23. VB Applications in Forest Resource Management

The following examples are the projects being programmed with Visual Basic:

(1) Forest Harvesting Simulator
(2) Optimal Tree-stem Bucking
(3) Log Inventory
(4) WVU Cruise
(5) Proceedings of the 24th Annual COFE Meeting

In this lecture, I am going to demonstrate these programs and show you some programming techniques.

23.1 Forest Harvesting Simulator

It enables you to perform the repetitive and complex forest harvesting simulations under Windows and NT platforms. The earliest version of this simulator just modeled one machine type – drive-to tree feller-buncher under DOS operating environment. Simulation was conducted by moving a physical machine model in a stand map on a digitizing pad. Since the first version, we have continued to improve the simulator to make it comprehensive, flexible, and even easier to perform a simulation. As new technologies have been introduced into computer platforms and programming tools, this simulator has also been upgraded consequently.

The current version of simulator was written with MS Visual Basic Version under Windows environment. Using the newest version Forest Harvesting Simulator, you can:

- Edit mapped stand
- Generate stands
- Simulate felling
- Simulate skidding or forwarding
- Monitor the traffic levels of extraction machines
- Analyze simulations
- Retrieve, view, and produce output of simulations

<u>Forest Stand Generation</u>

Random Pattern

If a random spatial pattern is requested, a ratio of the stand density to the total number of possible tree locations based on minimum X and Y spacing is first calculated. Then a random number with a uniform distribution between 0.0 and 1.0 is generated for each possible tree location. If this number is less than or equal to the ratio described, the coordinate location is assigned a tree. If the random number is greater than the ratio, the coordinate location is considered to be unoccupied (Farrar 1981). The minimum X and Y spacing are considered in this procedure when we model natural stands. At each location, tree DBH is assigned randomly. The total height and volume of that tree are then calculated based on the assigned DBH (Borders et al. 1990).

Uniform Pattern

All possible grids for tree locations are identified based on stand density and X and Y spacing. If X and Y both meet the minimum spacing requirements, a tree location was assigned in the center of this X by Y rectangle. A random variation of a half X_{min} or Y_{min} was allowed in modeling both the X and Y coordinates for each tree's location.

Clustered Pattern

When the clustered pattern is used, the number of cluster centers specified by the user is located randomly within a plot. By generating the X and Y coordinates randomly using a pair of random numbers, each tree is provided an initial location. The distances from that tree location to each of the cluster centers are determined and the nearest center is selected. The distance from this center to the tree is then multiplied by a random number between 0.0 and 1.0 to give a new location for that tree relative to the cluster center (Farrar 1981). New coordinates are then calculated for the tree and the distances between that location and the neighboring trees are checked to assure that minimum nearest distances are maintained. If a tree location has violated the distance parameter, the procedure is repeated; otherwise, the location is assigned as a tree location.

Felling Operations

The numerical simulation model for chain saw, feller-buncher, and harvester consists of two parts: (1) walk of the logger with a chain saw from tree to tree or machine movement from tree to tree; and (2) tree felling or processing (Figure 1).

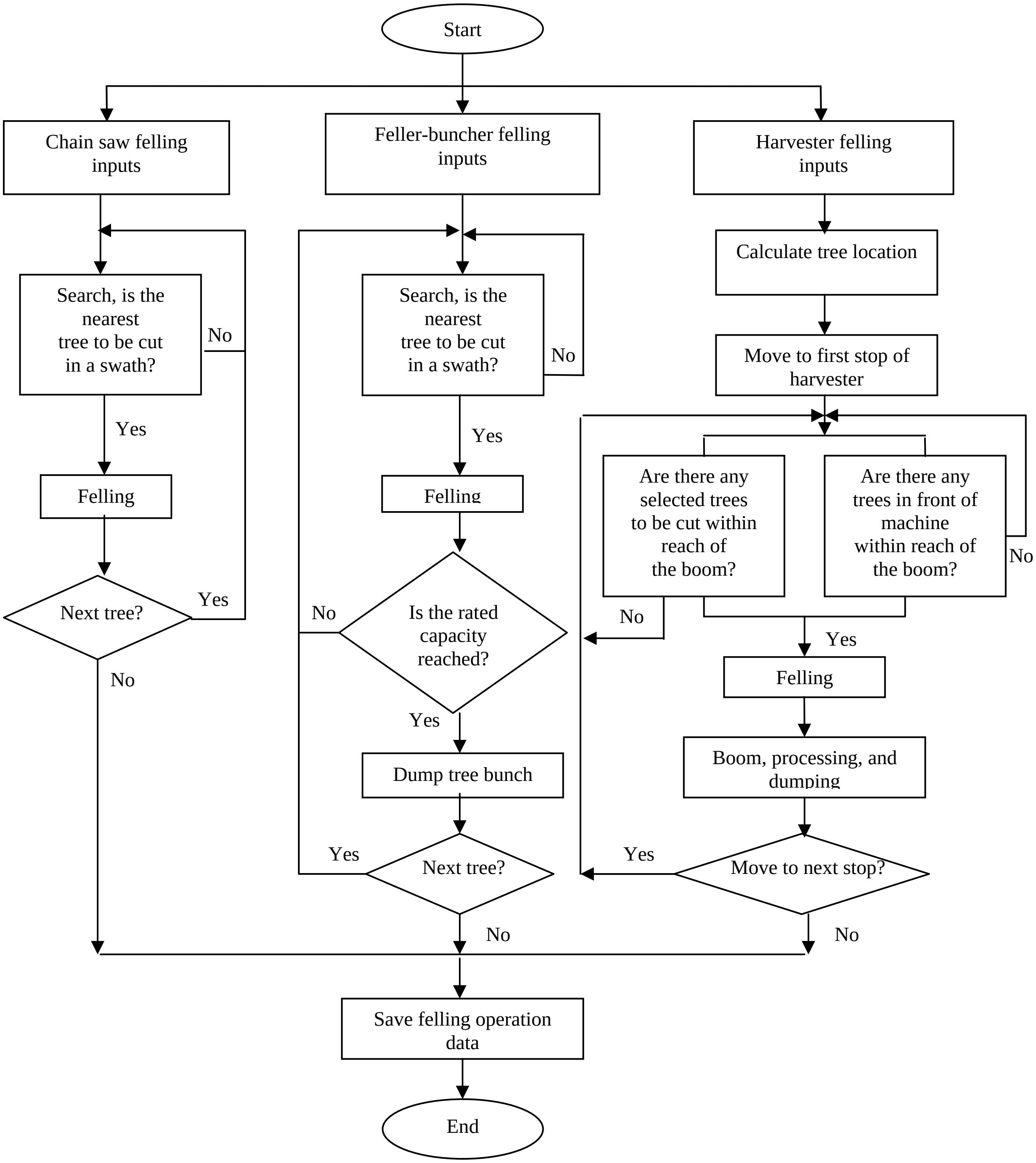

Start
Chain saw felling inputs
Feller-buncher felling inputs
Harvester felling inputs
Search, is the nearest tree to be cut in a swath?
No
Yes
Felling
Next tree?
Yes
No
Search, is the nearest tree to be cut in a swath?
No
Yes
Felling
Is the rated capacity reached?
No
Yes
Dump tree bunch
Next tree?
Yes
No
Calculate tree location
Move to first stop of harvester
Are there any selected trees to be cut within reach of the boom?
Are there any trees in front of machine within reach of the boom?
No
No
Yes
Felling
Boom, processing, and dumping
Move to next stop?
Yes
No
Save felling operation data
End

Figure 1. Flowchart of numerical felling operations.

Chain Saw Felling

Walk to tree, acquiring, felling, limbing, and topping are modeled for the chain saw. The felling direction is first defined within a random variation range and the sawyer is located at one end of a plot. Usually, the logger will move to the nearest tree to be cut and fell the selected tree in a narrow swath. When the logger reaches the other end of the plot, he/she will return to next nearest swath.

Feller-Buncher Felling

Four functions were modeled for the drive-to-tree feller-buncher: move to tree, cut the tree, move to dump, and dump. The feller-buncher is first located at one end of the plot and then moves parallel to the rows of trees; the rows are 4.5- to 6-meter wide. Marked trees on either side of the machine are removed. When the machine reaches the end of the row, it turns around and cuts another tree in the nearest swath, continuing until the plot is finished. The system searches for the “cut” tree and adds the tree to the felling head. A solid black circle at the location of cut tree will be drawn to signify the stump. This procedure is repeated until the head is full. The system then moves the machine image to the location of the bunch to be built and drops the trees.

Harvester Felling

Six functions were modeled for the cut-to-length harvester: move, boom extend/retreat, cut, swing boom, processing, and dumping. Unlike the feller-buncher, a harvester with a boom can reach several trees at a stop. Trees could be felled and processed with the same harvester. A circle around the harvester is drawn to indicate the reach range of the boom. This circle is moved as the harvester moves. The harvester usually runs in a straight trail and works in a 12- to 15-meter wide strip depending on the boom reach. Trees on the trail must be removed for machine travel. Trees on either side of the machine within the boom reach can be removed based on the user’s choice of harvest method. The processed trees are then dropped on either side of harvester trail for later forwarding.

<u>Extraction Simulation</u>

Extraction Patterns

In an interactive skidding simulation, a landing must be located first in the logging area that was created by felling a plot a fixed number of times. Tree or log pile data are provided by the felling simulation. The skidder machine will begin at the landing at the nearest tree pile and then move to the next closest pile until it is fully loaded. Then the loaded machine will travel back to the landing. While the forwarder is simulated in a similar manner, it follows the harvester’s trail and loads logs with a self-mounted boom.

Although interactive simulation allows constant and direct human input to the simulation, it is time consuming and often repetitive, especially with respect to uniform skidding or forwarding patterns. As a result, a numerical skidding or forwarding simulation was modeled in the system (Figure 2). To date, four skidding or forwarding patterns (SP1, SP2, SP3, and FP1) have been modeled (Figure 3):

SP1 - freestyle skidding (no designated skid trail)
SP2 - skid trail runs through the center of plot (one trail)
SP3 - skid trails traveling from the landing to the corners of plot (two trails)
FP1 - forwarding along the trails of the harvester (forwarding direct to road)

The program also allows the user to choose the landing location and the machine payload. The landing must be located before performing a simulation. The machine will begin at the landing and move to the nearest tree bunch or log pile, and then move to the next nearest one until it is fully loaded. The machine then follows the specified extraction pattern throughout the entire simulation process.

Traffic Intensity

The traffic intensity within each smaller grid, e.g., 5 by 5 meters is recorded into a file while the numerical extraction simulation is being performed. Four travel intensity categories for a skidder or forwarder were defined in the system (Carruth and Brown 1996):

TI1 - Trees on the plot have been felled.
TI2 - Trees that stood on the plot have been removed and no other traffic has passed through the plot.
TI3 - Trees that stood on the plot have been removed and trees outside the plot have been skidded through the plot. There have been 3 to 10 passes with a loaded machine.
TI4 - There have been more than 10 passes with a loaded machine through the plot.

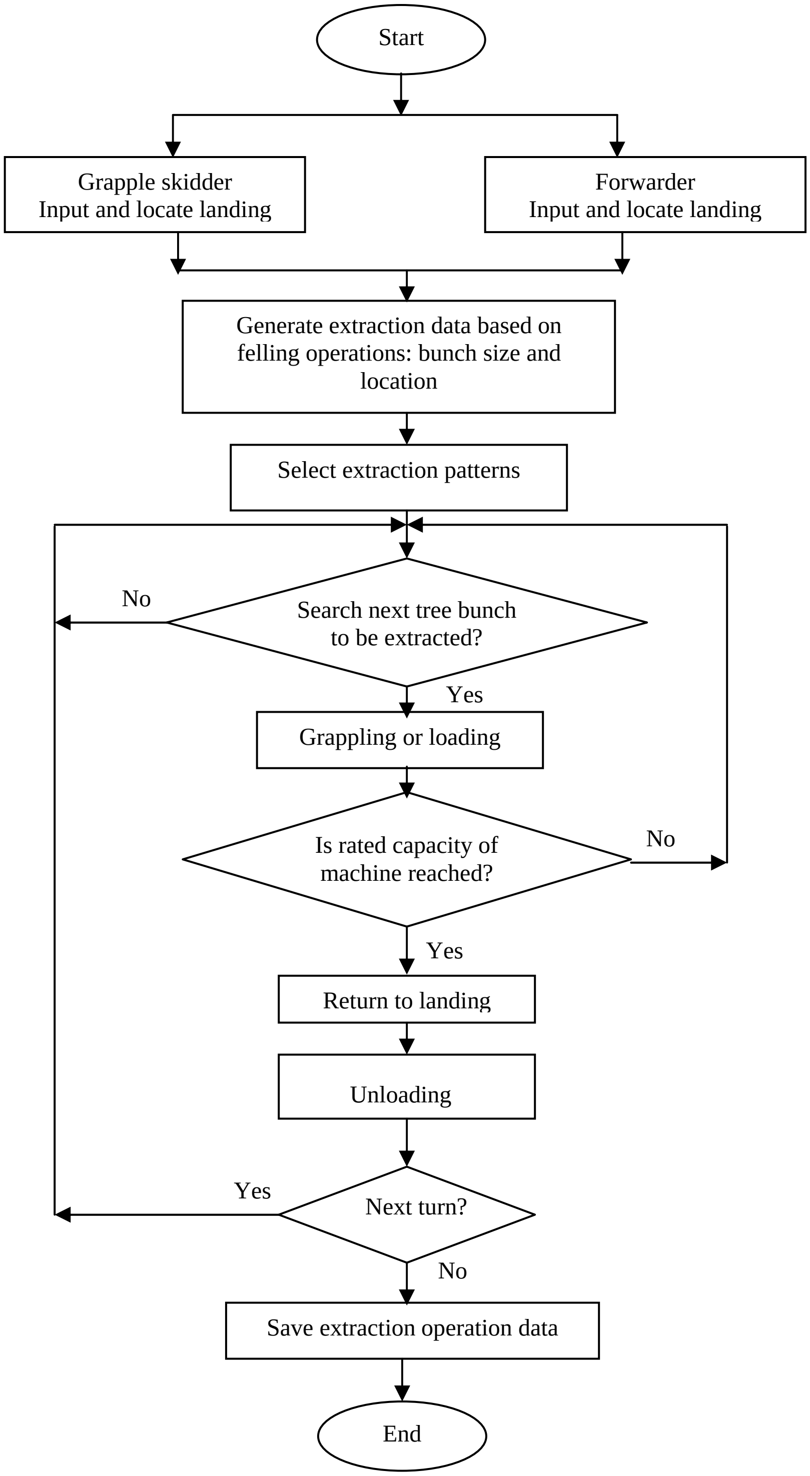
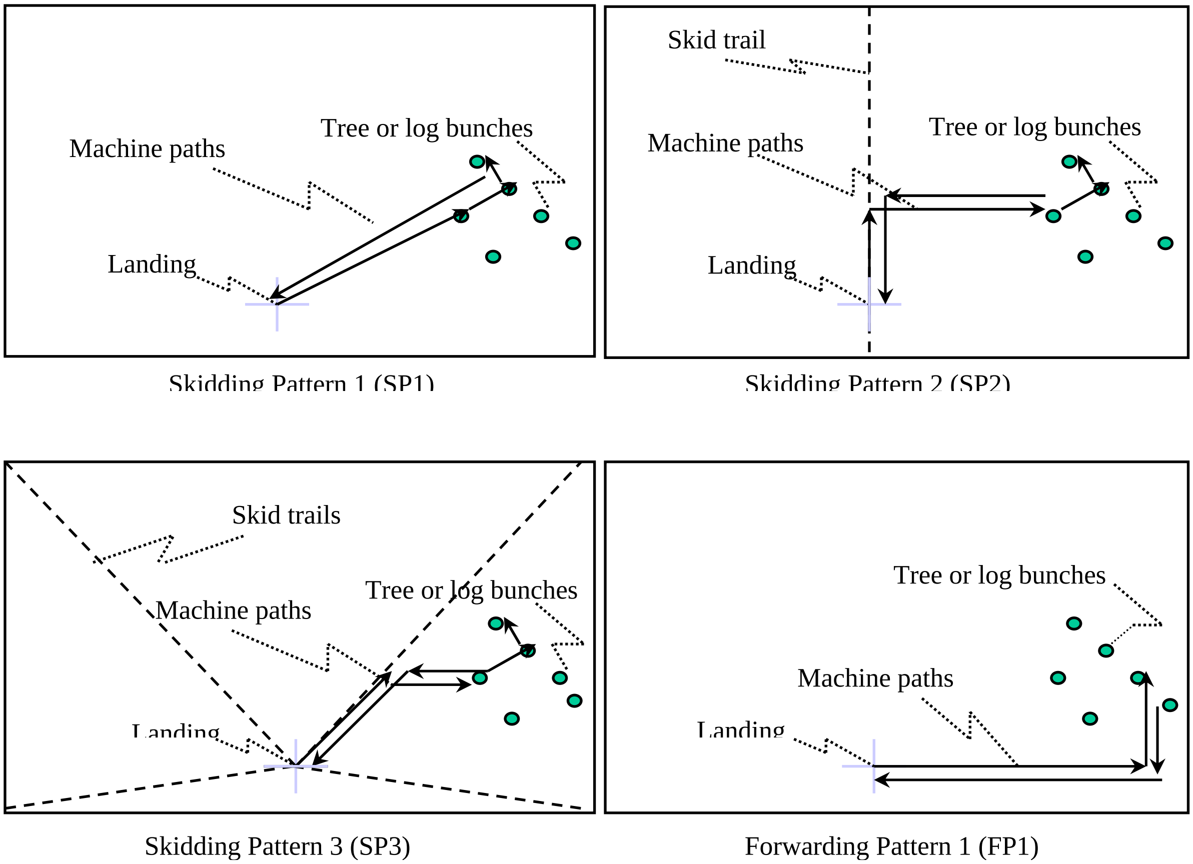

Start
Grapple skidder
Input and locate landing
Forwarder
Input and locate landing
Generate extraction data based on felling operations: bunch size and location
Select extraction patterns
Search next tree bunch to be extracted?
No
Yes
Grappling or loading
Is rated capacity of machine reached?
No
Yes
Return to landing
Unloading
Next turn?
Yes
No
Save extraction operation data
End

Figure 2. Flowchart of numerical extraction simulation.



Skidding Pattern 1 (SP1)

Skidding Pattern 2 (SP2)

Skidding Pattern 3 (SP3)

Forwarding Pattern 1 (FP1)

Figure 3. Diagram of extraction patterns.

After the machine is fully loaded, it will begin to return from its current position to the landing by the shortest and easiest route depending on the extraction pattern. The skidding area is divided into cells (5 by 5 meters) for accurate recording of travel intensity. This grid width allows two machines to pass each other on a trail. There are eight possible direction options for a machine to move from its current position to the next position.

This procedure was repeated until the end point (X_i, Y_i) was reached. The number of passes was recorded and accumulated for each grid that the loaded machine passed through as we traced from start point to end point. The travel intensity category in each grid is displayed in four colors depending on the intensity level. After the tracking is completed along the entire line segment, the number of passes for the loaded machine in each grid is stored in computer memory and saved to a file after the simulation is completed.

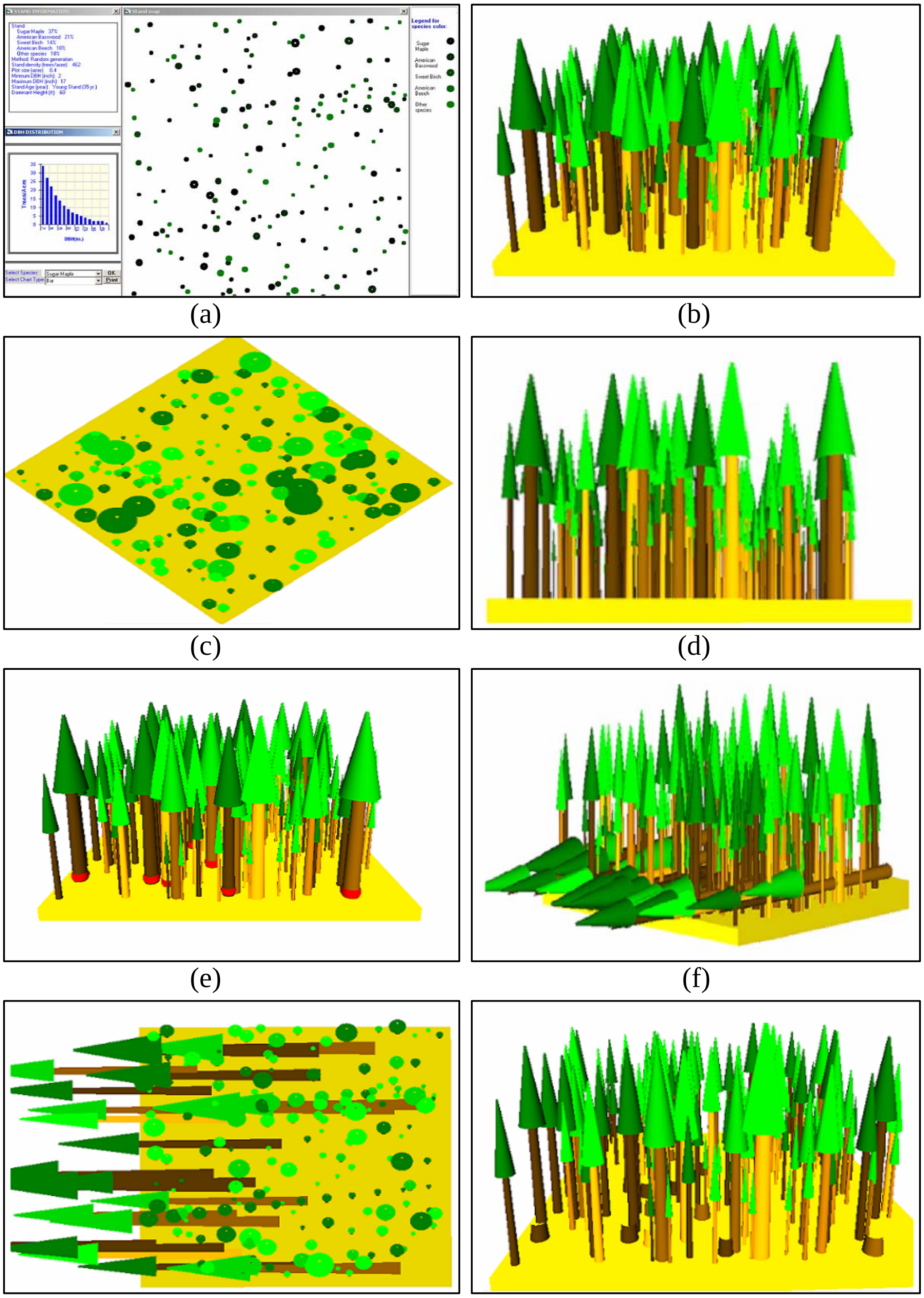
<u>Simulation Example</u>

A natural hardwood stand in central Appalachia was generated so as to illustrate the performance of the stand generation and harvesting simulation. Assuming the species composition is yellow poplar 40%, black cherry 18%, red maple 16%, red oak 15%, and other hardwoods 11%. The stand density is 485 trees per hectare with DBH range from 5 to 110 cm and plot size is 0.16-hectare. It is also assumed that the stand is about 75 years old and trees are randomly distributed.

Once the above information is entered, a 2D stand map is first generated and displayed (Figure 4a). Three smaller windows are used to display the stand information, color legends for species, and the DBH distribution by species or for overall species. Meanwhile a stand map data file is created and saved in the system. The 3D stand map could be displayed by changing the display mode. Some functionality could be performed on the 3D stand map. For example, the image could be rotated from left or right continuously to allow for examination of the stand structure from different directions. The user could also change the crown height and diameter by using the “tree design” module. In order to differentiate species on the map, a unique color is randomly generated and assigned to each species. Additionally, the tree height and DBH are also drawn to scale for better visualization.

Two projection modes (perspective projection and parallel projection) and three view modes (projective view, profile view, and overhead view) can be produced by the system. Perspective projection and projective view are the default projection mode and view mode, respectively (Figure 4b). Overhead view and profile view can be enabled by changing the view mode (Figure 4c and d). The 3D component can also allow the user to mark trees to be harvested (Figure 4e). Trees can be marked by species, DBH, or both, or by the user’s specified requirements such as marking diseased or poorly formed trees. The marked trees can then be felled (Figure 4f and g), and extracted from the plot (Figure 4h).

The system saves the operation data into the database for later analyses once a simulation run is complete. The analysis module of harvesting simulator can analyze the generated stand and compare it with a thinned or partially cut stand. This module provides: (1) elemental time summary, (2) machine summary by cycle, (3) summary of harvested stand and extracted site, and (4) production analysis as well as traffic intensity of extraction machines across the site.



Stand:
  Sugar Maple 37%
  American Basswood 21%
  Sweet Birch 14%
  American Beech 10%
  Other species 18%
Method: Random generation
Stand density (trees/acre): 462
Plot size (acre): 0.4
Minimum DBH (inch): 2
Maximum DBH (inch): 17
Stand Age (year): Young Stand (35 yr.)
Dominant Height (ft): 60

Select Species: Sugar Maple
Select Chart Type: Bar

(a) (b)

(c) (d)

(e) (f)

(g) (h)

Figure 4. Stand generation and harvesting simulation.

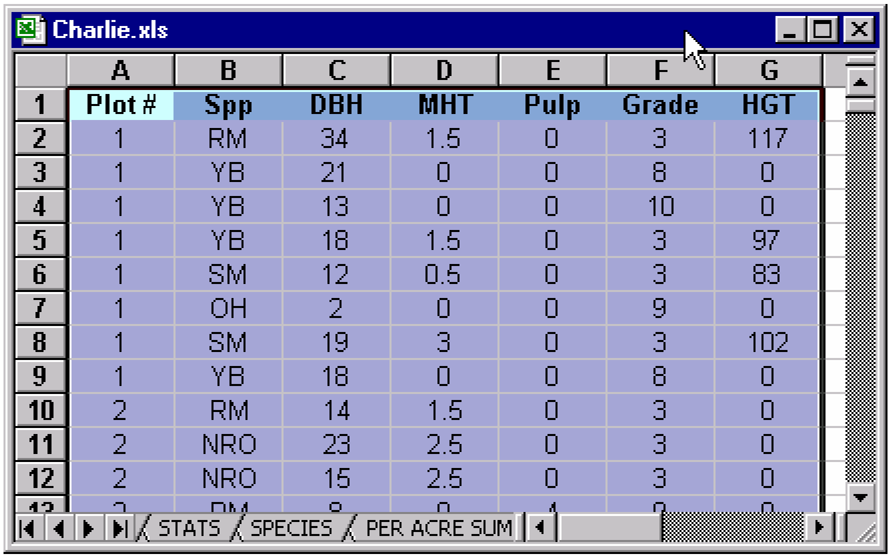
24.2 WVU Cruising

WVU Cruising is especially designed to analyze the field cruising data and provide the results in the format of MS Access report.

Field Cruising Data

The field cruising data should be in the format of MS Excel. In order to import the Excel data to WVU Cruise, you need to do the following things:

(1) Open the Excel file that contains the cruising data. The data must contains the fields of Plot#, Species (Spp), DBH, merchantable height in number of logs (MHT), Pulp, Grade, and total height in feet (HGT). These fields must be in the proper order. If you have no data for one or more fields, put 0s in the cells.



Charlie.xls

	A	B	C	D	E	F	G
1	Plot #	Spp	DBH	MHT	Pulp	Grade	HGT
2	1	RM	34	1.5	0	3	117
3	1	YB	21	0	0	8	0
4	1	YB	13	0	0	10	0
5	1	YB	18	1.5	0	3	97
6	1	SM	12	0.5	0	3	83
7	1	OH	2	0	0	9	0
8	1	SM	19	3	0	3	102
9	1	YB	18	0	0	8	0
10	2	RM	14	1.5	0	3	0
11	2	NRO	23	2.5	0	3	0
12	2	NRO	15	2.5	0	3	0
13	2	RM	8	0	4	9	0

Figure 5. Format of cruise data.

(2) Create a Named Range, DataRange, in your Excel spreadsheet

a. Highlight the row(s) and column(s) area where your data resides.
b. On the Insert menu, point to Name, and click define.
c. Enter the name DataRange for the Named Range name.
d. Click OK.

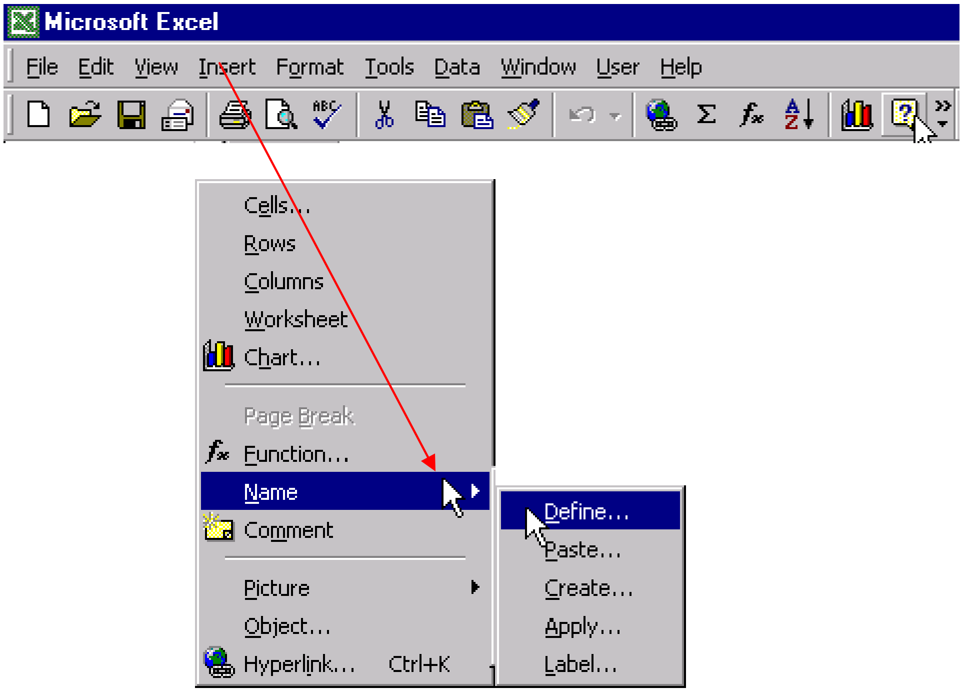


Figure 6. Define a data range associated with data object.

(3) Now, start WVU Cruise program, the main MDI form is displayed first. On the menu bar, there are File, Report, Tools, and Help menus.

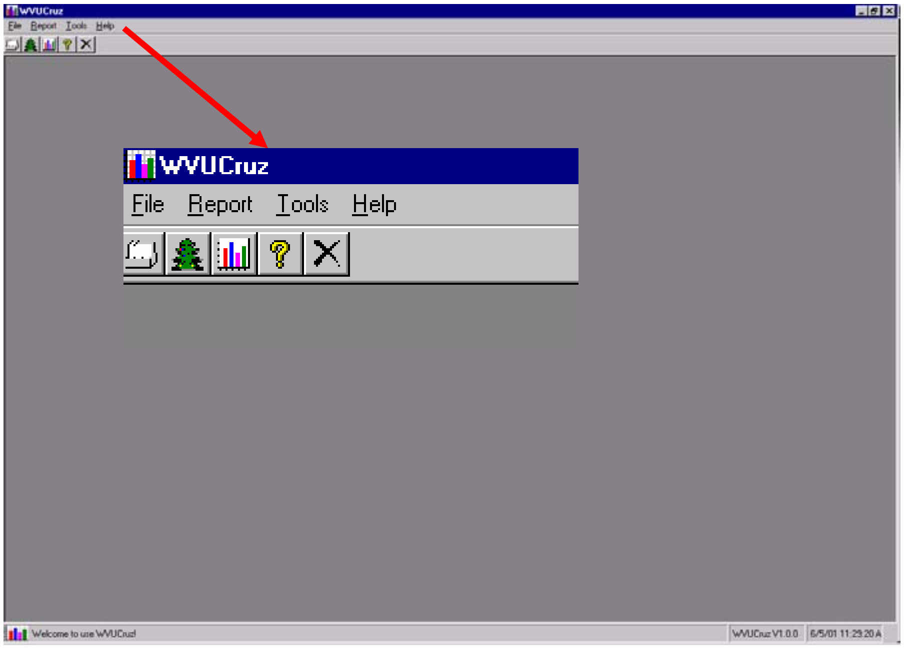


Figure 7. Menu and toolbars of WVU Cruise.

Import Data

(1) In the Tools menu, click Import, a dialog window is popped up for importing Excel data into the cruising program. Once the file is selected, click OK.

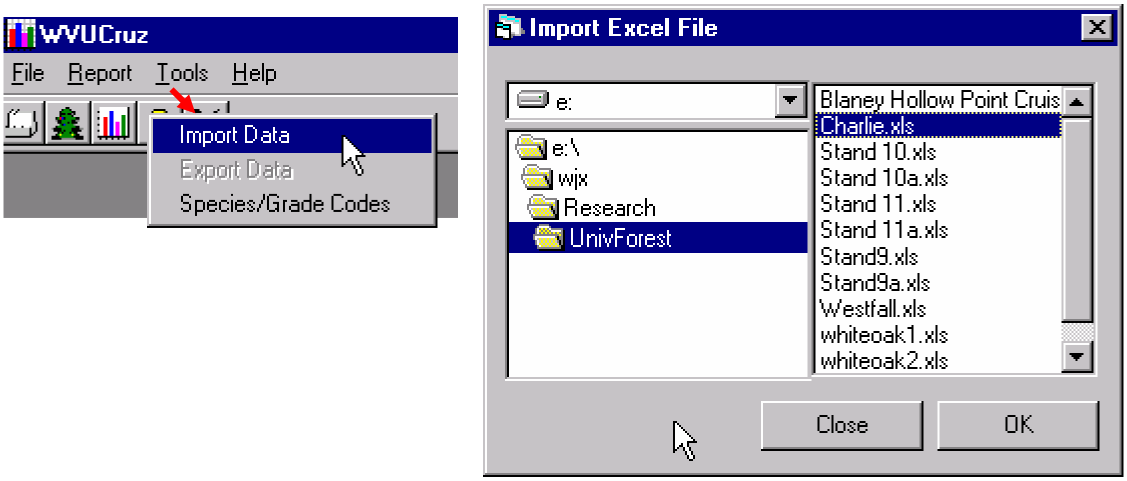
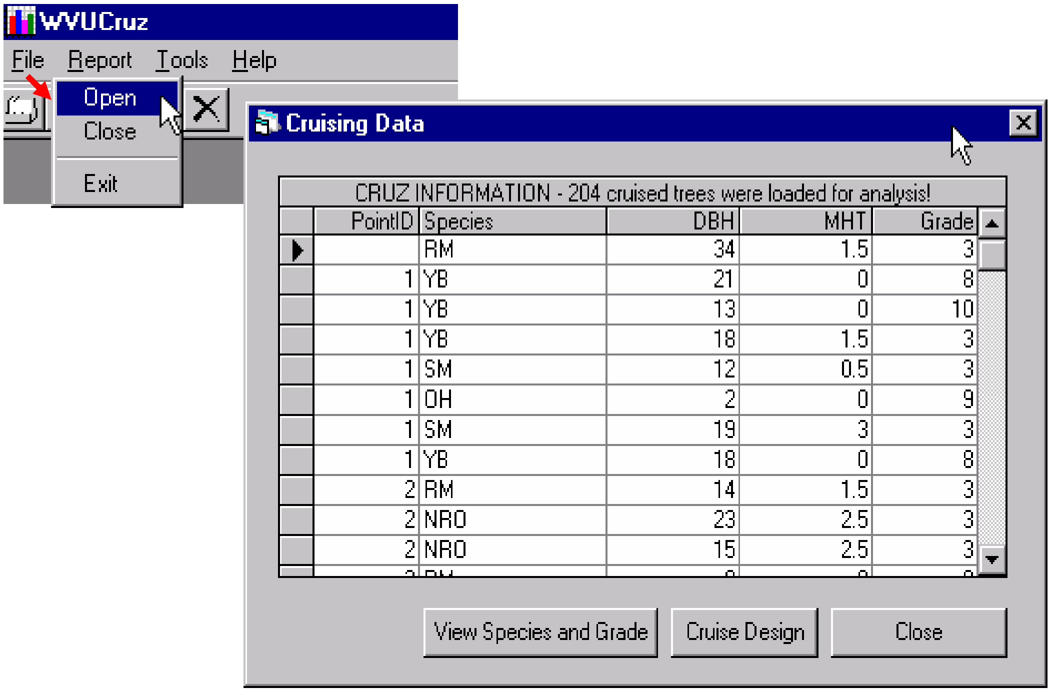


Figure 8. Import Excel data to WVU Cruise.

Load Data

(1) Now you can load the cruising data in the program. In the File menu, click Open, the cruising data will be loaded for analyses.



CRUZ INFORMATION - 204 cruised trees were loaded for analysis!

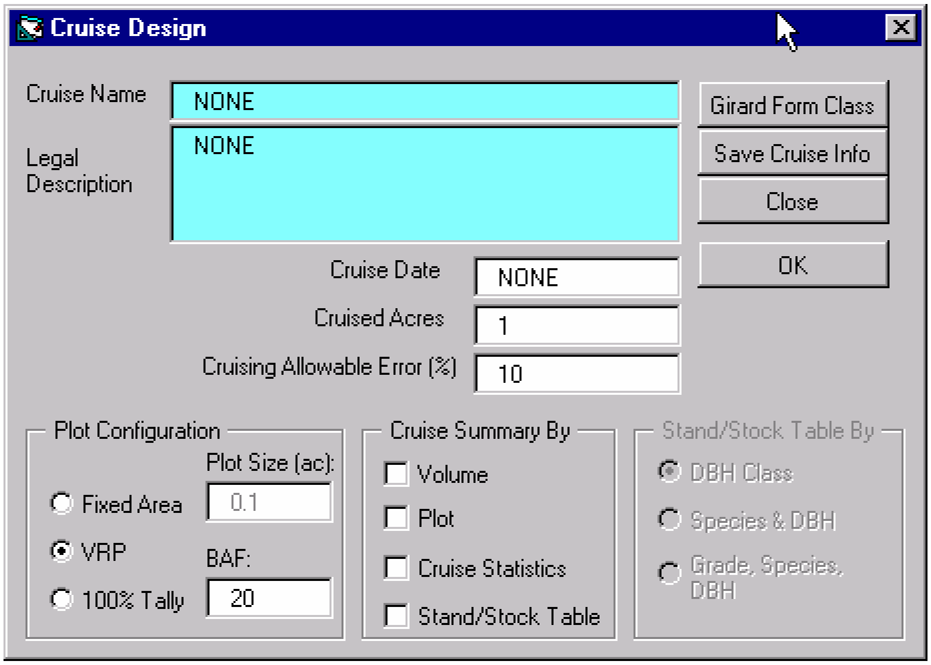
PointID	Species	DBH	MHT	Grade
	RM	34	1.5	3
1	YB	21	0	8
1	YB	13	0	10
1	YB	18	1.5	3
1	SM	12	0.5	3
1	OH	2	0	9
1	SM	19	3	3
1	YB	18	0	8
2	RM	14	1.5	3
2	NRO	23	2.5	3
2	NRO	15	2.5	3

Figure 9. Load cruise data for analysis.

(2) You can browse the data loaded. You should notice there are "View Species and Grade" and "Cruise Design" buttons on the form.

Cruise Design

If the user clicks the "Cruise Design" button, a design form will be popped up.



Cruise Name: NONE

Legal Description: NONE

Cruise Date: NONE

Cruised Acres: 1

Cruising Allowable Error (%): 10

Plot Configuration

○ Fixed Area — Plot Size (ac): 0.1

● VRP — BAF: 20

○ 100% Tally

Cruise Summary By

□ Volume

□ Plot

□ Cruise Statistics

□ Stand/Stock Table

Stand/Stock Table By

● DBH Class

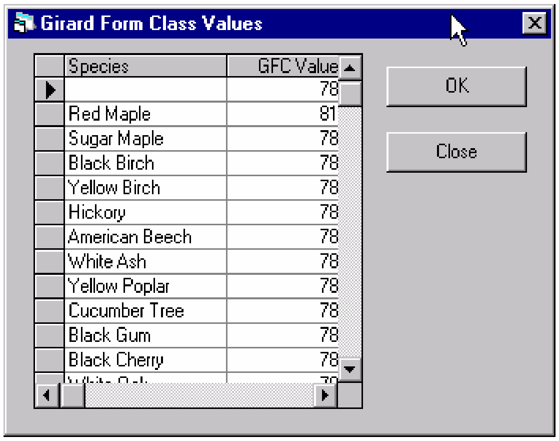
○ Species & DBH

○ Grade, Species, DBH

Figure 10. Cruise design window.

In this design window, you can:

(1) Design and save cruising information for report header. Simply enter the required text boxes and then click "Save Cruise Info".
(2) Select form class for a specific species. Click "Girard Form Class", a form is displayed.



Species	GFC Value
	78
Red Maple	81
Sugar Maple	78
Black Birch	78
Yellow Birch	78
Hickory	78
American Beech	78
White Ash	78
Yellow Poplar	78
Cucumber Tree	78
Black Gum	78
Black Cherry	78

Figure 11. Edit Girard form class by species.

(3) Configure plot. You can use fixed area, variable radius plot, or 100% tally.
(4) Summarize cruising data by:
   a. Volume
   b. Plot
   c. Cruise statistics
   d. Stand/stock table
      i. DBH class
      ii. Species and DBH
      iii. Grade, species, and DBH

Report

The summarized cruising data can be outputted in the format of Access:

(1) By Volume - Two parts of volume summary are provided: merchantable volume tract summary and merchantable volume per acre summary, which are saved in the database and then reported.
(2) Plot level result is also provided. Once the data are saved, a report by plot will be generated.
(3) The cruising statistics are also provided for volume per acre in cubic foot (CFV), in International Board foot (1/4) (IBFV), in Doyle (DBFV), trees per acre (TPA), and basal area per acre (BA/A). Statistics include mean, standard deviation, standard error, variance, coefficient of variance (CV), confidence interval at 95% level, percent of error, and sample size. The sample size will be especially useful for later cruising design.
(4) The Stand/Stock table report can be reported in three levels by DBH class, Species and DBH, and Grade, species, and DBH.

Programming

(1) Input data – convert MA Excel data into Access format then load then into the memory.

```
Dim xlBook As Excel.Workbook
Dim rgSpp As Range


Private Sub Command1_Click()

   On Error GoTo err_Handler

   Dim filePath As String
   Dim i, j, nExcelData As Integer
   Dim DataConn As ADODB.Connection
   Dim rdExcelData As ADODB.Recordset
```

```
    If Right(File1.Path, 1) <> "\" Then
        filePath = File1.Path & "\" & File1.fileName
   Else
        filePath = File1.Path & File1.fileName
    End If

    Set DataConn = New ADODB.Connection

    Path = filePath
    DRIVER = "{Microsoft Excel Driver (*.xls)}"
    Db = "DBQ=" & Path & ";"
    Db = Db & "DefaultDir=" & Path & ";"
    Db = Db & "Driver=" & DRIVER & ";"
    DataConn.Open Db
    ChDir App.Path
    Set rdExcelData = DataConn.Execute("SELECT * FROM DataRange")

        Set dbCruzData = OpenDatabase("dbCruzData.mdb")
        Set rdCruzData = dbCruzData.OpenRecordset("tblAllTree1")
        Call ClearTreeTable(rdCruzData)

    If rdExcelData.EOF Then
        MsgBox "No data can be loaded from this empty file!" & Chr(13) & filePath,
vbOKCancel + vbInformation, "Excel Conversion"
        Exit Sub
    Else
        j = 0
        nExcelData = 0
        Do While Not rdExcelData.EOF
            nExcelData = nExcelData + 1
            rdExcelData.MoveNext
        Loop
        frmCruzProg.Show
        frmCruzProg.Caption = "Importing cruising data ... "
        frmCruzProg.CruzProgBar.Max = nExcelData
        Screen.MousePointer = vbHourglass
        rdExcelData.MoveFirst
        Do While Not rdExcelData.EOF
            i = 0
            j = j + 1
            frmCruzProg.CruzProgBar.Value = j
            rdCruzData.AddNew
            For Each Field In rdExcelData.Fields
                 rdCruzData.Fields(i) = Field.Value
                 i = i + 1
            Next
            rdCruzData.Update
            rdExcelData.MoveNext
        Loop
    End If
    Set rdExcelData = Nothing
    Unload frmCruzProg
    Screen.MousePointer = vbDefault

    Exit Sub
```

```
err_Handler:
   Call Error_Handler

End Sub
```

(2) Process data – use arrays to hold the data and then compute trees per acre, basal area, and volume by species, dbh, and others.

```
‘Assign cruising data to arrays for processing
Public Sub AssignCruiseData()

   On Error GoTo err_Handler

   Dim i As Integer
   i = 1

   frmCruzProg.CruzProgBar.Max = nRecord
   Screen.MousePointer = vbHourglass
   'nRecord = rdCruiseData.RecordCount
   ReDim Preserve PointNo(nRecord), Species(nRecord), DBH1(nRecord), Height(nRecord),
PulpW(nRecord), Grade(nRecord), THeight(nRecord)
   ReDim SPPCruised(NofSpecies), PointCR(NofPoint), DClassCR(NofDClass),
GradeCR(NofGrade)
   rdCruzData.MoveFirst
   While Not rdCruzData.EOF
      frmCruzProg.CruzProgBar.Value = i
       PointNo(i) = rdCruzData("PointID")
       If IsNull(rdCruzData("Species")) Then
          Species(i) = "None"
      Else
          Species(i) = rdCruzData("Species")
      End If
       'Species(i) = CSpecies(Species(i))
       If IsNull(rdCruzData("DBH")) Then
          DBH1(i) = 0
       Else
          DBH1(i) = rdCruzData("DBH")
       End If
       If IsNull(rdCruzData("MHT")) Then
          Height(i) = 0
       Else
          Height(i) = rdCruzData("MHT")
       End If
       If IsNull(rdCruzData("Pulp")) Then
          PulpW(i) = 0
       Else
          PulpW(i) = rdCruzData("Pulp")
       End If
       If IsNull(rdCruzData("Grade")) Then
          Grade(i) = "None"
       Else
          Grade(i) = rdCruzData("Grade")
       End If
```

```
     If IsNull(rdCruzData("THT")) Then
        THeight(i) = 0
     Else
        THeight(i) = rdCruzData("THT")
     End If
    'Debug.Print Point(i), Species(i)
     i = i + 1
     rdCruzData.MoveNext
Wend

'Assign species
i = 1
rdSpecies.MoveFirst
While Not rdSpecies.EOF
    If IsNull(rdSpecies("Species")) Then
        SPPCruised(i) = "None"
    Else
        SPPCruised(i) = rdSpecies("Species")
    End If
    'Debug.Print SPPCruised(i)
    i = i + 1
    rdSpecies.MoveNext
Wend
'Assign plot
i = 1
rdNofPlot.MoveFirst
While Not rdNofPlot.EOF
    If IsNull(rdNofPlot("PointID")) Then
        PointCR(i) = 0
    Else
    PointCR(i) = rdNofPlot("PointID")
    End If
    'Debug.Print PointCR(i)
    i = i + 1
    rdNofPlot.MoveNext
Wend
'Assign DBH class
i = 1
rdDBHClass.MoveFirst
While Not rdDBHClass.EOF
    If IsNull(rdDBHClass("NofDClass")) Then
        DClassCR(i) = 0
    Else
        DClassCR(i) = rdDBHClass("NofDClass")
    End If
    i = i + 1
    rdDBHClass.MoveNext
Wend
'Assign grade
i = 1
rdNofGrade.MoveFirst
While Not rdNofGrade.EOF
    If IsNull(rdNofGrade("Grade")) Then
        GradeCR(i) = "None"
    Else
        GradeCR(i) = rdNofGrade("Grade")
        End If
        i = i + 1
        rdNofGrade.MoveNext
    Wend

    blCallAssignCruz = True

    Unload frmCruzProg
    Screen.MousePointer = vbDefault

    Exit Sub

err_Handler:
    Call Error_Handler

End Sub
```

24.3 CD-Based Proceedings

This is a relatively smaller project compared to previous ones. The basic idea is to develop an autorun CD to allow the users to read papers and other materials related to the meeting. In addition to using regular VB controls, the Microsoft Internet Control (Web browser) is used in this project.

This is CD-based proceedings of the 24th Annual Meeting of the Council on Forest Engineering. The proceedings were compiled as an auto run program that was written with MS VB.

The CD contains the following files:

Cofe24.exe	A compiled executable that is used to load the proceedings.
autorun.inf	Used to run Cofe24.exe automatically.
Msvbvm60.dll	A Microsoft VB virtual machine DLL.
VBRun60.exe	This file is used to install MS VB runtimes on client's machine.
README.txt	Instruction file.

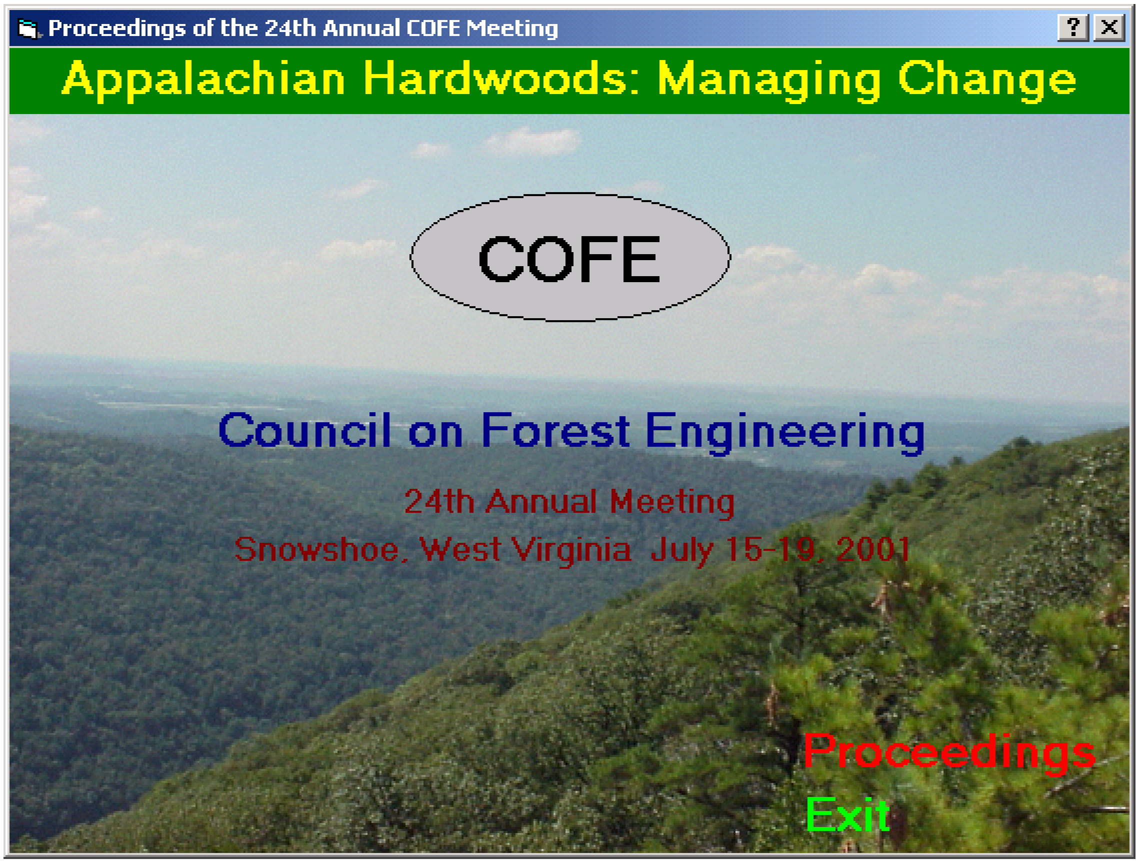
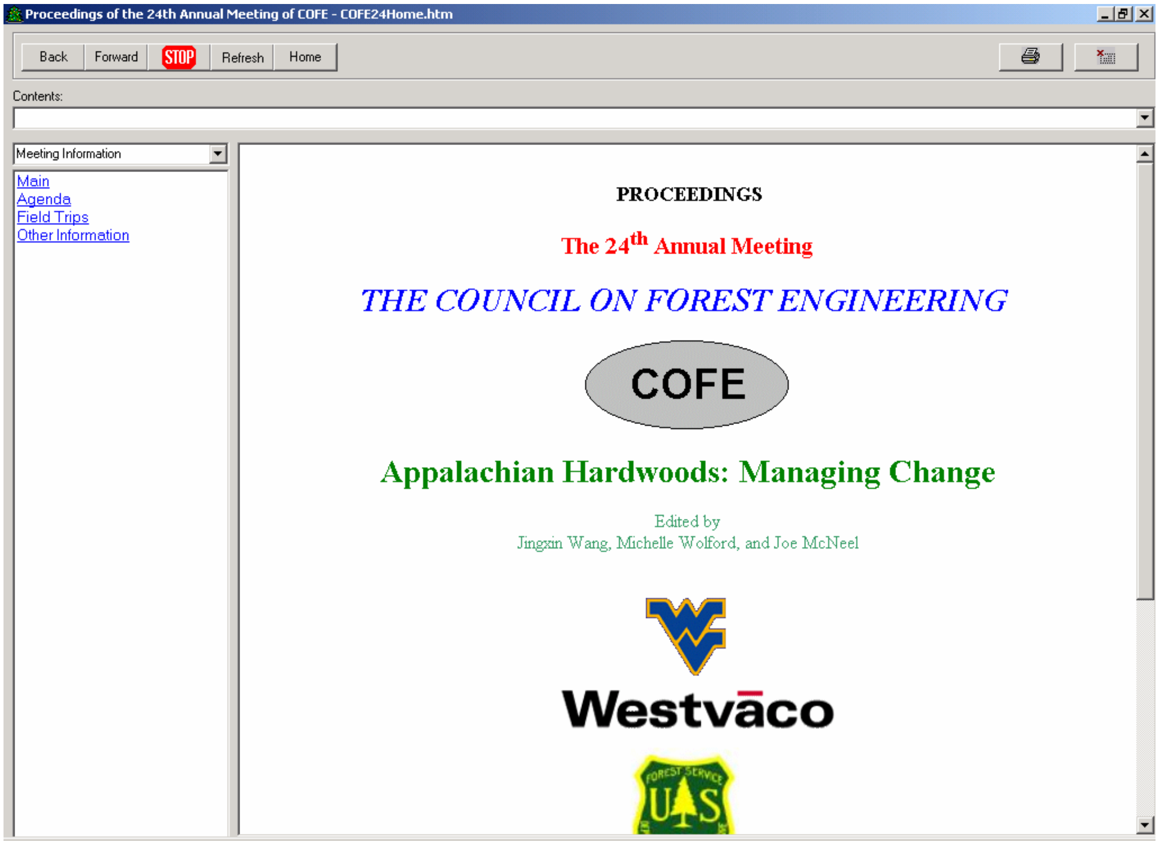

Proceedings of the 24th Annual COFE Meeting
?
Appalachian Hardwoods: Managing Change
COFE
Council on Forest Engineering
24th Annual Meeting
Snowshoe, West Virginia July 15-19, 2001
Proceedings
Exit

Figure 12. Start window of the proceedings.



PROCEEDINGS

The 24th Annual Meeting

THE COUNCIL ON FOREST ENGINEERING

COFE

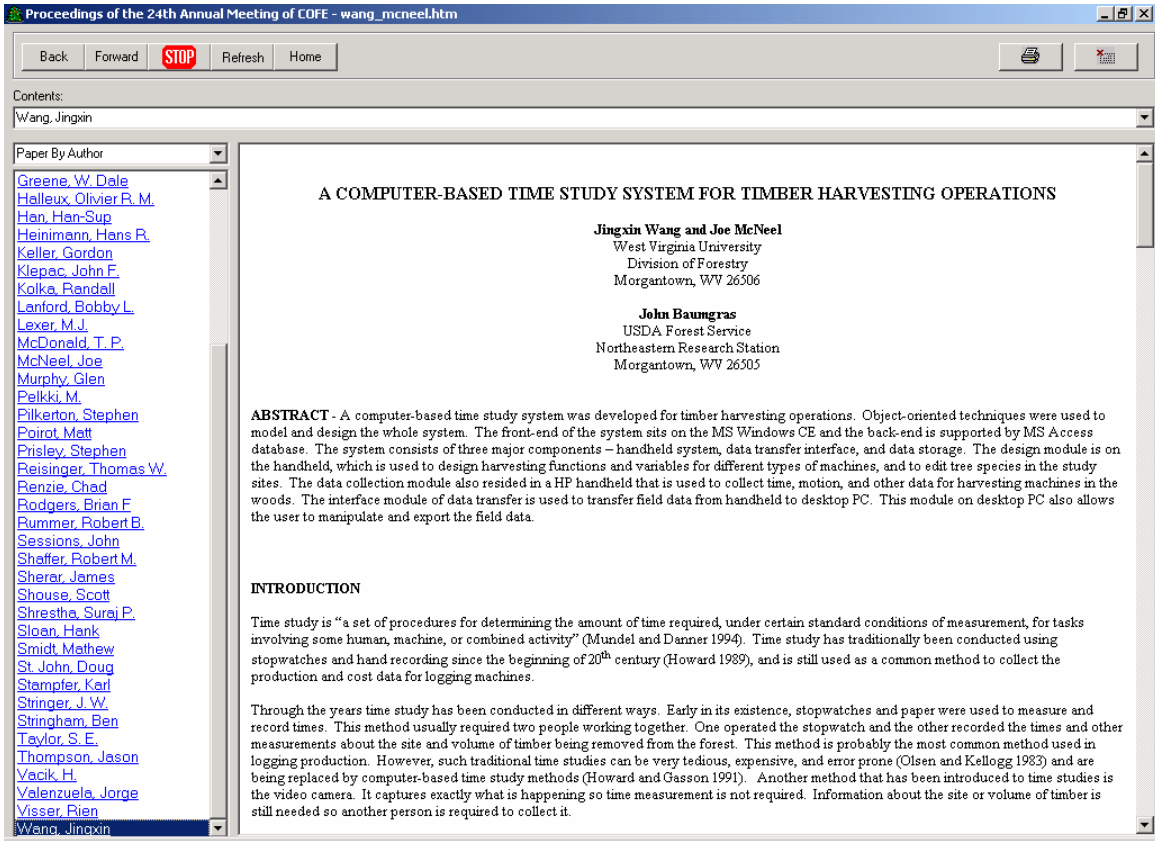
Appalachian Hardwoods: Managing Change

Edited by
Jingxin Wang, Michelle Wolford, and Joe McNeel

Figure 13. The main window of the proceedings.

The important things are the methods with Internet Control:

- Navigate
- GoBack
- GoForward
- GoHome
- Refresh
- Stop



A COMPUTER-BASED TIME STUDY SYSTEM FOR TIMBER HARVESTING OPERATIONS

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ABSTRACT - A computer-based time study system was developed for timber harvesting operations. Object-oriented techniques were used to model and design the whole system. The front-end of the system sits on the MS Windows CE and the back-end is supported by MS Access database. The system consists of three major components – handheld system, data transfer interface, and data storage. The design module is on the handheld, which is used to design harvesting functions and variables for different types of machines, and to edit tree species in the study sites. The data collection module also resided in a HP handheld that is used to collect time, motion, and other data for harvesting machines in the woods. The interface module of data transfer is used to transfer field data from handheld to desktop PC. This module on desktop PC also allows the user to manipulate and export the field data.

INTRODUCTION

Time study is “a set of procedures for determining the amount of time required, under certain standard conditions of measurement, for tasks involving some human, machine, or combined activity” (Mundel and Danner 1994). Time study has traditionally been conducted using stopwatches and hand recording since the beginning of 20th century (Howard 1989), and is still used as a common method to collect the production and cost data for logging machines.

Through the years time study has been conducted in different ways. Early in its existence, stopwatches and paper were used to measure and record times. This method usually required two people working together. One operated the stopwatch and the other recorded the times and other measurements about the site and volume of timber being removed from the forest. This method is probably the most common method used in logging production. However, such traditional time studies can be very tedious, expensive, and error prone (Olsen and Kellogg 1983) and are being replaced by computer-based time study methods (Howard and Gasson 1991). Another method that has been introduced to time studies is the video camera. It captures exactly what is happening so time measurement is not required. Information about the site or volume of timber is still needed so another person is required to collect it.

Figure 14. Browse a paper by author.

```
Option Explicit

Public StartingAddress As String
Dim mbDontNavigateNow As Boolean
Dim eQuery As OLECMDF


Private Sub cboCOFEBy_Click()

    On Error Resume Next
    If cboCOFEBy.Text = "Meeting Information" Then
        Call ShowCOFENews(lstCOFE24Tab)
    ElseIf cboCOFEBy.Text = "Paper By Author" Then
        Call ShowCOFEAuthor(lstCOFE24Tab)
    ElseIf cboCOFEBy.Text = "Paper By Title" Then
        Call ShowCOFEPaperTitle(lstCOFE24Tab)
    End If


End Sub

Private Sub cmdBack_Click()

    On Error Resume Next
    mainCOFEBrowser.GoBack

End Sub


Private Sub cmdForward_Click()

    On Error Resume Next

    mainCOFEBrowser.GoForward

End Sub

Private Sub cmdHome_Click()

    On Error Resume Next

    'mainCOFEBrowser.GoHome
    mainCOFEBrowser.Navigate App.Path & "\Cofe24\COFE24Home.htm"

End Sub

Private Sub cmdPrint_Click()

    On Error Resume Next

    eQuery = mainCOFEBrowser.QueryStatusWB(OLECMDID_PRINT)  'get print command
status
    If Err.Number = 0 Then
            If eQuery And OLECMDF_ENABLED Then
                mainCOFEBrowser.ExecWB OLECMDID_PRINT,
OLECMDEXECOPT_PROMPTUSER, "", ""    'Ok to Print?
          Else
                MsgBox "The Print command is currently disabled."
            End If
    End If

End Sub

Private Sub cmdRefresh_Click()

    On Error Resume Next

    mainCOFEBrowser.Refresh

End Sub

Private Sub cmdStop_Click()

    On Error Resume Next
    mainCOFEBrowser.Stop
    Me.Caption = mainCOFEBrowser.LocationName

End Sub

Private Sub Form_Load()
```

```
        On Error Resume Next
        ChDir App.Path
        Me.Show
        Form_Resize

        If Len(StartingAddress) > 0 Then
            cboAddress.Text = StartingAddress
            cboAddress.AddItem cboAddress.Text
            'try to navigate to the starting address
            mainCOFEBrowser.Navigate StartingAddress
        End If

        cboCOFEBy.AddItem "Meeting Information"
        cboCOFEBy.AddItem "Paper By Author"
        cboCOFEBy.AddItem "Paper By Title"
        cboCOFEBy.Text = "Meeting Information"
        mainCOFEBrowser.Navigate App.Path & "\Cofe24\COFE24Home.htm"
        Call ShowCOFENews(lstCOFE24Tab)
        lstCOFE24Tab.ToolTipText = "Double click to display the item."
        cmdBack.ToolTipText = "Back"
        cmdForward.ToolTipText = "Forward"
        cmdStop.ToolTipText = "Stop"
        cmdRefresh.ToolTipText = "Refresh"
        cmdHome.ToolTipText = "Home"
        cmdPrint.ToolTipText = "Print"
        cmdClose.ToolTipText = "Close"


    End Sub

  Private Sub Form_Resize()

        On Error Resume Next

        cboAddress.Width = Me.ScaleWidth - 100
        mainCOFEBrowser.Width = Me.ScaleWidth - 3100
        mainCOFEBrowser.Height = Me.ScaleHeight - (picAddress.Top + picAddress.Height) - 100
        lstCOFE24Tab.Height = Me.ScaleHeight - (picAddress.Top + picAddress.Height) - 400
        fraCmdButton.Width = Me.ScaleWidth - 100
        cmdPrint.Left = Me.ScaleWidth - 2200
        cmdClose.Left = Me.ScaleWidth - 1200

    End Sub
```

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