set it to top of the page
Press a key to continue...

Suboption 7: View Yield Table Graphs

This suboption will display the following screen with 3 further option. The first option again lets the user select a path on which yield data are stored. Option 2 lets the user select a file either from a list or by direct entry of a file name. Once a file has been selected, a graph sub menu with 7 plotting options will appear:

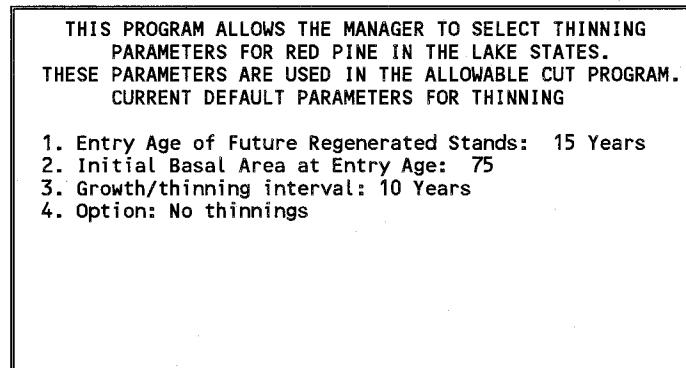
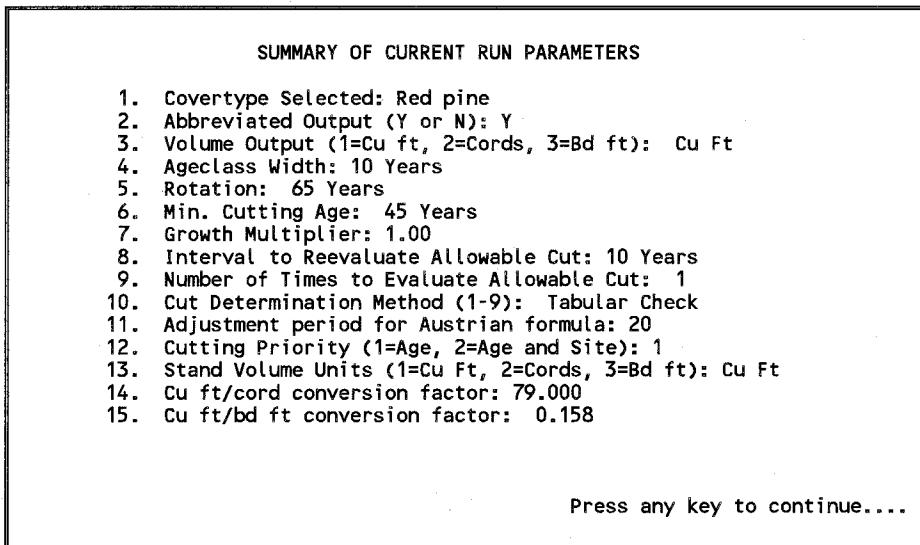


Suboption 8: Leaving Program

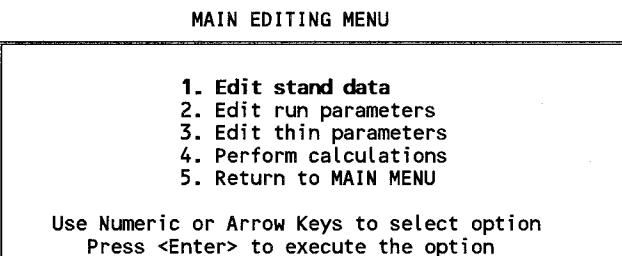
This option will return user to the ACESREDP Main Menu.

MAIN MENU Option 5 - Sample Run

This option provides the user the opportunity to see an application of the program before running it with personal data. A sample stand and run parameters are automatically loaded into the program. The program will display an error message if these files are not on the same directory as the ACESREDP program. The corresponding files **REDDAT.EXP** and **REDPAR.EXP** are listed in Appendix A. The program will display the sample run parameters first:



Press any key to continue....



STAND DATA INPUT AND EDITING SECTION
 Use the arrow keys to move through the list.
 There are 11 stand records for covertype: Red pine

Stand No.	Acres	Age Years	Volume/acre Cu Ft	Stocking Percent	Site Index
1	1400.00	105	613.00	18	55
2	8300.00	95	1334.00	41	55
3	25700.00	85	1503.00	50	55
4	60800.00	75	1177.00	43	55
5	150800.00	65	1681.00	68	55
6	383200.00	55	1394.00	65	55
7	409000.00	45	1194.00	66	55
8	286300.00	35	801.00	56	55
9	199600.00	25	441.00	44	55
10	177600.00	15	323.00	55	55
11	244700.00	5	198.00	122	55

Edit Volume Unit Edit Stand Add Stand Delete Stand Quit

The user can scroll through this list and perform any of the edit functions shown in the footer of the table. The sample data file has no data inconsistencies, thus the program gives the option to go directly to the ACESREDP calculations without further review of the run parameters. The latter would be shown in the summary of the run parameters if "Yes" is selected:

STAND DATA INPUT AND EDITING SECTION
 Use the arrow keys to move through the list.
 There are 11 stand records for covertype: Red pine

Stand No.	Acres	Age Years	Volume/acre Cu Ft	Basal Area sq ft/ac	Site Index
1	1400.00	105	613.00	17	55
2	8300.00	95	1334.00	38	55
3					
4	You can run ACESREDP now without further editing.				
5	Do you want to review/edit run or thin parameters first.				
6					
7	Yes			No	
8					
9	199600.00	25	441.00	37	55
10	177600.00	15	323.00	49	55
11	244700.00	5	198.00	121	55

Edit Volume Unit Edit Stand Add Stand Delete Stand Quit

If the user chooses to save the data now, he will be prompted for the information and the stand file is stored in the format shown in the appendix. If the data are not saved now, the old data format is maintained, and the next screen will be:

MAIN EDITING MENU

1. Edit stand data
2. Edit run parameters
3. Edit thin parameters
4. Perform calculations
5. Return to MAIN MENU

Use Numeric or Arrow Keys to select option
Press <Enter> to execute the option

Upon selecting option 4, the program will begin the simulation. The program will always store the results of the simulation in an ASCII file named "ACESREDP.TBL". If that file exists from a previous run, a warning message will be displayed. The program provides an option, however, for the user to change the name to another name with the following prompt:

File c:\aces\OUTPUT\ACESREDP.TBL exists and will be overwritten unless you specify a new name

Press a key to continue...

Outputs will be saved to file c:\aces\OUTPUT\ACESREDP.TBL
Do you want to save outputs under another file name

Yes

No

For "N" the program begins the calculations and when finished store the results in file "ACESREDP.TBL" and begin the display of results on the screen. For "Y" the program will ask for an output drive and a file name while checking for any user errors:

Saving ACESREDP Output File
Enter path or <ENTER> for default path: c:\aces\OUTPUT\

Enter data filename, or press only <ENTER> to use
default name: c:\aces\OUTPUT\ACESREDP.TBL

The program will check for the validity of the indicated disk drive, the file name, and any other error and prompt the user to take a corrective action if necessary. If the file name already exists on the drive, the user has the option to overwrite the file or to provide a new file name.

The ASCII output file "ACESREDP.TBL" or the one specified by the user can be later recalled for printing or incorporation into a forest planning report. After the output file name has been specified the program will begin its calculations. A message will indicate that the run can be interrupted at any time by simply hitting the <F10> key.

You may now press the <F10> key any time to stop calculations
Press a key to continue...

Screen output will begin as soon as the calculations are finished (a sample output can be seen in appendix C). Output begins with a summary of the initial growing stock distribution followed by estimates of the allowable cuts for 7 volume control methods. These output summaries are repeated for each year of the specified planning interval. Additionally, a detailed cutting plan is described for individual stands.

At the end of the run the program provides an opportunity to extend the analysis in several ways. One is to extend the simulation with the current data for additional simulation periods, the second is to start the simulation with totally new data or after editing any of the current input data, i.e., stand data and/or run parameters. The program asks:

Do you wish to run additional simulation periods?	
Yes	No

Enter number of additional intervals for simulation: ▶1◀

After each simulation period or block of simulation periods, the user will have the option to change any of the run parameters, e.g., rotation age or the allowable cut method. Chosing "1" for the number of times to evaluate allowable cut (option 9 in run parameter editing menu), the user can for example provide a user defined allowable cut for the simulation period and change it before an additional period is selected:

Do you want to change any of the run parameters?	
Yes	No

If the answer for additional simulation periods was "Y", and a "1" was entered for one additional period, but no run parameters were changed, output for an additional period follows beginning with the condition of the inventory at the end of the last period:

Do you wish to run additional simulation periods?	
Yes	No

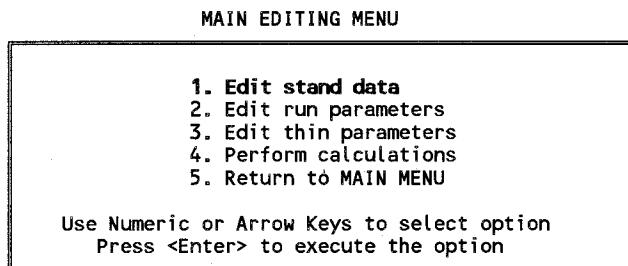
For a "N" answer the program will continue with an option for plotting of major results in the case that that one of the volume control methods was simulated. For area control no plots are being generated.

Do you want to view any plots of the results?	
Yes	No

For a <Yes>, the user will be able to view graphs related to the current computer run. Details of the graphics output can be seen under main menu option 8, View ACESREDP Graphs, which is described later in the manual. After returning from the graph program option, the user is prompted whether to run the same stand data with new run parameters:

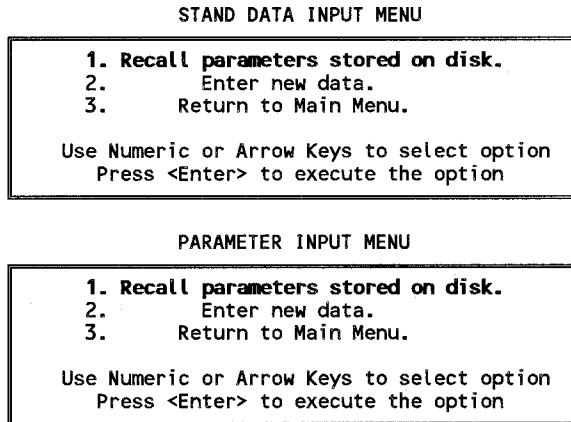
Do you wish to rerun same stand data with new run parameters?	
Yes	No

Here a "N"response will bring up the **MAIN MENU** which provides the option to begin with new existing data files, the creation of new input files and the option to quit. A "Y"response will bring up the **MAIN EDITING MENU** and the user has a chance edit stand data and/or run parameters before proceeding to carry out a new calculation. We will discuss here first option 4 of the **MAIN MENU**.



Main Menu Option 6 - Run ACESREDP

This option allows the user to either enter data for a simulation from the keyboard or to recall previously stored data from a storage device (hard disk or diskette). The data belong to two categories, stand data and run parameters. Correspondingly, two menu types will appear:



Data Entry Option 1 (Recall stand data from previously created files)

Suboption 1: See the list of filenames

The program will show a list of valid stand data or run parameter files that have a valid .DAT or .PAR extension (i.e.,the extensions appended to ACESREDP data files) for a user specified disk drive. The user can select a file by hitting the <Enter> key on a highlighted file.

STAND DATA FILE ENTRY CHOICES

1. See the list of filenames.
2. Enter the data filename.
3. Return to the MAIN MENU.

Use Numeric or Arrow Keys to select option
Press <Enter> to execute the option

For option 1, a list of files with extension ".DAT" will be displayed:

(1) GEIS77.DAT
(2) MNREDACE.DAT
(3) CASH.DAT
(4) ACESREDP.DAT
(5) CASHDATA.DAT
(6) CASH1.DAT
(7) RPVL.DAT
(8) RPVLNOTH.DAT
(9) FR5226.DAT
(10) More. . .

Select by entering a number or highlight
using cursor and pressing <Enter> or Spacebar

Suboption 2: Enter the data filename

This option will retrieve an existing data file that was previously created with ACESREDP. All stand files have a .DAT extension and all run parameter files have a .PAR extension as a part of their file names. To retrieve a specific ACESREDP data file from the STAND DATA INPUT MENU, enter 2. Specify the disk drive where the data file is located and then enter the appropriate file name. Because the program automatically appends an extension of .DAT onto every file name when it is created and retrieved, the user does not need to add this information. Therefore, to recall the data file called FILE1.DAT, the user would simply enter **FILE1** when prompted for the file name. Press <ENTER>, instead of entering a file name, if you are unsure of the data file name to be retrieved or to return to the MAIN MENU. You might need to edit the file using a text editing program. Appendix A shows the sample stand data and run parameter files ACESDAT.EXP and ACESREDPPAR.EXP. The user may refer to these to make appropriate corrections in existing files that do not conform to this version of ACESREDP. Save this edited ACESREDP file in DOS format and then reenter the ACESREDP program.

STAND DATA FILE ENTRY CHOICES

1. See the list of filenames.
2. Enter the data filename.
3. Return to the MAIN MENU.

Use Numeric or Arrow Keys to select option
Press <Enter> to execute the option

Enter data filename, or press only <ENTER> to return
to the MAIN MENU: **>bear.dat<**

Program assumes an extension of .DAT
No period and extension. Reenter file name

Press a key to continue...

STAND DATA FILE ENTRY CHOICES

1. See the list of filenames.
2. Enter the data filename.
3. Return to the MAIN MENU.

Use Numeric or Arrow Keys to select option
Press <Enter> to execute the option

For option 2, the user will be prompted for a file name:

Enter data filename, or press only <ENTER> to return
to the MAIN MENU: >bearis <

If a file with the proper extension of ".DAT" or ".PAR" is being requested that was not created by ACESREDP, a message that the file that you are trying to recall was not created by ACESREDP will appear. All ACESREDP data files are uniquely identified when created such that it is not possible to recall other data files, despite their .DAT or .PAR extensions. The **FILE ENTRY CHOICES** Menu automatically reappears after the error message is cleared by pressing any key to continue:

Illegal data file, not created by ACESREDP. There is
a format error in data file or the file is empty
You must either exit from ACESREDP and correct the
file with a line editor or use another input file
for the analysis

Press any key to continue...

Suboption 3: Return to the MAIN MENU

With this option the user can return to the MAIN MENU. He might for example want to read the model overview again or simply quit the session.

Data Entry Option 2 (Enter New Stand Data):

This option is designed for entry of new data into ACESREDP via the terminal keyboard. If data is to be entered from the keyboard, ACESREDP will prompt the user to begin entry of various inputs. The user has the option of specifying a title for the analysis to keep better track of a number of analyses. Title information will subsequently appear on the top of each page of the ACESREDP output. If you want to discontinue entry of title lines, press <ENTER> twice. Before stand data can be entered, the user must enter the volume units of the stand data to be entered and the covertype represented by the data.

RUN TITLE INPUT SECTION

Do you want to input/edit a title?
Yes No

Enter up to 5 lines of text up to 60 characters long.
Press <ENTER> at the end of each line

Press a key to continue...

STAND DATA INPUT SECTION

Line 1: ►Allowable cut simulation for Bear Island State Forest
Line 2: ►Data from 1989 phase II inventory
Line 3: ►

The program now automatically will display the following screen:

Do you have basal area or volume data for your stand
Basal Area Volume

Selecting <A>rea, the following screen will appear:

STAND DATA INPUT AND EDITING SECTION
Use the arrow keys to move through the list.
There are 0 stand records for covertype: Red pine

Stand No.	Acres	Age Years	Volume/acre	Basal Area sq ft/ac	Site Index
-----------	-------	-----------	-------------	---------------------	------------

Enter stands in any order by using the <A>dd option below.
Stands will be sorted by a user specified cutting priority.

Press a key to continue...

Edit Volume Unit Edit Stand Add Stand Delete Stand Quit

Selecting <V>olume, the user will be prompted for a volume unit which will then be displayed in subsequent stand editing screens:

STAND DATA INPUT AND EDITING SECTION
 Use the arrow keys to move through the list.
 There are 0 stand records for covertype: Red pine

Stand No.	Acres	Age Years	Volume/acre	Basal Area sq ft/ac	Site Index
-----------	-------	-----------	-------------	---------------------	------------

Is volume for stand data input in:
 1. Cu Ft/acre
 2. Cords/acre
 3. Bd Ft/acre
 Enter corresponding letter from below

Cu Ft Cords Bd Ft

Edit Volume Unit	Edit Stand	Add Stand	Delete Stand	Quit
------------------	------------	-----------	--------------	------

STAND DATA INPUT AND EDITING SECTION
 Use the arrow keys to move through the list.
 There are 0 stand records for covertype: Red pine

Stand No.	Acres	Age Years	Volume/acre	Basal Area sq ft/ac	Site Index
-----------	-------	-----------	-------------	---------------------	------------

Edit Volume Unit	Edit Stand	Add Stand	Delete Stand	Quit
------------------	------------	-----------	--------------	------

If volumes are entered, basal areas are calculated from volumes and vice versa. The following relationships are used to make these calculations:

$$\text{Volume} = 0.42 \times \text{Basal Area} \times \text{Height}$$

$$\text{Basal Area} = \text{Volume} / (\text{Height} \times 0.42) \text{ where}$$

$$\text{Height} = 1.89 \times \text{Site} \times (1 - e^{-0.01979 \times \text{Age}})^{1.3892}$$

Checking for Data Inconsistencies

Whenever a stand data file is being read in from a file or data are entered from the keyboard, the program goes through a series of internal checks for data consistencies even if option 4 "Perform Calculations" is selected from the Main Editing Menu. This procedure will ensure that there are no bad records containing for example negative ages, zero site indices, volumes/acre or basal areas/acre.

All growth projections internally are done in cubic feet, and all stand volumes whether entered as cords, cubic feet or bd ft are converted to cubic feet. The cu ft/cord conversion used is 79 ft³/cord, the cu ft/bd ft conversion is 6.329. The program will check each entry and give specific error messages if incorrect data are entered. The program automatically

enters the red pine covertype code. At this point entry of the stand data can begin by hitting the <Add> key. A data entry field for the first stand variable "Acres" will be highlighted:

STAND DATA INPUT AND EDITING SECTION						
Use the arrow keys to move through the list.						
There are 11 stand records for covertype: Red pine						
Stand No.	Acres	Age Years	Volume/acre Cu Ft	Basal Area sq ft/ac	Site Index	
1	1200	<				
<input type="button" value="Edit Volume Unit"/> <input type="button" value="Edit Stand"/> <input type="button" value="Add Stand"/> <input type="button" value="Delete Stand"/> <input type="button" value="Quit"/>						

Upon entry, a new data entry field is highlighted, etc.:

STAND DATA INPUT AND EDITING SECTION						
Use the arrow keys to move through the list.						
There are 11 stand records for covertype: Red pine						
Stand No.	Acres	Age Years	Volume/acre Cu Ft	Basal Area sq ft/ac	Site Index	
1	1200	> <				
<input type="button" value="Edit Volume Unit"/> <input type="button" value="Edit Stand"/> <input type="button" value="Add Stand"/> <input type="button" value="Delete Stand"/> <input type="button" value="Quit"/>						

Once completed, the full stand record will be displayed:

STAND DATA INPUT AND EDITING SECTION						
Use the arrow keys to move through the list.						
There are 11 stand records for covertype: Red pine						
Stand No.	Acres	Age Years	Volume/acre Cu Ft	Stocking Percent	Site Index	
1	1200.00	105	613.00	18	55	
<input type="button" value="Edit Volume Unit"/> <input type="button" value="Edit Stand"/> <input type="button" value="Add Stand"/> <input type="button" value="Delete Stand"/> <input type="button" value="Quit"/>						

The user proceeds by repeatedly hitting <Add> to enter all the required stand data up to a maximum of 300 stands. Upon completion, any entry can be edited by moving the cursor to a field and hitting <E> for <Edit> or any of the other keys that permit editing of the stand volume units, or covertype code. Additionally, stands may be added or deleted at this time also. When finished, hit <Esc> to produce a summary screen with an option to save the data:

STAND DATA INPUT AND EDITING SECTION
 Use the arrow keys to move through the list.
 There are 11 stand records for covertype: Red pine

Stand No.	Acres	Age Years	Volume/acre Cu Ft	Basal Area sq ft/ac	Site Index
1	1400.00	105	613.00	17	55
2	8300.00	95	1334.00	38	55
3					55
4	If you run ACESREDP now, it will use the edited data but the changes will be lost after the run if they are not saved now. Do you want to save changes now.				
5					55
6					55
7					55
8	Yes		No		
9					55
10	177600.00	15	323.00	49	55
11	244700.00	5	198.00	121	55

Edit Volume Unit Edit Stand Add Stand Delete Stand quit

For <Y>es, the program proceeds with saving the data. The program automatically appends an extension of .DAT to every stand data file that is saved. The program again will check for the validity of the indicated disk drive, the file name, and any other error and prompt the user to take a corrective action if necessary. If the file name already exists on the drive, the user has the option to overwrite the file or to provide a new file name. If the existing file is overwritten, all information previously contained in the file will be destroyed (i.e., erased). Once a user understands the very simple file structure (see also Appendix A for an example), it is much easier to generate the data outside ACESREDP with a text editor. Before the stand data are used in the simulation, the program goes through a series of checks. For example, it will require the user to edit stands with zero site index. If no editing was performed, the program will proceed with:

STAND DATA INPUT AND EDITING SECTION
 Use the arrow keys to move through the list.
 There are 11 stand records for covertype: Red pine

Stand No.	Acres	Age Years	Volume/acre Cu Ft	Basal Area sq ft/ac	Site Index
1	1400.00	105	613.00	17	55
2	8300.00	95	1334.00	38	55
3					
4	You can run ACESREDP now without further editing. Do you want to review/edit run or thin parameters first.				
5					
6					
7	Yes		No		
8					
9	199600.00	25	441.00	37	55
10	177600.00	15	323.00	49	55
11	244700.00	5	198.00	121	55

Edit Volume Unit Edit Stand Add Stand Delete Stand quit

For "YES", the program will return to the main editing menu.

Data Entry Option 2 (Enter New Run Parameters)

This option is designed for entry of new run parameter data via the terminal keyboard. If option 1 is selected, the user will see a summary screen with default parameters which can be edited if desired. It simplifies the data entry process, as only some of the parameters will be changed in most situations.

PARAMETER INPUT MENU	
1. Recall parameters stored on disk. 2. Enter new data. 3. Return to Main Menu.	
Use Numeric or Arrow Keys to select option Press <Enter> to execute the option	
SUMMARY OF CURRENT RUN PARAMETERS	
1. Covertype Selected: Red pine 2. Abbreviated Output (Y or N): Y 3. Volume Output (1=Cu ft, 2=Cords, 3=Bd ft): Cu Ft 4. Ageclass Width: 10 Years 5. Rotation: 65 Years 6. Min. Cutting Age: 45 Years 7. Growth Multiplier: 1.00 8. Interval to Reevaluate Allowable Cut: 10 Years 9. Number of Times to Evaluate Allowable Cut: 1 10. Cut Determination Method (1-9): Tabular Check 11. Adjustment period for Austrian formula: 20 12. Cutting Priority (1=Age, 2=Age and Site): 1 13. Stand Volume Units (1=Cu Ft, 2=Cords, 3=Bd ft): Cu Ft 14. Cu ft/cord conversion factor: 79.000 15. Cu ft/bd ft conversion factor: 0.158	
Do you want to change any run parameters? Yes No	

For a "No" answer, the user will have an opportunity to save the data on a file:

If you run ACESREDP now, it will use the default parameters. The default values will be lost if they are not saved. Do you want to save default values now.	
Yes	No

For a "Yes" answer, the parameter editing menu appears. The user simply moves the cursor to the parameter to be edited and hits the <Enter> key. The program will prompt for an appropriate input which in the case of some items are menus.

Run Parameters Editing Menu

Highlight the parameter you wish to edit using the arrow keys.
 Press <E> to edit the parameter and <Q> or <ESC> to quit.

1. Covertype Selected	:	Red pine
2. Abbreviated Output (Y or N)	:	Y
3. Volume Output (1=Cu ft, 2=Cords, 3=Bd ft)	:	Cu Ft
4. Ageclass Width (Years)	:	10
5. Rotation (Years)	:	65
6. Min. Cutting Age (Years)	:	45
7. Growth multiplier	:	1
8. Interval to Reevaluate Allowable Cut (Years)	:	10
9. Number of Times to Evaluate Allowable Cut	:	1
10. Cut Determination Method (1-9)	:	1
11. Adjustment period for Austrian formula	:	20
12. Cutting Priority (1=Age, 2=Age and Site)	:	1
13. Stand volume units (1=Cu Ft, 2=Cords, 3=Bd ft)	:	Cu Ft
14. Cu ft/ cord conversion factor	:	.79
15. Cu ft/bd ft conversion factor	:	.158

Edit **Quit**

For run parameter 10, the following menu screen will appear:

Cut Determination Option

- 1. Tabular Check
- 2. Modified Barnes
- 3. Austrian
- 4. Chapman
- 5. Hundeshagen
- 6. Von Mantel
- 7. Hanzlik
- 8. User input of allowable annual volume cut
- 9. Area Control adjusted for site productivity

Use Numeric or Arrow Keys to select option
Press <Enter> to execute the option

If option 8 is chosen, the following input will be requested from the user:

Enter annual allowable cut in Cords (currently 0)?

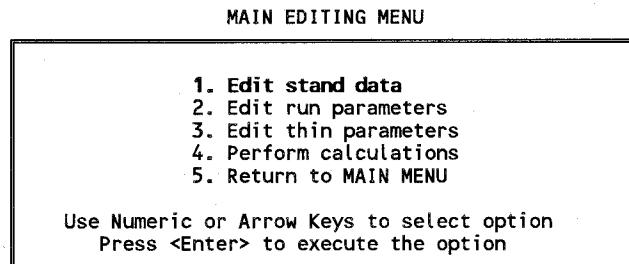
The number requested is in the same units as the output units that the user requested under option three. This number will be stored always in cubic foot volume equivalent when the edited data are saved as a parameter file. When the file is recalled, the user inputted annual volume cut will be automatically be converted into whatever output units the user selects at the time. Initially and whenever another volume control method than 8 is chosen, this parameter will be zero.

If you run ACESREDP now, it will use the edited data.
The changes will be lost if they are not saved now.
Do you want to save changes now.

Yes	No
-----	----

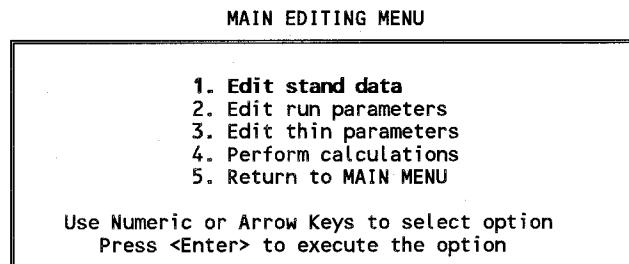
For "Yes", the program will first provide the option to save the data before proceeding to the MAIN EDITING MENU. The program will again check for the validity of the indicated disk drive, the file name, and any other error and prompt the user to take a corrective

action if necessary. If the file name already exists on the drive, the user has the option to overwrite the file or to provide a new file name. The program automatically appends an extension of .PAR onto every file that is saved. Once a user understands the very simple file structure (see also Appendix A for an example), it is easier to generate the data outside ACESREDP with a text editor. After any editing operation, the program will return to the MAIN Editing Menu:



Main Editing Menu Options

After the stand data and run parameter files have been successfully entered, the program provides an option to edit any inputs before calculations are carried out. The beginning point for data review and editing can be reached when the screen displays the prompt:



Option 1 (Edit stand data)

This option may be selected to edit the stand data. It will produce the stand data list in as many screens as required followed by several questions that will permit the editing of the run title, stand data including the modification of existing stand data, the deletion of stands, and the addition of stand data. This option first will generate a listing of the current stand data:

The following note appears if a stand was read in from a file for which stand stocking had never been calculated or edited and not been saved to a new file.

Stand stocking is calculated by dividing stand volume by the yield table volume. Stand stocking for some stands was set by the program to 100% if yield table volume for that age was negative or age was zero. For stands with illegal data (negative age or volume or zero/negative site index stocking was set temporarily to 0. Editing is required.

Press a key to continue...

Whenever an edited stand file is saved, the file will contain also the calculated/edited stocking percents so that the user does not have to go through all the stocking checks, the next time the stand file is requested. The computer will display:

Stand stocking was calculated already and has been edited before.
You still can edit further and save any changes you make.

Press a key to continue...

This will be followed by the run title input section described on page 24. The new title entered will be seen the next time the dit menu is activated which generates the new stand listing that reflects any editing changes that were made during the session.

RUN TITLE INPUT SECTION

ACESREDP Sample Stand Data File
Northeastern Minnesota Aspen Inventory for 1977

Do you want to input/edit a title?
Yes No

For "Yes", the user can enter up to 5 lines of a new title, the old title, if one existed will be lost. Below, 2 new title lines are entered. They will be displayed with a new stand listing:

Enter up to 5 lines of text up to 60 characters long.
Press <ENTER> at the end of each line

Press a key to continue...

RUN TITLE INPUT SECTION

Line 1: ►This will change the original title to:
Line 2: ►1977 aspen inventory, Bear Island State Forest
Line 3: ►

STAND DATA INPUT AND EDITING SECTION
 Use the arrow keys to move through the list.
 There are 11 stand records for covertype: Red pine

Stand No.	Acres	Age Years	Volume/acre Cu Ft	Basal Area sq ft/ac	Site Index
1	1400.00	105	613.00	17	55
2	8300.00	95	1334.00	38	55
3	25700.00	85	1503.00	46	55
4	60800.00	75	1177.00	39	55
5	150800.00	65	1681.00	60	55
6	383200.00	55	1394.00	56	55
7	409000.00	45	1194.00	57	55
8					55
9	Volume was entered, you cannot edit basal area				55
10	Press a key to continue...				55
11					55

Edit Volume Unit Edit Stand Add Stand Delete Stand Quit

STAND DATA INPUT AND EDITING SECTION
 Use the arrow keys to move through the list.
 There are 11 stand records for covertype: Red pine

Stand No.	Acres	Age Years	Volume/acre Cu Ft	Basal Area sq ft/ac	Site Index
1	1400.00	105	613.00	17	55
2	8300.00	95	1334.00	38	55
3					55
4	If you run ACESREDP now, it will use the edited data but the changes will be lost after the run if they are not saved now. Do you want to save changes now.				55
5					55
6					55
7					55
8	Yes		No		
9					55
10	177600.00	15	323.00	49	55
11	244700.00	5	198.00	121	55

Edit Volume Unit Edit Stand Add Stand Delete Stand quit

STAND DATA INPUT AND EDITING SECTION
 Use the arrow keys to move through the list.
 There are 11 stand records for covertype: Red pine

Stand No.	Acres	Age Years	Volume/acre Cu Ft	Basal Area sq ft/ac	Site Index
1	1400.00	105	613.00	17	55
2	8300.00	95	1334.00	38	55
3					55
4	You can run ACESREDP now without further editing. Do you want to review/edit run or thin parameters first.				55
5					55
6					55
7	Yes		No		
8					55
9	199600.00	25	441.00	37	55
10	177600.00	15	323.00	49	55
11	244700.00	5	198.00	121	55

Edit Volume Unit Edit Stand Add Stand Delete Stand quit

Within the stand editing routine, the user may use the cursor keys to select an entry for editing. Upon hitting the <Enter> key on a selected field, an empty field will be displayed for entry of a new number. The program will check for the validity of any entry and give appropriate error messages so that a corrective action can be taken by the user. If the user does not enter a new value, but simply uses the <Enter> key, the old field value will be displayed.

When all desired changes have been made, the user can then save all changes. For a "Yes", the user will be prompted for a drive, file name, and the various associated questions and error checks as described before. If the data are not saved, then the user would have to go through all necessary editing of stocking related problems again. With large data input files, this task can become quite tedious.

Even if data changed through the editing procedure were not saved, the program calculations will utilize the edited information. [CAUTION: Data corrections will be incorporated into the analysis even if they are not first saved.] Part of the program outputs are lists of all program inputs including stand information and run parameters. After changes have been made, the user again has a chance to review the newest stand list and will have another opportunity to make corrections, deletions, and/or additions. After changes have been made on the stand list and the changes have been saved or not, again the option for further editing will be available.

You can run ACESREDP now without further editing. Do you want to review/edit stand and/or run parameters first.	
Yes	No

For a "YES", the program will return to the edit menu, otherwise the ACESREDP calculations will begin without further editing.

Option 2 (Edit run parameters)

This option may be selected to edit any of the run parameters before beginning the simulations. The program will display a summary of the current run parameters and prompt the user for any changes. Within the run parameter editing routine, the user may use the cursor keys to select an entry for editing. Upon hitting the <Enter> key on a selected field, a prompt will provide the user the opportunity to enter a new parameter. The program will check for the validity of any entry and give appropriate error messages so that a corrective action can be taken by the user.

SUMMARY OF CURRENT RUN PARAMETERS

1. Covertype Selected: Red pine
2. Abbreviated Output (Y or N): Y
3. Volume Output (1=Cu ft, 2=Cords, 3=Bd ft): Cu Ft
4. Ageclass Width: 10 Years
5. Rotation: 65 Years
6. Min. Cutting Age: 45 Years
7. Growth Multiplier: 1.00
8. Interval to Reevaluate Allowable Cut: 10 Years
9. Number of Times to Evaluate Allowable Cut: 1
10. Cut Determination Method (1-9): Tabular Check
11. Adjustment period for Austrian formula: 20
12. Cutting Priority (1=Age, 2=Age and Site): 1
13. Stand Volume Units (1=Cu Ft, 2=Cords, 3=Bd ft): Cu Ft
14. Cu ft/cord conversion factor: 79.000
15. Cu ft/bd ft conversion factor: 0.158

Do you want to change any run parameters?
Yes No

Run Parameters Editing Menu

Highlight the parameter you wish to edit using the arrow keys.
Press <E> to edit the parameter and <Q> or <ESC> to quit.

- | | | |
|--|---|----------|
| 1. Covertype Selected | : | Red pine |
| 2. Abbreviated Output (Y or N) | : | Y |
| 3. Volume Output (1=Cu ft, 2=Cords, 3=Bd ft) | : | Cu Ft |
| 4. Ageclass Width (Years) | : | 10 |
| 5. Rotation (Years) | : | 65 |
| 6. Min. Cutting Age (Years) | : | 45 |
| 7. Growth multiplier | : | 1 |
| 8. Interval to Reevaluate Allowable Cut (Years) | : | 10 |
| 9. Number of Times to Evaluate Allowable Cut | : | 1 |
| 10. Cut Determination Method (1-9) | : | 1 |
| 11. Adjustment period for Austrian formula | : | 20 |
| 12. Cutting Priority (1=Age, 2=Age and Site) | : | 1 |
| 13. Stand volume units (1=Cu Ft, 2=Cords, 3=Bd ft) | : | Cu Ft |
| 14. Cu ft/ cord conversion factor | : | 79 |
| 15. Cu ft/bd ft conversion factor | : | .158 |

Edit

quit

After performing an edit, the run parameter summary screen will always be displayed with the new values. As long as an edit is requested it will open a screen with the appropriate prompt. After editing has been completed, the option for saving the edited parameters exists.

It is important to note that any editing that has taken place will be reflected in the current data set and will be carried forward into the following calculations even if the file is not saved.

Option 3 (Edit thin parameters)

The following editing screen will appear. Data entry and editing is the same as described under Main Menu option 4 (Review Red Pine Yield), except that only English units can be entered to run the allowable cut simulation.

THIS PROGRAM ALLOWS THE MANAGER TO SELECT THINNING PARAMETERS FOR RED PINE IN THE LAKE STATES.
THESE PARAMETERS ARE USED IN THE ALLOWABLE CUT PROGRAM.
CURRENT DEFAULT PARAMETERS FOR THINNING

1. Entry Age of Future Regenerated Stands: 15 Years
2. Initial Basal Area at Entry Age: 75
3. Growth/thinning interval: 10 Years
4. Option: No thinnings

Do you want to change any values?
Yes No

Thinning Parameters Editing Menu
Highlight the parameter you wish to edit using the arrow keys.
Press <E> to edit the parameter and <Q> or <ESC> to quit.

1. Entry Age for Future Regenerated Stands: 15
2. Initial BA at Entry Age: 75
3. Growth/thinning interval: 10
4. No thinnings: option 1

Edit Quit

After editing has been completed, the user is prompted as follows:

Thinning Parameters Editing Menu
Highlight the parameter you wish to edit using the arrow keys.
Press <E> to edit the parameter and <Q> or <ESC> to quit.

1. Entry Age for Future Regenerated Stands: 15
2. Initial BA at Entry Age: 75
3. Growth/thinning interval: 10
4. Optimal thinnings: option 3
- 5.
6. If you run ACESREDP now, it will use the edited data
7. but the changes will be lost after the run if they are not saved now. Do you want to save changes now.

Yes No

Edit Quit

Option 4 (Perform calculations)

This option may be selected to perform economic calculations. All data are first checked by the program for appropriateness. This includes checking for negative or zero numbers as well as for any extremes in site index, age, and volume. If any problems are encountered, the program will open the editing routine and provide appropriate messages to the user for correcting any problems before proceeding with the simulation. Once the simulation begins, outputs in the format of the sample run above or other form depending on user inputs for an allowable cut method and selection of an abbreviated or long output option will appear on consecutive screens. Appendix II shows partial sample listings of reports written to an ASCII file on the output directory.

Do you wish to pause between screens?	
Yes	No

With this option, the user can select to review each output screen. For <Yes>, the user needs to hit the <Enter> key after each screen, for <No> the program will not pause between screens.

Should allowable cuts be calculated:	
1. Annually	
2. Each Planning Period	
Enter corresponding letter from below	
Annually	Planning Period

With this option, the user can select to have the allowable cut be recalculated every year or only every planning period.

This question will appear after the end of any simulation run or period:

Do you wish to rerun after editing stand data or run parameters?	
Yes	No

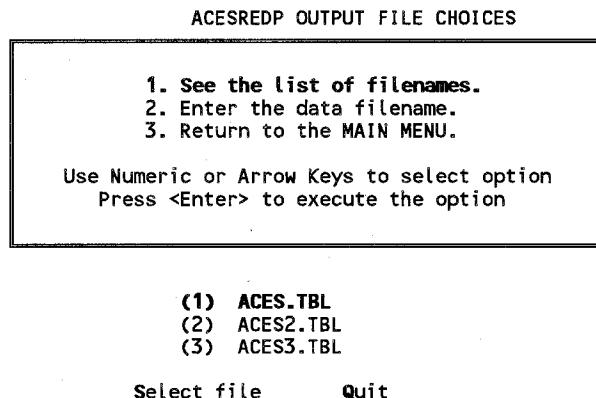
Option 5 (Return to MAIN MENU)

This option will return the user to the MAIN MENU described above on page 9. By selecting this option, the user has decided to discontinue further processing of the current simulation alternative. All data entries will be lost if this option is selected after previously specifying that data should not be saved. In addition to being able to begin processing a new alternative from the MAIN MENU, the user may also exit the program.

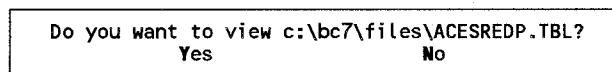
Main Menu Option 7 - View ACESREDP Output

This option is used to view program output generated during a run or any output tables generated in any previous run. As stated before, ACESREDP output tables are saved under a user specified file name or the default name "ACESREDP". The program automatically

adds the extension ".TBL" to each output file. When option 6 is selected from the main menu, the following screen appears. For option 1, the program will request the user to enter a drive letter and then display a list of ACESREDP files that have a valid .TBL extension for a user specified disk drive. The user can select a file by hitting the <Enter> key on a highlighted file. For option 2, the program will prompt the user for a drive letter and the name of the file. For option 3 or <Quit> under option 1, the program will return to the same menu shown below, and the user can make another selection.



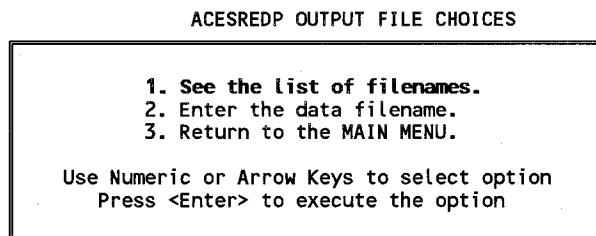
The example above shows the screen when option 1 was selected. If the user hits <Enter> or <Select file> on the highlighted file "ACESREDP.TBL", the program will respond with



For <Yes>, the program will display the output on the screen. the message to turn on the printer will appear:

Main Menu Option 8 - Print ACESREDP Output

This option is used to print program output generated during a run or any output tables generated in any previous run. When option 7 is selected from the main menu, the following screen appears. For option 1, the program will request the user to enter a drive letter and then display a list of ACESREDP files that have a valid .TBL extension for a user specified disk drive. The user can select a file by hitting the <Enter> key on a highlighted file. For option 2, the program will prompt the user for a drive letter and the name of the file. For option 3 or <Quit> under option 1, the program will return to the same menu shown below, and the user can make another selection.



The example above shows the screen when option 1 was selected. If the user hits <Enter> or <Select file> on the highlighted file "ACESREDP.TBL", the program will respond with

Do you want to print c:\bc7\files\ACESREDP.TBL?
Yes No

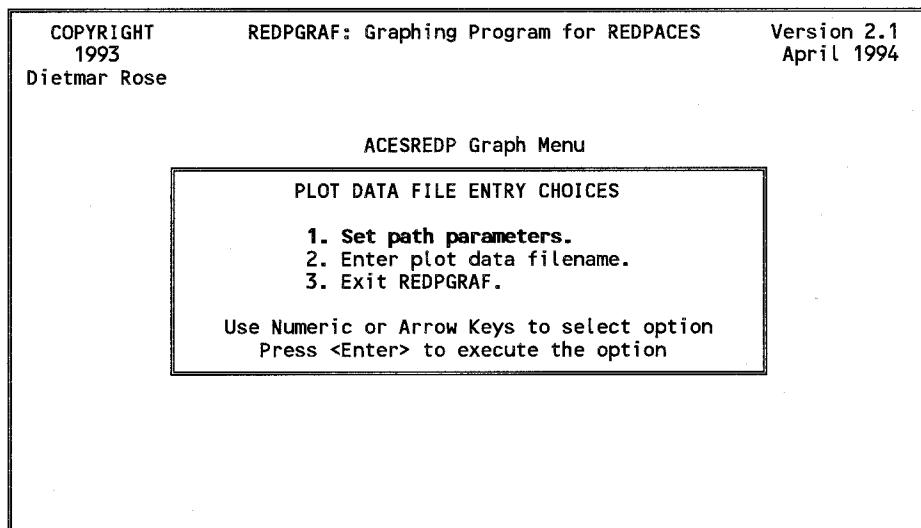
For <Yes>, the following message to turn on the printer will appear:

Turn the printer on and set it to the top of the page
Press a key to continue...

Main Menu Option 9 - View ACESREDP Graphics

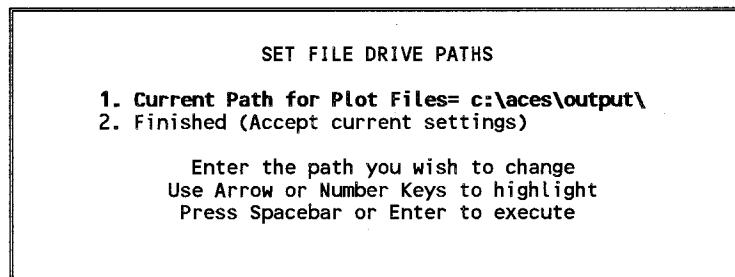
This option allows the user to view the current ACESREDP output in form of graphs by calling REDPGRAF, a stand-alone program. While a routine is included in the program that checks for the best screen mode depending on the computer and its graphics capabilities, the graphics portion of the program might not work in all cases. In that case, the user should let the author know the type of problem that occurred and information on the specific computer system. A modification of the program for that specific situation will be attempted at the earliest convenient time.

A "Y" answer will generate a menu which allows the user to enter a name of a file with plot data generated in the current or any previous run. The plot data files have an extension ".PLT" and have the same name as the file name for the ACESREDP outputs (default ACESREDP.TBL) or specified by the user. If the user chooses the selection option one below, the system will display all files with a "PLT" extension. By selecting one of the files, the plot file is automatically loaded. If the second entry option is used, the user needs to enter only the common part of the plot file name, in this case ACESREDP.

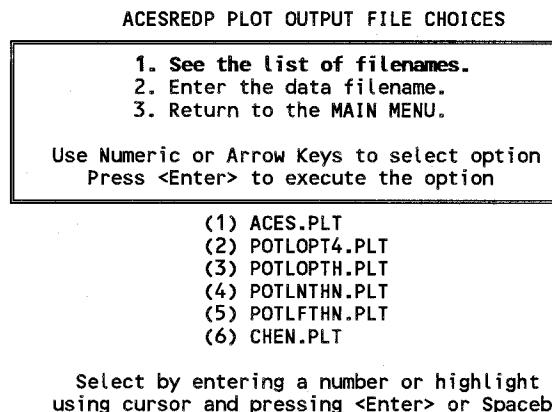


Suboption 1: Set Path Parameters

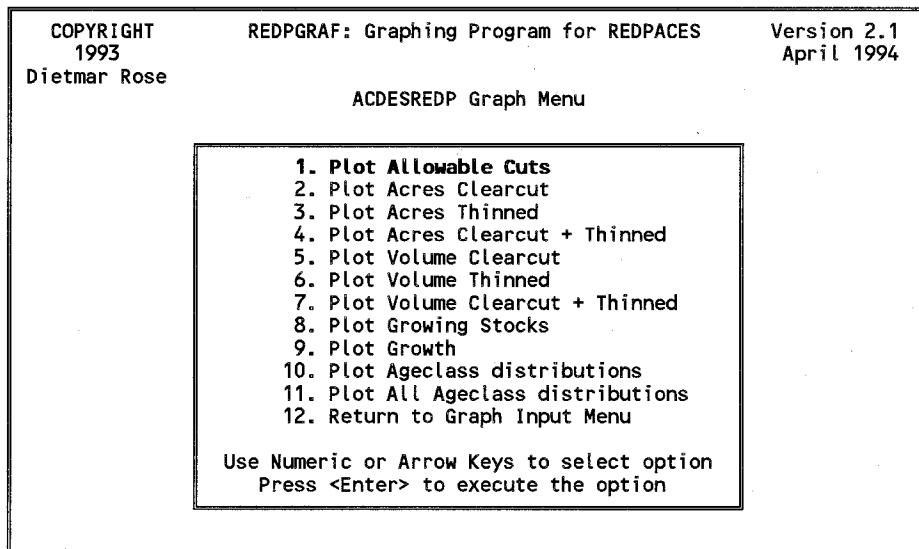
For option 1, the user can change the default path to another path from which to read plot files:



Suboption 2: Enter Plot Data File



The program checks for the validity of the entered file and then displays eight options for plotting key results of the simulation. Plots can only be seen on the screen. The user simply type the menu number or uses the cursor key to highlight a specific choice. Upon hitting the <Enter> key the program will display the associated graphic output. In the case of area control, no plots are being generated.



The first plot shows the allowable cuts for all volume control methods over the planning horizon as well as the volume cut that would have been calculated under area control with adjustment for site productivity. Plot 2 shows the acreage harvested under the user selected volume control method and area control. Plot 3 will display both actual and desirable growth and growing stock volumes over the planning horizon. Plot 4 displays net present values (NPW) for each cutting method. Plot type 5 displays the ageclass distribution for a user defined planning period between "1" and the last simulated period, here "3":

Enter planning period or a number between 1 and 3: ▶ ◀

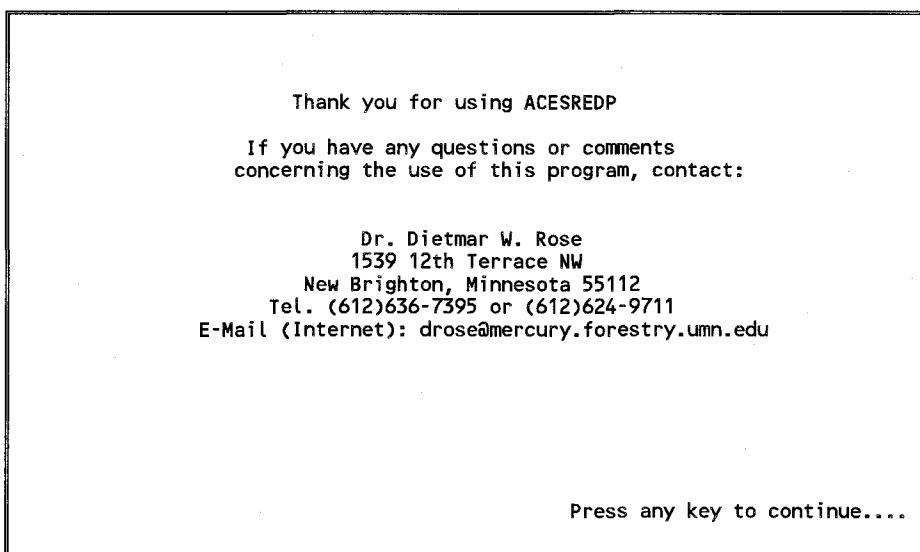
The sixth option generates a bar graph of the ageclass distributions of all periods side by side in order to assess how ageclasses changed over time. The seventh option will return the user to the ACESREDP graph module - File entry choices where additional files with plot data can be read in or a return to the ACESREDP simulations can be requested.

Suboption 3: Exit REDPGRAF

This option will return the user to the ACESREDP Main Menu.

Main Menu Option 10 - Exit

This option is used to exit the program, returning to the operating system. All program processing will be terminated if this option is selected.



Appendix B provides output listings for three sample runs of ACESREDP. A desirable procedure in any simulation analysis is to examine how sensitive key system variables, e.g., growing stock volumes, growth, age-class distributions, and allowable-cut volumes are to changes in various run parameters such as control method, interval of allowable cut recalculation, stocking under management, etc. Knowledge about the impacts of the various run parameters is an essential part of the assessment of the risk associated with an allowable cut decision. It gives valuable insights into what might happen if alternative cutting scenarios were implemented. The editing features of ACESREDP make it easy to examine many allowable cut options for one or many inventory situations.

REFERENCES

- Bellman, R.E. 1957. *Dynamic programming*. Princeton University Press, Princeton, NJ. 340p.
- Buongiorno, J. and J. K. Gilless. 1987. *Forest Management and Economics*. MacMillan Publishing Company, New York. 285 p.
- Burk, T.E. and D.W. Rose. 1980. Description of a forest regulation simulator. University of Minnesota, College of Forestry, Department of Forest Resources, Staff Paper Series No. 13. 12p.
- Chen, C.M., D.W. Rose, and R.A. Leary. 1980. Derivation of optimal stand density over time - A discrete stage, continuous state dynamic programming solution. *For. Sci.* 26:217-227.
- Chen, C.M., D.W. Rose, and R.A. Leary. 1980. How to formulate and solve optimal stand density over time problems for even-aged stands using dynamic programming. U.S. For. Serv. Gen. Tech. Rep. NC-56. 17p.
- Clutter, J.L., J.C. Fortson, L.V. Pienaar, G.H. Brister, and R.L. Bailey. 1983. *Timber Management: A Quantitative Approach*. John Wiley and Sons. New York. 333p.
- Leuschner, W.A. 1984. *Introduction to Forest Resource Management*. John Wiley and Sons. New York. 298p.
- Meyer, A.H., A.B. Recknagel, D.D. Stevenson, and R.A. Bartoo. 1961. *Forest Management (2nd Edition)*. John Wiley and Sons. New York. 282p.
- Rose, D.W. and T.E. Burk. 1980. Development of a model for simulation of forest regulation techniques. University of Minnesota, Agricultural Experiment Station, Technical Bulletin 324. 22p.
- Rose, D.W., C.M. Chen, and R.A. Leary. 1981. Maximum cubic volume production through easily derived optimum thinning schedules. *J. For.* 79:32-35.
- Walters, D.K. and A.R. Ek. 1991. Whole stand models of yield and density for mixed stands developed from forest inventory and analysis data. (in preparation)

APPENDIX - I: SAMPLE STAND DATA AND RUN PARAMETER FILES

STAND DATA FILE

When a stand data file is generated using a text editor, make sure that the first line includes the words "ACESREDP DATA FILE" and the number of title lines

The same file having been saved from the editing screen would appear with the stocking proportions displayed and the stocking indicator parameter would be "-1":

ACESREDP DATA FILE, 2
 Northeastern Minnesota aspen inventory for 1977
 Volume in cu ft per acre
 Species Stands BA entered Data Saved Data Checked
 1 11 0 -1 -1
 1400,105,613,.24138055347076,55
 8300,95,1334,.555666640124336,55
 etc.

RUN PARAMETER FILE

ACESREDP PARAMETER FILE (necessary first line in each run parameter file)
"Y",1,10,65,45,1,10,1,1,0,20,1,79,.158
15,75,10,1,0,0,0,0,0

- Abbreviated output
- Demand curve parameters (intercept and slope)
- Volume Output Units
- Ageclass Width
- Rotation
- Minimum Cutting Age
- Anticipated Stocking after Harvest
- Interval to Reevaluate Allowable Cut
- Number of Times to Evaluate Allowable Cut
- Cut Determination Method
- User defined allowable cut volume (0 unless option 8 for cut determination method)
- Adjustment period for Austrian formula
- Cutting Priority
- Abbreviated Output
- Cu ft/cord conversion factor
- Cu ft/bd ft conversion factor

APPENDIX II - SAMPLE OUTPUT

Short Output - Annual Allowable Cut Calculation

SUMMARY OF STAND DATA

Stand	Acres	Age	Basal Area sq ft/ac	Volume per acre	Site Index
1	1400	105	17	613.00	55
2	8300	95	38	1334.00	55
3	25700	85	46	1503.00	55
4	60800	75	39	1177.00	55
5	150800	65	60	1681.00	55
6	383200	55	56	1394.00	55
7	409000	45	57	1194.00	55
8	286300	35	48	801.00	55
9	199600	25	37	441.00	55
10	177600	15	49	323.00	55
11	244700	5	121	198.00	55

SUMMARY OF RUN PARAMETERS

1. Covertype Selected: Red pine
2. Abbreviated Output (Y or N): N
3. Volume Output (1=Cu ft, 2=Cords, 3=Bd ft): Cu Ft
4. Ageclass Width: 10 Years
5. Rotation: 65 Years
6. Min. Cutting Age: 45 Years
7. Growth Multiplier: 1.00
8. Interval to Reevaluate Allowable Cut: 10 Years
9. Number of Times to Evaluate Allowable Cut: 1
10. Cut Determination Method (1-9): Tabular Check
11. Adjustment period for Austrian formula: 20
12. Cutting Priority (1=Age, 2=Age and Site): 1
13. Stand Volume Units (1=Cu Ft, 2=Cords, 3=Bd ft): Cu Ft
14. Cu ft/cord conversion factor: 79.000
15. Cu ft/bd ft conversion factor: 0.158

SUMMARY OF THINNING PARAMETERS

No thinnings

1. Entry Age of Future Regenerated Stands: 15 Years
2. Initial Basal Area at Entry Age: 75 sq ft
3. Growth/thinning interval: 10 years
4. Option: No thinnings

DISTRIBUTION OF GROWING STOCK IN YEAR: 0 OF PLANNING PERIOD: 0

Age (years)	Site (ft)	Area (acres)	BA (sqft)	Yield/acre Cu Ft	Total yield M Cu Ft	Annual growth Cu Ft	growth Cu Ft/ac
110	55	1400	16.9	613.00	858.200	37207	26.58
100	55	8300	38.5	1334.00	11072.200	438198	52.79
90	55	25700	45.8	1503.00	38627.102	1646528	64.07
80	55	60800	38.5	1177.00	71561.602	3737945	61.48
70	55	150800	60.3	1681.00	253494.797	13451327	89.20
60	55	383200	56.5	1394.00	534180.813	35546496	92.76
50	55	409000	57.0	1194.00	488345.969	41336976	101.07
40	55	286300	48.1	801.00	229326.297	28187660	98.45
30	55	199600	37.3	441.00	88023.602	18108966	90.73
20	55	177600	48.9	323.00	57364.801	21456958	120.82
10	55	244700	120.7	198.00	48450.602	0	0.00
Total		1947400	60.3	935.25	1821305.875	163948256	84.19
Desirable				3480.87	6778647.000	235440032	120.90

Allowable cut for Austrian was set to zero because it is negative

Annual Cutting Report for Planning Period: 1 Year: 1 (all volume units in Cu Ft)
Annual Allowable Volume Cut = 127894656

=====
Acres Clearcut = 99636 Clearcut Volume = 127894656 Cut Vol/Acre = 1283.62
Acres Thinned = 0 Thinning Volume = 0 Cut Vol/Acre = 0.00
Acres Treated = 99636 Total Volume Cut= 127894656
Allowable Cut Volume Not Met = 0
=====

etc. until last year of simulation period

Allowable cut for Austrian was set to zero because it is negative

Annual Cutting Report for Planning Period: 1 Year:10 (all volume units in Cu Ft)
Annual Allowable Volume Cut = 147781584

=====
Acres Clearcut = 67936 Clearcut Volume = 147781584 Cut Vol/Acre = 2175.30
Acres Thinned = 0 Thinning Volume = 0 Cut Vol/Acre = 0.00
Acres Treated = 67936 Total Volume Cut= 147781584
Allowable Cut Volume Not Met = 0
=====

VOLUME CONTROL ALLOWABLE CUT AVERAGES FOR PLANNING PERIOD 1
(Avg. Annual Allowable Cut According To: Tabular Check actually simulated)

Tabular Check = 140749488 Cu Ft
Modified Barnes = 190559584 Cu Ft
Austrian = 0 Cu Ft
Chapman = 97204480 Cu Ft
Hundeshagen = 65277748 Cu Ft
Von Mantel = 75177504 Cu Ft
Hanzlik = 149099856 Cu Ft
User Input = 0 Cu Ft

ACTUAL CUTTING SUMMARY FOR ALLOWABLE CUT METHOD SELECTED

Acres thinned/yr = 0 Thinning volumes = 0 Cu Ft
Acres clearcut/yr = 77177 Clearcut volumes = %140749488 Cu Ft
All acres treated/yr = 77177 Total volume cut = %140749488 Cu Ft
Avg. Annual allowable cut shortfall = 0 Cu Ft

DISTRIBUTION OF GROWING STOCK IN YEAR:10 OF PLANNING PERIOD: 1

Age (years)	Site (ft)	Area (acres)	BA (sqft)	Yield/acre Cu Ft	Total yield M Cu Ft	Annual growth Cu Ft	Annual growth Cu Ft/ac
60	55	267432	89.3	2293.08	613243.938	32080856	119.96
50	55	286300	85.6	1923.33	550648.125	36397072	127.13
40	55	199600	82.6	1565.19	312411.125	26932932	134.93
30	55	177600	122.7	1805.43	320644.094	30171856	169.89
20	55	244700	120.7	198.00	48450.602	43909336	179.44
10	55	487404	75.0	0.00	0.000	0	0.00
0	55	284364	75.0	0.00	0.000	0	0.00
Total		1947400	89.4	947.62	1845397.875	169492064	87.04
Desirable				3480.87	6778647.000	235440032	120.90

Appendix II - Partial Sample Listings of File Outputs for Different Options

The three report components below, summary of stand data, summary of run parameters, and the initial growing stock distribution are part of every report, but are shown only once here to save space.

Covertype Selected: Aspen

SUMMARY OF STAND DATA

Stand	Acres	Age	Volume/acre	Site Index
1	1400	105	613.00	55
2	8300	95	1334.00	55
3	25700	85	1503.00	55
4	60800	75	1177.00	55
5	150800	65	1681.00	55
6	383200	55	1394.00	55
7	409000	45	1194.00	55
8	286300	35	801.00	55
9	199600	25	441.00	55
10	177600	15	323.00	55
11	244700	5	198.00	55

SUMMARY OF RUN PARAMETERS

1. Discount Rate (Percent): 4.00
2. Demand Curve: \$/Cords = a - b * Quan Harv with
a= 5 b= 0
3. Volume Output (1=Cu ft, 2=Cords, 3=Bd ft): Cords
4. Ageclass Width: 10 Years
5. Rotation: 65 Years
6. Min. Cutting Age: 45 Years
7. Anticipated Stocking after Harvest: 100.00 Percent
8. Growth Multiplier: 1.00
9. Interval to Reevaluate Allowable Cut: 10 Years
10. Number of Times to Evaluate Allowable Cut: 3
11. Cut Determination Method (1-9): Tabular Check
12. Adjustment period for Austrian formula: 20
13. Cutting Priority (1=Age, 2=Age and Site): 1
14. Detailed Annual Output Reports (Y or N): Y
15. Cu ft/cord conversion: 79.000
16. Cu ft/bd ft conversion: 0.158

DISTRIBUTION OF GROWING STOCK AT BEGINNING OF PLANNING PERIOD 0

Age (years)	Site (ft)	Area (acres)	Yield/acre Cords	Total yield M Cords	Annual growth Cords	growth Cords/ac
110	55	1400	7.76	10.863	58.5	0.04
100	55	8300	16.89	140.154	888.2	0.11
90	55	25700	19.03	488.951	3718.0	0.14
80	55	60800	14.90	905.843	8460.5	0.14
70	55	150800	21.28	3208.795	37867.8	0.25
60	55	383200	17.65	6761.782	104479.5	0.27
50	55	409000	15.11	6181.595	131184.3	0.32
40	55	286300	10.14	2902.865	90787.5	0.32
30	55	199600	5.58	1114.223	57848.7	0.29
20	55	177600	4.09	726.137	80582.4	0.45
10	55	244700	2.51	613.299	0.0	0.00
Total		1947400	11.84	23054.504	515875	0.26
Desirable			12.88	25089.840	891638	0.46

Sample Run with Periodic Allowable Cut Calculation and Detailed Output

The allowable cut is calculated only once for every planning period and is kept constant at the calculated level during the selected planning period. The detailed output option generates annual stand-level harvest reports as well as growing stock distribution reports. Stand numbers with a "/" show newly created stands from a partial stand clearcut and the number of the stand having been split.

Sample Run with Annual Allowable Cut Calculation and Detailed Output

The allowable cut is calculated once for every year of the planning period. The detailed output option generates annual stand-level harvest reports as well as growing stock distribution reports.

Sample Run with Annual Allowable Cut Calculation and Brief Output

The allowable cut is calculated once for every year of the planning period. The brief output option generates annual aggregate harvest reports and only periodic growing stock distribution reports.