United States
Department of
Agriculture

Forest Service

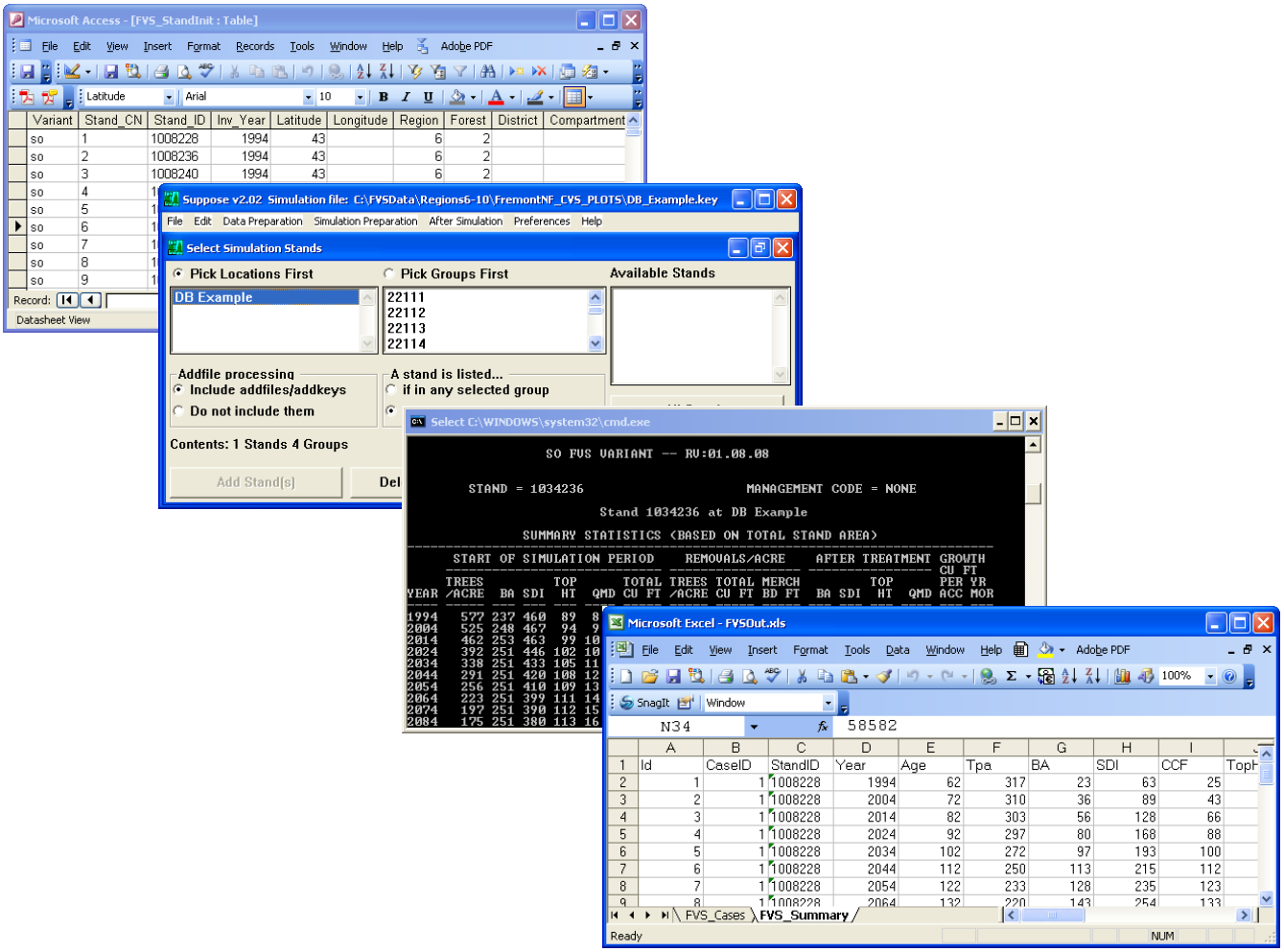
**Forest Management
Service Center**

Fort Collins, CO

2003

Revised:
March 2018

Users Guide to the Database Extension of the Forest Vegetation Simulator Version 2.0 (Legacy FVS 32-bit)



Authors:

Nicholas L. Crookston, USDA-FS, Moscow, ID
Dennis L. Gammel, USDA-FS, Moscow, ID
Stephanie Rebain, USDA-FS, Fort Collins, CO
Donald C.E. Robinson, ESSA Technologies Ltd., Vancouver, Canada
Chad Keyser, USDA-FS, Fort Collins, CO
Christopher Dahl, USDA-FS, Fort Collins, CO

Crookston, Nicholas L.; Gammel, Dennis L.; Rebain, Stephanie; Robinson, Donald; Keyser, Chad E.; Dahl, Christopher A. 2003 (revised March 2015). Users Guide to the Database Extension of the Forest Vegetation Simulator Version 2.0. Internal Rep. Fort Collins, CO: U. S. Department of Agriculture, Forest Service, Forest Management Service Center. 60p.

TABLE OF CONTENTS

TABLE OF CONTENTS **3**

1.0 INTRODUCTION **4**

2.0 OUTPUT DATA TABLE STRUCTURE **5**

2.1 BASE FVS SYSTEM TABLES 6
2.2 FIRE AND FUELS EXTENSION TABLES 12
2.3 DWARF MISTLETOE IMPACT MODEL TABLES 23
2.4 ECONOMICS ANALYSIS EXTENSION TABLES 25
2.5 WESTERN ROOT DISEASE MODEL TABLES 27

3.0 INPUT DATA TABLE STRUCTURE **30**

3.1 AUTOMATIC COLUMN MATCHING AND EXTRA VARIABLES 34
3.2 KEYWORD ORDER IS IMPORTANT 35
3.3 AUTOMATIC DATA TYPE CONVERSION 35
3.4 LINKING TO AN INPUT DATABASE WITH SUPPOSE 36

4.0 KEYWORDS **38**

4.1 CONNECTIONS 38
4.2 OUTPUT TABLE CONTROL 38
4.3 STAND AND TREE INTIALIZATION 43

5.0 EVENT MONITOR – DATABASE INTERACTION **45**

6.0 EXAMPLES **47**

6.1 – EXAMPLE 1: CREATE A DATABASE CONTAINING SUMMARY AND COMPUTE TABLES 47
6.2 – EXAMPLE 2: DELETE EXISTING TABLES. 48
6.3 – EXAMPLE 3: STAND INFORMATION INITIALIZATION 48
6.4 – EXAMPLE 4: INPUT STAND/PLOT AND TREE DATA FROM AN FSVEG-DERIVED DATABASE. 49
6.5 – EXAMPLE 5: EVENT MONITOR – DATABASE INTERACTION 51

7.0 ACKNOWLEDGMENTS **54**

8.0 REFERENCES **55**

9.0 APPENDIX 1: DATA SOURCE NAMES (DSN) **56**

1.0 INTRODUCTION

You can directly load FVS (Wykoff and others 1982, Dixon 2002) predictions into databases, initialize FVS and Suppose from databases, or both, using the Database Extension to the Forest Vegetation Simulator (DB-FVS). This document says how to use the system capabilities and outlines how the extension works. Examples are also provided.

DB-FVS runs on Microsoft Windows platforms using Object Database Connectivity (ODBC). You provide a file name of a data base object or a Data Source Name (DSN) and other connection information, and the DB-FVS software can then interact with your databases. Excel spreadsheet files, Access database files, and SQL-based databases like Oracle can then directly interact with DB-FVS. Support for transferring information to and from other SQL-based relational databases has been tested but is not universally guaranteed.

DB-FVS version 1.0 output limited information generated from FVS. This version outputs most information generated from FVS. This document describes our thinking and provides a pattern that can be followed when adding more features.

This document assumes that you know how to use FVS in general and concepts related to ODBC, SQL, Excel, and Access. For help on FVS, see the Web site http://www.fs.fed.us/fmsc, and for help on ODBC see the Microsoft Windows Help system on your computer. See Appendix 1 for instructions on creating a data source name (DSN).

Here is a general description of DB-FVS functionality. For output, the program produces a set of tables that form a relational database. These data are sent to a database connection you specify. For input, the program sets initial stand variables, tree variables, or both by inputting information found in a database. The input is taken from the result of an SQL query run on a separate database connection from the one used for output. The details of these two kinds of operations are presented in sections 2-4 that outline the output and input table structures and the keywords used to control the system. Examples are presented to illustrate the concepts.

DB-FVS also supports interaction between databases and FVS's Event Monitor (Crookston 1990). This interaction occurs at any time step during the simulation and is covered in section 5, titled Event Monitor – Database Interaction. Using this facility, you can add rows to a database table, setting the values in the table equal to any variable known to the Event Monitor at any time step during the simulation. You can also set the value of user-defined Event Monitor variables to values found in a database, again at any time step during the simulation.

While not inherently part of the DB-FVS, the Suppose Interface may now populate its list of stands based on its capability to read DB-FVS input tables; the process is explained in section 3.4.

2.0 OUTPUT DATA TABLE STRUCTURE

A typical use of DB-FVS is to optionally output the tables outlined in sections 2.1 – 2.4 to form a simple relational database. When any of these tables are output, the **FVS_Cases** table is automatically generated. The details of this table are outlined below.

FVS_Cases contains a list of FVS projections, called *cases.* Each case is the projection of one stand run with a specific set of options. A single run of FVS can include several stands, a few stands each run using different options, or both. Therefore, one run of FVS may generate several cases. The FVS_Cases table identifies a case by defining the data columns listed in table 2.0.1. This table is automatically generated if any of the other tables in this section are generated.

Data in the FVS_Cases table can be joined to data in the following tables using the universal variable `CaseID` as a key. Information in the other tables can be joined using `CaseID` and `Year` as keys.

FVS keywords are used to specify which output tables you want, as is done for other parts of the FVS system. Joining information between tables depends on you not destroying the relationship between the `CaseID` values in the related tables. This version of DB-FVS does not insure the integrity of these relationships.

Table 2.0.1 – The content of the FVS_Cases table.

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier
Stand_CN	Text	Text	Char(40)	Stand control number
StandID	Text	Text	Char(26)	Stand identification
MgmtID	Text	Text	Char(4)	Management identification
RunTitle	Text	Text	Char(72)	Label combining the StandID and the title assigned to the run.
KeywordFile	Text	Text	Char(50)	The FVS keyword file name used to make the run.
SamplingWt	Number	Double	Real	The stand sampling weight entered using the DESIGN keyword or from the input database.
Variant	Text	Text	Char(2)	The FVS variant used.
Version	Text	Text	Char(10)	Version number (e.g. 2063) of source code in repository from which release executable was built.
RV	Text	Text	Char(8)	Revision version is the date assigned to the release (e.g. 20180108)
Groups	Text	Text	Char(250)	List of grouping codes assigned to the stand
RunDateTime	Text	Text	Char(19)	The date and time of the run in the following format: `YYYY-mm-dd-hh:mm:ss`

2.1 Base FVS System Tables

2.1.1 FVS_Summary and FVS_Summary_East

FVS_Summary and **FVS_Summary_East** contain the information from the FVS summary statistics output table plus the case number and an automatic row identification value (tables 2.1.1.1 and 2.1.1.2). Note that there are slightly different formats for Western U.S. variants of FVS versus those used in the Eastern part of the country. Note that this table is output at the end of the simulation of a case, not during the simulation. Refer to section 4.3.1.4 of the Essential FVS Guide for more information on the summary statistics table.

Table 2.1.1.1 – The content of the FVS_Summary table.

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier that corresponds to the FVS_Cases table
StandID	Text	Text	Char(26)	Stand identification
Year	Integer	Integer	Integer	Year of the projection
Age	Integer	Integer	Integer	Stand age
TPA	Number	Double	Real	Trees per acre
BA	Number	Double	Real	Basal area per acre
SDI	Number	Double	Real	Stand density index
CCF	Number	Double	Real	Crown competition factor
TopHt	Number	Double	Real	Average dominant height
QMD	Number	Double	Real	Quadratic mean DBH
TcuFt	Number	Double	Real	Total cubic foot volume
McuFt	Number	Double	Real	Merchantable cubic foot volume
BdFt	Number	Double	Real	Merchantable board foot volume
RTPA	Number	Double	Real	Removed trees per acre
RTCuFt	Number	Double	Real	Removed total cubic foot volume
RMCuFt	Number	Double	Real	Removed merchantable cubic foot volume
RBdFt	Number	Double	Real	Removed merchantable board foot volume
ATBA	Number	Double	Real	After thin basal area
ATSDI	Number	Double	Real	After thin stand density index
ATCCF	Number	Double	Real	After thin crown competition factor
ATTopHt	Number	Double	Real	After thin average dominant height
ATQMD	Number	Double	Real	After thin quadratic mean DBH
PrdLen	Integer	Integer	Integer	Period length (years)
Acc	Number	Double	Real	Accretion (ft^3/acre/year)
Mort	Number	Double	Real	Mortality (ft^3/acre/year)
MAI	Number	Double	Real	Mean annual increment
ForTyp	Integer	Integer	Integer	Forest cover type
SizeCls	Integer	Integer	Integer	Stand size class
StkCls	Integer	Integer	Integer	Stand stocking class

Table 2.1.1.2 – The content of the FVS_Summary_East table.

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier that corresponds to the FVS_Cases table
StandID	Text	Text	Char(26)	Stand identification
Year	Integer	Integer	Integer	Year of the projection
Age	Integer	Integer	Integer	Stand age
TPA	Number	Double	Real	Trees per acre
BA	Number	Double	Real	Basal area per acre
SDI	Number	Double	Real	Stand density index
CCF	Number	Double	Real	Crown competition factor
TopHt	Number	Double	Real	Average dominant height
QMD	Number	Double	Real	Quadratic mean DBH
MCuFt	Number	Double	Real	Merchantable cuft volume (pulpwood + sawtimber)
SCuFt	Number	Double	Real	Sawtimber cubic foot volume
SBdFt	Number	Double	Real	Sawtimber board foot volume
RTPA	Number	Double	Real	Removed trees per acre
RMCuFt	Number	Double	Real	Removed merchantable (pulpwood + sawtimber) cubic foot volume
RSCuFt	Number	Double	Real	Removed sawtimber cubic foot volume
RSBdFt	Number	Double	Real	Removed sawtimber board foot volume
ATBA	Number	Double	Real	After thin basal area
ATSDI	Number	Double	Real	After thin stand density index
ATCCF	Number	Double	Real	After thin crown competition factor
ATTopHt	Number	Double	Real	After thin average dominant height
ATQMD	Number	Double	Real	After thin quadratic mean DBH
PrdLen	Integer	Integer	Integer	Period length (years)
Acc	Number	Double	Real	Accretion (ft^3/acre/year)
Mort	Number	Double	Real	Mortality (ft^3/acre/year)
MAI	Number	Double	Real	Mean annual increment
ForTyp	Integer	Integer	Integer	Forest cover type
SizeCls	Integer	Integer	Integer	Stand size class
StkCls	Integer	Integer	Integer	Stand stocking class

2.1.2 FVS_Compute

FVS_Compute contains the FVS compute variables. Like the Summary table, this table contains the corresponding case number and a row identification value (table 2.1.2.1). When the database type is Excel, the columns in this table are defined to be the compute variables in the *first* case added to the database. This is due to a limitation in Excel as other databases allow for adding columns to a table that contains data. Therefore, for other database types, if an FVS compute variable is used in a case subsequent to the first case, a new column is generally added to the table for that variable. An option is available to control the process of automatically adding columns (see section 4.2). Like FVS_Summary, this table is output at the end of the simulation of a case, not during the simulation. Refer to the Essential FVS Guide for more information on compute variables.

Table 2.1.2 – The content of the FVS_Compute table.

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier that corresponds to the FVS_Cases table
StandID	Text	Text	Char(26)	Stand identification
Year	Integer	Integer	Integer	Year of the projection
Variable 1	Number	Double	Real	The first variable where the column name is the actual compute variable name
Variable 2	Number	Double	Real	The second variable
… Variable n	Number	Double	Real	The nth compute variable

2.1.3 FVS_Treelist, FVS_Cutlist, and FVS_ATRTList

FVS_Treelist contains information for individual trees similar to the output generated using the FVS TreeList keyword (table 2.1.3). The data for each time step is output during the simulation of a case.

FVS_Cutlist contains information for individual cuts similar to the output generated using the FVS CutList keyword (table 2.1.3). The data for each time step is output during the simulation of a case.

FVS_ATRTList contains information for individual trees following thinning treatments similar to the output generated using the FVS ATRTList keyword (table 2.1.3). The data for each time step is output during the simulation of a case. Both the "Base FVS System: ATRTList" and "Database Extension: ATRTList" keywords are needed to send this list to the output database.

More information regarding the Treelist, Cutlist, and After Treatment Treelist can be found in section 4.3.3.1 of the Essential FVS Guide.

Table 2.1.3 – The content of the FVS_Treelist, FVS_Cutlist and FVS_ATRTList tables.

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier that corresponds to the FVS_Cases table
StandID	Text	Text	Char(26)	Stand identification
Year	Integer	Integer	Integer	Year of the projection
PrdLen	Integer	Integer	Integer	Length of the projection cycle
TreeId	Text	Text	Char(8)	Tree identification
TreeIndex	Integer	Integer	Integer	Tree index
Species	Text	Text	Char(3)	Species code
TreeValue	Integer	Integer	Integer	Tree value class
SSCD	Integer	Integer	Integer	Special tree code
PtIndex	Integer	Integer	Integer	Point (or plot) index
TPA	Number	Double	Real	Trees per acre
MortPA	Number	Double	Real	Mortality trees per acre
DBH	Number	Double	Real	Diameter at breast height
DG	Number	Double	Real	Diameter growth (DBH increment)
Ht	Number	Double	Real	Height
HtG	Number	Double	Real	Height growth
PctCr	Integer	Integer	Integer	Percent live crown
CrWidth	Number	Double	Real	Crown width
MistCD	Integer	Integer	Integer	Mistletoe rating code
BAPctile	Number	Double	Real	Basal area percentile
PtBAL	Number	Double	Real	Point-level basal area in larger trees
TcuFt	Number	Double	Real	Total cubic feet (Merchantable cuft volume (pulpwood + sawtimber) in eastern variants)
McuFt	Number	Double	Real	Merchantable cubic feet (Merchantable sawtimber cuft volume in eastern variants)
BdFt	Number	Double	Real	Merchantable board feet
Mdefect	Integer	Integer	Integer	Defect percent on MCuFt
Bdefect	Integer	Integer	Integer	Defect percent on BdFt
TruncHt	Integer	Integer	Integer	Truncated height
EstHt	Number	Double	Real	Estimated height
ActPt	Integer	Integer	Integer	Actual point (or plot) number from input
Ht2TDCF	Real	Real	Real	Height to the merchantable cubic foot top diameter in western variants and height to the pulpwood top diameter in eastern variants *only available when using profile equations
Ht2TDBF	Real	Real	Real	Height to the merchantable board foot top diameter in western variants and height to the sawlog top diameter in eastern variants *only available when using profile equations

2.1.4 FVS_StrClass

FVS_StrClass contains information that is identical to the data output of the Structural Statistics Table in FVS (table 2.1.4). The Structural Statistics Table is described in detail in section 4.3.2.2 of the Essential FVS Guide.

Table 2.1.4 – The content of the FVS_StrClass table.

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier that corresponds to the FVS_Cases table
StandID	Text	Text	Char(26)	Stand identification
Year	Integer	Integer	Integer	Year of the projection
Removal_Code	Number	Double	Real	0 = Before tree removal, 1 = After tree removal
Stratum_1_DBH	Number	Double	Real	Stratum 1 nominal dbh
Stratum_1_Nom_Ht	Number	Double	Real	Stratum 1 nominal height
Stratum_1_Lg_Ht	Number	Double	Real	Height of the tallest tree in stratum 1
Stratum_1_Sm_Ht	Number	Double	Real	Height of the shortest tree in stratum 1
Stratum_1_Crown_Base	Number	Double	Real	Weighted average height to crown base for trees in stratum 1
Stratum_1_Crown_Cover	Number	Double	Real	Percent canopy cover, accounting for overlap, of trees in stratum 1
Stratum_1_Species_1	Text	Text	Char(3)	Tree species that accounts for the most crown cover of the trees in stratum 1
Stratum_1_Species_2	Text	Text	Char(3)	Tree species that accounts for the second most crown cover of the trees in stratum 1
Stratum_1_Status_Code	Number	Double	Real	Stratum 1 status code where 0 = invalid stratum, 1 = valid stratum, and 2 = the uppermost valid stratum
Stratum_2_DBH	Number	Double	Real	Stratum 2 nominal dbh
Stratum_2_Nom_Ht	Number	Double	Real	Stratum 2 nominal height
Stratum_2_Lg_Ht	Number	Double	Real	Height of the tallest tree in stratum 2
Stratum_2_Sm_Ht	Number	Double	Real	Height of the shortest tree in stratum 2
Stratum_2_Crown_Base	Number	Double	Real	Weighted average height to crown base for trees in stratum 2
Stratum_2_Crown_Cover	Number	Double	Real	Percent canopy cover, accounting for overlap, of trees in stratum 2
Stratum_2_Species_1	Text	Text	Char(3)	Tree species that accounts for the most crown cover of the trees in stratum 2
Stratum_2_Species_2	Text	Text	Char(3)	Tree species that accounts for the second most crown cover of the trees in stratum 2
Stratum_2_Status_Code	Number	Double	Real	Stratum 2 status code where 0 = invalid stratum, 1 = valid stratum,

Column Name	Data Type			Description
	Excel	Access	SQL	
				and 2 = the uppermost valid stratum
Stratum_3_DBH	Number	Double	Real	Stratum 3 nominal dbh
Stratum_3_Nom_Ht	Number	Double	Real	Stratum 3 nominal height
Stratum_3_Lg_Ht	Number	Double	Real	Height of the tallest tree in stratum 3
Stratum_3_Sm_Ht	Number	Double	Real	Height of the shortest tree in stratum 3
Stratum_3_Crown_Base	Number	Double	Real	Weighted average height to crown base for trees in stratum 3
Stratum_3_Crown_Cover	Number	Double	Real	Percent canopy cover, accounting for overlap, of trees in stratum 3
Stratum_3_Species_1	Text	Text	Char(3)	Tree species that accounts for the most crown cover of the trees in stratum 3
Stratum_3_Species_2	Text	Text	Char(3)	Tree species that accounts for the second most crown cover of the trees in stratum 3
Stratum_3_Status_Code	Number	Double	Real	Stratum 3 status code where 0 = invalid stratum, 1 = valid stratum, and 2 = the uppermost valid stratum
Number_of_Strata	Number	Double	Real	Number of valid strata
Total_Cover	Number	Double	Real	Total percent canopy cover, accounting for overlap, of trees in the stand
Structure_Class	Text	Text	Char(4)	Stand structural class: 0 = bare ground, 1 = stand initiation, 2 = stem exclusion, 3 = understory reinitiation, 4 = young forest multistrata, 5 = old forest single stratum, 6 = old forest multistrata

2.2 Fire and Fuels Extension Tables

2.2.1 FVS_Potfire

FVS_Potfire contains the information similar to the FFE Potential Fire Report that is generated using the FVS Fire Model keyword POTFIRE (table 2.2.1). The data for each time step is output during the simulation of a case. More information on this report can be found in Section 2.5.7 Output within the FFE Guide.

Table 2.2.1 – The Potential Fire FVS_PotFire table.

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier that corresponds to the FVS_Cases table
StandID	Text	Text	Char(26)	Stand identification
Year	Integer	Integer	Integer	Year of the projection
Surf_Flame_Sev	Number	Double	Real	Surface Flame Length (ft), severe fire
Surf_Flame_Mod	Number	Double	Real	Surface Flame Length (ft), moderate fire
Tot_Flame_Sev	Number	Double	Real	Total Flame Length (ft), severe fire
Tot_Flame_Mod	Number	Double	Real	Total Flame Length (ft), moderate fire
Fire_Type_Sev	Text	Text	Char(8)	The Severe Fire Type
Fire_Type_Mod	Text	Text	Char(8)	The Moderate Fire Type
PTorch_Sev	Number	Double	Real	Probability of torching, severe fire
PTorch_Mod	Number	Double	Real	Probability of torching, moderate fire
Torch_Index	Number	Double	Real	The 20-ft wind speed (miles/hour) required to cause a torching of trees
Crown_Index	Number	Double	Real	The 20-ft wind speed (miles/hour) required to cause an active crown fire
Canopy_Ht	Number	Double	Real	Height of the base of canopy (ft)
Canopy_Density	Number	Double	Real	Bulk density of canopy (kg/m^3)
Mortality_BA_Sev	Number	Double	Real	Percent of the basal area that would be killed in severe fire conditions
Mortality_BA_Mod	Number	Double	Real	Percent of the basal area that would be killed in moderate fire conditions
Mortality_VOL_Sev	Number	Double	Real	Total volume that would be killed under severe fire conditions (ft^3)
Mortality_VOL_Mod	Number	Double	Real	Total volume that would be killed under moderate fire conditions (ft^3)
Pot_Smoke_Sev	Number	Double	Real	Potential amount of smoke (tons/acre) in severe fire conditions
Pot_Smoke_Mod	Number	Double	Real	Potential amount of smoke (tons/acre) in moderate fire conditions
Fuel_Mod1	Number	Double	Real	Current fuel model 1
Fuel_Mod2	Number	Double	Real	Current fuel model 2
Fuel_Mod3	Number	Double	Real	Current fuel model 3
Fuel_Mod4	Number	Double	Real	Current fuel model 4
Fuel_Wt1	Number	Double	Real	Percent weighting for corresponding model.
Fuel_Wt2	Number	Double	Real	Percent weighting for corresponding model.
Fuel_Wt3	Number	Double	Real	Percent weighting for corresponding model.
Fuel_Wt4	Number	Double	Real	Percent weighting for corresponding model.

2.2.2 FVS_Potfire_East

FVS_Potfire_East contains the information similar to the FFE Potential Fire Report that is generated using the FVS Fire Model keyword POTFIRE with the SN or CS variant (table 2.2.2). Since the SN variant has a different potential fire report output, there was a need for a separate table. More information on this report can be found in Section 2.5.7 Output within the FFE Guide.

Table 2.2.2 – The Potential Fire FVS_PotFire_East table.

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier that corresponds to the FVS_Cases table
StandID	Text	Text	Char(26)	Stand identification
Year	Integer	Integer	Integer	Year of the projection
Flame_Len_Sev	Number	Double	Real	The Severe Flame Length (ft)
Flame_Len_Mod	Number	Double	Real	The Moderate Flame Length (ft)
Canopy_Ht	Number	Double	Real	Height of the base of canopy (ft)
Canopy_Density	Number	Double	Real	Bulk density of canopy (kg/m^3)
Mortality_BA_Sev	Number	Double	Real	Percent of the basal area that would be killed in severe fire conditions
Mortality_BA_Mod	Number	Double	Real	Percent of the basal area that would be killed in moderate fire conditions
Mortality_VOL_Sev	Number	Double	Real	Total volume that would be killed under severe fire conditions (ft^3)
Mortality_VOL_Mod	Number	Double	Real	Total volume that would be killed under moderate fire conditions (ft^3)
Pot_Smoke_Sev	Number	Double	Real	Potential amount of smoke (tons/acre) in severe fire conditions
Pot_Smoke_Mod	Number	Double	Real	Potential amount of smoke (tons/acre) in moderate fire conditions
Fuel_Mod1_Sev	Number	Double	Real	Current fuel model 1: Severe fire conditions
Fuel_Mod2_Sev	Number	Double	Real	Current fuel model 2: Severe fire conditions
Fuel_Mod3_Sev	Number	Double	Real	Current fuel model 3: Severe fire conditions
Fuel_Mod4_Sev	Number	Double	Real	Current fuel model 4: Severe fire conditions
Fuel_Wt1_Sev	Number	Double	Real	Percent weighting for corresponding model.
Fuel_Wt2_Sev	Number	Double	Real	Percent weighting for corresponding model.
Fuel_Wt3_Sev	Number	Double	Real	Percent weighting for corresponding model.
Fuel_Wt4_Sev	Number	Double	Real	Percent weighting for corresponding model.
Fuel_Mod1_Mod	Number	Double	Real	Current fuel model 1: Moderate conditions
Fuel_Mod2_Mod	Number	Double	Real	Current fuel model 2: Moderate conditions
Fuel_Mod3_Mod	Number	Double	Real	Current fuel model 3: Moderate conditions
Fuel_Mod4_Mod	Number	Double	Real	Current fuel model 4: Moderate conditions
Fuel_Wt1_Mod	Number	Double	Real	Percent weighting for corresponding model.
Fuel_Wt2_Mod	Number	Double	Real	Percent weighting for corresponding model.
Fuel_Wt3_Mod	Number	Double	Real	Percent weighting for corresponding model.
Fuel_Wt4_Mod	Number	Double	Real	Percent weighting for corresponding model.

2.2.3 FVS_CanProfile

FVS_CanProfile contains canopy fuels profile information that is used to determine the canopy base height and canopy bulk density (table 2.2.3). Specifically, output is the available canopy fuel (kg/m^3 or lbs/acre/ft) at various heights above the ground (feet or meters). As described in the FFE Guide, available canopy fuel is foliage and small branchwood (half of the 0-0.25 inch branchwood). Generally, it only includes conifer trees above 6 ft tall, but this assumption can be changed with the FFE keyword CanCalc. ***The FVS_CanProfile table is created thru the use of the FFE keyword CanFProf (rather than a DBS keyword). See the FFE Guide for additional information about this keyword.*

Table 2.2.3 – The content of the FVS_CanProfile table.

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier that corresponds to the FVS_Cases table
StandID	Text	Text	Char(26)	Stand identification
Year	Integer	Integer	Integer	Year of the projection
Height_m	Number	Double	Real	Height above the ground in meters
Canopy_Fuel_kg_m3	Number	Double	Real	Available canopy fuel in kg/m^3 at the specified height.
Height_ft	Number	Double	Real	Height above the ground in feet
Canopy_Fuel_lbs_acre_ft	Number	Double	Real	Available canopy fuel in lbs/acre/ft at the specified height.

2.2.4 FVS_Fuels

FVS_Fuels contains the output information that is identical to the data output of the FFE All Fuels Report (table 2.2.4). The data for each time step is output during the simulation of a case. More information on this report can be found in Section 2.4.10 Output within the FFE Guide.

Table 2.2.4 – The All Fuels FVS_Fuels table.

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier that corresponds to the FVS_Cases table
StandID	Text	Text	Char(26)	Stand identification
Year	Integer	Integer	Integer	Year of the projection
Surface_Litter	Number	Double	Real	Ground litter (tons/acre)
Surface_Duff	Number	Double	Real	Surface duff (tons/acre)
Surface_lt3	Number	Double	Real	Dead fuel less than 3 inches (tons/acre)
Surface_ge3	Number	Double	Real	Dead fuel greater than or equal to 3 inches (tons/acre)
Surface_3to6	Number	Double	Real	Dead fuel between 3 and 6 inches (tons/acre)
Surface_6to12	Number	Double	Real	Dead fuel between 6 and 12 inches (tons/acre)
Surface_ge12	Number	Double	Real	Dead fuel greater than or equal to 12 inches (tons/acre)
Surface_Herb	Number	Double	Real	Live Herbs (tons/acre)
Surface_Shrub	Number	Double	Real	Live Shrubs (tons/acre)
Surface_Total	Number	Double	Real	Sum of all surface fuels (both dead and

Column Name	Data Type			Description
	Excel	Access	SQL	
				live) (tons/acre)
Standing_Snag_lt3	Number	Double	Real	Dead standing wood less than 3 inches (tons/acre)
Standing_Snag_ge3	Number	Double	Real	Dead standing wood greater than or equal to 3 inches (tons/acre)
Standing_Foliage	Number	Double	Real	Standing Foliage (tons/acre)
Standing_Live_lt3	Number	Double	Real	Live standing wood less than 3 inches (tons/acre)
Standing_Live_ge3	Number	Double	Real	Live standing wood greater than or equal to 3 inches (tons/acre)
Standing_Total	Number	Double	Real	Total standing wood (dead and live) (tons/acre)
Total_Biomass	Int	Int	Int	Total amount of all standing wood and surface fuels (tons/acre)
Total_Consumed	Int	Int	Int	Total amount of fuel (not including live trees) that was consumed in fire
Biomass_Removed	Int	Int	Int	Amount of wood that was harvested (dead or live) (tons/acre)

2.2.5 FVS_BurnReport

FVS_BurnReport contains information similar to the FFE Burn Conditions Report (table 2.2.5). More information on this report can be found in Section 2.5.7 Output within the FFE Guide.

Table 2.2.5 – The FVS_BurnReport table.

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier that corresponds to the FVS_Cases table
StandID	Text	Text	Char(26)	Stand identification
Year	Integer	Integer	Integer	Year of the burn
One_Hr_Moisture	Number	Double	Real	Moisture of 0 – 0.25” fuels (%)
Ten_Hr_Moisture	Number	Double	Real	Moisture of 0.25 – 1” fuels (%)
Hundred_Hr_Moisture	Number	Double	Real	Moisture of 1 – 3” fuels (%)
Thousand_Hr_Moisture	Number	Double	Real	Moisture of 3”+ fuels (%)
Duff_Moisture	Number	Double	Real	Duff moisture (%)
Live_Woody_Moisture	Number	Double	Real	Live woody fuel moisture (%)
Live_Herb_Moisture	Number	Double	Real	Live herbaceous fuel moisture (%)
Midflame_Wind	Number	Double	Real	Midflame wind speed (mi/hr)
Slope	Number	Double	Real	Stand slope (%)
Flame_length	Number	Double	Real	Total flame length (ft)
Scorch_height	Number	Double	Real	Scorch height (ft)
Fire_Type	Text	Text	Char(8)	The type of fire
FuelModl1	Number	Double	Real	Fuel model 1
Weight1	Number	Double	Real	Weight given to fuel model 1 (%)
FuelModl2	Number	Double	Real	Fuel model 2
Weight2	Number	Double	Real	Weight given to fuel model 2 (%)
FuelModl3	Number	Double	Real	Fuel model 3
Weight3	Number	Double	Real	Weight given to fuel model 3 (%)
FuelModl4	Number	Double	Real	Fuel model 4
Weight4	Number	Double	Real	Weight given to fuel model 4 (%)

2.2.6 FVS_Consumption

FVS_Consumption contains information similar to the FFE Fuel Consumption Report (table 2.2.6). More information on this report can be found in Section 2.5.7 Output within the FFE Guide.

Table 2.2.6 – The FVS_Consumption table.

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier that corresponds to the FVS_Cases table
StandID	Text	Text	Char(26)	Stand identification
Year	Integer	Integer	Integer	Year of the fire
Min_Soil_Exp	Number	Double	Real	Mineral Soil Exposure (%)
Litter_Consumption	Number	Double	Real	Consumed litter (tons/acre)
Duff_Consumption	Number	Double	Real	Consumed duff (tons/acre)
Consumption_lt3	Number	Double	Real	Consumed dead fuel less than 3 inches (tons/acre)
Consumption _ge3	Number	Double	Real	Consumed dead fuel greater than or equal to 3 inches (tons/acre)
Consumption _3to6	Number	Double	Real	Consumed dead fuel between 3 and 6 inches (tons/acre)
Consumption _6to12	Number	Double	Real	Consumed dead fuel between 6 and 12 inches (tons/acre)
Consumption _ge12	Number	Double	Real	Consumed dead fuel greater than or equal to 12 inches (tons/acre)
Consumption_Herb_Shrub	Number	Double	Real	Consumed Herbs and Shrubs (tons/acre)
Consumption _Crowns	Number	Double	Real	Consumed crown material (tons/acre)
Total_Consumption	Number	Double	Real	Consumption of all surface fuels (both dead and live) (tons/acre)
Percent_Consumption_Duff	Number	Double	Real	Consumption of duff (%)
Percent_Consumption_ge3	Number	Double	Real	Consumption of dead fuel greater than or equal to 3 inches (%)
Percent_Trees_Crowning	Number	Double	Real	Percentage of trees with crowning (%)
Smoke_Production_25	Number	Double	Real	Smoke Produced < 2.5 microns (tons/acre)
Smoke_Production_10	Number	Double	Real	Smoke Produced < 10 microns (tons/acre)

2.2.7 FVS_Mortality

FVS_Mortality contains information similar to the FFE Mortality Report (table 2.2.7). More information on this report can be found in Section 2.5.7 Output within the FFE Guide.

Table 2.2.7 – The FVS_Mortality table.

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier that corresponds to the FVS_Cases table
StandID	Text	Text	Char(26)	Stand identification
Year	Integer	Integer	Integer	Year of the fire
Species	Text	Text	Char(3)	Species
Killed_class1	Number	Double	Real	Trees per acre killed in diameter class 1*
Total_class1	Number	Double	Real	Trees per acre in diameter class 1 before fire
Killed_class2	Number	Double	Real	Trees per acre killed in diameter class 2
Total_class2	Number	Double	Real	Trees per acre in diameter class 2 before fire
Killed_class3	Number	Double	Real	Trees per acre killed in diameter class 3
Total_class3	Number	Double	Real	Trees per acre in diameter class 3 before fire
Killed_class4	Number	Double	Real	Trees per acre killed in diameter class 4
Total_class4	Number	Double	Real	Trees per acre in diameter class 4 before fire
Killed_class5	Number	Double	Real	Trees per acre killed in diameter class 5
Total_class5	Number	Double	Real	Trees per acre in diameter class 5 before fire
Killed_class6	Number	Double	Real	Trees per acre killed in diameter class 6
Total_class6	Number	Double	Real	Trees per acre in diameter class 6 before fire
Killed_class7	Number	Double	Real	Trees per acre killed in diameter class 7
Total_class7	Number	Double	Real	Trees per acre in diameter class 7 before fire
Bakill	Number	Double	Real	Basal area of killed trees (ft2/acre)
Volkill	Number	Double	Real	Volume of killed trees (cuft/acre) (This is total cuft volume in western variants and merchantable cuft volume in eastern variants.)

*The diameter classes can be changed with the FFE MORTCLAS keyword and are the following by default:
Diameter class 1: 0 – 5”
Diameter class 2: 5 – 10”
Diameter class 3: 10 – 20”
Diameter class 4: 20 – 30”
Diameter class 5: 30 – 40”
Diameter class 6: 40 – 50”
Diameter class 7: > 50”

2.2.8 FVS_SnagSum

FVS_SnagSum contains information similar to the FFE Snag Summary Report (table 2.2.8). More information on this report can be found in Section 2.3.8 Output within the FFE Guide.

Table 2.2.8 – The FVS_SnagSum table.

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier that corresponds to the FVS_Cases table
StandID	Text	Text	Char(26)	Stand identification
Year	Integer	Integer	Integer	Year of the projection
Hard_snags_class1	Number	Double	Real	Hard snags in size class 1
Hard_snags_class2	Number	Double	Real	Hard snags in size class 2
Hard_snags_class3	Number	Double	Real	Hard snags in size class 3
Hard_snags_class4	Number	Double	Real	Hard snags in size class 4
Hard_snags_class5	Number	Double	Real	Hard snags in size class 5
Hard_snags_class6	Number	Double	Real	Hard snags in size class 6
Hard_snags_total	Number	Double	Real	Hard snags total (>0”)
Soft_snags_class1	Number	Double	Real	Soft snags in size class 1
Soft_snags_class2	Number	Double	Real	Soft snags in size class 2
Soft_snags_class3	Number	Double	Real	Soft snags in size class 3
Soft_snags_class4	Number	Double	Real	Soft snags in size class 4
Soft_snags_class5	Number	Double	Real	Soft snags in size class 5
Soft_snags_class6	Number	Double	Real	Soft snags in size class 6
Soft_snags_total	Number	Double	Real	Soft snags total (>0”)
Hard_soft_snags_total	Number	Double	Real	Hard and soft snags total (>0”)

[1] The size classes can be changed with the FFE SNAGCLAS keyword and are the following by default:
Size class 1: >= 0”
Size class 2: >= 12”
Size class 3: >=18”
Size class 4: >=24”
Size class 5: >=30”
Size class 6: >=36”

2.2.9 FVS_SnagDet

FVS_SnagDet contains information similar to the FFE Detailed Snag Report (table 2.2.9). More information on this report can be found in Section 2.3.8 Output within the FFE Guide.

Table 2.2.9 – The FVS_SnagDet table.

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier that corresponds to the FVS_Cases table
StandID	Text	Text	Char(26)	Stand identification
Year	Integer	Integer	Integer	Year of the projection
Species	Text	Text	Char(3)	Species
DBH_Class	Integer	Integer	Integer	Diameter class (uses the same diameter break points as the FVS_SnagSum table as determined by the FFE SnagClas keyword)
Death_DBH	Number	Double	Real	Average dbh (inches) at time of death
Current_Ht_Hard	Number	Double	Real	Average height of hard snags
Current_Ht_Soft	Number	Double	Real	Average height of soft snags
Current_Vol_Hard	Number	Double	Real	Cuft volume of hard snags*
Current_Vol_Soft	Number	Double	Real	Cuft volume of soft snags
Total_Volume	Number	Double	Real	Total volume
Year_Died	Integer	Integer	Integer	Year the snags died
Density_Hard	Number	Double	Real	Density of hard snags (snags/acre)
Density_Soft	Number	Double	Real	Density of soft snags (snags/acre)
Density_Total	Number	Double	Real	Total density (snags/acre)

*The volume estimates in this table are for the entire snag record, not per snag. Also, the volume estimates are total cuft/acre in western variants but merchantable cuft/acre in eastern variants.

2.2.10 FVS_Carbon

FVS_Carbon contains output information identical to the main Carbon report produced by the FFE extension: reporting above- and below-ground live and dead stand carbon pools. Output may be expressed using imperial (tons/acre, the default), metric (metric tons/hectare) or combined (metric tons/acre) units, depending on the FFE CarbCalc keyword. (table 2.2.10). More information on this report can be found in Section 2.6.2 Output within the FFE Guide.

Table 2.2.10 – The content of the FVS_Carbon table. [1]

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier that corresponds to the FVS_Cases table
StandID	Text	Text	Char(26)	Stand identification
Year	Integer	Integer	Integer	Year of the projection
Aboveground_Total_Live	Number	Double	Real	Aboveground live C (tons/ac)
Aboveground_Merch_Live	Number	Double	Real	Aboveground merchantable C (tons/ac)
Belowground_Live	Number	Double	Real	Belowground live C(tons/ac)
BelowGround_Dead	Number	Double	Real	Belowground dead C (tons/ac)
Standing_Dead	Number	Double	Real	Standing dead C (snags) (tons/ac)
Forest_Down_Dead_Wood	Number	Double	Real	Woody debris C (tons/ac)
Forest_Floor	Number	Double	Real	Forest floor C (tons/ac)
Forest_Shrub_Herb	Number	Double	Real	Shrub & herb C (tons/ac)
Total_Stand_Carbon	Number	Double	Real	Total stand C (tons/ac)
Total_Removed_Carbon	Number	Double	Real	Total removed C (tons/ac)
Carbon_Released_From_Fire	Number	Double	Real	C in fuel consumed by fire (tons/ac)

[1] Measurement units may be imperial (tons/acre, default), metric (metric tons/hectare), or combined (metric tons/acre), depending on FFE CarbCalc keyword.

2.2.11 FVS_Hrv_Carbon

FVS_Hrv_Carbon contains output information identical to the Harvested Carbon report produced by the FFE extension: reporting the fate of carbon that is harvested. Output may be expressed using imperial (tons/acre, the default), metric (metric tons/hectare) or combined (metric tons/acre) units, depending on the FFE CarbCalc keyword (table 2.2.11). More information on this report can be found in Section 2.6.2 Output within the FFE Guide.

Table 2.2.11 – The content of the FVS_Hrv_Carbon table. [1]

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier that corresponds to the FVS_Cases table
StandID	Text	Text	Char(26)	Stand identification
Year	Integer	Integer	Integer	Year of the projection
Products	Number	Double	Real	Wood Products C (tons/ac)
Landfill	Number	Double	Real	Landfill C (tons/ac)
Energy	Number	Double	Real	Energy C (tons/ac)
Emissions	Number	Double	Real	Emitted C (tons/ac)
Merch_Carbon_Stored	Number	Double	Real	Stored C (tons/ac)
Merch_Carbon_Removed	Number	Double	Real	Removed C (tons/ac)

[1] Measurement units may be imperial (tons/acre, default), metric (metric tons/hectare), or combined (metric tons/acre), depending on FFE CarbCalc keyword.

2.2.12 FVS_Down_Wood_Cov

FVS_Down_Wood_Cov contains information similar to the FFE Down Woody Debris Cover Report (table 2.2.12). More information on this report can be found in Section 2.4.10 Output within the FFE Guide.

Table 2.2.12 – The FVS_Down_Wood_Cov table.

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier that corresponds to the FVS_Cases table
StandID	Text	Text	Char(26)	Stand identification
Year	Integer	Integer	Integer	Year of the projection
DWD_Cover_3to6_Hard	Number	Double	Real	Cover of 3 – 6” hard down wood (%)
DWD_Cover_6to12_Hard	Number	Double	Real	Cover of 6 – 12” hard down wood (%)
DWD_Cover_12to20_Hard	Number	Double	Real	Cover of 12 – 20” hard down wood (%)
DWD_Cover_20to35_Hard	Number	Double	Real	Cover of 20 – 35” hard down wood (%)
DWD_Cover_35to50_Hard	Number	Double	Real	Cover of 35 – 50” hard down wood (%)
DWD_Cover_ge_50_Hard	Number	Double	Real	Cover of 50”+ hard down wood (%)
DWD_Cover_Total_Hard	Number	Double	Real	Total cover of hard down wood (%)
DWD_Cover_3to6_Soft	Number	Double	Real	Cover of 3 – 6” soft down wood (%)
DWD_Cover_6to12_Soft	Number	Double	Real	Cover of 6 – 12” soft down wood (%)
DWD_Cover_12to20_Soft	Number	Double	Real	Cover of 12 – 20” soft down wood (%)
DWD_Cover_20to35_Soft	Number	Double	Real	Cover of 20 – 35” soft down wood (%)
DWD_Cover_35to50_Soft	Number	Double	Real	Cover of 35 – 50” soft down wood (%)
DWD_Cover_ge_50_Soft	Number	Double	Real	Cover of 50”+ soft down wood (%)
DWD_Cover_Total_Soft	Number	Double	Real	Total cover of soft down wood (%)

2.2.13 FVS_Down_Wood_Vol

FVS_Down_Wood_Vol contains information similar to the FFE Down Wood Debris Volume Report (table 2.2.13). More information on this report can be found in Section 2.4.10 Output within the FFE Guide.

Table 2.2.13 – The FVS_Down_Wood_Vol table.

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier that corresponds to the FVS_Cases table
StandID	Text	Text	Char(26)	Stand identification
Year	Integer	Integer	Integer	Year of the projection
DWD_Volume_0to3_Hard	Number	Double	Real	Volume of 0 – 3” hard down wood (cuft/acre)
DWD_Volume_3to6_Hard	Number	Double	Real	Volume of 3 – 6” hard down wood (cuft/acre)
DWD_Volume_6to12_Hard	Number	Double	Real	Volume of 6 – 12” hard down wood (cuft/acre)
DWD_Volume_12to20_Hard	Number	Double	Real	Volume of 12 – 20” hard down wood (cuft/acre)
DWD_Volume_20to35_Hard	Number	Double	Real	Volume of 20 – 35” hard down wood (cuft/acre)
DWD_Volume_35to50_Hard	Number	Double	Real	Volume of 35 – 50” hard down wood (cuft/acre)
DWD_Volume_ge_50_Hard	Number	Double	Real	Volume of 50”+ hard down wood (cuft/acre)
DWD_Volume_Total_Hard	Number	Double	Real	Total volume of hard down wood (cuft/acre)
DWD_Volume_0to3_Soft	Number	Double	Real	Volume of 0 – 3” soft down wood (cuft/acre)
DWD_Volume_3to6_Soft	Number	Double	Real	Volume of 3 – 6” soft down wood (cuft/acre)
DWD_Volume_6to12_Soft	Number	Double	Real	Volume of 6 – 12” soft down wood (cuft/acre)
DWD_Volume_12to20_Soft	Number	Double	Real	Volume of 12 – 20” soft down wood (cuft/acre)
DWD_Volume_20to35_Soft	Number	Double	Real	Volume of 20 – 35” soft down wood (cuft/acre)
DWD_Volume_35to50_Soft	Number	Double	Real	Volume of 35 – 50” soft down wood (cuft/acre)
DWD_Volume_ge_50_Soft	Number	Double	Real	Volume of 50”+ soft down wood (cuft/acre)
DWD_Volume_Total_Soft	Number	Double	Real	Total volume of soft down wood (cuft/acre)

2.3 Dwarf Mistletoe Impact Model Tables

2.3.1 FVS_DM_Spp_Sum

FVS_DM_Spp_Sum contains the output information that is identical to the data output of the Species-Specific report in the FVS Interim Dwarf Mistletoe Model (table 2.3.1). The data for each time step is output during the simulation of a case. Dwarf mistletoe tables are created at the *beginning* of each time step. In contrast, most other tables are created at the end of each time step. This difference is maintained here for consistency with the existing structure of the mistletoe extension. More information on this report can be found in Section 3.3.2 within the Dwarf Mistletoe Model User's Guide.

Table 2.3.1 – The content of the FVS_DM_Spp_Sum table.

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier that corresponds to the FVS_Cases table
StandID	Text	Text	Char(26)	Stand identification
Year	Integer	Integer	Integer	Year of the projection
Spp	Text	Text	Char(2)	2-character species code
Mean_DMR	Number	Double	Real	Average dwarf mistletoe rating for species
Mean_DMI	Number	Double	Real	Average dwarf mistletoe rating for infected trees for species
Inf_TPA	Integer	Integer	Integer	Trees acre infected for species
Mort_TPA	Integer	Integer	Integer	Trees per acre killed by mistletoe for species
Inf_TPA_Pct	Integer	Integer	Integer	Trees per acre (% of stand) infected for species
Mort_TPA_Pct	Integer	Integer	Integer	Trees per acre (% of stand) killed by mistletoe for species
Stnd_TPA_Pct	Integer	Integer	Integer	Trees per acre (% of stand) for species

2.3.2 FVS_DM_Stnd_Sum

FVS_DM_Stnd_Sum contains the output information that is identical to the data output of the Stand Average report in the FVS Interim Dwarf Mistletoe Model (table 2.3.2). The data for each time step is output during the simulation of a case[1]. More information on this report can be found in Section 3.3.1 within the Dwarf Mistletoe Model User's Guide.

Table 2.3.2 – The content of the FVS_DM_Stnd_Sum table.

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier that corresponds to the FVS_Cases table
StandID	Text	Text	Char(26)	Stand identification
Year	Integer	Integer	Integer	Year of the projection
Age	Integer	Integer	Integer	Stand Age
Stnd_TPA	Integer	Integer	Integer	Stand trees per acre at the start of cycle
Stnd_BA	Integer	Integer	Integer	Stand basal area per acre at the start of cycle
Stnd_Vol	Integer	Integer	Integer	Stand volume per acre at the start of cycle
Inf_TPA	Integer	Integer	Integer	Trees per acre of the total infected by mistletoe
Inf_BA	Integer	Integer	Integer	Basal area infected by mistletoe of the total
Inf_Vol	Integer	Integer	Integer	Volume per acre infected by mistletoe of the total
Mort_TPA	Integer	Integer	Integer	Trees per acre killed by mistletoe

Column Name	Data Type			Description
	Excel	Access	SQL	
Mort_BA	Integer	Integer	Integer	Basal area killed by mistletoe of the total
Mort_Vol	Integer	Integer	Integer	Volume killed by mistletoe of the total
Inf_TPA_Pct	Integer	Integer	Integer	Trees per acre (% of stand) infected by mistletoe
Inf_Vol_Pct	Integer	Integer	Integer	Volume (% of stand) infected by mistletoe
Mort_TPA_Pct	Integer	Integer	Integer	Trees per acre (% of stand) killed by mistletoe
Mort_Vol_Pct	Integer	Integer	Integer	Volume (% of stand) killed by mistletoe
Mean_DMR	Number	Double	Real	Average dwarf mistletoe rating for the stand
Mean_DMI	Number	Double	Real	Average dwarf mistletoe rating of infected trees

2.3.3 FVS_DM_Sz_Sum

FVS_DM_Sz_Sum contains the output information that is identical to the data output of the Diameter Class report in the FVS Interim Dwarf Mistletoe Model (table 2.3.3). The data for each time step is output during the simulation of a case[1]. More information on this report can be found in Section 3.3.3 within the Dwarf Mistletoe Model User's Guide.

Table 2.3.3 – The content of the FVS_DM_Sz_Sum table.

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier that corresponds to the FVS_Cases table
StandID	Text	Text	Char(26)	Stand identification
Year	Integer	Integer	Integer	Year of the projection
Type	Text	Text	Char(3)	"TPA" (trees/acre); "INF" (trees/acre infected); "MRT" (trees/acre killed by mistleteo); "DMR" (average dwarf mistletoe rating); "DMI" (average dwarf mistletoe rating of infected trees)
0-3in	Number	Double	Real	Units vary by type for each diameter class
3-5in	Number	Double	Real	
5-7in	Number	Double	Real	
…	…	…	…	2 inch diameter classes
17-19in	Number	Double	Real	
gt19in	Number	Double	Real	

2.4 Economics Analysis Extension Tables

2.4.1 FVS_EconSummary

FVS_EconSummary contains output identical to the Economics Analysis Extension (ECON) summary measures table (table 2.4.1). More information on this report can be found in Section III within the User Guide to the FVS Economic Extension.

Table 2.4.1 – The content of the FVS_EconSummary table.

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier that corresponds to the FVS_Cases table
Year	Integer	Integer	Integer	Year of the projection
Period	Integer	Integer	Integer	Cycle length
Pretend_Harvest	Text	Text	Char(3)	Pretend or actual harvests, “yes” for pretend.
Undiscounted_cost	Number	Double	Real	Undiscounted cost (accumulation of all costs)
Undiscounted_revenue	Number	Double	Real	Undiscounted revenue (accumulation of all revenues)
Discounted_cost	Number	Double	Real	Discounted cost
Discounted_revenue	Number	Double	Real	Discounted revenue
PNV	Number	Double	Real	Present Net Value
IRR	Number	Double	Real	Internal Rate of Return
BC_Ratio	Number	Double	Real	Benefit-Cost Ratio
RRR	Number	Double	Real	Realizable Rate of Return
SEV	Number	Double	Real	Soil Expectation Value
Value_of_forest	Number	Double	Real	Value of forest
Value_of_trees	Number	Double	Real	Value of trees
Mrch_Cubic_Volume	Integer	Integer	Integer	Harvested Merchantable cubic foot volume (west) and Sawlog cubic foot volume (east)
Mrch_BoardFoot_Volume	Integer	Integer	Integer	Harvested Merchantable board foot volume (west) and Sawlog board foot volume (east)
Discount_Rate	Number	Double	Real	Discount rate
Given_SEV	Number	Double	Real	SEV entered by user

2.4.2 FVS_EconHarvestValue

FVS_EconHarvestValue contains output identical to the Economics Analysis Extension (ECON) harvest volumes and gross values table (table 2.4.2). More information on this report can be found in Section III within the User Guide to the FVS Economic Extension.

Table 2.4.2 – The content of the FVS_EconHarvestValue table.

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier that corresponds to the FVS_Cases table
Year	Integer	Integer	Integer	Year of the projection
Species	Text	Text	Char(8)	Species
Min_DIB	Number	Double	Real	Minimum top diameter inside bark
Max_DIB	Number	Double	Real	Maximum top diameter inside bark
Min_DBH	Number	Double	Real	Minimum diameter at breast height
Max_DBH	Number	Double	Real	Maximum diameter at breast height
TPA_Removed	Integer	Integer	Integer	Trees per acre removed
TPA_Value	Integer	Integer	Integer	Trees per acre value
Tons_Per_Acre	Integer	Integer	Integer	Tons of material
Ft3_Removed	Integer	Integer	Integer	Cubic foot volume removed
Ft3_Value	Integer	Integer	Integer	Cubic foot volume value
Board_Ft_Removed	Integer	Integer	Integer	Board foot volume removed
Board_Ft_Value	Integer	Integer	Integer	Board foot volume value
Total_Value	Integer	Integer	Integer	Total value

2.5 Western Root Disease Model Tables

2.5.1 FVS_RD_SUM

FVS_RD_SUM contains the output information that is identical to the data output of the Summary Statistics for Root Disease Areas (table 2.5.1). The data for each time step is output during the simulation of a case. More information on this report can be found in Section 7.2 within the Western Root Disease Model User's Guide.

Table 2.5.1 – The content of the FVS_RD_Sum table.

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier that corresponds to the FVS_Cases table
StandID	Text	Text	Char(26)	Stand identification
Year	Integer	Integer	Integer	Year of the projection
Age	Integer	Integer	Integer	Stand Age
RD_Type	Text	Text	Char(1)	Root disease type
Num_Centers	Integer	Integer	Integer	Number of disease centers
RD_Area	Number	Double	Real	Diseased area of stand (acres)
Spread_Ft_per_Year	Number	Double	Real	Disease spread rate (ft/year)
Stumps_per_Acre	Number	Double	Real	Number of stumps per acre
Stumps_BA	Number	Double	Real	Basal area of stumps (square feet)
Mort_TPA	Number	Double	Real	Mortality trees per acre
Mort_CuFt	Number	Double	Real	Mortality cubic feet per acre
Unin_TPA	Number	Double	Real	Uninfected trees per acre
Inf_TPA	Number	Double	Real	Infected trees per acre
Ave_Pct_Root_Inf	Number	Double	Real	Average percent root system infected
Live_Merch_CuFt	Number	Double	Real	Live merchantable cubic foot volume
Live_BA	Number	Double	Real	Live basal area
New_Inf_Prp_Ins	Number	Double	Real	New infected proportion of total TPA inside beginning period existing disease centers.
New_Inf_Prp_Exp	Number	Double	Real	New infected proportion of total TPA within expansion area of disease centers.
New_Inf_Prp_Tot	Number	Double	Real	New infected proportion of total TPA within new total disease area (existing + expansion).

2.5.2 FVS_RD_DET

FVS_RD_DET contains the output information that is identical to the data output of the Detailed Output of Stand Attributes Inside Root Disease Patches (table 2.5.2). More information on this report can be found in Section 7.3 within the Western Root Disease Model User's Guide.

Table 2.5.2 – The content of the FVS_RD_DET table.

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier that corresponds to the FVS_Cases table
StandID	Text	Text	Char(26)	Stand identification
Year	Integer	Integer	Integer	Year of the projection
RD_Type	Text	Text	Char(1)	Root disease type
RD_Area	Number	Double	Real	Disease area in acres

Column Name	Data Type			Description
	Excel	Access	SQL	
Species	Text	Text	Char(2)	Tree species
Mort_10Pctile_DBH	Number	Double	Real	Mortality trees 10 percentile DBH inches
Mort_30Pctile_DBH	Number	Double	Real	Mortality trees 30 percentile DBH inches
Mort_50Pctile_DBH	Number	Double	Real	Mortality trees 50 percentile DBH inches
Mort_70Pctile_DBH	Number	Double	Real	Mortality trees 70 percentile DBH inches
Mort_90Pctile_DBH	Number	Double	Real	Mortality trees 90 percentile DBH inches
Mort_100Pctile_DBH	Number	Double	Real	Mortality trees 100 percentile DBH inches
Mort_TPA_Total	Number	Double	Real	Mortality total trees per acre
Live_10Pctile_DBH	Number	Double	Real	Live trees 10 percentile DBH inches
Live_30Pctile_DBH	Number	Double	Real	Live trees 30 percentile DBH inches
Live_50Pctile_DBH	Number	Double	Real	Live trees 50 percentile DBH inches
Live_70Pctile_DBH	Number	Double	Real	Live trees 70 percentile DBH inches
Live_90Pctile_DBH	Number	Double	Real	Live trees 90 percentile DBH inches
Live_100Pctile_DBH	Number	Double	Real	Live trees 100 percentile DBH inches
UnInf_TPA_Total	Number	Double	Real	Live uninfected total trees per acre
Inf_TPA_Total	Number	Double	Real	Live infected total trees per acre
Pct_Roots_Inf	Number	Double	Real	Average percent of root system infected

2.5.3 FVS_RD_Beetle

FVS_RD_Beetle contains the output information that is identical to the data output of the Trees Per Acre Killed by Bark Beetles in Each Time Period (table 2.5.3). More information on this report can be found in Section 7.4 within the Western Root Disease Model User's Guide.

Table 2.5.3 – The content of the FVS_RD_Beetle table.

Column Name	Data Type			Description
	Excel	Access	SQL	
CaseID	Text	Text	Char(36)	Unique FVS case identifier that corresponds to the FVS_Cases table
StandID	Text	Text	Char(26)	Stand identification
Year	Integer	Integer	Integer	Year of the projection
Species	Text	Text	Char(2)	Tree species
In_Inf_0_5_DBH	Number	Double	Real	Disease area infected TPA mortality in 0-5 inch DBH class
In_Inf_5_10_DBH	Number	Double	Real	Disease area infected TPA mortality in 5-10 inch DBH class
In_Inf_10_15_DBH	Number	Double	Real	Disease area infected TPA mortality in 10-15 inch DBH class
In_Inf_15_20_DBH	Number	Double	Real	Disease area infected TPA mortality in 15-20 inch DBH class
In_Inf_20_25_DBH	Number	Double	Real	Disease area infected TPA mortality in 20-25 inch DBH class
In_Inf_25_30_DBH	Number	Double	Real	Disease area infected TPA mortality in 25-30 inch DBH class
In_Inf_30_DBH	Number	Double	Real	Disease area infected TPA mortality in 30+ inch DBH class
In_Inf_Mort	Number	Double	Real	Disease area infected TPA mortality total
In_Inf_Live_before	Number	Double	Real	Disease area infected TPA live before beetle kill
In_UnInf_0_5_DBH	Number	Double	Real	Disease area uninfected TPA mortality in 0-5 inch DBH class
In_UnInf_5_10_DBH	Number	Double	Real	Disease area uninfected TPA mortality in 5-10

				inch DBH class
In_UnInf_10_15_DBH	Number	Double	Real	Disease area uninfected TPA mortality in 10-15 inch DBH class
In_UnInf_15_20_DBH	Number	Double	Real	Disease area uninfected TPA mortality in 15-20 inch DBH class
In_UnInf_20_25_DBH	Number	Double	Real	Disease area uninfected TPA mortality in 20-25 inch DBH class
In_UnInf_25_30_DBH	Number	Double	Real	Disease area uninfected TPA mortality in 25-30 inch DBH class
In_UnInf_30_DBH	Number	Double	Real	Disease area uninfected TPA mortality in 30+ inch DBH class
In_UnInf_Mort	Number	Double	Real	Disease area uninfected TPA mortality total
In_UnInf_Live_Before	Number	Double	Real	Disease area uninfected TPA live before beetle kill
Outside_0_5_DBH	Number	Double	Real	Nondiseased area TPA mortality in 0-5 inch DBH class
Outside_5_10_DBH	Number	Double	Real	Nondiseased area TPA mortality in 5-10 inch DBH class
Outside_10_15_DBH	Number	Double	Real	Nondiseased area TPA mortality in 10-15 inch DBH class
Outside_15_20_DBH	Number	Double	Real	Nondiseased area TPA mortality in 15-20 inch DBH class
Outside_20_25_DBH	Number	Double	Real	Nondiseased area TPA mortality in 20-25 inch DBH class
Outside_25_30_DBH	Number	Double	Real	Nondiseased area TPA mortality in 25-30 inch DBH class
Outside_30_DBH	Number	Double	Real	Nondiseased area TPA mortality in 30+ inch DBH class
Outside_Mort	Number	Double	Real	Nondiseased area TPA mortality total
Outside_Live_Before	Number	Double	Real	Nondiseased area TPA live before beetle kill
Stand_Mort_Total	Number	Double	Real	Mortality TPA for total stand area

3.0 INPUT DATA TABLE STRUCTURE

DB-FVS supports the initializations of stand and tree information in FVS. The STANDSQL or TREESQL keywords are used along with an SQL query on pre-existing databases. The keywords are detailed in section 4.3. *When building a keyword file with Suppose and linking to an Access input database, these keywords should be included within the FVSKeywords column of the FVS_GroupAddFilesAndKeywords table and automatically inserted when a stand or plot is added to the simulation.*

DB-FVS input tables must generally conform to the definitions listed in tables 3.0.1 and 3.0.2. The formats presented in tables 3.0.1 and 3.0.2 have some flexibility and all fields are not required (as specified below). More detailed descriptions input data requirements can be found in Sections 3.3 and 4.2 of the Essential FVS Guide. The following Table 3.0.1 shows a standard input database format option for the FVS input FVS_StandInit and FVS_PlotInit tables.

Table 3.0.1 – The predefined table structure (FVS_StandInit and FVS_PlotInit tables) used for initializing stand/plot information when using the STANDSQL keyword.

Column Name	Data type	Description
Stand_CN	Char(40)	Stand control number. Not read by FVS when previously set, but may be used for querying purposes. (Not included in the Blank_Database).
Stand_ID *Required*	Integer or Char(26)	Stand identification code. Required by Suppose 2.0+ when processing stand lists from the stand initiation table. Not read by FVS when previously set, but may be used for querying purposes.
StandPlot_CN	Char(40)	Plot control number. Not read by FVS, but may be used for querying purposes. This variable is usually included when processing plots as stands in Suppose. (Not included in the FVS_StandInit table or the Blank_Database).
Plot_ID	Double	Plot ID: Used to compute the StandPlot_ID in the FVS_PlotInit table. Not read by FVS, but may be used for querying purposes.
StandPlot_ID *Required when plots run as stands*	Integer or Char(26)	Plot identification code. Required by Suppose 2.0+ when populating stand lists from the plot initiation table. (Not included in the FVS_StandInit table).
Variant *Required*	Char*	The two character variant identification code. Required by Suppose 2.0+ when populating stand lists. May contain more than one variant separated by a space, by default the first variant listed is selected by Suppose.
Inv_Year *Required*	Integer	The stand's inventory year corresponding to IY(1) in FVS. Required by Suppose 2.0+ when populating stand lists.
Groups	Char*	A list of Grouping codes separated by spaces, tabs, carriage returns, or newlines. Used by Suppose 2.0+ when populating stand lists. NOTE- The "All_Stands" or "All_Plots" grouping codes are used for linking the FVS_StandInit and FVS_PlotInit tables with the FVS_GroupAddFilesAndKeywords table and should not be deleted.
AddFiles	Char*	A list of Addfile names (.kcp) separated by tabs, carriage returns, or newlines that will be inserted into the simulation file as one or more components by Suppose 2.0+.
FVSKeywords	Char*	A list of FVS keywords separated by carriage returns or newlines. Keywords must be formatted using FVS formatting rules. Added to simulations by Suppose 2.0+.
Latitude	Double	Latitude in degrees of the stand's location
Longitude	Double	Longitude in degrees of the stand's location

Column Name	Data type	Description
Region	Integer	USDA-FS Region code
Forest	Integer	USDA-FS National Forest code
District	Integer	USDA-FS District code
Compartment	Integer	USDA-FS Compartment code
Location *Recommended – can be entered as Region/Forest*	Integer	Location Code representing the nearest Region/Forest/District/Compartment codes and corresponds to KODFOR in FVS. When specified, Location takes precedence over Region, Forest, District, and Compartment. Refer to the Variant Overview for valid codes
Ecoregion	Char(6)	Bailey's Ecoregion code, used in the Southern variant
PV_Code or Habitat	Integer or Char(10)	PV_Code identifies the potential vegetation. It is often the Habitat type or Plant association code. The two names shown are synonymous. Refer to the Variant Overview for valid codes
PV_Ref_Code	Integer	Potential vegetation reference code for the PV_Code
Age	Integer	Stand age in years
Aspect *Recommended*	Double	Aspect in degrees
Slope *Recommended*	Double	Slope in percent
Elevation	Double	Stand elevation represented in 100's of feet for all variants except AK were it is elevation in 10's of feet.
ElevFt *Recommended*	Double	Elevation in feet. When specified, ElevFt takes precedence over Elevation.
Basal_Area_Factor *Required***	Double	Basal area factor corresponding to BAF in FVS. A positive value is interpreted as a basal area factor and a negative value is interpreted as the inverse of a large-tree fixed area plot.
Inv_Plot_Size *Required***	Double	The inverse of the small-tree fixed area plot
Brk_DBH *Required***	Double	Breakpoint DBH in inches between large and small tree plots
Num_Plots *Recommended*	Integer	Number of plots in stand. If blank or 0 (zero), the number of plots in the stand is determined by counting the numbers of unique plot identification codes on the tree record data.
NonStk_Plots	Integer	Number of non-stockable plots in the stand. If blank, count nonstockable plots on tree records (value class = 8).
Sam_Wt	Double	Sampling Weight used to compute the average yield tables and other weighted averages (Often represents the stand size in acres)
Stk_Pcnt	Double	Stockable percent. A value entered in this field will override the calculation based on number of plots stockable versus total number of plots.
DG_Trans	Integer	Diameter growth translation code (0=inside-bark previous growth diameter increment, 1=diameter measurement at beginning of growth period, 2=inside-bark subsequent growth diameter increment, 3=diameter measurement at the end of growth period)
DG_Measure	Integer	Diameter growth measurement period in years
HTG_Trans	Integer	Height growth translation code (0= previous growth height increment, 1=height measurement at beginning of growth period, 2= subsequent growth height increment, 3=height measurement at the end of growth period)
HTG_Measure	Integer	Height growth measurement period
Mort_Measure	Integer	Mortality measurement period
Max_BA	Double	Maximum basal area
Max_SDI	Double	Maximum stand density index
Site_Species	Integer or Char(8)	Site species code

Column Name	Data type	Description
Site_Index	Double	Site index for the sites species (Refer to Variant Overview for base age assumed by FVS for the species used).
Model_Type	Integer	Model type code (may be used in CR variant)
Physio_Region	Integer	Physiographic region code
Forest_Type	Integer	FIA Forest type code
State	Integer	FIA state code
County	Integer	FIA county code
Fuel_Model	Integer	Fire behavior fuel model (when specified, this assignment overrides other fuel model assignment logic used within FFE and is in effect for the length of the simulation or until a new model or assignment logic is specified by an FFE keyword)
Fuel_0_25_H or Fuel_0_25	Double	Initial tons per acre of 0 to 0.25 inch hard/sound fuel
Fuel_25_1_H or Fuel_25_1	Double	Initial tons per acre of 0.25 to 1 inch hard/sound fuel
Fuel_0_1	Double	Initial tons per acre of 0 to 1 inch hard/sound fuel, if not using previous two fields
Fuel_1_3_H or Fuel_1_3	Double	Initial tons per acre of 1 to 3 inch hard/sound fuel
Fuel_3_6_H or Fuel_3_6	Double	Initial tons per acre of 3 to 6 inch hard/sound fuel
Fuel_6_12_H or Fuel_6_12	Double	Initial tons per acre of 6 to 12 inch hard/sound fuel
Fuel_12_20_H or Fuel_12_20 or Fuel_gt_12	Double	Initial tons per acre of 12 to 20 inch hard/sound fuel or initial tons per acre of greater than 12 inch hard/sound fuel.
Fuel_20_35_H or Fuel_20_35	Double	Initial tons per acre of 20 to 35 inch hard/sound fuel
Fuel_35_50_H or Fuel_35_50	Double	Initial tons per acre of 35 to 50 inch hard/sound fuel
Fuel_gt_50_H or Fuel_gt_50	Double	Initial tons per acre of greater than 50 inch hard/sound fuel
Fuel_0_25_S	Double	Initial tons per acre of 0 to 0.25 inch soft/rotten fuel
Fuel_25_1_S	Double	Initial tons per acre of 0.25 to 1 inch soft/rotten fuel
Fuel_1_3_S	Double	Initial tons per acre of 1 to 3 inch soft/rotten fuel
Fuel_3_6_S	Double	Initial tons per acre of 3 to 6 inch soft/rotten fuel
Fuel_6_12_S	Double	Initial tons per acre of 6 to 12 inch soft/rotten fuel
Fuel_12_20_S	Double	Initial tons per acre of 12 to 20 inch soft/rotten fuel
Fuel_20_35_S	Double	Initial tons per acre of 20 to 35 inch soft/rotten fuel
Fuel_35_50_S	Double	Initial tons per acre of 35 to 50 inch soft/rotten fuel
Fuel_gt_50_S	Double	Initial tons per acre of greater than 50 inch soft/rotten fuel
Fuel_Litter	Double	Initial tons per acre of litter
Fuel_Duff	Double	Initial tons per acre of duff
Photo_Ref	Integer	Photo series reference number (1 – 32, see FFE guide)
Photo_Code	Char(13)	Photo code (appropriate character strings depend on the photo series reference number, see FFE guide)

*can be character of any length or text/memo in MS Access

**if left blank the variant specific default will be assigned. Refer to the Variant Overview – Quick Guide to Default Settings section for the default value used.

Table 3.0.2 – The predefined table structure (FVS_TreeInit table) used for initializing tree information when using the TREESQL keyword. More detailed information on sample tree data descriptions can be found in Section 4.2 of the Essential FVS Guide.

Column Name	Data type*	Description
Stand_CN	Char(40)	Links to Stand_CN in Table 3.0.1. Not read by FVS, but may be used for querying purposes. (Not included in the Blank_Database).
Stand_ID *Required*	Integer or Char(26)	Links to Stand_ID in Table 3.0.1. Required by Suppose 2.0+. Not read by FVS when previously set, but may be used for querying purposes.
StandPlot_CN	Char(40)	Links to StandPlot_CN within FVS_PlotInit table, described in Table 3.0.1. Not read by FVS, but may be used for querying purposes. (Not included in the Blank_Database).
StandPlot_ID *Required to run plots as stands*	Integer or Char(26)	Links to StandPlot_ID within FVS_PlotInit table, described in Table 3.0.1. Not read by FVS, but may be used for querying purposes.
Plot_ID *Recommended*	Double	Plot Identification. Should be unique for an individual stand but can be repeated for plots in different stands.
Tree_ID	Double	Tree Identification Code. Should be unique to each plot but can be repeated for trees in different plots.
Tree_Count *Recommended*	Double	The number of trees represented by the tree record. If left blank, FVS assumes the tree record represents a single sample tree.
History	Double	History Code 0-5 are live trees, 6 and 7 died during mortality observation, 8 and 9 died before mortality observation period. Tree records coded as 8 or 9 are included in the inventory list of trees but are not included in stand densities during calibration. Dead tree records are maintained through time only by the Fire and Fuels Extension (FFE).
Species *Required*	Char(8)	Tree Species Code, can be the FVS alpha code, FIA code or USDA plant symbol. Refer to the Variant Overview for species and codes recognized.
DBH or Diameter *Required*	Double	Diameter at Breast Height in inches. Diameter is an alias for DBH in this version. Trees smaller than 4.5 feet in height should be assigned a small, but nonzero, diameter (for example, an estimated bud width or 0.1 inch). Trees with blank or zero values are ignored. Some species may use diameter at root collar diameter (DRC). Refer to the Growth Relationships section of the Variant Overview for these species.
DG	Double	Diameter Growth in inches (not tenths of inches). Used for large tree diameter growth calibration when minimum number of sample trees are included for the species.
Ht *Recommended*	Double	Total height in feet
HtG	Double	Height Growth in feet. May be used for small tree height growth calibration.
HtTopK	Double	Height to top kill is the height to the point of the tree of top kill in feet. Only used if a damage code of 96 or 97 is specified in an appropriate field.
CrRatio *Recommended*	Double	Values 1-9 are read as a crown ratio code (refer to section 4.2.1 of the *Essential FVS Guide*). Values of 10-99 are interpreted as percent live crown.
Damage1	Double	Damage Code 1, refer to section 4.2.1 and Appendix A of the *Essential FVS Guide* for details on suitable damage and severity codes
Severity1	Double	Severity Code corresponding to damage code 1
Damage2	Double	Second damage code.
Severity2	Double	Second severity code.
Damage3	Double	Third damage code.
Severity3	Double	Third severity code.
TreeValue	Double	Tree Value Class Code: 1 for desirable, 2 for acceptable, 8 for non-

		stockable and any other number is interpreted as a live cull
Prescription	Double	Prescription code used only with THINPRSC keyword in FVS. Values less than or equal to 1 represent a leave tree. Values of 2 and greater may represent trees marked for removal
Age	Double	Age of the tree record.
Slope	Integer	Slope Percentage on the plot where the tree was located
Aspect	Integer	Aspect in degrees on the plot where the tree was located
PV_Code or Habitat	Integer or Char(10)	The potential vegetation code on the plot where the tree was located (see notes in table 3.0.1 for the stand).
TopoCode	Double	Topography Code 1=bottom, 2=lower, 3=mid slope, 4=upper slope, and 5=ridge top, on the plot where the tree was located
SitePrep	Double	Site Preparation code 1=none, 2=mechanical, 3=burn, and 4=road cuts/road fills/stockable road beds, on the plot where the tree was located

3.1 Automatic Column Matching and Extra Variables

The names used in the input table are matched to internal FVS variables. Not all columns need to exist (See the column names to determine if required or recommended), the names are not case-sensitive and the order is not important. In addition, you may have data columns in your input database that are not recognized or used by FVS. Extra columns may be included for reference purposes and are ignored.

The following Tables 3.1.1 and 3.1.2 list examples of additional variables which may be included for reference, but ignored by FVS, within the FVS_StandInit, FVS_PlotInit tables, and FVS_TreeInit tables.

Table 3.1.1 – Examples of additional variables that may be included within FVS_StandInit and FVS_PlotInit Tables. These variables are not included within the FVS Blank_Database and are not currently recognized or used by FVS.

Column Name	Data type	Description
Gis_Link	Char(26)	An identifier to link a USFS FSVeg setting to a GIS coverage
Project_Name	Char(25)	Defined by the organization. Project names or identifiers should be consistent when applied to multiple settings. This column is used to retrieve information for all plots installed under the same project or to list a particular survey type
Datum	Char(50)	The reference system used for geodetic control, within which latitude and longitude are defined
Site_Index_Reference_Code	Char(3)	Site Index reference identifier
Site_Index_Base_Age	Double	The reference age on which site index is based

Table 3.1.2 – Examples of additional variables which may be included in the FVS_TreeInit table. These variables are not included within the FVS Blank_Database and are not currently recognized or used by FVS.

Column Name	Data type	Description
Tree_CN	Char(34)	Foreign key to the tree record in Nrv_tree_measurements table of FSVeg (USFS only) formatted data
Tag_Id	Char(5)	Represents unique identifier attached to a tree or assigned to a tree record
Site_Tree_Flag	Double	Flag to indicate if a tree was recorded as a site tree

<table>
<tr><th>Column Name</th><th>Data type</th><th>Description</th></tr>
<tr><td>Diameter_Ht</td><td>Double</td><td>Height (feet) above the ground where the diameter was measured. 4.5 implies a DBH (diameter at breast height) measurement. 0 implies a DRC (diameter at root collar) measurement.</td></tr>
<tr><td>Ht_To_Live_Crown</td><td>Char(40)</td><td>Vertical distance (in feet) from the ground to the base of the live crown (Curtis 1983). Sometimes called height to crown.</td></tr>
<tr><td>Crclass</td><td>Char(2)</td><td>Relative position of the tree with respect to other trees or competing vegetation. Crown class for each tree is judged in the context of its immediate environment; that is, those trees which are competing for sunlight with the subject tree. This is a useful descriptor of the competitive status of trees in all structural types of stands, although crown classes were originally conceived to classify trees in even-aged or storied stands. Following is a table of codes from USFS Common Stand Exams (CSE)
<table>
<tr><th>Code</th><th>Description</th><th>Use</th></tr>
<tr><td>OP</td><td>Open grown, crown receives optimal sunlight above and sides.</td><td>CSE</td></tr>
<tr><td>DO</td><td>Dominant, full sunlight from above and partly from sides.</td><td>CSE</td></tr>
<tr><td>CO</td><td>Codominant, full sunlight from above, but little from sides.</td><td>CSE</td></tr>
<tr><td>IN</td><td>Intermediate, sunlight only from holes in canopy</td><td>CSE</td></tr>
<tr><td>OV</td><td>Overtopped</td><td>CSE</td></tr>
<tr><td>RE</td><td>Remnant</td><td>CSE</td></tr>
<tr><td>AB</td><td>Leader above brush</td><td>CSE</td></tr>
<tr><td>IB</td><td>Leader within brush</td><td>CSE</td></tr>
<tr><td>UB</td><td>Leader overtopped by brush</td><td>CSE</td></tr>
<tr><td>SU</td><td>Suppressed, no sunlight, below canopy in even-aged stands.</td><td></td></tr>
<tr><td>UN</td><td>Understory</td><td></td></tr>
</table></td></tr>
<tr><td>Defect_Cubic</td><td>Double</td><td>Cubic foot volume loss, in percent</td></tr>
<tr><td>Defect_Board</td><td>Double</td><td>Board foot volume loss in percent</td></tr>
</table>

3.2 Keyword Order is Important

FVS variables have default values that are used in place of missing data. Standard FVS keywords can be used instead of and in addition to DB-FVS queries. When the FVS keywords are specified prior to DB-FVS queries, the values they contain behave like defaults. That is, they are replaced by values in the database when values are found. If the standard FVS keywords follow the DB-FVS queries, the values they contain replace those from the database. That is, the values entered last are used.

3.3 Automatic Data Type Conversion

Data types in your input tables may differ from those shown in tables 3.0.1 and 3.0.2. DB-FVS will automatically convert most numeric data types into integers or floating point numbers as necessary, retaining the precision of the number as it is stored in the database. But there are some restrictions. If the data type in tables 3.0.1 and 3.0.2 is shown to be integer, you cannot code a number that contains a decimal value. For example, you cannot enter Inv_Year as 1995.5; it must be 1995 without the decimal. On the other hand, it can be stored in your database as a character string, text variable,

number, signed or unsigned integer and it will be properly read by DB-FVS and converted to an integer automatically.

In the case of Stand_ID (and others shown to be Integer or Char), the program allows you to code either numeric value or a character value. If it is stored as a number in the database, DB-FVS will convert the value to a character string.

The rules for data type conversions from those in various databases to those used in DB-FVS are complicated, vary by ODBC driver, and they are different for each underlying database. In addition, the ODBC tool kit (Canaima Software 2000) used in writing DB-FVS contains conversion rules to map the many different underlying data types used in the computer industry to the subset supported in Fortran, the language used to write FVS. Generally, these conversions work very well and make a lot of sense. If you suspect your FVS run is failing or that input data is not being read or expanded correctly because of some unintended data conversions, we recommend comparing the field names and data types within your database to the Blank_Database template.

Note – Insure that data types and column properties within your input database tables match those specified in the previous tables. Incorrect data types may result in unread or misinterpreted data. Best practice is to use the FVS Blank Database as a template for creating or comparing new input databases.

Here are some details on types used in the tables 3.0.1 and 3.0.2.

- *Integer* is a 32 bit integer.
- *Float* is a 32 bit floating point number without an implied decimal location.
- *Double* is a 64 bit floating point number without an implied decimal location.
- *Char(n)* is a fixed length character string of length *n*.
- *Text* is used in some output tables as is a variable length character string.
- *Memo* is similar to the *Char* type, but stores up to 65,536 characters

In MS Access, file type *Integer* and *Double* are specified as *Number* and *Char(n)* as *Text*.

3.4 Linking to an Input Database with Suppose

The Suppose graphical user interface (GUI) is a separate computer program used by most FVS users to perform FVS simulations. Suppose simplifies the tasks of simulating changes in forest vegetation by reducing the users need to know detailed computer and FVS system knowledge. Beginning with version 2.0, Suppose gained the ability to interact with DB-FVS input tables within MS Access or Excel formats. In version 2.7, Suppose gained the ability to interact with DB-FVS tables within SQLite databases. For Suppose to be able to interact with the DB-FVS input tables, the following modifications need to be performed and database fields must use the correct data type formats as specified previously:

- The Suppose locations file format provides for direct links to input databases through a new record type, record type C. This record type allows Suppose to connect to a MS Access or SQLite database that has DB-FVS input tables. Record type C contains the

location (project) label and a link to the input DB-FVS database. The fields associated with record type C are defined in table 3.4.1.

Table 3.4.1 – Record Type C of the Suppose 2.0+ locations file.

Field 1:	Record type, always code a C.
Field 2:	Project name, entered as a quoted string.
Field 3:	Name of the input database.
Field 4:	User name of the input database (if required).
Field 5:	Password to the input database (if required).

- When prompted by the locations file, Suppose will process the stand or plot initiation table within the identified database. The stand initiation table must be named FVS_StandInit and the plot initiation table must be named FVS_PlotInit (if it is included). Suppose will process the stand initiation table unless the user modifies Suppose preferences to process plots as stands, in which case it will process the plot initiation table. Processing plots as stands can be selected in Suppose by selecting *Preferences*, then *Suppose Preferences*, and changing the *Process plots as stands* to "Yes".

- Users may specify grouping codes for stands, and FVS keywords or addfiles to add to simulations in the Groups, FVSKeywords, and AddFiles columns, respectively. Correct linkage of the input database tables when running Suppose requires a common grouping code (such as All_Stands) be included under the Groups field within both the FVS_GroupAddFilesAndKeywords table and the FVS_StandInit table. This links the FVSKeywords entry (DSNIn, TREESQL, and STANDSQL keywords and information) of the FVS_GroupAddFilesAndKeywords table with the FVS_StandInit table. If an FVS_PlotInit table is included, then a common grouping code (such as All_Plots) should be used to link with the FVS_GroupAddFilesAndKeywords.

- FVS keywords or AddFiles may also be added to stands through a stand's grouping code via a new table specific to Suppose interactions called "FVS_GroupAddFilesAndKeywords." Formats for columns in this table may be found in table 3.4.2.

Table 3.4.2 – The predefined FVS_GroupAddFilesAndKeywords table structure for Suppose 2.0+.

Column Name	Data type	Description
Groups	Char**	A list of Grouping Codes separated by spaces, tabs, carriage returns, or newlines. NOTE- The "All_Stands" or "All_Plots" grouping codes are used for linking the FVS_StandInit and FVS_PlotInit tables with the FVS_GroupAddFilesAndKeywords table and should not be deleted
AddFiles	Char*	A list of Addfile names (.kcp) separated by tabs, carriage returns, or newlines, which will be inserted into simulation files as one or more components
FVSKeywords	Char*	A list of FVS keywords, separated by carriage returns or newlines, which define the FVS run. Keywords must be formatted using FVS formatting rules. The Database DSNIn, TREESQL, and STANDSQL keywords and associated information is often listed here. Added to simulations by Suppose 2.0+

*can be character of any length or text/memo in MS Access
**recommend text in MS Access 2010 and newer

4.0 KEYWORDS

Keywords control DB-FVS. Sequences of DB-FVS keywords begin with the DATABASE keyword and end with the END keyword. This pattern can be entered as often as desired. One major difference between the DB-FVS and many other extensions of FVS is that the actions of some DB-FVS keywords affect all the stands that follow in the run until these keywords are later modified in the simulation. In many extensions, the entire set of options is reset to the default values for each stand (or *case*). In DB-FVS, settings are global for the run unless noted differently.

4.1 Connections

The connection used for output is different from the connection used for input. This, for example, allows for the ability to read information from a corporate read-only database while creating output in a separate database, perhaps Excel or Access, on your personal computer.

DSNIN Specifies the file name or DSN, Username, and Password delimited by a space for the input database connection. The default is `FVSIn.mdb`; rules shown for the DSNOUT keyword are used for detecting if a file name versus a DSN is specified.

DSNOUT Specifies the file name or DSN, Username, and Password for the output database connection. These three items are entered on the line that follows the keyword. If any item contains a blank, the item must be enclosed in quotation marks (`""`). DB-FVS interprets the first item as a file name if the last characters are `".xls" or ".xlsx"` (when the file is an Excel workbook), `".mdb"` or `".accdb"` (when the file is an Access database), or `".SQLite"` or `".db"` (when the file is an SQLite database). Otherwise, the first item is considered a DSN. The default is `FVSOut.xls`. Once specified, the value entered using this keyword applies to all stands in a single run of FVS unless a new DSNOUT keyword in entered.

4.2 Output Table Control

There are basic keywords that are used to specify which output tables are desired. In addition to these options, the ability to enter an SQL command to be run immediately on the database is covered in section 5. Section 6.1 shows a simple example of how to use the functionality listed here.

ATRTLIST Signals that the FVS_ATRTList (After Treatment Treelist) table is to be output (table 2.1.3). It must be used in conjunction with the standard FVS ATRTLIST keyword. ATRTLIST by default will direct the output specified by the FVS ATRTLIST keyword to both the database and to the tree list output file. The table is output during the simulation.

Field 1: Code a value of 2 for the output to be sent to the database only and a value of 1 for both the database and the output file (default is 1).

Field 2: Specifies species code format in the output table. Code a value of 0 to output species' codes based on the format of the last tree record of a species read in the input data, code a value of 1 to output species using the FVS alpha code format, code a value of 2 to output species using the FIA code format, or code a value of 3 to output species using the USDA Plants symbol format (default is 0).

BURNREPT Signals the creation of the FVS_BurnReport table (table 2.2.5), which stores the same data as that of the FFE Burn Conditions Report. This keyword must be used in conjunction with the FFE BURNREPT keyword. The table is output during the simulation.

Field 1: Code a value of 2 for the output to be sent to the database only and a value of 1 for both the database and the output file (default is 1).

CARBRPTS Signals the creation of the FVS_Carbon (table 2.2.10) and FVS_Hrv_Carbon (table 2.2.11) database tables, which store the same data as that of the FFE Carbon and Harvested Products reports, respectively. This DBS extension keyword must be used in conjunction with the FFE CarbRept and CarbCut keywords. The table is output during the simulation.

Field 1: Code a value of 2 for the output to be sent to the database only and a value of 1 for both the database and the output file (default is 1).

COMPUTE Signals that the FVS_Compute table is to be output (table 2.1.2). The table is output at the end of the simulation.

Field 1: Code a value of 1 if you want DB-FVS to not add columns for Event Monitor variables that exist for the current case but are not part of an existing FVS_Compute table. Note that this is the default behavior when the database is an Excel workbook. Code a zero or blank to cause additional columns to be added as needed (default is blank).

Field 2: Code a value of 1 if you want variables whose names start with an underscore character (such as: `_name`) to be output. The default is zero or blank and results in these variables not being added to the FVS_Compute table.

CUTLIST Signals that the FVS_Cutlist table is to be output (table 2.1.3). It must be used in conjunction with the standard FVS CUTLIST keyword. CUTLIST by default will direct the output specified by the FVS CUTLIST keyword to both the database and to the tree list output file. The table is output during the simulation.

Field 1: Code a value of 2 for the output to be sent to the database only and a value of 1 for both the database and the output file (default is 1).

Field 2: Specifies species code format in the output table. Code a value of 0 to output species' codes based on the format of the last tree record of a species read in the input data, code a value of 1 to output species using the FVS alpha code format, code a value of 2 to output species using the FIA code format, or code a value of 3 to output species using the USDA Plants symbol format (default is 0).

DWDCVOUT Signals the creation of the FVS_Down_Wood_Cov (table 2.2.12) database table, which stores the same data as that of the FFE Down Woody Debris Cover report. This DBS extension keyword must be used in conjunction with the FFE DWDCvOut keyword. The table is output during the simulation.

Field 1: Code a value of 2 for the output to be sent to the database only and a value of 1 for both the database and the output file (default is 1).

DWDVLOUT Signals the creation of the FVS_Down_Wood_Vol (table 2.2.13) database table, which stores the same data as that of the FFE Down Woody Debris Volume report. This DBS extension keyword must be used in conjunction with the FFE DWDVlOut keyword. The table is output during the simulation.

Field 1: Code a value of 2 for the output to be sent to the database only and a value of 1 for both the database and the output file (default is 1).

ECONRPTS Signals the creation of the FVS_EconSummary and the FVS_EconHarvestValue tables (tables 2.5.1 and 2.5.2), which store the same data as that of the ECON Summary Measures and Harvest Volumes and Gross Values reports. This keyword must be used in conjunction with the Economics extension. The table is output during the simulation.

Field 1: Code a value of 1 for Summary Measures output only or a value of 2 for Summary Measures and Harvest Volumes and Gross Values output (default is 2).

Field 2: Specifies species code format in the output table. Code a value of 0 to output species' codes based on the format of the last tree record of a species read in the input data, code a value of 1 to output species using the FVS alpha code format, code a value of 2 to output species using the FIA code format, or code a value of 3 to output species using the USDA Plants symbol format (default is 0).

FUELREPT Signals the creation of the FVS_Consumption table (table 2.2.6), which stores the same data as that of the FFE Fuel Consumption and Physical Effects Report. This keyword must be used in conjunction with the FFE FUELREPT keyword. The table is output during the simulation.

Field 1: Code a value of 2 for the output to be sent to the database only and a value of 1 for both the database and the output file (default is 1).

FUELSOUT Signals the creation of the FVS_Fuels table (table 2.2.4), which stores the same data as that of the FVS Fire Model's All Fuels Report. This keyword must be used in conjunction with the Fire Model FUELOUT keyword. The table is output during the simulation.

Field 1: Code a value of 2 for the output to be data to the database only and a value of 1 for both the database and the output file (default is 1).

MISRPTS Signals the creation of up to 3 reports: the FVS_DM_Spp_Sum, FVS_DM_Stnd_Sum and FVS_DM_Sz_Sum tables (tables 2.3.1, 2.3.2, and 2.3.3). These tables store the same data as the Species-Specific, Stand Average and Diameter Class reports of the FVS Interim Dwarf Mistletoe Model. If the FVS_DM_Sz_Sum report (table 2.3.3) is desired, this keyword must be used in conjunction with the Mistletoe Model's MISTPRT keyword. The table is output during the simulation.

Field 1: Code a value of 2 for the output to be sent to the database only and a value of 1 for both the database and the output file (default is 1).

MORTREPT Signals the creation of the FVS_Mortality table (table 2.2.7), which stores the same data as that of the FFE Mortality Report. This keyword must be used in conjunction with the FFE MORTREPT keyword. The table is output during the simulation.

Field 1: Code a value of 2 for the output to be sent to the database only and a value of 1 for both the database and the output file (default is 1).
Field 2: Specifies species code format in the output table. Code a value of 0 to output species' codes based on the format of the last tree record of a species read in the input data, code a value of 1 to output species using the FVS alpha code format, code a value of 2 to output species using the FIA code format, or code a value of 3 to output species using the USDA Plants symbol format (default is 0).

POTFIRE Signals that the Potential Fire report is to be output to the database (FVS_PotFire, tables 2.2.1 and 2.2.2). This keyword must be used in conjunction with the POTFIRE keyword. The table is output during the simulation.

Field 1: Code a value of 2 for the output to be sent to the database only and a value of 1 for both the database and the output file (default is 1).

PPBMBKP Signals the creation of the FVS_BM_BKP table (table 2.4.2), which stores the same data as that of the WWPB Model detailed BKP output file. This keyword must be

used in conjunction with the WWPB Model keyword BKPOUT. The table is output during the simulation.

Field 1: Enter a "2" for the output to be sent to the database only, or a "1" for both the database table and the WWPBM output file (default is 1).

PPBMMAIN Signals the creation of the FVS_BM_Main table (table 2.4.1), which stores the same data as that of the Westwide Pine Beetle (WWPB) Model "Main" output file. This keyword must be used in conjunction with the WWPB Model keyword MAINOUT. The table is output during the simulation.

Field 1: Enter a "2" for the output to be sent to the database only, or a "1" for both the database table and the WWPBM output file (default is 1).

PPBMTREE Signals the creation of the FVS_BM_Tree table (table 2.4.3), which stores the same data as that of the WWPB Model detailed tree-by-size class output file. This keyword must be used in conjunction with the WWPB Model keyword TREEOUT. The table is output during the simulation.

Field 1: Enter a "2" for the output to be sent to the database only, or a "1" for both the database table and the WWPBM output file (default is 1).

PPBMVOL Signals the creation of the FVS_BM_Vol table (table 2.4.4), which stores the same data as that of the WWPB Model detailed tree volume output file. This keyword must be used in conjunction with the WWPB Model keyword VOLOUT. The table is output during the simulation.

Field 1: Enter a "2" for the output to be sent to the database only, or a "1" for both the database table and the WWPBM output file (default is 1).

SNAGOUT Signals the creation of the FVS_SnagDet table (table 2.2.9), which stores the same data as that of the FFE Detailed Snag Report. This keyword must be used in conjunction with the FFE SnagOut keyword. The table is output during the simulation.

Field 1: Code a value of 2 for the output to be sent to the database only and a value of 1 for both the database and the output file (default is 1).
Field 2: Specifies species code format in the output table. Code a value of 0 to output species' codes based on the format of the last tree record of a species read in the input data, code a value of 1 to output species using the FVS alpha code format, code a value of 2 to output species using the FIA code format, or code a value of 3 to output species using the USDA Plants symbol format (default is 0).

SNAGSUM Signals the creation of the FVS_SnagSum table (table 2.2.8), which stores the same data as that of the FFE Summary Snag Report. This keyword must be used in

conjunction with the FFE SnagSum keyword. The table is output during the simulation.

Field 1: Code a value of 2 for the output to be sent to the database only and a value of 1 for both the database and the output file (default is 1).

STRCLASS Signals the creation of the FVS_StrClass table (table 2.1.4), which stores the same data as the base FVS Structural Statistics report. This keyword must be used in conjunction with the base FVS StrClass keyword. The table is output during the simulation.

Field 1: Code a value of 2 for the output to be sent to the database only and a value of 1 for both the database and the output file (default is 1).

SUMMARY Signals that the FVS_Summary table is to be output (tables 2.1.1.1 or 2.1.1.2). The table is output at the end of the simulation.

TREELIST Signals that the FVS_Treelist table is to be output (table 2.1.3). It must be used in conjunction with the standard FVS TREELIST keyword. TREESLIST by default will direct the output specified by the FVS TREELIST keyword to both the database and to the tree list output file. The table is output during the simulation.

Field 1: Code a value of 2 for the output to be sent to the database only and a value of 1 for both the database and the output file (default is 1).
Field 2: Specifies species code format in the output table. Code a value of 0 to output species' codes based on the format of the last tree record of a species read in the input data, code a value of 1 to output species using the FVS alpha code format, code a value of 2 to output species using the FIA code format, or code a value of 3 to output species using the USDA Plants symbol format (default is 0).

4.3 Stand and Tree Intialization

The STANDSQL and TREESQL keywords are used for initializing stand/plot and tree information as listed in tables 3.0.1 and 3.0.2. An SQL statement is entered following either keyword. The statements are run on the DSNIN connection that is active when the keyword is processed. You can change the connection from one database to another and use multiple keywords as necessary to enter your data.

Code the SQL statements on one or more lines. The string "EndSQL", on a line that contains no other information, signals the end of the statement. (Note that the '&' character is not used to continue an SQL statement as is sometimes the case on FVS keywords.) The maximum length of the SQL statement is set at 5000 characters (leading blanks are removed, trailing blanks are converted to one blank). Immediately prior to processing the SQL commands, DB-FVS modifies them according to the following rules. The string `%StandID%` is replaced by the current stand identification code, `%Stand_CN%` is replaced by the current stand-level data base control number (StandCN),

`%MgmtID%` is replaced by the current management identification code, and `%Variant%` is replaced by the 2 character variant identification code. See sections 6.3 and 6.4 for examples of how to use these keywords (including special information for Excel users).

STANDSQL Signals that the result data from the SELECT SQL statement following this keyword, is to initialize the FVS stand information. Use the "AS" clause if the columns for the stand table in the input database are not titled exactly as the column names listed in table 3.0.1.

TREESQL Signals that the result data from the SELECT SQL statement, entered following this keyword, is to initialize the FVS tree information. Use the "AS" clause if the columns are not titled the same as the column names listed in table 3.0.2. The rules for STANDSQL apply to this keyword.

5.0 EVENT MONITOR – DATABASE INTERACTION

As pointed out in the introduction, DB-FVS supports interaction between databases and the Event Monitor. This interaction occurs at any time step during the simulation, at the same place in the FVS code where Event Monitor's COMPUTE keyword is processed. You can also use the keywords presented in this section to cause an SQL statement to be run on the input or output database connections immediately upon entry of the keyword rather than at a scheduled time during the simulation.

The SQLOUT and SQLIN keywords are used to facilitate the capabilities outlined here. Both keywords operate exactly the same way except that SQLOUT operates on the connection defined by the DBSOUT keyword and SQLIN operates on the connection defined by the DBSIN keyword. Beyond that, the action taken by DB-FVS depends on the result of the SQL statement. For example, if the SQL statement is a DROP TABLE, no action beyond execution of the statement is taken.

You control when during the FVS simulation the SQL statements are actually executed. When the first field is left blank, the statement is executed immediately upon being read by the program. When a value is entered in the first field, the statement is considered an FVS activity and scheduled to be executed during the year or cycle indicated. Like any other FVS activity, an SQLOUT or SQLIN statement can be scheduled predicated on conditions using the IF-THEN construct supported by the Event Monitor.

SQL statements are preprocessed prior to being run using the rules shown in section 4.3. If the statement is scheduled to occur during the simulation rather than immediately upon being read, then any Event Monitor variable can also be used in a substitution. For example, if %BBA% is coded in the SQL statement, then the string %BBA% will be replaced with the current value of the corresponding Event Monitor variable. This preprocessing rule extends to all defined Event Monitor variables, including those defined by the user via the Event Monitor's COMPUTE keyword. Substitutions are not made for Event Monitor functions, like SPMCDBH(). If a variable is not defined or not found, the SQL statement is not executed.

If the result of a SQL statement is a result table, as would typically be the case when a SELECT statement is entered, then the following action is taken by DB-FVS. The column names from the table are compared to the names of user-defined Event Monitor variables. For any matching variable, the value found in the last row of the result table is used to set the value of Event Monitor variable. For example, say you define an Event Monitor variable called BATARG using the COMPUTE keyword. If the result table from the SQL statement also has a column called BATARG, the value found in the last row of the table will be assigned to that compute variable. Note that the value BATARG could then be used in a thinning keyword to specify the target basal area, for example, using the Event Monitor's PARMS feature.

SQLIN Signals that an SQL statement follows this keyword. The SQL statement is run on the input database – the one specified using the DSNIN keyword. Use the rules outlined in section 4.3 for coding the statement.

Field 1: The year or cycle during the simulation that the SQL statement is executed. If blank (the default), the statement is executed immediately upon being read by DB-FVS. When the SQL statement is a Select statement meant to set the value of Event Monitor variables, the variables must be defined prior to executing the query. Event Monitor variables are defined (but not given values) simply by using them in logical expressions, compute expressions, or by using parms on keywords.

SQLOUT Signals that an SQL statement follows this keyword. The SQL statement is run on the output database – the one specified using the DSNOUT keyword. Use the rules outlined in section 4.3 for coding the statement.

Field 1: The year or cycle during the simulation that the SQL statement is executed. If blank, the statement is executed immediately upon being read by DB-FVS.

6.0 EXAMPLES

6.1 – Example 1: Create a Database Containing Summary and Compute Tables

The listing in Figure 6.1 illustrates the keywords that are needed for a bare ground run of FVS simulation, and to write the Compute and Summary tables to an Access database. The run assumes that an Access Database file called FVSOutAccess.mdb would have been created prior to making the run.

Lines 1-14 are standard FVS keywords that define the stand and request four variables be computed for each time step of the simulation.

Line DB 1 signals that DB-FVS keywords follow.

Line DB 2 signals that the following line (DB 3) contains the Access Database file name.

Line DB 4 requests the Compute table be generated and line DB 5 request the Summary table be generated in the related database. Recall that if any table is created the FVS_Cases table is automatically created as well.

Line DB 6 signals the end of the DB-FVS keywords.

Line 15 and 16 are base FVS keywords used to process the run and stop.

```
Line      |                                   Column ruler
Number    |----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8
          | Keyword      Field 1   Field 2   Field 3   Field 4   Field 5   Field 6   Field 7
      1   | StdIdent
      2   | BareGround
      3   | Screen
      4   | InvYear         2000
      5   | StdInfo          110       692        84       243        20        53
      6   | NumCycle          10
      7   | NoTrees
      8   | StrClass
      9   | Compute            0
     10   | Str$0   = BSClass
     11   | Str$1   = ASClass
     12   | Cover$0 = BCanCov
     13   | Cover$1 = ACanCov
     14   | End
   DB 1   | DataBase
   DB 2   | DSNOut
   DB 3   | FVSOutAccess.mdb
   DB 4   | Compute
   DB 5   | Summary
   DB 6   | End
     15   | Process
     16   | Stop
```

Figure 6.1 – The keyword file used to make a bare ground simulation with compute variables and summary data output to the database referred to with DSN FVSOutAccess.

6.2 – Example 2: Delete Existing Tables.

In addition to the commands illustrated in example 1, this example (fig 6.2) illustrates how to add an SQL statement that will operate on the database at the moment that the keyword is entered in the run.

Lines 1-14, DB 1 through DB 5, and 15-16 are the same as in example 1.

Line DB 6 signals that SQL statements follow on the next line and line DB 7 contains the statement that, in this case deletes the Compute table. Line DB 8 signals the end of the SQL statements. The keyword on line DB 6 is SQLOut signifying that command applies the output database.

Line DB 7 signals that no additional DB-FVS keywords are entered.

Line Number	Column ruler ----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8 Keyword Field 1 Field 2 Field 3 Field 4 Field 5 Field 6 Field 7
1-14	see figure 1
DB 1	DataBase
DB 2	DSNOut
DB 3	FVSOutAccess.mdb
DB 4	Compute
DB 5	Summary
DB 6	SQLOut
DB 7	Drop Table FVS_Compute
DB 8	EndSQL
DB 9	End
15	Process
16	Stop

Figure 6.2 – The keyword file from Example 1 augmented with an SQL command used to delete the Compute table. In this case, DB-FVS will create a fresh version of the table that contains information for the single case generated with the run.

6.3 – Example 3: Stand Information Initialization

Figure 6.3 illustrates the keywords that are needed to make a bare ground run of FVS with stand information initialization coming from a table called `FVS_StandInit` inside an Access database stored in the working directory called `FVSIn.mdb` and that file would have been created prior to making the run.

Lines 1-6 are standard FVS keywords that define the FVS run.

Line DB 1 signals that DB-FVS keywords follow.

Line DB 2 signals that the following line (DB 3) contains the data base file name, in this case `FVSIn.mdb`.

Line DB 4 signals that the following lines (DB 5-7) will contain a SQL statement that will provide FVS with needed stand information from the database. Line DB 8 contains the "EndSQL" string needed to signify the end of the SELECT statement. Note that `%StandID%` will be converted

to `BareGround` when the SQL statement is preprocessed. Note that the stand identification code is entered on line 2.

When Excel workbooks are used as a database, changes to the query must be made. An Excel workbook would be the database if line DB 3 were `FVSIn.xls` rather than `FVSIn.mdb`. When Excel is used as a database, the workbook sheets are considered tables and the first row of the sheet contains the column names. The required change in the query affects the table name. For example, given the sheet name is `FVS_StandInit` (as shown in line DB 6), the name used in the SQL statement must be `[FVS_StandInit$]` to conform to the naming conventions used in Excel.

Line DB 9 signals that no additional DB-FVS keywords are being used.

Line 7 and 8 are as in lines 15-16 of Example 1.

```
Line                                   Column ruler
Number  ----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8
        Keyword      Field 1   Field 2   Field 3   Field 4   Field 5   Field 6   Field 7
     1  StdIdent
     2  BareGround
     3  Screen
     4  NumCycle          10
     5  NoTrees
     6  StrClass
  DB 1  DataBase
  DB 2  DSNIN
  DB 3  FVSIn.mdb
  DB 4  StandSQL
  DB 5  SELECT *
  DB 6  FROM FVS_StandInit
  DB 7  WHERE Stand_ID = '%StandID%'
  DB 8  EndSQL
  DB 9  End
     7  Process
     8  Stop
```

Figure 6.3 – The keyword file used to initialize stand information from a database.

6.4 – Example 4: Input Stand/Plot and Tree Data from an FSVeg-Derived Database.

Figure 6.4 illustrates the keywords that are needed to enter both the stand/plot-level and tree-level data from an FSVeg-derived database. FSVeg is the USDA Forest Service's national "Field Sampled Vegetation" database. It is an Oracle database used to store data from stand examinations, grid-based strategic inventories, permanent re-measured inventory plots, forest inventories, and other field sampled vegetation sources. The system contains three database views that can be used in database queries specifically designed to initialize FVS. The views provide the input data as delineated in tables 3.0.1 and 3.0.2, as well as additional data that are not read by FVS. This example demonstrates how to use those data when processing stands (A) or processing plots as stands (B). FSVeg has a utility that builds a copy of the necessary data tables for a selected subset of the data stored in FSVeg. The copy is stored as an Access database file stored on individual computers. This example assumes that the copy has been made and it is stored in the working directory as

`FVS_Data.mdb`. Technically, when the data are copied to the access table, the data are stored in tables and not accessed by views. From a practical point of view, there is no difference between accessing the data as a table in Access or a view in Oracle. As pointed out below, this example would work either way simply by changing the name of the database source (see lines DB 2-3) in example (A) or (B).

Example (A)
Lines 1-2 sets the stand-level *control number* to the value listed on line 2. The control number is a unique database number that can be up to 40 characters long.

Lines 3-4 are standard FVS keywords.

Line DB 1 signals that DB-FVS keywords follow.

Lines DB 2-3 specifies the data base file name, in this case `FVS_Data.mdb`. Note that this example could be changed to query the Oracle database by changing line DB 3 to specify a data source name (DSN). The DSN would reference the Oracle database that contains FSVeg. Within the USDA Forest Service, `idb` would be a typical entry for this line.

Line DB 4 signals that the following lines (DB 5-6) contain a SQL statement that will provide FVS with needed stand information from the database. Line DB 7 contains the "EndSQL" string needed to signify the end of the SELECT statement. Note that `%Stand_CN%` will be converted to `1234567890123456789` when the SQL statement is preprocessed.

Lines DB 8-11 accomplish the same task for the tree-level data as done for the stand-level data.

Line 12 ends the database keywords and lines 5 and 6 are standard FVS keywords.

Example (B)
Lines 2, 5-6, and 10 have been modified from Example (A) to process plots as stands.

Line 2 sets the plot-level *control number* to the value listed on line 2, which is the variable Stand_CN concatenated with plot_ID.

Line 5 reads plot data from the `FVS_PlotInit` table.

Lines 6 and 10 select data based on the `StandPlot_CN` variable. Note that `%Stand_CN%` will be converted to `1234567890123456789_0001` when the SQL statement is preprocessed.

(A) Processing Stands

```
Line                                   Column ruler
Number  ----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8
        Keyword      Field 1   Field 2   Field 3   Field 4   Field 5   Field 6   Field 7
     1  StandCN
     2  1234567890123456789
     3  Screen
     4  NumCycle          10
  DB 1  DataBase
  DB 2  DSNIN
  DB 3  FVS_Data.mdb
  DB 4  StandSQL
  DB 5  SELECT * FROM FVS_StandInit
  DB 6  WHERE Stand_CN = '%Stand_CN%'
  DB 7  EndSQL
  DB 8  TreeSQL
  DB 9  SELECT * FROM FVS_TreeInit
 DB 10  WHERE Stand_CN = '%Stand_CN%'
 DB 11  EndSQL
 DB 12  End
     5  Process
     6  Stop
```

(B) Processing Plots as Stands

```
Line                                   Column ruler
Number  ----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8
        Keyword      Field 1   Field 2   Field 3   Field 4   Field 5   Field 6   Field 7
     1  StandCN
     2  1234567890123456789_0001
     3  Screen
     4  NumCycle          10
  DB 1  DataBase
  DB 2  DSNIN
  DB 3  FVS_Data.mdb
  DB 4  StandSQL
  DB 5  SELECT * FROM FVS_PlotInit
  DB 6  WHERE StandPlot_CN = '%Stand_CN%'
  DB 7  EndSQL
  DB 8  TreeSQL
  DB 9  SELECT * FROM FVS_TreeInit
 DB 10  WHERE StandPlot_CN = '%Stand_CN%'
 DB 11  EndSQL
 DB 12  End
     5  Process
     6  Stop
```

Figure 6.4 – The keyword file used to initialize stand/plot information and tree information from an FSVeg-derived Access data base called FVS_Data.mdb.

6.5 – Example 5: Event Monitor – Database Interaction

Figure 6.5 illustrates how to code an SQL query that results in an Event Monitor variable being set. The example assumes that a table called Harvestable exists in the Excel workbook called harvestFlags.xls and that the table has at least two columns, one called Stand_ID (stored as character data) and the other called CanHarv, stored as a number.

Lines 1-8 are standard FVS keywords that define the FVS run, just like those used in Example 1. Line DB 1 signals that DB-FVS keyword follow.

Lines DB 2-3 signals that the following line (DB 3) contains the Data Source Name for the input data source. In this case, source is the Excel workbook harvestFlags.xls.

Line DB 4 signals that an SQL statement is being entered and that it is scheduled to run in cycle 1. Note that the Event Monitor will use the value of CanHarv retrieved from the data base when evaluating the logical expression specified in line 10.

Lines DB 5-7 is the SQL statement that will be run. Note that the statement is subject to preprocessing, so the string `%StandID%` will be automatically converted to the stand's identification. The preprocessing occurs just prior to the statement being executed. Note that Stand_ID is stored as a character string in the database and therefore `%StandID%` must be enclosed in quotation marks.

Lines DB 8-9 first end the SQL statement and then the input to the DB-FVS extension.

Lines 9-13 test the value of `CanHarv` and schedule a clear cut if its value is 1. Note that `CanHarv` will be undefined until the query specified in lines DB 4-DB8 runs.

Lines 14 and 15 are as in lines 15-16 of Example 1.

```
Line      Column ruler
Number    ----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8
          Keyword      Field 1   Field 2   Field 3   Field 4   Field 5   Field 6   Field 7
      1   StdIdent
      2   BareGround
      3   Screen
      4   InvYear         2000
      5   StdInfo          110       692        84       243        20        53
      6   NumCycle          10
      7   NoTrees
      8   StrClass
   DB 1   DataBase
   DB 2   DSNIN
   DB 3   harvestFlags.xls
   DB 4   SQLIN              1
   DB 5   SELECT CanHarv
   DB 6   FROM Harvestable
   DB 7   WHERE Stand_ID = '%StandID%'
   DB 8   EndSQL
   DB 9   End
      9   IF
     10   CanHarv eq 1
     11   Then
     12   ThinATA           1         0
     13   EndIf
     14   Process
     15   Stop
```

Figure 6.5 – The keyword file used to set the value of an Event Monitor variable equal to the value stored in a database table.

As pointed out in the Event Monitor documentation (Crookston 1990), FVS calls the Event Monitor just prior to and just after cutting is simulated. The Event Monitor process scheduled SQL statements as it computes user-defined variables.

This example can be simply changed to illustrate additional capabilities. Note that the database functions illustrated in Example 1 could be merged into this example so that the capabilities of both examples are included. To do that, lines 9-14 from fig. 6.1 would be inserted into this example at a good spot, like after line 8. Lines DB 2-5 from Example 1 would be inserted as well, say between DB 1 and 2 or between DB 8 and 9.

Another possible change to the example further illustrates how the system works. Note that if the table `Harvestable` preexisted in the output database (the database file `FVSOutAccess.mdb` referred to by the DSNOUT connection), the query could have been run on that database connection rather than the input connection. That change would require using the SQLOUT keyword on line DB 4 rather than SQLIN. Furthermore, lines DB 2 and 3 would be deleted. The point is this: while the names, “OUT” and “IN”, have meaning to the standard functionality (writing tables as illustrated in Example 1 and reading tables as in Example 3), they do not imply that only input queries are allowed on the input connection as input queries can be executed on the DSNOUT connection as well, and *vice versa*.

7.0 ACKNOWLEDGMENTS

We thank Andrew Robinson, College of Natural Resources, University of Idaho, for his encouragement and ideas. Richard Teck and Frank Spirek, USDA Forest Service, were instrumental in designing and building the FSVeg views.

8.0 REFERENCES

Canaima Software. 2000. User Manual the ODBC Fortran-90 Library Version 2.00.001. Available as file f90SQLHelp.chm from the vendor.

Crookston, Nicholas L. 1990. User's guide to the Event Monitor: Part of the Prognosis Model Version 6. General Technical Report INT-275. Ogden UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 27 p.

Dixon, Gary E. comp. 2002 (revised frequently). Essential FVS: A user's guide to the Forest Vegetation Simulator. Internal Rep. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Forest Management Service Center.

Hawksworth, Frank G., Julie C. Williams-Cipriani, Bov B. Eav, Brian W. Geils, Ralph R. Johnson, Michael A. Marsden, Jerome S. Beatty, Gregory D. Shubert, Donald C.E. Robinson, and Lance David. *in press*. Dwarf Mistletoe impact modeling system. User guide and reference manual: Non-spatial model. 2005 Update. FHTET 05- *xx*. USDA Forest Service, Forest Health Technology Enterprise Team, Fort Collins, CO

Reinhardt, Elizabeth; Crookston, Nicholas L. (Technical Editors). 2003. The Fire and Fuels Extension to the Forest Vegetation Simulator. Gen. Tech. Rep. RMRS-GTR-116. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 209 p.

Smith, Eric L.; McMahan, Andrew; David, Lance; Havis, Robert; Crookston, Nicholas L.; Beukema, Sarah J; Robinson, Donald C. *In Press*. Westwide Pine Beetle Model Version 2.0: Keyword Guide. FHTET 05-*xx*. Fort Collins, CO. U.S. Department of Agriculture, Forest Service, Forest Health Protection, Forest Health Technology Enterprise Team. 55 p.

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.

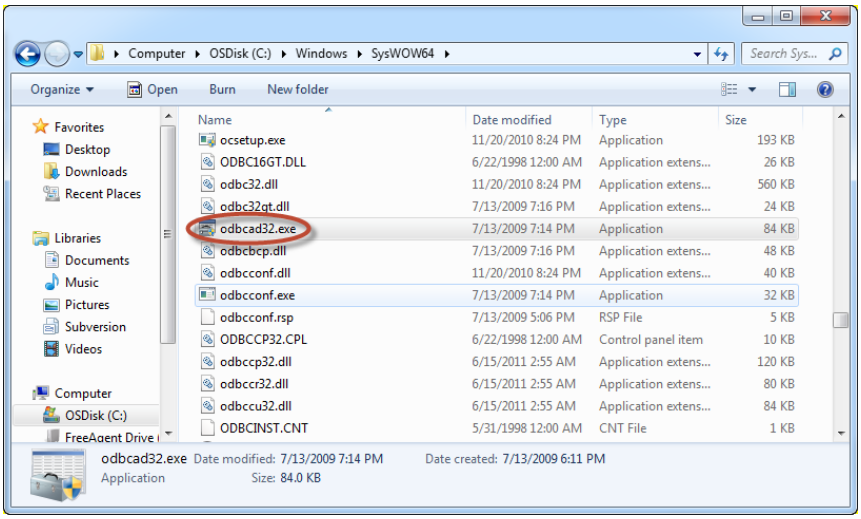
9.0 APPENDIX 1: DATA SOURCE NAMES (DSN)

The Database Extension of the Forest Vegetation Simulator uses Open Database Connectivity (ODBC) on Windows operating systems to interact with certain databases. For this interaction to take place a Data Source Name (DSN) must be created so that FVS knows which driver and database to communicate with. The steps in creating the DSN and relating it to an Excel workbook are presented below with options for Windows 7 or earlier versions of the Windows-based operating system. You can use similar steps for creating a DSN that relate to Access, Oracle, or other databases.

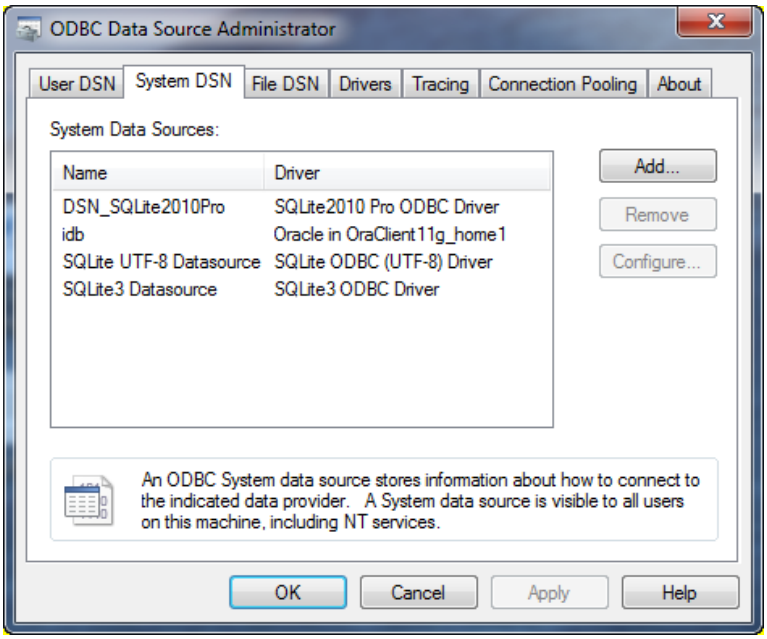
Adding or Editing DSN Settings for Windows 7:
Windows 7 includes functionality for 32-bit or 64-bit systems applications. FVS and MS Office are each available in 32-bit and 64-bit versions, and to interact correctly on your computer, these versions must be identical. Windows 7 does not allow you to have both the 32-bit and 64-bit versions of the ODBC Access drivers (*.mdb, *.accdb) installed on your computer at the same time. If you installed a version of FVS distributed by the USFS, you will be using a 32-bit version of FVS and must use a 32-bit version of MS Office if you plan to use the DBS extension with MS Access files. However, if you are using a custom-compiled version of FVS (e.g. from the open-fvs project site), you may have decided to build a 64-bit version of FVS and must therefore use a 64-bit version of MS Office if you want to use the DBS extension with Access. Likewise, the ODBC Data Source Administrator also has different versions (with the same misleading name, but in different directories) for configuring 32-bit and 64-bit ODBC drivers. By default within Windows 7, the standard method for opening the ODBC Data Source Administrator (Start Menu > Control Panel > Administrative Tools > Data Sources (ODBC)) defaults to the settings for 64-bit applications. These are appropriate for 64-bit versions of FVS and MS Office, but incorrect for the more common 32-bit versions of FVS and MS Office. If your computer uses a 32-bit version of FVS and MS Office, follow the steps below to open and modify the 32-bit ODBC settings.

Note – Modifying ODBC settings may require administrative privileges on your computer.

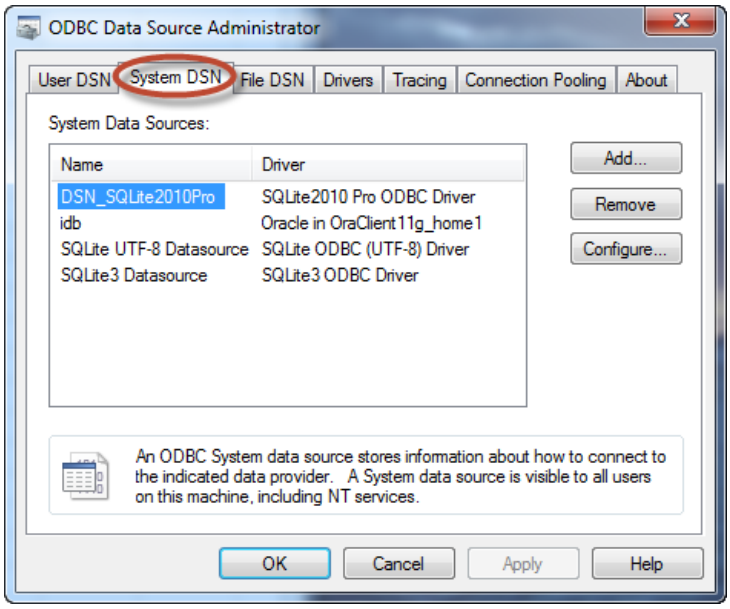
1. Navigate to the odbcad32.exe file within the Windows\SysWOW64 folder on your hard (root) drive.



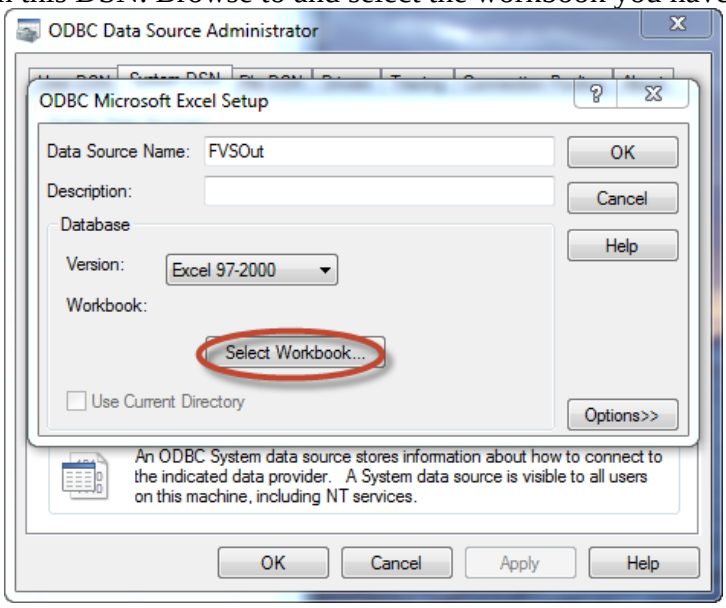
2. Run the odbcad32.exe file to open the 32-bit ODBC Data Source Administrator and select the System DSN tab. *Note – US Forest Service users may need to run this with administrative or in "Run Elevated" mode.*



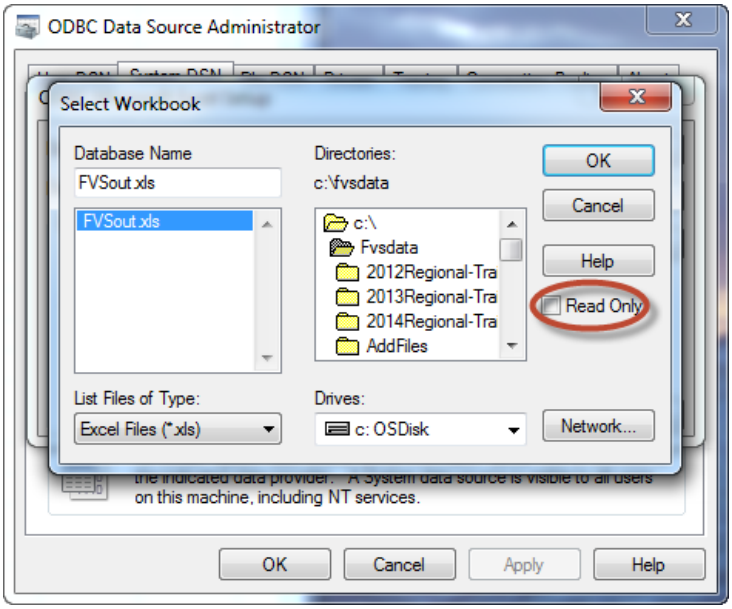
3. You will see a list of drivers for different database sources that you can choose from. To create an Excel DSN you will need to have first created an Excel workbook If you have not already created the workbook, do so now by opening Excel and saving the workbook under the name you will use in step 4 when you Select Workbook. Choose the Microsoft Excel Driver and click the Finish button.



4. Now you need to enter a DSN name that you would like to use. The example here is FVSOut, which is the default DSN used in DB-FVS. You then will need to Select Workbook to associate with this DSN. Browse to and select the workbook you have created.



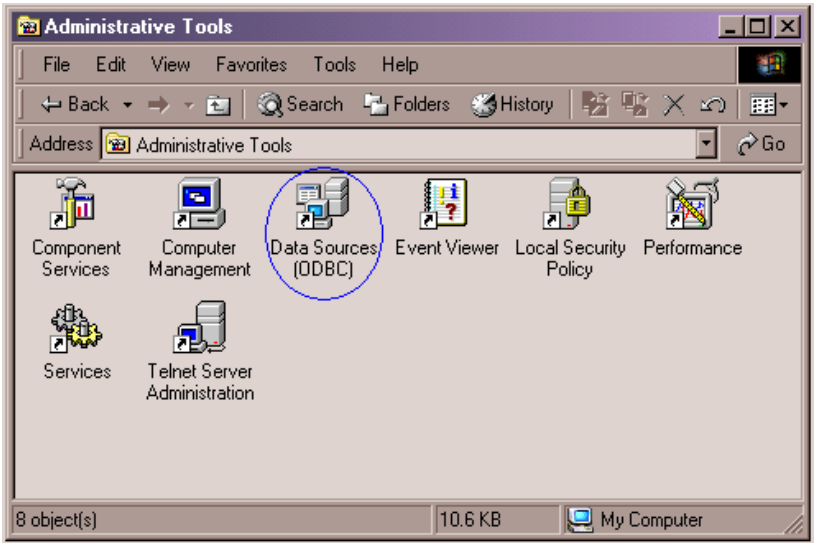
5. Make sure that the read only check box is not selected and click OK. Click OK to the remaining open ODBC windows and you are finished creating a DSN using the Excel ODBC drivers.



Adding or Editing DSN Settings in Windows XP or earlier operating systems:

1. Open the control panel and locate the ODBC Administrator. It should be located directly in the control panel if you are running Windows 95, 98, NT or ME. If you running Windows 2000 or XP, you will find the ODBC Administrator under the Administrative Tools.

2. Open the ODBC Administrator, select the System DSN tab and click the Add button.



3. Skip to Step 3 of the Windows 7 instructions above.