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Microcomputer Software for Calculating the Western Oregon Elk Habitat Effectiveness Index

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Erratum

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Software: The HEIWEST software can be obtained at http://www.fs.fed.us/r6/uma/projects/tools/

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Abstract

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This paper describes the operation of the microcomputer program HEIWEST, which was developed to automate calculation of the western Oregon elk habitat effectiveness index (HEI). HEIWEST requires little or no training to operate and vastly simplifies the task of measuring HEI for either site-specific project analysis or long-term monitoring of elk habitat. It is especially useful as a project analysis tool where many silvicultural alternatives are evaluated for their effects on elk habitat. The program also can be used to calculate interior habitat and edge length for indices of forest fragmentation. Data to run HEIWEST program can be derived from a GIS or manually input from within the program. A floppy diskette with a copy of the program and sample data is distributed with the publication.

Keywords: Roosevelt elk, elk habitat, habitat effectiveness index, wildlife software, western Oregon.

Contents

Introduction

This paper describes the microcomputer program HEIWEST, which automates calculation of the western Oregon elk habitat effectiveness index developed by Wisdom and others (1986). The western Oregon HEI model measures habitat quality for Roosevelt elk *(Cervus elaphus roosevelti),* and is one of several HEIs used in the Pacific Northwest and elsewhere to evaluate and monitor elk habitat (Black and others 1976; Thomas and others 1979, 1988).

HEIWEST performs all the calculations required by the HEI model, including the spatial analysis of cover and forage areas. The program requires little or no training to operate and can be used to quickly measure HEI as part of project planning or monitoring efforts. It is especially useful in project analyses where several silvicultural alternatives must be evaluated for their effects on elk habitat. The program also can be used to calculate interior habitat and edge length for indices of forest fragmentation (Harris 1984). Habitat maps for HEIWEST can be derived from a GIS (geographic information system), such as the MOSS/MAPS used by the Forest Service in the Pacific Northwest Region, or be manually input from within the program. The HEIWEST program and example data are included on a diskette distributed with this paper.

The Western Oregon HEI Model

The HEIWEST program calculates HEI from coefficients of habitat use published by Wisdom and others (1986). This model evaluates four habitat components: the size and spacing of forage and cover areas, the density of roads open to vehicular traffic, the quality of cover, and the quality of forage. Each is measured with subindices that can range from 0.0 (no value) to 1.0 (optimum condition). The HEI is computed as the geometric mean of these subindices as follows:

$$HEIsrfc = (HEs \times HEr \times HEc \times HEf)^{1/N},$$

where

HEs = habitat-effectiveness index derived from size and spacing of forage and cover areas,

HEr = habitat-effectiveness index derived from the density of roads open to vehicular traffic,

HEc = habitat-effectiveness index derived from the quality of cover,

HEf = habitat-effectiveness index derived from the quality of forage, and

1/N = Nth root of the product taken to obtain the geometric mean where N = the number of habitat variables.

See Wisdom and others (1986) for additional details. The HEIWEST program was developed to quantitatively replicate as closely as possible this model.

Getting Started

Hardware Requirements

HEIWEST is written and compiled in TURBO Pascal version 6.0 and operates on IBM-compatible microcomputers with DOS version 2.0 or later[1]. HEIWEST automatically detects the type of video display installed (for example, monochrome, VGA, EGA, CGA) and takes advantage of the capabilities of each. A 1.2 megabyte (MB) floppy drive is required to read the distribution diskette. HEIWEST prints to most printers by using the standard ASCII printer control characters to control formatting.

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Random Access Memory (RAM) requirements depend on project area size; at least 130 kilobytes (KB) must be available to load the program and process habitat maps having 60,000 pixels (31,000 acres for maps with 50- by 50-yard pixels). Larger maps require more memory. The maximum map size accommodated by the program, 600 columns by 800 rows (ca. 240,000 acres at 50- by 50-yard pixels), requires 540K RAM. A math coprocessor and a mouse with a Microsoft-compatible driver are optional equipment.

Installation

The distribution diskette contains five files. HEIWEST.EXE is the executable program for calculating HEI. WEST.MAP and WEST.DB are a sample habitat map and a database, respectively. HEIUTIL.EXE is a utility program that facilitates the conversion of MOSS-MAPS GIS data to the HEIWEST format. B.COM is a file-browsing utility that can be used in conjunction with HEIUTIL.EXE.

No special installation routines are necessary to run HEIWEST or the accessory programs. They can be run directly from the distribution diskette or copied onto a hard drive. It is convenient to create a subdirectory (for example, C:\HEI) on the hard drive into which the files can be copied and the program executed.

Program Overview

HEIWEST.EXE calculates HEI components from a digital habitat map and numerical data on open road mileage. Open road mileage is entered from the keyboard with each HEIWEST session by using menu options. Cover and forage data are derived from a habitat map constructed for each project area. The habitat map is an ASCII computer file in which an original line map has been translated into a grid of square pixels of a fixed area. The pixel size can be set by the user, the maximum size being 100 yards on a side (2.066 acres). The habitat type of each pixel (for example, optimal cover, thermal cover, hiding cover, and forage) is represented by one of 12 habitat codes (table 1). As an example, figure 1A shows the map published by Wisdom and others (1986, p. 23), and figure 1B shows the same map in HEIWEST format.

Table 1—Habitat codes used by HEIWEST

Code	Habitat type
1	Cover treated by clearcutting, burning, seeding and fertilization
2	Cover treated by clearcutting, burning and seeding
3	Cover treated by clearcutting and burning
4	Cover treated by clearcutting
5	Cover treated by commercial thinning
6	Cover treated by shelterwood cutting
7	Meadow or pasture treated with fertilizer
8	Untreated meadow or pasture
9	Talus
A	Optimal cover
B	Thermal cover
C	Hiding cover

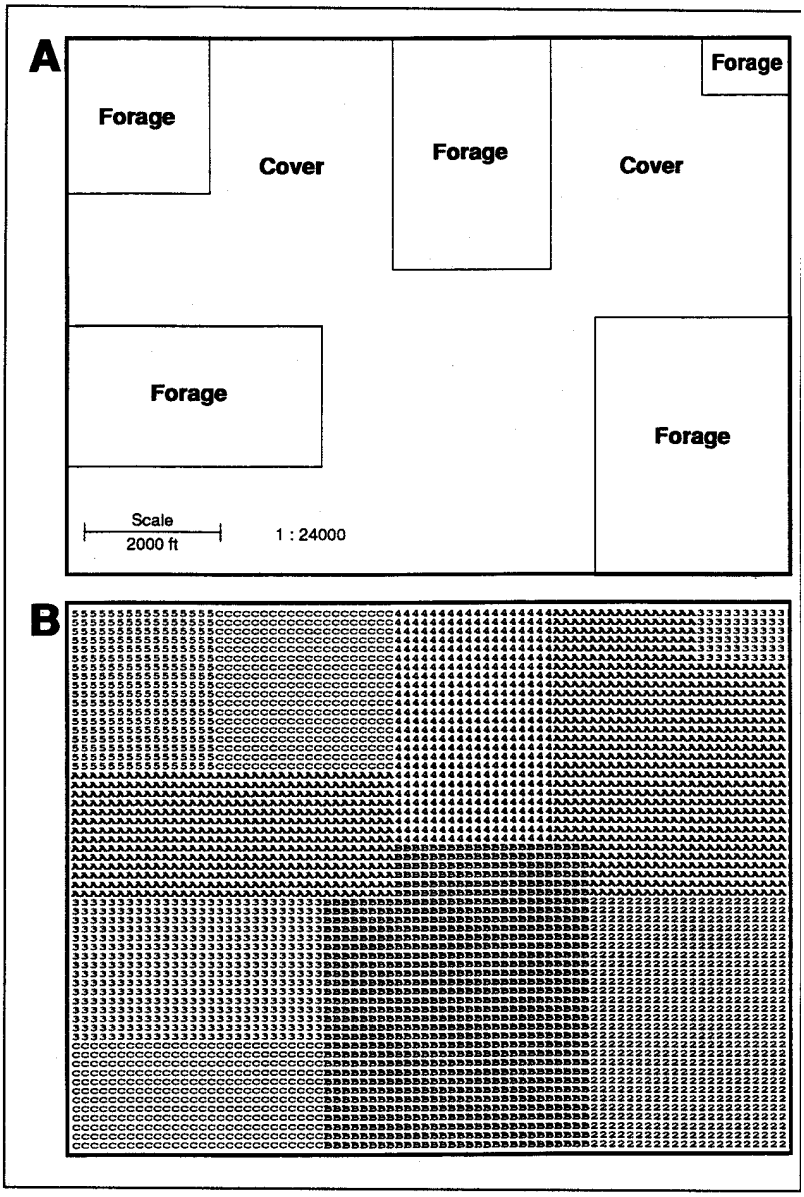

Figure 1—(**A**) Reproduction of the example habitat map from Wisdom and others (1986, fig. 16, p. 23). (**B**) Map in (A) as represented in raster format used by HEIWEST. Each symbol represents a 50- × 50-yard pixel (0.517 acre) of a specific habitat type. See table 1 for habitat code definitions.

Methods Used by HEIWEST for Calculating HEI

The calculation of the individual HE components by the HEIWEST is described briefly below. Refer to Wisdom and others (1986) for details.

The HEs subindex used to measure the size and spacing of forage and cover areas is calculated by HEIWEST with a search algorithm that moves to each pixel on the map and determines the linear distance to the nearest pixel of opposite habitat type (forage versus cover). The distance is used to classify the pixel and associated acreage for the distance bands. The HEs is then calculated by using the weighting factors as described in Wisdom and others (1986). The classification of pixels into distance bands is illustrated in figure 2 for the example map in figure 1.

The HEr to measure the effect of open road density is calculated according to Wisdom and others (1986, figure 8) with equations developed by Lyon (1983). The appropriate equation depends on the road density. If the road density (RD) is less than 1.1 miles/mile ^{2} then,

$$HEr = 0.4 + [(6 - RD)/6]6 \times 0.6.$$

If the road density is greater than or equal to 1.1 miles/mi^2 but less than 2 miles/mile^2 then,

$$HEr = 0.486 + 0.092 \times (2\text{-}RD)/0.89.$$

If the road density is greater than or equal to 2 miles/mile^2 but less or equal to 6 miles/mile^2 then,

$$HEr = 0.104 + (6\text{-}RD)/4 \times 0.382.$$

If the road density is greater than 6 miles/mile^2 then HEr = 0.104.

Hence, an analysis area with no open roads has an HEr value of 1.0. An open road density greater than 6.0 has an HEr value of 0.104.

The HEc to measure the quality of cover is calculated as the weighted proportion of cover occupied by each habitat type, as described in Wisdom and others (1986, p. 28). The proportion of area in each cover type is multiplied by a weighting factor and summed. The weighting factors are 1.0 for optimal cover, 0.5 for thermal cover, and 0.1 for hiding cover.

The HEf to measure the quality of forage is calculated as the weighted proportion of forage in each of the forage types, as described in Wisdom and others (1986, p. 29). The proportion of area in each forage type is multiplied by a weighting factor and summed. See Wisdom and others (1986, p. 29) for the weighting factors.

A Quick Demonstration

This section provides instructions to demonstrate the HEIWEST program and its capabilities. Insert the distribution diskette in the A: drive and type "HEIWEST". Press any key after viewing the opening screen. Note the help window, which contains program operation and calculation parameters. The "PgUp" and "PgDn" keys are used to browse through six pages of help information. The help window can be activated from elsewhere in the program by pressing the "F1" key. The "Esc" key is used to close the help window. Press the "/" key to obtain the main menu. Selections from this menu are activated by typing the capitalized letter of each menu option. Load the sample map by selecting the "Map" and "Load" menu options (type "M" and "L"), and then type "WEST.MAP". Press the "Enter" key and the sample map will load and appear on the screen. Each code on the map represents a square pixel of 50 yards on a side 0.517 acre). The codes displayed on the map represent various habitat types

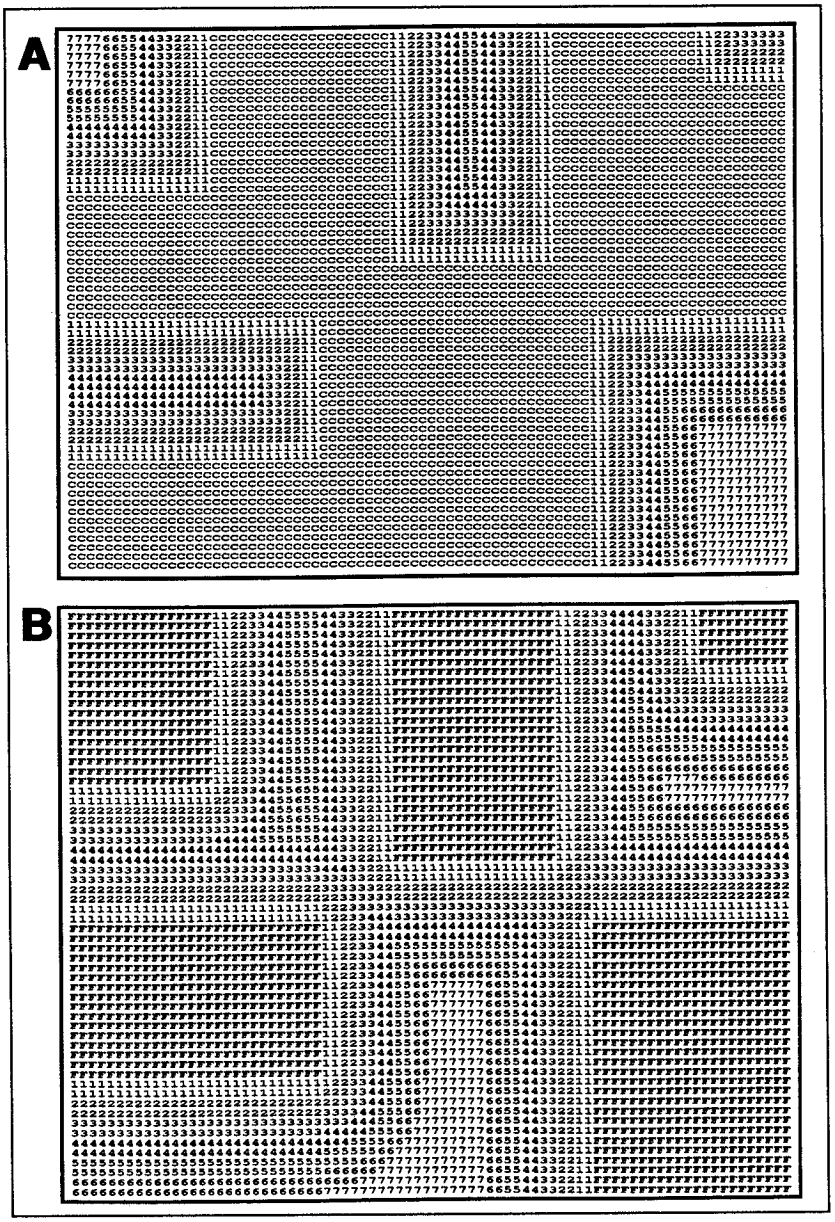

Figure 2—Assignment of distance bands into forage (**A**) and cover (**B**) by HEIWEST for the map in figure 1. Distance bands (in yards) are shown by symbols 1 through 8: 1 = 1-100; 2 = 101-200 3 = 201-300; 4 = 301-400; 5 = 401-500; 6 = 501-600; 7 = >601. Forage = F and cover = A, B, or C.

as indicated in table 1. The cursor location can be changed by pressing the four arrow keys. In the lower left corner, the definition of the habitat code is displayed for the current position of the cursor.
The habitat map contains the information required to calculate three of the four habitat parameters—HEs and HEc and HEf—which measure the size and spacing of the cover and forage areas, cover quality, and forage quality, respectively. Information to calculate the HEr for roads is input for each map by choosing "Options" and "Roads" and entering an open road mileage. HEI now can be calculated by choosing "Run" from the main menu. The results will be sent to the screen (fig. 3) and can be sent to a printer or file by entering the appropriate response to the prompt.

To see the what-if capabilities of HEIWEST for timber sale planning, use the arrow keys to position the cursor within an area of cover habitat (map code "A", "B", or "C"). Harvest treatments can be applied to habitat maps by changing map codes to "4" (clearcut) with either the keyboard or the mouse. Clicking the left mouse button will change the habitat code at the mouse cursor to the last code entered from the keyboard. Each pixel that is changed represents treating of 0.517 acre. When a harvest unit has been outlined in this manner, run HEIWEST again to see changes in the HEI that have resulted from the treatments. Each alternative developed in this manner can be saved in a separate habitat map by choosing "Map" and "Save" from the main menu and entering a filename. To quit HEIWEST choose "Quit" from the main menu.

The HEIWEST Command Menu

To activate the main menu in HEIWEST, press the forward "/" key. The complete menu system is shown in figure 4. Select a menu choice by pressing the letter key corresponding to the first letter of each command. The user may exit a menu without selecting a command by pressing the "Esc" key. Selecting a command either causes a program action, displays a submenu, or prompts for user-supplied information. Prompts ending with a question mark generally expect a "yes" or "no" response (the lone exception is the "Options Forage Species" command). Pressing the "Y" key corresponds to a "yes" response; any other key corresponds to a "no" response. Prompts that end with three dots generally are status messages indicating an action that the program is currently executing; however, if such a prompt contains the message "Press any key," the program halts execution until the user completes the action requested and presses any key, thereby signaling the program to continue. Prompts ending with a colon expect the user to type an appropriate response. Some prompts will display a default response.

The "Map" command is used to load existing maps, save newly created or changed maps, print maps, and to clear the map display so that a new map can be created. All these operations are accessed on a submenu that appears after the "Maps" command is invoked, as explained below.

Loading, Viewing, Editing, and Printing Maps

Loading maps-The "Load" command reads from an existing habitat maps file. If the specified file name is not found, the prompt for the file name is redisplayed for editing and re-entry. If the specified file name is found, the map display is cleared automatically, an open database will be closed, and the map is loaded into memory. Map files must conform to the standard ASCII convention, commonly referred to as "text files." The ASCII convention calls for an end-of-line sequence (ASCII code 13 followed by ASCII code 10) at the end of each line. In addition, an end-of-file marker (ASCII code 26) must exist at the end of the file. If standard text editors are used to create maps, or the maps are generated with the procedures outlined later in this paper, the map files conform to the ASCII convention. If maps are created with word

Calculation Results For: WEST.MAP

Edge Length = 36300.0 Feet Open Road = 0.0 Miles

Habitat	1-100	101-200	201-300	301-400	401-500	501-600	>600	Total	%
CC+B+S+F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CC+B+S	49.6	45.5	41.3	37.2	33.1	28.9	82.6	318.2	12.8
CC+B	84.7	72.3	59.9	45.5	0.0	0.0	0.0	262.4	10.6
CC	68.2	59.9	51.7	43.4	18.6	0.0	0.0	241.7	9.7
ComThin	33.1	28.9	24.8	20.7	16.5	12.4	12.4	148.8	6.0
ShltrWd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Meadow+F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Meadow	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Talus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Optimal	121.9	134.3	147.7	120.4	66.6	39.3	16.5	646.7	26.1
Thermal	65.6	74.9	75.4	69.7	66.1	58.4	91.9	502.1	20.2
Hiding	66.1	66.1	66.1	66.1	66.1	28.9	0.0	359.5	14.5

HEs=0.67 HEr=1.00 HEc=0.62 HEf=0.46 HEI=0.66 2479.3 100.0

Treatment Codes: CC=Clearcut B=Burned S=Seeded F=Fertilized

Figure 3—Screen report from HEIWEST for the habitat map WEST.MAP.

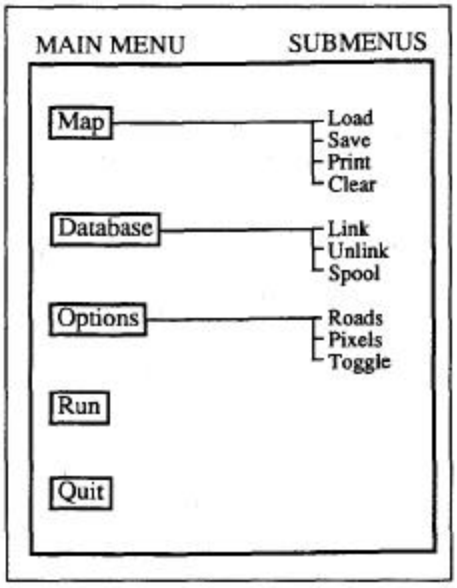

Figure 4—The command menu for the HEIWEST program.

processors, they must be saved as "text files." When maps are loaded, every character on the line is read, but only the characters corresponding to known habitat codes (see table 1) will appear in the map. Characters and numbers not used by HEIWEST (all other numbers and letters in the alphabet) become blanks in the map. If characters with ASCII codes of less than 32 appear in the map (special characters and symbols), they are ignored during the load process, thereby compacting map rows and possibly realigning columns. Any map lines containing more characters than the maximum number of map array columns (600) are truncated. Any map file lines exceeding the maximum number of map array rows are ignored.

Viewing maps-Once a map is loaded, it can be viewed and edited. The location of the highlighted cursor can be changed, within the limits of the map array, by several means. The four arrow keys move the cursor to adjacent pixels. The "PgUp" and "PgDn" keys display the next screen portion of the map above and below the current display. Holding the "Ctrl" key down and pressing the right or left arrow displays the next screen portion of the map to the right or left of the current display. Pressing the "Home" key moves the cursor to the upper left corner of the map array, and pressing the "End" key moves the cursor to the bottom right corner of the map. The latter corner is the intersection of the last column and last row containing a habitat code; it is not necessarily equivalent to the bottom right corner of the map array.

Editing maps-Habitat codes contained in the map can be added, changed, or deleted during a viewing session. Pressing any of the keys corresponding to valid habitat codes (table 1) accordingly replaces the contents of the pixel highlighted by the cursor. It also is possible to change habitat codes with a mouse; pressing the left mouse key replaces the pixel contents with the last habitat code typed from the keyboard. Blank pixels can be added to the analysis area by this method, and the contents of any highlighted pixel can be erased by pressing the "Del" key, thereby placing that pixel outside the analysis area.

Saving maps-Maps are saved by using the "Save" command. Maps also can be saved whenever the "Load", "Clear", and "Quit" commands are activated, which automatically prompt the user to save any changes made since the map was last saved.

Printing maps-The "Print" command sends the current map to an attached printer. The map is printed on numbered pages containing 128 columns and 56 rows with map coordinates in the margins. The printer must be capable of printing 132 characters per line and 60 lines per page. Printers that use letter-size paper must be set for compressed print mode. The user will be prompted to press any key when the printer is on-line and ready to receive the map. A bell rings to alert the user if printing problems occur.

Clearing the viewing screen-The "Clear" command clears the map array. Once the array is cleared, a new map can be created by entering habitat codes directly. It is not necessary to "Clear" before loading a new map file. If changes have been made to the current map, the user is prompted to save the current map and the save process is called. "Clear" also will close an open database.

Changing Defaults for Roads, Pixel Size, and Display

The "Options" command changes default parameters associated with open road miles, map pixel size, and display attributes. Changes made to default parameters are not saved and must be specified anew with each HEIWEST session. Selecting the "Options" command leads to a submenu of the default parameters, as described below.

Open road mileage-Selecting the "Roads" command prompts the user to input the number of miles of road open to vehicular traffic within the map analysis area. The default is zero, but valid input ranges from zero to 9999.9 miles. Any valid entry will change the current number of road miles.

Map pixel size-Selecting the "Pixels" command prompts the user to input the number of feet per side of the map pixels. The default is 150 feet, but valid input ranges from 66 to 300 feet. Entering zero feet returns to the map display without changing the current pixel size.

Display attributes—If an EGA or VGA graphics adapter is installed, the "Toggle" command will appear on the "Options" menu. This option switches the display to 43 (EGA) or 50 (VGA) lines from the standard 25 lines.

Calculating HEI and Printing the Results

The "Run" command calculates HEI from the cover map and its associated parameters. A bell rings when the calculations are complete. The results are displayed along with a prompt to print the results. The map display returns to the screen when the printing process is completed.

Using the Database Feature of HEIWEST

HEIWEST has a database feature that allows databases to be linked to habitat maps. The "Database" command is used to access an ASCII database file associated with the current map. Each record of the database corresponds to a pixel address and has five 10-character fields containing attributes pertaining to the pixel. Once a database has been linked to the current map, the user can display the attributes of the pixel covered by the highlighted cursor. This feature is useful for associating attributes such as stand identification numbers with the current map. The user can also use the database features to generate a database of attribute data for all treated pixels, which can be useful for summarizing the treatment effects in terms of map attributes. The timber volumes of treated pixels could be summed, for example, to produce an estimate of the harvest volume associated with a particular HEI.

Databases to link with HEIWEST must be an ASCII file sorted in order of row (y-coordinate) within column (x-coordinate). The file must end with an end-of-file marker (^Z or ASCII code 26). Each line (record) in the database file must begin with the number 8 and finish with an end-of-line sequence (ASCII codes 13 and 10). In addition, each line must have 56 characters between the number 8 and the end-of-line sequence. The first six characters are the pixel address with which to associate the attribute data: they are followed by five 10-character attribute fields. All attribute fields must exist regardless of usage. Unused fields should be filled with spaces, if there are no data available. Many types of software, such as database managers, word processors and spreadsheets, can be used to create and maintain a database. But the structure and sorting requirements must be met for the HEIWEST software to properly access the associated data.

The required format of the database files is as follows:

Field no.	Field subject	Field width
		Characters
1	Leader "8"	1
2	Column number	3
3	Row number	3
4	Attribute 1	10
5	Attribute 2	10
6	Attribute 3	10
7	Attribute 4	10
8	Attribute 5	10

Selecting the database command leads to a submenu of the commands to link, unlink, and spool databases. These functions are described below.

Linking a database - Databases are linked to a habitat map by using the "Link" command. If a map is currently displayed, selecting the "Link" command prompts the user to specify the name of the database file to link. Any database currently linked to the map closes automatically before linking the newly specified database. The message "F2 Shows Attributes" is displayed on the status line whenever a database is linked to the current map. Pressing "F2" causes the linked database to be searched for a record corresponding to the address of the pixel covered by the highlighted cursor. If such a record is located, the record attributes are displayed on the status line. Otherwise, the message "Attribute Data Not Found" is displayed. Press any key to clear the status line and return to the current map when finished viewing the displayed attributes.

To demonstrate the database linking procedure, the WEST.DB file on the distribution diskette can be linked to WEST.MAP by using the above procedures. Next, position the cursor on any pixel in the map, and press the "F2" key. Attributes from the database are displayed along the bottom of the screen.

Unlinking databases - Databases are unlinked and closed with the "Unlink" command.

Spooling databases - The spooling feature provides a method of reporting the database attributes for all pixels that have had habitat codes changed to one of the treatment codes (habitat codes "3", "4", or "5"). The user is first prompted to specify the name of the database file to which records are spooled. Entering no file name does not spool the database and instead returns the program to the map display. At the completion of the file spool process, the program returns to the map display.

The spooling feature can be demonstrated with the WEST.DB file on the distribution map. After loading WEST.MAP and linking WEST.DB, change some of the habitat codes to "4", thereby signifying a clearcut. Invoke the "Spool" command and enter a filename. Exit the program, and view the spooled data with B.COM program (provided on the distribution diskette) by typing "B filename", where filename is the name given to the spooled data. These data then can be imported to a database to describe affected resources.

Quitting the Program

HEIWEST is terminated with the "Quit" command. If changes have been made to the current map since it was last saved, "Quit" prompts the user to save the current map.

Obtaining Habitat Maps for HEIWEST

There are several ways to obtain cover maps for HEIWEST. In all methods, the starting point is a cover map showing polygons of the basic habitat types. The simplest method for converting these maps into a text file of cover codes is to overlay a Mylar grid constructed so that each pixel corresponds to the selected pixel size (for example 50 by 50 yards, or 0.517 acre) on the cover map, and code the value of each pixel directly on the Mylar. The codes are typed directly into an ASCII file with any editor. Mylar grids can be generated with CAD software.

With GIS software, such as MOSS-MAPS, cover maps can be digitized, rasterized (converted to a pixel map), and exported. In MOSS, vector maps are converted to raster format with the "Polycell" command. Maps should be polycelled to a pixel size of 25, 50, or 100 yards on a side. Our testing indicates that a pixel size of 50 by 50 yards (0.517 acre) produces good resolution and minimizes errors in the raster process. When prompted by MOSS in the polycell process, enter 0.517 acre, with a pixel ratio of 1. The map type is "Discrete", "Type 7", and pixels are assigned by "Subject Number" (option 5).

Exporting the map is most easily accomplished with the MOSS-MAPS "SPSS" command, which produces an ASCII data file containing row, column, and map subjects. This same technique can be used to generate databases to link with habitat maps. When prompted in the SPSS procedure whether to eliminate empty cases, choose "yes". After downloading to the microcomputer, this file is processed with HEIUTIL.EXE program distributed with HEIWEST to regenerate the map. The polycelled map should be examined to ensure that MOSS assigned values to map subjects according to the format required by HEIWEST (see table 1). To determine if the map requires recoding, examine the raster map subjects by using the "Describe" command. If subjects are incorrectly coded, they can be recoded within the HEIUTIL
program.

Optimal Pixel Size for Habitat Maps

HEIWEST can process maps having pixels between 0.1 and 2.066 acres. The maximum size of 2.066 acres is determined by the distance bands in the HEI model being in increments of 100 yards, and a 100-yard-square pixel is 2.066 acres. For HEIWEST to function as intended, pixels should have dimensions of either 25, 50, or 100 yards on a side, which corresponds to 0.129, 0.517, and 2.066 acres, respectively. Our tests with cover maps of winter range in the Blue Mountains showed that a pixel size of 0.517 acre is the most efficient scale. Larger pixel sizes (for example 2,066 acres) resulted in a loss of small "stringers" of cover during the polycell process in MOSS-MAPS. These small cover areas may not be significant in terms of habitat use by elk (see Thomas and others 1988), but we believe their deletion from the habitat map should be performed by wildlife biologists rather than by GIS software. In addition, with 100- by 100-yard pixels, the diagonal distance between pixels centers is 141.42 yards, and thus habitat comparisons between diagonal pixels contribute to the 101- to 200-yard spacing band. These problems are largely nonexistent with pixel sizes of 0.517 or 0.129 acre. The only problem with using a smaller pixel size is that map arrays become somewhat large and processing time is increased.

Using HEIWEST to Calculate Fragmentation

HEIWEST can also be used to calculate indices of edge-to-area and forest fragmentation (Harris 1984). For example, suppose it is desired to estimate the acreage of "interior" late seral stage habitat. For this example, "interior" will be defined as late seral habitat that is at least 100 yards from the edge between the later and all other seral stages. The first step is to prepare a habitat map, as described earlier, and code the late seral stage habitat as a "2" or "3" in the map. Code all other habitat as "1". In this way, late seral habitat is represented as cover, and other seral stages as forage. The map is processed with HEIWEST, which will output the area in each of the 100-yard distance bands into the late seral stage habitat. In this example, "interior" habitat would be calculated as the sum of the area in all the distance bands except the 0-100 yards. This general method can be applied to data describing virtually any habitat feature (for example, acres of habitat that are at least 100 yards from a road).

It also is possible to calculate another index of fragmentation, the edge-to-area ratio (Thomas and others 1979). The total edge length of the habitat coded as cover ("1" and "2") in the habitat map is output to the screen along with the total area. The edge-to-area ratio is calculated as the edge length divided by the total area.

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This paper describes the operation of the microcomputer program HEIWEST, which was developed to automate calculation of the western Oregon elk habitat effectiveness index (HEI). HEIWEST requires little or no training to operate and vastly simplifies the task of measuring HEI for either site-specific project analysis or long-term monitoring of elk habitat. It is especially useful as a project analysis tool where many silvicultural alternatives are evaluated for their effects on elk habitat. The program also can be used to calculate interior habitat and edge length for indices of forest fragmentation. Data to run HEIWEST program can be derived from a GIS or manually input from within the program. A floppy diskette with a copy of the program and sample data is distributed with the publication.

Keywords: Roosevelt elk, elk habitat, habitat effectiveness index, wildlife software, western Oregon.

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