USDA United States Department of Agriculture

Forest Service

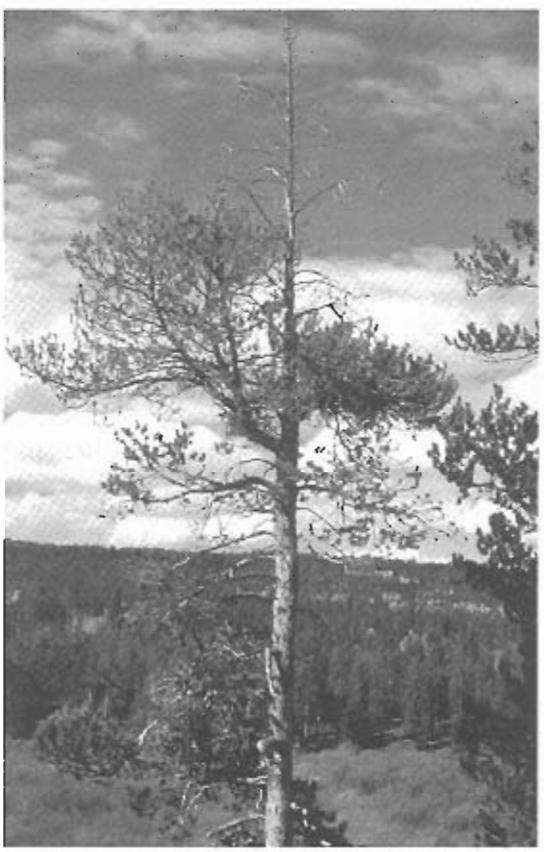
Rocky Mountain Research Station

General Technical Report RMRS-GTR-49

April 2000

Forest Insect and Disease Tally System (FINDIT) User Manual

Barbara J. Bentz



Abstract

Bentz, Barbara J. 2000. **Forest insect and disease tally system (FINDIT) user manual.** Gen. Tech. Rep. RMRS-GTR-49. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 12 p.

FINDIT, the Forest Insect and Disease Tally System, is an easy-to-use tool for analyzing insect and disease population information taken during stand surveys. Incidence of insects, pathogens, and other biotic and abiotic influences on forest ecosystems are summarized using traditional mensurational measurements. Information is summarized by diameter class, tree species, influencing agent, and for the entire stand. Several insect and disease hazard rating systems are also included. FINDIT version 1.2 runs within the Windows platform.

Keywords: computer program, bark beetle, stand survey analysis, pathogen, defoliator, dwarf mistletoe

The Author

Barbara J. Bentz is a Research Entomologist and Project Leader of the Rocky Mountain Research Station project Disturbance Ecology in the Interior West: Bark Beetle Disturbance in Conifer Forests, and Assistant Professor in the Forest Resources Department at Utah State University. Dr. Bentz received a Ph.D. degree in entomology from Virginia Tech, an M.S. degree in forest resources from the University of Idaho, and a B.S. degree in forestry from Stephen F. Austin State University.

Acknowledgments

Dawn Hansen (former Entomologist, Forest Health Protection, Ogden, UT) provided continual feedback on the program during development, as well as review of the manual. Jim Long and David Chojnacky reviewed the mensuration equations used in the program. Shirley Waters supplied volume equations. Leslie Brown and Manish Chandra assisted with programming. Forest Health Protection in Regions 3 and 4 provided startup funds to initiate the program, and the Forest Health Technology Enterprise Team provided funds to develop the Windows graphical user interface (GUI). David Graham (INTECS International, Fort Collins, CO) developed the GUI for FINDIT version 1.2.

Contents

Contact Barbara Bentz for details on obtaining the FINDIT software:
e-mail: bbentz@fs.fed.us telephone: (435) 755-3577

Rocky Mountain Research Station
324 25th Street
Ogden, UT 84401

Forest Insect and Disease Tally System (FINDIT) User Manual

Barbara J. Bentz

Introduction and Use

Indigenous insect and disease populations are important components of healthy forest ecosystems. Outbreak phases, during which population numbers increase nonlinearly, are often inherent components of the natural cycle of these populations, and serve a vital role in the regulation of many ecosystems. During the outbreak phase of population cycles, however, and when dealing with exotic species, competition with humans for significant economic resources is a common issue. In areas where forest resources (including recreation, timber, and wildlife) are important commodities and insect and disease populations exist, managers require information that will facilitate decisions on appropriate strategies for reducing risk to epidemic-phase populations. Additionally, for those species that are natural disturbance agents in forest ecosystems, managers also need the capability to accommodate and utilize insect and disease populations in maintaining dynamic ecological systems. Both aspects are critical for forest ecosystem management and require detailed information about insect and disease population events.

FINDIT, the Forest Insect and Disease Tally system, is a simple tool for quick analysis of insect and disease population information taken from stand surveys. FINDIT provides a summary of biotic and abiotic factors that have been sampled, but it does not make any management decisions. Decisionmaking is left to the user, given the summary information provided by FINDIT. FINDIT was initially patterned after INDIDS, the Forest Insect and Disease Damage Survey system, which was developed to help managers estimate losses caused by various insect and disease populations (Bousfield 1980). However, INDIDS was developed for the Forest Service Data General (DG) computer system, which is no longer in operation. FINDIT was developed specifically to run on the personal computer platform, and includes modifications and enhancements not found in INDIDS. Data formats and codes previously used in INDIDS have been modified somewhat for FINDIT. Therefore, to analyze INDIDS data files using FINDIT, modifications to the data file are needed.

Getting Started

System Requirements—

- PC compatible with a floppy drive.
- Windows 95, 98, 2000, or NT 4.0.

Installation—To install FINDIT (ver 1.2), place the disk in floppy drive A: and run **Setup**. The program and all necessary files will be placed in the specified directory on the hard drive.

Running FINDIT (ver 1.2)—To begin the FINDIT program within Windows, double click on the FINDIT icon under **Start, Programs**. A Project within FINDIT is a collection of files where each file represents survey information for a single stand. A Project may contain an infinite number of stand survey files. The FINDIT program has a routine for entering data for stand surveys. Alternatively, a stand survey file can be created using Microsoft Excel (see appendix for instructions). Once the FINDIT program is running, follow steps 1 through 4 to analyze stand survey(s) information.

Step 1—Create a new FINDIT Project. Select **File→New**. This will create a new FINDIT Project.

Step 2—Add stand survey files to the Project. If stand survey files have previously been created, choose **Survey→Add** (or **Add Survey**) to add an existing survey file to the Project. Each stand survey file must be added separately. There is no limit to the number of survey files in a Project. To create a survey file using the FINDIT data entry routine:

Step 2.1—Choose **Survey→New** (or ***New Survey*** button), and the ***Edit Survey Header*** dialog box will be displayed. Enter the header information (see appendix). Select the Next button.

Step 2.2—Add tree information for the stand survey. The ***Edit Survey Entries*** dialog box will be displayed. Each line in the Survey file represents a single tree (except for regeneration, see appendix). Enter information for a single tree and select the ***Add Entry*** button. Continue in this fashion until all trees within the data set have been entered. When all items have been entered select the ***Next*** button.

Step 2.3—Save the survey file. The ***Save FINDIT Survey*** dialog box will be displayed. Save the data file in the appropriate directory.

Step 2.4—Enter additional stand survey file information. Repeat steps 2.1 through 2.3 for each additional stand survey to be included in the project.

Step 3—Save the project. Select **File→Save As**.

Step 4—Execute FINDIT. Choose **Tools→Execute FINDIT** (or ***Execute FINDIT*** button) to run the FINDIT program. All stand survey files within the current project will be executed.

Output reports from each stand survey file are stored in the same directory as the survey file. Output files have the same name as the stand survey file, but with the extension 'out.' The list of data input and output filenames for a project are saved in the directory with the .fid extension.

To view and print the FINDIT output report after running the program:

Step 1—Select a stand survey file from the Project list. Click on the filename of the survey in the FINDIT Project window. This filename will be highlighted.

Step 2—View the output report. Select **View→ Report** (or ***View Report*** button). A Report View Window will appear with the results for the highlighted stand survey.

Step 3—Print the output report. Select **File→Print**. Output will be sent to the default printer.

Data

FINDIT is designed to accept stand survey data collected using fixed or variable plot methods. Please consult a mensuration reference such as Husch and others (1982) for information and methodology on these survey types. Format specifications and codes are included in the appendix.

Data Input

Each stand survey file must only contain data for a single stand that has been sampled with a specific number of plots. Use additional survey files to analyze additional stands. Data may be entered using Microsoft Excel (see appendix), a text editor such as WordPad within Windows, or the data entry routine within FINDIT (***New Survey*** button). The first line of each survey file, the header line, contains information about the stand and survey sampling procedure. The header line is followed by individual tree data, where each line represents a single tree. The one exception involves regeneration tree data. If more than one tree of a particular species that is regeneration size exists in a plot, replicates may be entered in columns 5 through 7 of that tree data line. There is no limit to the number of trees or number of plots in each stand survey file. Valid species and insect codes for the tree data are in the appendix. Although three sets of columns are available for entering insect and disease codes (I&D), the first I&D code must be in the first column (25 and 26). If there is no code in the first column, FINDIT assumes there are no other I&D codes for that particular tree. Also, the mortality causing agent (if any) must be in the first column. In addition to the 29 predefined insect and disease codes (appendix), the user may define up to three additional codes (30, 31, 32) for impacts on trees such as weather, fire, additional insect and disease species not included in the original codes, and other special needs such as tallying downed and infested trees. To add a label for a user-defined code, choose **Tools→Set User Code Labels**. The user will be prompted for a label, which includes three lines with a maximum of six characters in each line. If you chose to not enter a custom label, the default label for output purposes is "User Code xx." User-defined code 30 is reserved for agents that result in death of the tree. Trees with a 30 code are included in mortality estimates.

Data Analysis

Survey data collected in either fixed or variable plot design may be input into FINDIT. The type of survey is indicated in column 1 of the header line, and the size (basal area factor or fixed plot size) is included in columns 7 and 8 (appendix). Calculations are based on 2 inch diameter at breast height (d.b.h.) classes:

Inches
0-2.9
3.0-4.9
5.0-6.9
7.0-8.9
9.0-10.9
11.0-12.9
13.0-14.9
15.0-16.9
17.0-18.9
≥19.0

All stand summary statistics are calculated using only tree data with a d.b.h. greater than the entered d.b.h. breakpoint (columns 14 through 16 on the header line). The default d.b.h. breakpoint is 5.0 inches. Any value from 0.0 to 19.0 inches may be entered as a d.b.h. breakpoint, and only trees with a d.b.h. greater than or equal to the d.b.h. breakpoint entered will be included in calculations. Expansion for regeneration plots is included by default, based on a 1/300 acre plot. If the d.b.h. breakpoint value is less than 5.0, all trees in

classes less than the d.b.h. breakpoint class are considered regeneration. Otherwise, all trees less than 5.0 inches d.b.h. are considered for regeneration. A "1" entered in columns 10 through 12 of the header line causes regeneration data to not be computed. If a regeneration plot size other than 1/300 acre is desired, the appropriate value must be entered in columns 10 through 12 of the header line. All regeneration statistics are calculated using fixed plot formulas.

Trees Per Acre and Basal Area—Total trees per acre (TA) and basal area (BA) for trees greater than or equal to the d.b.h. breakpoint (default = 5.0 inches d.b.h.) are calculated as:

Fixed plot design

$$TA = \frac{Number\ of\ trees}{Size\ of\ plot \times number\ of\ plots}$$

$$BA = \frac{\sum_{i=0}^{i=n} (0.005454 \times DBH_i^2)}{Size\ of\ plot \times number\ of\ plots}$$

Variable plot design

$$TA = \frac{\sum_{i=0}^{i=n} \left(\frac{BAF}{0.005454 \times DBH_i^2} \right)}{Number\ of\ plots}$$

$$BA = \frac{BAF \times number\ of\ trees}{Number\ of\ plots}$$

where

n = total number of trees
BAF = basal area factor.

Quadratic Mean Diameter—Quadratic mean diameter (QMD) is an alternative method for calculating average tree diameter, based on an expansion to an area basis. Only trees larger than the d.b.h. breakpoint are included in QMD calculations. QMD is calculated for each plot, then averaged for the stand.

$$QMD = \sqrt{\frac{\frac{BA}{TA}}{0.005454}}$$

Stand Density Index— Stand density index (SDI) is a measure of relative stand density that is independent of stand age and site quality (Reineke 1933). To account for uneven-age distributions and age distributions that may not be normal, SDI is calculated for each tree, then summed for the stand (Long 1995; Long and Daniels 1990). Only live trees larger than the d.b.h. breakpoint are included in calculations.

$$SDI = TA_i \times \left(\frac{DBH_i}{10} \right)^{1.6}$$

where

DBH_i = d.b.h. of the ith tree
TA_i = trees per acre represented by the ith tree.

Live Age—If age values are included in the input file, the arithmetic mean age of each species and the total stand are calculated as:

$$Live\ age = \frac{\sum_{i=0}^{i=N} Age_i}{N}$$

where

N = number of live trees with a recorded age.

Age is not expanded to an area basis.

Crown Competition Factor—Crown competition factor (CCF) (Krajicek and others 1961; Wykoff and others 1982) is a relative measure of stand density that is based on tree diameters. Individual tree values of CCF are an estimate of the percentage of an acre that would be covered by the tree crown if it were open grown. CCF for a stand is the summation of the individual tree CCF values. A value of 100 theoretically indicates that tree crowns will just touch in an unthinned, evenly spaced stand. CCF is estimated, using only live trees larger than the d.b.h. breakpoint, as:

if d.b.h. ≥10 inches:

$$CCF_i = TA_i \times \left(a_0 + a_1 \times DBH_i + a_2 \times DBH_i^2 \right)$$

if d.b.h. <10 inches:

$$CCF_i = TA_i \times \left(b_0 + DBH_i^{b_1} \right)$$

where

TA_i = trees per acre for the ith tree
a_0, a_1, a_2, b_0, b_1 are species-specific parameters.

Board Foot Volume Computation—Board foot volume (BFV) computations are based on Kemp (1956) for northern species and Hann and Bare (1978) for southwestern species. Because height values are only measured on a subsample in each plot, heights for each tree are predicted using a linear regression based on measured d.b.h. and height data in the stand (see Wykoff and others 1982 for parameter values). For tree species in the Northern (1) and Rocky Mountain Regions (2 and 4) (Douglas-fir, grand fir, subalpine fir, white fir, larch, alpine larch, Englemann spruce, blue spruce, bristlecone pine, limber pine, whitebark pine, western white pine, ponderosa pine, lodgepole pine,

western redcedar, western hemlock, mountain hemlock, birch, ash, cottonwood, aspen), BVF is computed to an 8 inch top, assuming a 7 inch minimum d.b.h. and an unforked tree. For species found in the Southwestern Region (3) (Douglas-fir, Corkbark fir, southwestern white pine, Englemann spruce, ponderosa pine, aspen, white fir), BFV is computed to a 6 inch top, assuming an unforked tree. Region code entered on the header line of each stand survey file is used to determine volume equations to be used. Volume equations for Apache pine, juniper, Chihuahua pine, Arizona pine, and pinyon are not included.

Northern species

$$BFV_i = a \times X_i - b \times TA_i$$

where

BFV_i = Scribner Board Foot Volume for tree i
X_i = $d.b.h.^2$ x *height* for tree i
a, b = species-specific parameters
TA_i = trees per acre for tree i.

Southwestern species

$$BFV_i = BFV_I \times R_{S/I} \times TA_i$$

where

BFV_i = Scribner board foot volume for tree i
BFV_I = international board foot volume
$R_{S/I}$ = ratio of actual gross Scribner BFV to International BFV
TA_i = trees per acre for tree i.

Statistical Measures—The standard error of the mean (SEM) is calculated for stand and species-specific estimates of trees per acre (TA), basal area (BA), quadratic mean diameter (QMD), and stand density index (SDI). The standard error of the mean is inversely proportional to the square root of the number of observations in the calculated plot mean, and is an estimate of the variance among plots for each measure.

Insect and Disease Rating Systems—Included are systems used for rating stand susceptibility to the mountain pine beetle (*Dendroctonus ponderosae* Hopkins), the spruce beetle (*D. rufipennis* Kirby), the Douglas-fir beetle (*D. pseudotsugae* Hopkins), and dwarf mistletoe (*Arceuthobium* spp.). Although all systems have not been validated, they are currently used to gain a better understanding of stand conditions conducive to the growth of an epidemic insect population. **The user is urged to use caution when interpreting results.**

Mountain Pine Beetle Loss Model—A model that estimates trees per acre (TA) of lodgepole pine (*Pinus contorta*) infested and killed by the mountain pine beetle over a 10 year period is included (Cole and McGregor 1983). Predictions of mortality from this model were found to be within about 25 percent of the actual mortality (Cameron and others 1990). Output includes TA killed by diameter class for each year. If no infested trees are currently in the stand, a default percentage of trees in each d.b.h. class are assumed infested and used to initiate the model run (Cole and McGregor 1983). Beetle-induced mortality on a yearly basis is a function of the number of green trees (≥5.0 inches d.b.h.) available for infestation, and the number of trees infested the previous year in each diameter class. Q, the probability of a tree in a particular diameter class not being infested, was estimated by Cole and McGregor using data from a mountain pine beetle infestation in lodgepole pine in Yellowstone National Park. This model assumes that beetles emerging from trees in a particular diameter class only attack trees in that same diameter class. Model output is only printed if there are live lodgepole pine trees in the stand. Because parameter values were originally developed for lodgepole pine, this system is not valid for use with mountain pine beetle in ponderosa pine (*P. ponderosa*).

d.b.h. class	Default infestation	Q
inches	*percent*	
0-2.9	0.000	1.00
3-4.9	.000	1.00
5-6.9	.0038	.9937
7-8.9	.0128	.9820
9-10.9	.0206	.9650
11-12.9	.0353	.9090
13-14.9	.0500	.7430
15-16.9	.1429	.3090
17-18.9	.1500	.2850
≥19	.1500	.2850

$$Mortality_{t+1} = GreenTA \times \left(1 - \exp(\log Q) \times Mortality_t\right)$$

where

$Mortality_t$ = TA infested in the stand at time t
Q = diameter class dependent coefficient.

Spruce Beetle Susceptibility Rating—Schmid and Frye (1976) developed a system for rating the susceptibility of spruce stands to population outbreaks of the spruce beetle. This system has not been officially validated, so the user is urged to use caution when interpreting these susceptibility rating results. Although this system has not been officially validated, it is often used to gain a better understanding of specific stand conditions that are conducive to a spruce beetle population outbreak. Four stand factors are used:

1. Arithmetic average diameter of live spruce in the stand that are greater than 10.0 inches d.b.h.
2. Basal area (BA) of the live stand.

3. Proportion of live spruce basal area in the stand.
4. Physiographic location of the stand.

If live spruce are present in the stand (with d.b.h. ≥10 inches) a rating is calculated using factors 1 through 3. The user is urged to include the physiographic location of the stand (information that is not part of the input data file) to calculate a total stand rating. Results are printed only if there are live spruce trees in the stand.

Douglas-fir Beetle Susceptibility Rating—Weatherby and Their (1993) developed a rating system for the Douglas-fir beetle based on information from Furniss and others (1981) (also see Steel and others 1996). This system provides an indication of stand susceptibility. Although this system was validated on the Boise National Forest, the user is urged to use caution in interpreting results, especially when data from areas other than the Boise National Forest are applied. The system is based on:

1. Stand basal area of all live trees (≥5.0 inches d.b.h.).
2. Proportion of the stand basal area comprised of live Douglas-fir trees.
3. Average age of Douglas-fir in the stand based on at least two site trees per plot (≥5.0 inches d.b.h.).
4. Arithmetic average diameter of all Douglas-fir ≥9 inches d.b.h.

Values for each attribute are assigned a class, and a rating value of Low, Moderate or High is then calculated based on the summation of values within a class. This table is only printed if the stand data contains live Douglas-fir trees with a d.b.h. ≥9 inches.

Average Dwarf Mistletoe Rating System—When codes are included for the six-class dwarf mistletoe rating system (Hawksworth 1977), an average dwarf mistletoe rating (DMR) for the stand is calculated by host species. Although a DMR is typically recorded only for live trees, trees currently infested with bark beetles, for example, could also be rated for dwarf mistletoe in the field. Therefore, because FINDIT considers bark beetle infested trees as dead, DMRs are categorized by both live and dead trees. The stand DMR (of live and/or dead trees) is calculated for each species as:

$$DMR = \frac{\sum_{i=0}^{i=N} rating_i}{N}$$

where

$rating_i$ = Hawksworth (1977) mistletoe rating for tree i

N = number of trees in stand with a Hawksworth rating.

Output

Program output consists of four general sections: (1) stand-level, (2) species-specific, (3) regeneration, and (4) insect and disease rating systems. Stand-level information is printed for each input file, while the three other sections are only printed if the appropriate data is contained in the input file. The stand-level section includes summary statistics, by species and d.b.h. class, for the entire stand. TA, BA, BFV, and QMD are calculated by species for all trees (≥d.b.h. breakpoint) in the data set, including both live and dead. Only green living trees are included in calculations for Live QMD, Live SDI, Live BFV, Live TA, Live BA, Live Age (N), Stand CCF and percent of Stand BA, and percent of Stand TA. Only dead trees are included in calculations for Dead TA and Dead BA. Dead tree calculations include trees with I&D Codes 1, 2, 3, 4, 8, 9, 14, 16, 18, 28, or 30. Trees with the remaining codes are included in live tree calculations.

In the second output section, a separate table is developed for each species. If at least one tree in a particular species has an I&D code other than 0, a table is printed for that species. Each table consists of a column for each I&D code recorded for trees of that species. Within each column, TA and BA by d.b.h. class are calculated. Total TA, BA, and QMD are also calculated for each I&D code. Output for a particular I&D code is only printed if it is found in the data. If no trees in the survey have an I&D code recorded, no species-specific tables will be printed. Dwarf mistletoe ratings (DMR) on both live and dead trees are output for each species with at least one tree coded for dwarf mistletoe.

Where a single tree has more than one I&D code recorded, that tree will be included in calculations for each code. In this manner, all trees affected by a particular insect or disease population will be included in the Total TA, BA, and QMD for each code. However, when totals are calculated for the entire species, each tree is included only once. Therefore, in cases where more than one I&D code is recorded for at least one tree, adding column totals will **not** sum to the Total for that species.

A table of regeneration information is printed next if the appropriate data is found in the input file. Regeneration data consists of all trees with a d.b.h. less than the assigned d.b.h. breakpoint (header line, columns 14 through 16). Columns 10 through 12 of the header line must also have a value other than '1,' which represents the size of the regeneration plot (e.g., 300 for 1/300 acre) (see appendix). A value of '1' in this column results in **no** regeneration information in the output file.

Rating system results for *D. ponderosae*, *D. rufipennis*, and *D. pseudotsugae* are only printed if live trees of the respective hosts (lodgepole pine, Englemann spruce, and Douglas-fir) are found within the input file. Otherwise, a table of results is not printed.

References

Bousfield, W. E. 1980. R-1 forest insect and disease damage survey system. Rep. 3450. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region State and Private Forestry. 23 p.

Cameron, D. E.; Stage, A. R.; Crookston, N. L. 1990. Performance of three mountain pine beetle damage models compared to actual outbreak histories. Res. Pap. INT-435. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 13 p.

Cole, W. E.; McGregor, M. D. 1983. Estimating the rate and amount of tree loss from mountain pine beetle infestations. Res. Pap. INT-318. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 22 p.

Hann, D. W.; Bare, B. B. 1978. Comprehensive tree volume equations for major species of New Mexico and Arizona: I. Results and methodology. Res. Pap. INT-209. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 43 p.

Hawksworth, F. G. 1977. The 6-class dwarf mistletoe rating system. Gen. Tech. Rep. RM-48. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 7 p.

Husch, B.; Miller, C. I.; Beers, T. W. 1982. Forest mensuration. New York: John Wiley and Sons. 402 p.

Kemp, P. D. 1956. Region 1 volume tables for cruise computations. Northern Region Handbook R1-2430-31. Missoula, MT: U.S. Department of Agriculture, Forest Service.

Krajicek, J.; Brinkman, K.; Gingrich, S. 1961. Crown competition—a measure of density. Forest Science. 7(1): 35-42.

Long, J. N. 1995. Using stand density index to regulate stocking in uneven-aged stands. Uneven-aged management: opportunities, constraints and methodologies. Misc. Publ. 56. Montana Forest and Conservation Experiment Station: 110-122.

Long, J. N.; Daniel, T. W. 1990. Assessment of growing stock in uneven-aged stands. Western Journal of Applied Forestry. 5(3): 93-96.

Reineke, L. H. 1933. Perfecting a stand density index for even aged forests. Journal of Agriculture Research. 46: 627-638.

Schmid, J. M.; Frye, R. H. 1976. Stand ratings for spruce beetles. Res. Note RM-309. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 4 p.

Steele, R.; Williams, R. E.; Weatherby, J. C.; Reinhardt, E. D.; Hoffman, J. T.; Thier, R. W. 1996. A stand hazard rating for central Idaho forests. Gen. Tech. Rep. INT-332. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 61 p.

Weatherby, J. C.; Thier, R. W. 1993. A preliminary validation of a Douglas-fir beetle hazard rating system, Mountain Home Ranger District, Boise National Forest. Rep. R4-93-05. Boise, ID: U.S. Department of Agriculture, Intermountain Region, Forest Pest Management.

Wykoff, W. R.; Crookston, N. L.; Stage, A. R. 1982. User's guide to the stand prognosis model. Gen. Tech. Rep. INT-133. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 112 p.

Appendix

Data Input

All values must be entered in **integer** format (except where specified) and **right justified** in the appropriate column. Each data file represents one stand.

Header (line 1)

Column	Description
1	Survey type (variable plot = 1, fixed plot = 2).
3-5	Total number of plots.
7-8	Plot size (BAF or fixed size; e.g., BAF = 10 or fixed = 10 [1/10 acre]).
10-12	Regeneration plot size: 1 if no regeneration included, or size. Default = 300 (1/300 acre).
14-16	d.b.h. breakpoint. Default = 5.0 inches (enter as integer, e.g., 50).
18	Forest Service Region.
20-34	Forest name.
36-50	Stand name.
52-61	Survey date (format mm/dd/yy).
63-65	Surveyors initials.
67-80	Additional comments.

Tree data (lines 2-n)

Column	Description
1-3	Plot number[a].
5-7	Number of tree replicates[b].
9-11	Species code (alphabetic characters).
13-15	d.b.h. (inches) (enter as integer).
17-19	Height (feet).
21-23	Age.
25-26	Insect and disease code.
28-29	Insect and disease code.
31-32	Insect and disease code.

[a]Plot number must be smaller than or equal to the total number of plots entered in columns 3 through 5 of the header line.
[b]Tree replicate entries are for regeneration data only.

Header line variables [maximum number of characters]

Survey type: Survey sample type, either fixed (2) or variable (1) [1].

Total number of plots: Total number of plots in stand survey [3].

Plot size: Size of survey plot used in sampling. Fixed plot size (e.g., 10 = 1/10 acre), or BAF (e.g., 20) [2].

Regeneration plot size: Size of survey plot used in sampling regeneration. Enter 1 if no regeneration sampled, or size of plot. Default value = 300, which represents 1/300 acre plot size. Regeneration is all trees smaller in diameter than the d.b.h. breakpoint, or smaller than 5.0 inches if the d.b.h. breakpoint entered is greater than 50 [3].

d.b.h. breakpoint: Entered in inches as an integer (e.g., 50 represents 5.0). Any value from 0.0 to 19.0 may be entered. Only trees with a d.b.h. ≥ the entered value will be used in calculations. The default value is 5.0. If the d.b.h. breakpoint is less than 5.0, the entered value is also used as a breakpoint for calculations of regeneration statistics. In this case, all trees with a d.b.h. below the breakpoint value are considered regeneration [3].

Forest Service Region: One digit code for the Forest Service Region in which the stand is located [1].

Forest name:	Descriptive name of forest [15].
Stand name:	Descriptive name of stand [15].
Survey date:	Date of field survey with format mm/dd/yy [10].
Surveyors' initials:	Initials of field crew responsible for field survey [3].
Comments:	Any combination of alpha and numerical characters to describe data [13].

Tree line variables [maximum number of characters]

Plot number:	Number representing the plot the tree was located in [3].
Number of tree replicates:	These columns are used for regeneration data only. If several trees exist in a plot and they are the same size and species, one line of data may be used to represent them. Enter the number of replicates in this column. For example, if there are four lodgepole pine seedlings with a 0.1 inch d.b.h., one line of data with a '001' in columns 13 through 15, 'LLP' in columns 9 through 11, and a '004' in columns 5 through 7 would represent all four trees [3].
Species code:	Alphabetic character abbreviation (see below) for the tree species [3].
d.b.h.:	Diameter at breast height, in inches, entered as an integer (e.g., 190 represents 19.0 and 50 represents 5.0) [3].
Height:	Height, in feet, of the tree entered as an integer (e.g., 56) [3].
Age:	Age, in years, of the tree entered as an integer [3].
Insect and disease codes:	Up to three codes (see below) may be included for each tree with a maximum of two characters per code. If a tree is live and healthy with no symptoms, a 0 (the default) is entered. If a tree is dead, the mortality causing agent must be entered as the first code (columns 25 and 26). Other symptoms the tree may have are entered in columns 28 and 29, 31 and 32.

Insect and disease codes (columns 25 and 26, 28 and 29, 31 and 32), and tree mortality status assigned to each code.

Code	Description	Tree status
0	Healthy tree, no damage	Live
1	Unknown mortality	Dead
2	Current beetle attack	Dead
3	Last year's beetle attack	Dead
4	Older beetle attack	Dead
5	Unsuccessful beetle attack	Live
6	Current beetle strip attack	Live
7	Older beetle strip attack	Live
8	Current secondary beetle attack (bole only)	Dead
9	Older secondary beetle attack (bole only)	Dead
10	Secondary beetle strip attack (bole only)	Live
11	Light defoliation (≥25 percent)	Live
12	Moderate defoliation (26-50 percent)	Live
13	Heavy defoliation (≥51 percent)	Live
14	Defoliator mortality	Dead
15	Root disease on live tree	Live
16	Root disease on dead tree	Dead
17	Blister rust on live tree	Live
18	Blister rust on dead tree	Dead
19	Mistletoe class 1	Live
20	Mistletoe class 2	Live
21	Mistletoe class 3	Live
22	Mistletoe class 4	Live
23	Mistletoe class 5	Live
24	Mistletoe class 6	Live
25	Top Kill (>⅓ of crown)	Live
26	Bole Canker	Live
27	Branch flagging (>30 percent of needles)	Live
28	Decay	Dead
29	Animal or environmental impact	Live
30	User-defined (mortality agent)	Dead
31	User-defined	Live
32	User-defined	Live

Species codes (columns 9 through 11)

Ash	ASH or GA
Aspen	QA or ASP
Birch	B
Cottonwood	CW
Fir, Douglas	DF
Fir, grand	GF
Fir, red	RF
Fir, subalpine, corkbark	AF, SAF or CBF
Fir, white	WF
Incense cedar	IC
Juniper	J
Larch	L or WL
Larch, subalpine, alpine	AL
Mountain hemlock	MH
Pine, Apache	AP
Pine, Arizona	ARP
Pine, bristlecone	BCP
Pine, Chihuahua	CHP
Pine, Jeffery	JP
Pine, limber	PF or WLP
Pine, lodgepole	LP or LPP
Pine, ponderosa	PP, BJP or YP
Pine, southwestern white	SWP
Pine, sugar	SP
Pine, western white	WP
Pine, whitebark	WBP or WB
Pine, pinyon	P
Spruce, blue	BS
Spruce, Englemann	S or ES
Western hemlock	WH or H
Western redcedar	C or WRC
Other hardwoods	OH

Using Microsoft Excel to create a FINDIT stand survey file

Each Excel spreadsheet column will represent a FINDIT variable. For example, the "plot number" variable of each tree data line must contain three characters; therefore, the Excel column must be formatted as three characters. To do this, with the plot number column of the spreadsheet highlighted (column A), click on **Format→Cells→Number**. Choose "**Custom**," "0," and enter "000." Save this entry. That column will now be formatted to take up three characters. Repeat this for the remaining variables of the tree data line using "000" for those variables requiring three characters and "00" for those requiring two characters. In the species columns, choose "**Text**" as the format type. Because the species variable requires three characters, but the text format will not allow this length to be set, when entering the species code spaces must be added to fill in the three characters. For example, if a juniper tree is being entered, the field must be entered as "␣J␣" or "␣␣J" or "J␣␣." Likewise for ponderosa pine "␣PP" or "PP␣" with 1 space either before or after the PP code. All columns must have a value entered. For each tree, enter 0 in all columns without a value.

Change the cell formats of row 1 to match the variables of the header line. Do this in the same manner you set up the column formats above, but do it for each individual cell rather than an entire column. The forest name, stand name, and comment variables will need to be entered as type "Text," and the date column will need to be set as a "Date" format.

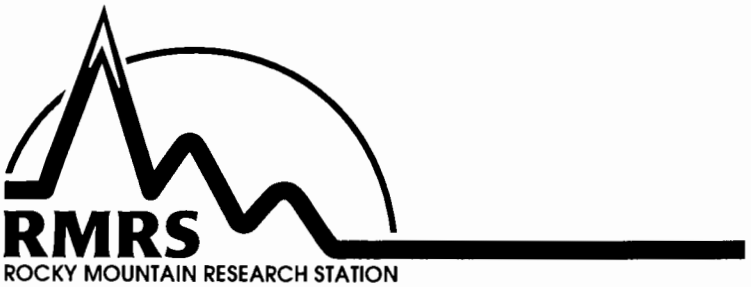
For FINDIT to be able to read the file, you must save it as a Text (Tab delimited *.txt) file. The saved survey file can now be entered into a FINDIT project.

Header (row 1)

Excel column	Number of characters	Excel format	Data description
A	1	0	Survey type (variable plot = 1, fixed plot = 2)
B	3	000	Total number of plots
C	2	00	Plot size (BAF or fixed size)
D	3	000	Regeneration plot size: 1 if no regeneration included, or size. Default = 300 (1/300 acre)
E	3	000	d.b.h. breakpoint. Default = 50 (represents 5.0 inches)
F	1	0	Forest Service Region
G	15	Text	Forest name (optional)
H	15	Text	Stand name (optional)
I	10	Date	Date (optional)
J	3	Text	Observer initials (optional)
K	13	Text	Comments (optional)

Tree data (rows 2-n)

Excel column	Number of characters	Excel format	Data description
A	3	000	Plot number
B	3	000	Number of tree replicates (for regeneration only)
C	3	Text	Species code
D	3	000	d.b.h. (inches)
E	3	000	Height (feet)
F	3	000	Age
G	2	00	Insect and disease code
H	2	00	Insect and disease code
I	2	00	Insect and disease code



The Rocky Mountain Research Station develops scientific information and technology to improve management, protection, and use of the forests and rangelands. Research is designed to meet the needs of National Forest managers, Federal and State agencies, public and private organizations, academic institutions, industry, and individuals.

Studies accelerate solutions to problems involving ecosystems, range, forests, water, recreation, fire, resource inventory, land reclamation, community sustainability, forest engineering technology, multiple use economics, wildlife and fish habitat, and forest insects and diseases. Studies are conducted cooperatively, and applications may be found worldwide.

Research Locations

Flagstaff, Arizona
Fort Collins, Colorado*
Boise, Idaho
Moscow, Idaho
Bozeman, Montana
Missoula, Montana
Lincoln, Nebraska
Reno, Nevada
Albuquerque, New Mexico
Rapid City, South Dakota
Logan, Utah
Ogden, Utah
Provo, Utah
Laramie, Wyoming

*Station Headquarters, Natural Resources Research Center,
2150 Centre Avenue, Building A, Fort Collins, CO 80526