

# ***FCCS User's Guide***

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**Version 1.0**

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## ***Abstract***

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The Fuel Characteristic Classification System (FCCS) is a user-friendly computer program that builds, characterizes, and classifies fuels throughout North America. The system offers consistently organized fuels data along with numerical outputs to fire behavior, fire effects, and dynamic vegetation models. The flexible design of the FCCS allows users to realistically define the structural complexity and geographical diversity of fuels created through natural processes (e.g., forest succession and disturbance) and human activities (e.g., forest harvesting and fuels management). Each fuelbed is organized into six strata, including canopy, shrub, nonwoody vegetation, woody fuels, litter-lichen-moss, and ground fuels. Most strata are further divided into categories and subcategories. Over 200 national fuelbeds, compiled from literature, fuels datasets and expert opinion, are available in the FCCS reference library. Users may select a national fuelbed to represent their specific project or customize a fuelbed to reflect actual site conditions. The FCCS calculator generates assigned and calculated fuel characteristics and lists results by fuelbed, stratum, category and subcategory. The system also calculates fire potentials which provide an index of the intrinsic capacity of each fuelbed for surface fire behavior, crown fire, and consumption of available fuels.



# About This Users Guide

Welcome to the Fuel Characteristic Classification System (FCCS). The FCCS is a user-friendly computer program that builds, characterizes, and classifies fuels throughout North America. This Users Guide is organized into 11 sections:

**FCCS Overview.** Describes general features of the FCCS.

**FCCS Basics.** Presents basic information you will need to know to use the FCCS, such as installation, opening and exiting the FCCS, getting help, and screen navigation.

**Recording and Managing Data.** Provides information about entering fuelbed data and managing existing fuelbed files in the FCCS.

**Creating and Interpreting Reports.** Describes reports in the FCCS and how to interpret them.

**Quick Reference.** Summarizes key information to help you start using the FCCS.

**References.** Lists literature cited in this manual.

**Appendix A:** Map of Bailey Ecoregion divisions in the United States.

**Appendix B:** List of the FCCS national fuelbeds.

**Glossary:** Defines key words used in this manual and the FCCS.

## Conventions

This manual uses the following conventions:

Menu selections, buttons, and dialog box names are shown in **Bold text**. For example, "Select the **F**ile menu."

Commands you type from the keyboard are shown in *italics*. For example, "Enter *Test Unit 1* as the name of the trial burn unit"

Key names are shown in SMALL CAPS.

Key combinations are shown separated by a hyphen (-). For example, "press SHIFT-F1" means "hold down the SHIFT key and press F1."

"Click" refers to pressing the primary mouse button (Usually the left mouse button).

"Double click" refers to pressing the primary mouse button twice.

"Right click" refers to pressing the secondary mouse button.

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## ***FCCS Overview***

The Fuel Characteristic Classification System (FCCS) provides fire and fuel managers with a nationally consistent and durable procedure to characterize and classify fuels. You can use the FCCS to inventory fuel characteristics and to generate numerical inputs to fire behavior, fire effects, and dynamic vegetation models.

The FCCS defines a fuelbed as the inherent physical characteristics of fuels that contribute to fire behavior and effects. A fuelbed can represent any scale that you consider to be mostly uniform. The FCCS describes fuelbeds in six strata including canopy, shrub, nonwoody vegetation, woody fuels, litter - lichen - moss, and ground fuels. Each stratum is further divided into one or more categories to represent the complexity of wildland and managed fuels.

The FCCS calculates fuel characteristics for each fuelbed stratum, category, and subcategory and provides outputs in a printable report. The characteristics include percent cover, depth, height, height to live crown, percent live foliar moisture content, density, diameter at breast height, live fuel loading, dead fuel loading, fuel area index, packing ratio, and optimum packing ratio

The FCCS output reports also include a set of FCCS fire potentials:

- Index of surface fire behavior potential from 0-9;
- Index of crown fire potential from 0-9; and
- Index of available fuel potential from 0-9.

Fire potentials are a set of relative values that rate the intrinsic physical capacity of any wildland fuelbed to release energy, and to spread, crown, consume, and smolder under extremely dry conditions. The FCCS fire potentials provide a flexible means of expressing any fuelbed as a function of its potential to produce fire behavior or effects. The intent is to provide a flexible and robust approach to quantifying fuels that is easy to communicate.

Fire potentials can be used to map fire hazard and to facilitate communication of the degree of fire hazard. They can also be used in conjunction with knowledge of environmental conditions to approximate fire behavior and effects (i.e., scaled downward to reflect fuel moisture conditions or scaled upwards to represent wind or slope).

### ***How Can the FCCS Help Me?***

Characterizing fuels and assessing their potential to burn has always been important to fire and fuel managers and is becoming increasingly important to other specialists, including ecologists, air quality/smoke managers, landuse planners, and global change scientists / carbon modelers.

If you are working on a fire hazard reduction project, you may wish to use the FCCS to select and/or build fuelbeds that represent pre- and post-burn fuel conditions. The FCCS calculator summarizes fuel characteristics for each fuelbed you analyze and ranks the fuelbed on its surface fire, crown fire and available fuel potentials. The FCCS can be used as a planning tool to target which fuels should be removed to effectively reduce the on-site fire hazard. It can also be used as a reporting tool to summarize pre and post-burn fuel characteristics and fire hazard potential.

Air quality specialists may run the FCCS to calculate fuel loadings to be used as inputs to emissions and smoke production software packages such as Consume (<http://www.fs.fed.us/pnw/fera/products/consume.html>) or BlueSky (<http://www.fs.fed.us/pnw/airfire/>).

Landscape ecologists who wish to map fuel loadings, carbon stores, or fire hazards can use the FCCS to calculate fuel loading and/or fire potentials as inputs to their GIS project.

## ***How Do I Use the FCCS?***

Follow these basic steps to use the FCCS:

- 1) Select a fuelbed that best matches a fuel environment of interest by querying the FCCS national fuelbed library.

The selected fuelbed represents best-available knowledge on the types of fuel (fuelbed strata, categories, and subcategories), their characteristics (size, physical arrangement, biomass, and moisture content), and relative abundance for that fuel environment.

- 2) You can either accept the default settings of the selected fuelbed or customize the fuelbed using more detailed information about vegetation structure, fuel composition, and fuel dimensions and/or loadings.

FCCS fuelbeds provide a starting point or baseline. Each variable may be modified to capture the complexity of fuels across time and space. You may also wish to reduce the complexity of fuelbeds to represent a coarser scale of interest.

- 3) When you have completed reviewing or customizing fuelbed data, FCCS will calculate quantitative fuel characteristics and fire potentials specific to the fuelbed in question based on modal value inputs.
- 4) You may view summarized inputs and calculated output in four printable reports.

## ***Which Data Do I Enter?***

The FCCS calculates fuel characteristics and the inherent potential of a fuelbed for surface fire behavior, crown fire, and consumption of available fuels. Appendices C and D contain complete technical information about the FCCS calculator. Basic data to complete the calculations are entered into the following data entry screens. Most input variables allow for a maximum, minimum and modal value to be entered. Only modal values are required to run the calculator.

- The **Canopy stratum** has three categories including Trees, Snags and Ladder fuels, each of which is represented by a separate icon. Click on the page tabs to enter data for each category.
- The **Shrub stratum** records shrub information in primary and secondary shrub layers.
- The **Nonwoody stratum** records herbaceous vegetation (grasses, sedges, rushes and forbs) inputs in primary and secondary layers.
- The **Woody fuels stratum** has 5 categories: all downed and dead wood, sound wood, rotten wood, stumps, and woody fuel accumulations. Click on the page tabs to enter data for each category.
- The **LLM stratum** records data on Litter, Lichen, and Moss layers.
- The **Ground Fuels stratum** has 3 categories including Duff, Basal Accumulations, and Squirrel Middens.

To create a new fuelbed, select a fuelbed from the FCCS national fuelbed database, preferably one that has similar inputs to your site, and save it as a customized fuelbed. Enter only those inputs applicable to your fuelbed. For example, if your fuelbed is a grassland with no trees or shrubs, simply click “Not present” in the Canopy and Shrub stratum screens. For more detailed information on creating your own fuelbeds, please see “Recording and Managing Data.”

## ***How Were the FCCS Fuelbeds Developed?***

The FCCS contains over 200 fuelbeds that you can select and modify for your specific application. The fuelbeds were developed by the Fire and Environmental Applications Team (FERA) and contain data from the following sources: regional workshops (see map below); published literature; USDA Forest Service photo series, general technical reports, and research papers; other government literature and large databases (e.g., National Park Service and Fuel Inventory and Analysis); MS and PhD thesis; white papers, field data, and other unpublished data; and expert opinion.

The FCCS fuelbeds were developed to represent fuel characteristics throughout the nation. The following table summarizes FCCS fuelbeds by region and the change agents they represent.

Region	Number of FCCS fuelbeds	Represented change agents
Boreal (Alaska)	19	Insects and Disease
Hawaii	18	Introduction of Exotic Species, Grazing, Wildfire
Northeast	19	Fire Exclusion, Selection Cut, Insects and Disease, Clearcut, Wildfire
Pacific Northwest	31	Fire Exclusion, Selection Cut, Wildfire, Clearcut, Thinning, Prescribed Fire, Insects and Disease
Rocky Mountains and Central	38	Fire Exclusion, Insects and Disease, Grazing, Prescribed Fire, Introduction of Exotic Species, Wildfire, Windthrow
Sierra Nevada	16	Fire Exclusion, Grazing, Prescribed Fire
Southeast	47	Fire Exclusion, Insects and Disease, Windthrow, Prescribed Fire, Selection Cut, Clearcut, Thinning, Introduction of Exotic Species
Southwest	28	Fire Exclusion, Selection Cut, Grazing, Prescribed Fire, Wildfire

## ***How Does FCCS Analyze Data?***

### ***Fuel Characteristics***

The FCC System calculates or infers fuel characteristics using the best available published data and, where necessary, unpublished information. The data used in calculations originate from either using a FCCS National Fuelbed or customized fuelbed created for a specific purpose. All calculations are based on modal inputs. Minimum and maximum inputs are for reference purposes only.

Some characteristics, such as percent cover or fuel loading in the case of nonwoody vegetation or downed woody fuel, are inputs in the FCCS editor and simply summarized and reported by the calculator. Many of the fuel characteristics calculated in the FCCS are important inputs to the FCCS fire potential calculations.

The FCCS summarizes and calculates the following fuel characteristics:

- 1) **Fuel loading (total, live and dead):** Unless input directly into the FCCS, fuel loadings are calculated from dimensional inputs and summarized as total, live and dead loading by stratum, category and subcategory in reports.
- 2) **Fuel area index (FAI):** Fuel Area Index (FAI) is a relatively new and useful concept in fire behavior modeling. Analogous to Leaf Area Index, FAI is the surface area of fuels per unit ground area. In order to assimilate the heterogeneous fuel structures captured by the FCCS national database, FCCS calculates the total fuel surface area on all size classes of fuels, including live foliar biomass. FAI is used to calculate FCC Fire Potentials.
- 3) **Percent cover:** Percent cover is generally an input variable and refers to the percent cover by crown projection of trees, shrubs and nonwoody vegetation and by linear estimates of woody and ground fuels.
- 4) **Packing ratio ( $\beta$ ):** Packing ratio ( $\beta$ ) is the fraction of a fuelbed volume that is occupied by fuel particles (Rothermel 1972) and is an important factor in predicting fire behavior. At very low packing ratios (or fuel densities), fire spread is limited and fire intensities are therefore low. At very high packing ratios, the lack of oxygen limits fuel combustion. Each fuel environment has an optimum packing ratio in which fuels are ideally configured for maximum fire intensity (Rothermel 1972). Packing ratio is calculated by species and/or subcategory in each stratum and summed by stratum.
- 5) **Optimum packing ratio ( $\beta$  opt):** Conceptually, every fuel type has an ideal or optimum packing ratio in which fuels are configured in a way that results in maximum fire spread and intensity (Rothermel 1972). In other words, under an optimum packing ratio, fuels are tightly spaced enough for maximum heat transfer but not so dense that oxygen is limiting to the combustion process. FCCS calculates an optimum packing ratio using the same general equation for every fuel stratum except for ground fuels. Optimum packing ratio is used to calculate FCCS Fire Potentials.
- 6) **Density:** Density refers to the number of trees, stumps and other fuel categories per unit acre. Density values are input into the FCCS and summarized and reported by the calculator.
- 7) **Height to live crown:** Applicable only to the canopy stratum, height to live crown is input into the FCCS and summarized and reported by the calculator.
- 8) **Height:** Height refers to the distance from the ground to top of a fuel. It is a common FCCS input and is summarized and reported by the calculator.

- 9) Depth:** Depth of each fuel stratum and category is a basic measure of the vertical structure of a fuelbed. The term height (ft) is used in canopy, shrub, and nonwoody strata whereas depth (inches) is used for woody, litter-lichen-moss, and ground fuels strata. The woody stratum contains fuels that are generally continuous (e.g., small diameter woody debris and duff) and fuels that are by nature discontinuous (e.g., stumps and woody fuel accumulations). For consistency, FCCS only considers the depth of continuous fuels in the woody stratum.
- 10) Live foliar moisture:** Live foliar moisture is an input in the Canopy, Shrub and Nonwoody vegetation strata and is simply reported by the calculator.

### ***FCCS Fire Potentials***

FCCS calculates and reports nine fire potentials for every fuelbed, arranged in three categories (Figure 1):

**FCCS surface fire behavior potential (FBP):** Fire behavior potential is calculated as the maximum of the three component potentials, scaled to values of 0 to 9. The three components of FBP are:

***Reaction potential (RP)*** (0-10): represents the reaction intensity (energy release per unit area per unit time) under extremely dry conditions. Reaction potential is a function of the volume of fuels per unit of ground surface, depth of the surface fuelbed strata, heat of combustion, damping coefficients due to moisture and mineral content, and a scaling factor.

***Spread potential (SP)*** (0-10): proportional to the rate of spread (distance per unit time at benchmark condition) in surface fuels and is a function of reaction intensity, propagating energy flux, and the heat sink provided by unburned fuels in advance of the spreading flame.

***Flame length potential (FP)*** (0-10): provides a measure of predicted flame length (in feet, at benchmark conditions) proportional to fireline intensity or flame length. Flame length potential is derived from the product of reaction intensity (Byram 1959, Albini 1976).

**Crown fire potential (CFP):** FCCS uses a rule-based ranking of crown fire potential based on limited scientific understanding of the factors that control torching and crowning. Hopefully, continuing research will provide improved quantification of the factors that control crown fire potential so that estimates of CFP can be improved in future FCCS releases. Crown Fire Potential is scaled from 0-9 and is calculated as the maximum of TC/3, DC/1.5, or IC (see below).

**FCCS torching potential (TC) (0-10):** ranks the probability for individual crown ignition. In a multi-layered canopy with a vertical gap between the overstory and understory, TC is the maximum of two sub-components that independently rates the torching potential in each.

**FCCS dependent crown fire potential (DC) (0-10):** represents the likelihood and intensity of canopy fires that are strongly coupled to a spreading surface fire front based heavily on the relationship of fireline intensity to canopy base height as advanced by Van Wagner (1977) and Scott and Reinhardt (2005), to represent the likelihood and intensity of canopy fires that are strongly coupled to a spreading surface fire front.

**FCCS independent crown fire potential (IC) (0-10):** based on the probability of torching and canopy closure.

**Available fuel potential (AFP):** Available fuel potential estimates the oven-dry, combustible biomass in the flaming, smoldering, and residual smoldering phases of combustion. The index is expressed in units of 10 tons per acre and estimates total fuel loading of all fuel elements within a set depth from the surface of the fuel component.

**Flame available fuel (FA) (0-10):** the sum of mass (tons per acre/10) within one-half inch (12.7 mm) of the surface of the fuel element, and in turn is the sum of three sub-components:

**Flame-reactive surface available fuel (FAR) (0-10):** Mass of fuel consumed in the flaming front of a spreading surface fire and that contributes to forward energy transfer. It is the mass of thermally thin fuel elements plus a thin skin of larger fuel elements, with a thickness that represents the depth of the pyrolysis zone (defined as "Reaction Thickness" or RT later in this paper). The surface fuel includes the shrub (foliage only), nonwoody fuels, woody fuels, and litter-lichen moss strata.

**Flame-Available Post-reactive surface fuels (FAP) (0-10):** Remainder of flame-available surface fuel after the passage of the flaming front plus the flame-available fuel in the ground stratum, if present.

**Flame-available canopy fuel (FAC) (0-10):** Mass of tree canopy and fine twigs.

**Smoldering available fuel (SA) (0-10):** Mass between ½ and 2 inches (51 mm) of a fuel surface.

**Residual available fuel (RA) (0-10):** Mass between 2 and 4 inches (100mm) of a fuel surface.

## ***What Results Do I Get?***

The FCCS presents results in four printable reports:

- **Potentials:** the FCCS fire potentials
- **General:** summary of basic fuel characteristics
- **Strata & categories:** fuelbed characteristics by stratum and category
- **Input:** summary of input data

## ***FCCS Basics***

This chapter introduces you to the basic information you need in order to use the FCCS, including:

How to install, start, and exit the FCCS.

An overview of the FCCS screens and how to use them.

Information about backing up and restoring files.

### ***Downloading the FCCS***

You can download the FCCS installation file from the Fire and Environmental Research Applications team (FERA) web site:

<http://www.fs.fed.us/pnw/fera/fccs/downloads.html>

Right click on the [fccs.zip](#) file to start the download.

You may wish to download this file to a place that is easy to locate, such as your desktop or c:\.

### ***Installing the FCCS***

#### **Step 1: Verify that the Java Virtual Machine (JVM) is current**

FCCS requires the JVM version 1.5 or later. To verify that your machine has a current version, open a command line window<sup>1</sup> and type:

```
JAVA -VERSION
```

If you get a message that java is not recognized, JVM is not installed.

---

<sup>1</sup> To access the command line window in Microsoft Windows, go to the **Start Menu**, select **Run** and type CMD.EXE.

If a recent version of JVM is installed, you should see a message similar to this:

```
java version "1.5.0_02"  
Java(TM) 2 Runtime Environment, Standard Edition  
(build 1.5.0_02-b09)  
Java HotSpot(TM) Client VM (build 1.5.0_02-b09,  
mixed mode, sharing)
```

Any JVM version 1.5 or more recent is fine.

### **Step 2: If you *do not* have a current version of Java Virtual Machine, install it or upgrade your version**

You may need administrative privileges for this install.

Verify you have administrative privileges by clicking the time on the tool bar in the lower right corner of your screen. You will be allowed to change the date and time on your computer if you have administrative privileges. If you do not have administrative privileges, please contact your system administrator for assistance.

Go to <http://www.java.com>

Click on the Java Software Download button.

You will be asked if you accept the "Terms of Use". Click **Continue**.

Once the installation is complete, follow **Step 1** to verify that you have a current, working copy of Java Virtual Machine.

### **Step 3: Install the FCCS**

Unzip the downloaded file, **fccs.zip**. The file unzips into a fccs directory (folder) that contains several subdirectories and three files (build.xml, fccs.bat, and fccs.jar).

Navigate into the directory in which you installed FCCS.

Double-click on the file **fccs.bat** to launch the application from the command window.

Depending on your computer's processing speed, the program may take a few moments to load.

If there is a problem with your installation, the FCCS will write any associated error messages in the command window. In the event of a problem, you should copy the error messages and send them to [FCCS Tech Support](#) for help diagnosing the problem.

## ***Opening the FCCS***

You may open FCCS by double-clicking on the **fccs.jar** file located in the directory where you unzipped the FCCS program.

Depending on your computer's processing speed, the program may take a few moments to load. The FCCS Welcome screen will appear and display photos of sample fuelbeds and their locations.

Click **NEXT** at the bottom of the screen to enter the Fuelbed Selection Screen.

## ***Exiting the FCCS***

Click **Exit** at the bottom of any editor screen or the **X** button at the top right corner of any screen in the FCCS.

If you have made any modifications to a fuelbed, you will be prompted to save the customized fuelbed under a new name before exiting.

## ***Getting Help***

To get help in the FCCS, click **Help** at the bottom of any screen. Select a topic from the list on the left panel. Details will appear on the panel to the right.

## **FCCS Quick Reference Guide**

The Quick Reference Guide provides basic information for navigating and using the FCCS.

### **Quick Reference Guide**

#### ***Installation instructions***

Your computer must have a recent (version 1.5 ) copy of Java Virtual Machine to run FCCS. If this is your first time installing FCCS, please refer to “Installing the FCCS” for more detailed instructions.

In a regular internet browser, download **fccs.zip** from the FCCS download site. Unzip **fccs.zip** into a destination directory of your choosing. The **fccs.zip** file unzips to a directory named **fccs**.

#### ***Opening the FCCS***

Open the FCCS by double-clicking on **fccs.bat** located in the directory where you unzipped the FCCS program.

#### ***Welcome screen***

The **FCCS Welcome screen** displays photos of sample fuelbeds and their locations. It also provides contact information for the FCCS development team and lists sponsors.

Click **NEXT** at the bottom of the screen to enter the Fuelbed Selection Screen.

#### ***Fuelbed selection screen***

There are two ways to select a fuelbed in the Fuelbed Selection Screen:

##### **1. Click *Search by Fuelbed Environment***

- To search for a fuelbed, you must first select an Ecoregion - Vegetation form combination. Additional search variables are optional. To select additional search variables, click on the corresponding button under “Include in search,” then click on the down arrow to the right of each variable box to make your selection.
- After selecting search variables, click **Search by fuelbed environment**. [Note: not all search variable combinations result in a fuelbed match.]
- Select a fuelbed in the search results listed at the bottom left of the screen. A description of the selected fuelbed will appear to the right. Click **Next** to view and edit the fuelbed characteristics.

##### **2. Click *Select fuelbed by filename***

- Select a fuelbed filename from the Open dialog box, then click **Open** to view the fuelbed name and description. Click **Next** to view and edit the selected fuelbed.

## Quick Reference Guide

<b><i>Editor screens</i></b>	<p>The <b>Editor screens</b> allow you to view and modify fuelbed characteristics organized by fuelbed stratum.</p> <p>Click on the illustrated tabs at the top of the screen to toggle between Canopy, Shrub, Nonwoody, Woody, Litter-lichen-moss, Ground fuel, and Customize fuelbed screens.</p>
<b><i>Customizing fuelbed data</i></b>	<p>To create a new fuelbed, you must select a fuelbed from the FCCS national fuelbed database and save it as a customized fuelbed.</p> <p>Editing tips:</p> <ul style="list-style-type: none"> <li>• Single click on any white data entry space to customize the fuelbed.</li> <li>• Press ENTER or single click on another white data entry space to complete your entry.</li> <li>• If your entry exceeds soft minimum and maximum values, you will receive a warning message but the entry will be recorded.</li> <li>• If your entry exceeds hard minimum and maximum limits, you will receive an error message, and the entry will not be recorded.</li> </ul>
<b><i>Saving custom fuelbeds</i></b>	<p>Click <b>Save As</b> at the bottom of any editor screen to save your customized fuelbed. In the Save window enter a filename and click <b>Save</b> in the Save window. For future viewing in the FCCS, you should keep your customized fuelbed in the default user_fuelbed directory.</p>
<b><i>Units of measure</i></b>	<p>All units are in the English measurement system. Measurement units such as feet or inches are dependent on the fuel category. For example, tree heights are entered as feet whereas tree diameters are in inches.</p>
<b><i>Min Mode and Max inputs</i></b>	<p>The FCCS records three values for numeric inputs: minimum, modal and maximum values. Most fuelbeds in the FCCS national library represent a range of actual site conditions. The minimum and maximum inputs represent minimum and maximum values for a particular fuelbed. The modal value represents the most common value for a particular fuelbed.</p>
<b><i>Common or scientific name lookup tool</i></b>	<p>To find the scientific name for a common plant name (or vice versa) click Common/scientific name lookup at the bottom of any editor screen. To switch between common name and scientific name searches, click on the appropriate radio button.</p> <p>Scroll down and select a name from the left panel. If you select a scientific name, common name and outmoded scientific name matches are listed on the right panel. If you select a common name, scientific name and outmoded scientific names are listed.</p>

### Quick Reference Guide

<b><i>Return to the Fuelbed Selection Screen</i></b>	Click <b>Back</b> at the bottom of any Editor screen to exit the fuelbed and select a new fuelbed for editing. If you have made any modifications to the fuelbed, you will be prompted to save your customized fuelbed.
<b><i>Help</i></b>	Click <b>Help</b> at the bottom of any screen. Select a topic from the list on the left panel. Details will appear on the panel to the right.
<b><i>Calculate button</i></b>	Click <b>Calculate</b> at the bottom of any editor screen to initiate the FCCS calculator and enter the Report screen.
<b><i>Report screen</i></b>	<p>You can select any one of the following report types to <b>print to file</b> by clicking on the corresponding radio button:</p> <ul style="list-style-type: none"> <li>• <b>Potentials report:</b> fire potentials</li> <li>• <b>General report:</b> summary of basic fuel characteristics</li> <li>• <b>Strata &amp; categories report:</b> calculated fuelbed characteristics by stratum and category</li> <li>• <b>Combustion report:</b> calculated fuelbed characteristics by combustion environment</li> <li>• <b>Input report:</b> summary of input data</li> </ul>
<b><i>Printing output reports</i></b>	<p>The best way to print output reports from the FCCS is to save the report as a PDF (Adobe Acrobat® file format) and open it in Adobe Reader®.</p> <p>If your computer already has Adobe Reader installed, you can simply double-click on the PDF file to view and print it.</p>
<b><i>Exiting the FCCS</i></b>	<p>Click <b>Exit</b> at the bottom of any editor screen or the <b>X</b> button at the top right corner of any screen in the FCCS.</p> <p>If you have made any modifications to a fuelbed, you will be prompted to save the customized fuelbed under a new name before exiting.</p>

# Navigating the FCCS screens

## The FCCS Welcome screen

When you open the FCCS, the first screen you see is the FCCS Welcome screen. Photos of sample FCCS National Fuelbeds, selected from the USDA Forest Service photo series database, are randomly displayed on this screen along with contact information of the FCCS development team and logos of our main sponsors and collaborators.

Click **Next** to enter the FCCS.



## Fuelbed Selection Screen

After **Next** is clicked at the bottom of the Welcome screen, the Fuelbed Selection screen will appear. On slower systems, the program may take several seconds to load. The right panel of the Fuelbed Selection screen, entitled "Welcome to the Fuel Characteristics Classification System," provides basic instructions for navigating the FCCS.

Search for Fuelbed 1.0 ( 1.71 08291000 )

Click for Information:

- Ecoregions
- Vegetation forms
- Structural classes
- Cover types
- Change agents
- Natural fire regimes
- FRCC

Introduction

Search term: Hot Continental-220

Broadleaf Forest

Not Used

SAF 001: Jack Pine

Avalanche

R0

Class 1

Include in search:

- Hot Continental-220
- Broadleaf Forest
- Not Used
- SAF 001: Jack Pine
- Avalanche
- R0
- Class 1

Search for Fuelbed

- or -

Select Fuelbed by filename

Click a fuelbed for details

Next ... Help

Welcome to the Fuel Characteristic Classification System.

To begin using the Fuel Characteristic Classification System (FCCS), you may search for a fuelbed either by using combinations of the seven selection criteria on the top left or by choosing a fuelbed filename. To use the selection criteria, you must choose an Ecoregion and Vegetation form. You can view examples of each selection criterion by clicking on its label. After selecting the appropriate criteria, click the "Search for Fuelbed" button and a list of fuelbed(s) with simple descriptions will appear in the bottom left panel. To find a fuelbed by filename, click the "Select Fuelbed by filename" button and a file selection pop-up box will appear. After scrolling through the list of available fuelbeds, choose the one that meets your objectives, and then click the "Open" box. The fuelbed will appear in the bottom left panel of the selection screen and a general information page for the chosen fuelbed will appear on the right hand side of the selection screen. After reviewing this information, click the "Next..." button to open the fuelbed data file and proceed with FCCS.

Fuelbed data is arranged in a series of tabs and sub-tabs that represent strata (Canopy, Shrubs, Nonwoody, Woody, Litter Lichen Moss, and Ground fuel) and categories (e.g., Trees, Snags, and Ladder fuels). If data are available and applicable, minimum, maximum, and modal values are given.

If you choose to change data in a fuelbed, click on the "Customize fuelbed" tab to define the general information necessary to document your work, and then click on the "Save as..." button to save and name your customized fuelbed. Your customized fuelbed will be stored in a directory called "user\_fuelbeds" unless you specify otherwise.

Clicking the "Calculate" button invokes the FCCS calculator and creates several output reports that include fire potentials, fuel

## Search for Fuelbed

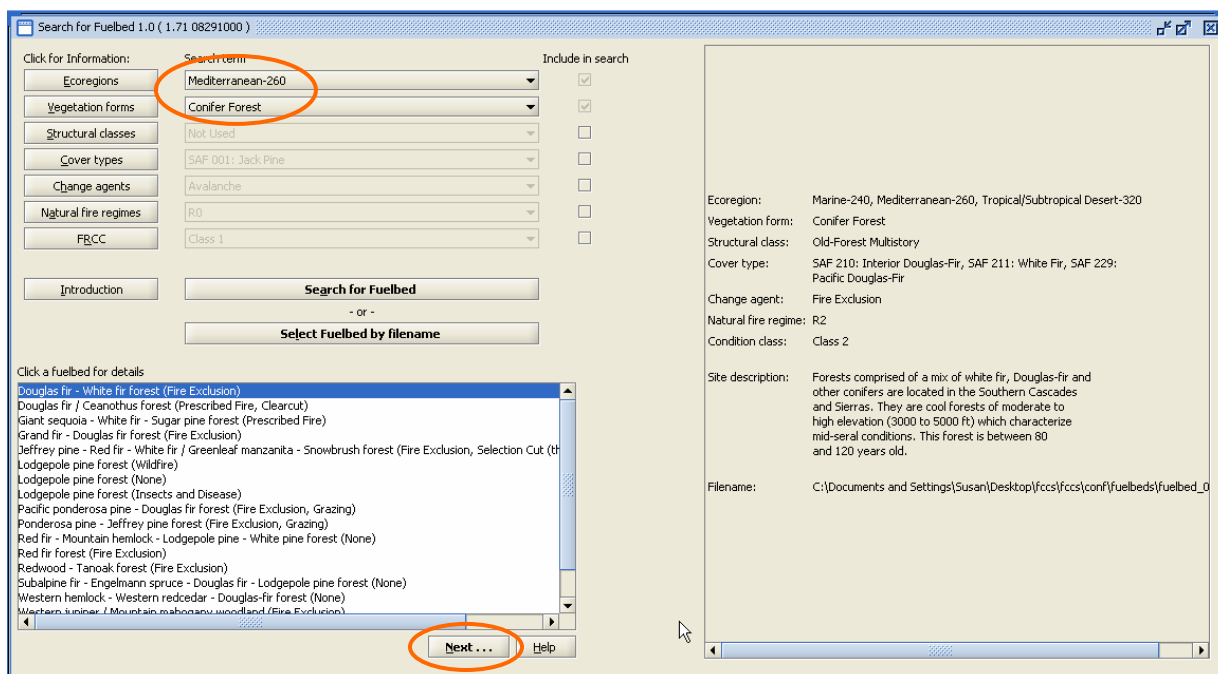
There are seven search variables to help you query the FCCS national fuelbeds. You must select an ecoregion and vegetation form combination to perform a query. The other five search variables are optional. To include an optional search variable, you must first click on the box to the right of the variable (under "Include in search"). To change a search variable, click on the down arrow to the right of each variable box and make your selection.

After choosing a search variable combination, click Search for Fuelbed. A list of fuelbed matches should appear in the search results panel at the bottom left of the screen. Not all search variable combinations result in matches.

Select a fuelbed name from the list. Note that fuelbed names include associated change agents in parentheses. A fuelbed description appears in the top right window, replacing the "Welcome to the Fuel Characteristic Classification System" message.

Click **Next** to view and edit the selected fuelbed.

*In this example, the selected ecoregion is Mediterranean and vegetation form is Conifer Forest. This query results in multiple matches. A description for a highlighted fuelbed, entitled "Douglas-fir-White fir forest (Fire Exclusion)" is displayed in the right panel.*



## Click for Information

For a visual or descriptive example of each search variable, click the variable name button. A graphic or text description will appear in the right panel.

In this example, the **Structural class** button was selected under "Click for information." The seven structural class options are illustrated in the right panel, and Old Forest Single Story is highlighted in the Structural class toggle box.

The screenshot shows the 'Search for Fuelbed 1.0' application window. On the left, under 'Click for Information:', the 'Structural classes' button is highlighted with an orange circle. Below it, a search table is visible:

Click for Information:	Search term	Include in search
Ecoregions	Mediterranean-260	<input type="checkbox"/>
Vegetation forms	Conifer Forest	<input type="checkbox"/>
<b>Structural classes</b>	<b>Stem Exclusion Closed Canopy</b>	<input checked="" type="checkbox"/>
Cover types	SAF 001: Jack Pine	<input type="checkbox"/>
Change agents	Avalanche	<input type="checkbox"/>
Natural fire regimes	R0	<input type="checkbox"/>
FBCC	Class 1	<input type="checkbox"/>

Below the search table are buttons for 'Introduction', 'Search for Fuelbed', '- or -', and 'Select Fuelbed by filename'. A list of fuelbeds for details is shown at the bottom left, including 'Douglas fir - White fir forest (Fire Exclusion)'. The right panel displays seven structural class illustrations with labels: Old-Forest Multistory, Old-Forest Single Story, Stand Initiation, Stem Exclusion Closed Canopy, Stem Exclusion Open Canopy, Understory Re-initiation, and Young-Forest Multistory.

## Refining a Fuelbed Query

To refine a query, select a new combination of search variables:

- Activate additional search variable lists by clicking the "Include in search" box to the right of the search item.
- Select specific search variables by clicking the down arrow at the right of the toggle box and highlighting a variable name.
- To view and edit a fuelbed, highlight a fuelbed name from the list and click **Next**

*In this example, a Structural class variable, Old-Forest Single Story, was selected in addition to Ecoregion = Mediterranean and Vegetation form = Conifer Forest. The refined query results in two fuelbed matches. Lodgepole pine forest (Insects and Disease) was selected to view its description.*

Search for Fuelbed 1.0 ( 1.71 08291000 )

Click for Information: Search term Include in search

Ecoregions	Mediterranean-260	<input checked="" type="checkbox"/>
Vegetation forms	Conifer Forest	<input checked="" type="checkbox"/>
Structural classes	Old-Forest Single Story	<input checked="" type="checkbox"/>
Cover types	SAF 001: Jack Pine	<input type="checkbox"/>
Change agents	Avalanche	<input type="checkbox"/>
Natural fire regimes	R0	<input type="checkbox"/>
FRCC	Class 1	<input type="checkbox"/>

Introduction Search for Fuelbed - or - Select Fuelbed by filename

Click a fuelbed for details

Lodgepole pine forest (Insects and Disease)  
Subalpine fir - Engelmann spruce - Douglas fir - Lodgepole pine forest (None)

Ecoregion: Marine-240, Mediterranean-260, Temperate Steppe-330, Temperate Desert-340  
Vegetation form: Conifer Forest  
Structural class: Old-Forest Single Story  
Cover type: SAF 218: Lodgepole Pine  
Change agent: Insects and Disease  
Natural fire regime: R3  
Condition class: Class 2

Site description: Lodgepole pine forests occur in mid-montane forests throughout Washington, Oregon and the Rocky Mountains. This stand is over 80 years old, and has been attacked by pine bark beetles less than 5 years ago.

Filename: C:\Documents and Settings\Susan\Desktop\fccs\fccs\conf\fuelbeds\fuelb

Next... Help

## Using Multiple Search Variables

Queries with multiple search variables may not produce matches. When this occurs, try rerunning the query with fewer search variables or modify your search variable combination. If the FCCS does not contain a fuelbed that exactly matched your criteria, you may wish to find the closest match and modify it to your specific needs.

*In this example, the inclusion of R1 Natural fire regime did not produce a match. The system returned the message "No Matches – retry with broader search."*

The screenshot shows the 'Search for Fuelbed 1.0 (1.71.08291000)' application window. The search criteria are as follows:

Search term	Include in search
Ecoregions: Mediterranean-260	<input checked="" type="checkbox"/>
Vegetation forms: Conifer Forest	<input checked="" type="checkbox"/>
Structural classes: Old-Forest Single Story	<input checked="" type="checkbox"/>
Cover types: SAF 001: Jack Pine	<input type="checkbox"/>
Change agents: Avalanche	<input type="checkbox"/>
Natural fire regimes: R1	<input checked="" type="checkbox"/>
FRCC: Class 1	<input type="checkbox"/>

Buttons: Search for Fuelbed, - or -, Select Fuelbed by filename

Click a fuelbed for details: No Matches - retry with broader search

Buttons: Next ..., Help

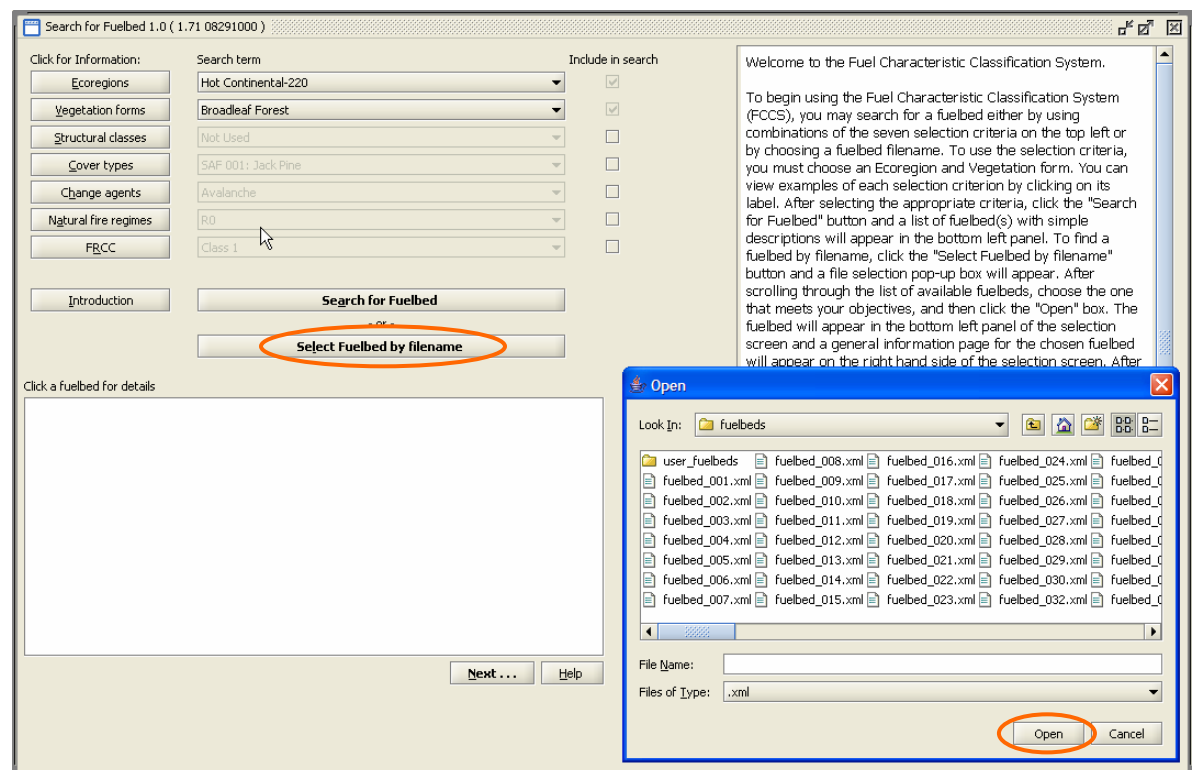
Results:

Ecoregion: Marine-240, Mediterranean-260, Temperate Steppe-330, Temperate Desert-340  
Vegetation form: Conifer Forest  
Structural class: Old-Forest Single Story  
Cover type: SAF 218: Lodgepole Pine  
Change agent: Insects and Disease  
Natural fire regime: R3  
Condition class: Class 2  
Site description: Lodgepole pine forests occur in mid-montane forests throughout Washington, Oregon and the Rocky Mountains. This stand is over 80 years old, and has been attacked by pine bark beetles less than 5 years ago.  
Filename: C:\Documents and Settings\Susan\Desktop\fccs\conf\fuelbeds\fuel

## Select Fuelbed by Filename

Users may also select a fuelbed by filename. Click **Select fuelbed by filename** to choose from a list of fuelbeds in the Open dialog box. For a list of fuelbed files in the FCCS national fuelbed reference library, see Appendix B.

- Select a filename from the list of available fuelbed files.
- Click **Open**. This will close the Open dialog box. A description of the selected fuelbed will be displayed in the right panel of the Fuelbed selection screen.
- Click **Next** to view and edit the selected fuelbed.



## Editor Screens

After you select a fuelbed and click **Next**, the system enters the FCCS Editor where you can view and modify fuelbed data.

There are six stratum tabs in the Editor: Canopy, Shrub, Nonwoody fuels, Woody fuels, Litter lichen moss, and Ground fuels. A customize fuelbed tab is also available to document modified fuelbeds. Click on individual tabs to switch between screens.

Canopy stratum - Trees: live tree > 4.5 feet in height

Total Canopy Cover

	Mode	Min	Max
Total percent cover (%)	50.0	10.0	100.0

not present

Overstory

	Mode	Min	Max
Percent cover (%)	50.0	10.0	100.0
Height (ft)	63.2	20.0	105.0
Height to live crown (ft)	36.9	10.0	60.0
Live foliar moisture content (%)	100.0	70.0	300.0
Density (#/acre)	218.0	150.0	350.0
Diameter at breast height (in)	8.2	6.0	12.0

Scientific Name	Rel Cover
Pinus contorta	100.00

Total relative cover (%)

100% required for Relative Cover

not present

Midstory

	Mode	Min	Max
Percent cover (%)	not present	not present	not present
Height (ft)	not present	not present	not present
Height to live crown (ft)	not present	not present	not present
Live foliar moisture content (%)	not present	not present	not present
Density (#/acre)	not present	not present	not present
Diameter at breast height (in)	not present	not present	not present

Scientific Name	Rel Cover
-----------------	-----------

Total relative cover (%)

100% required for Relative Cover

not present

version: 1.0 (1.71 08291000)

# ***Recording and Managing Data***

This chapter provides screen-by-screen instructions for entering and modifying data necessary to run calculations in the FCCS.

## ***Units of Measure***

All units are in the English measurement system. Measurement units such as feet or inches depend on the fuel category. For example, tree heights are entered in feet, and tree diameters are in inches.

## ***Min, Mode and Max Inputs***

The FCCS calculator only requires inputs in the Mode column; you do not need to enter Min and Max data unless you wish to have them for future reference.

Although only Mode inputs are required to run the FCCS calculator, the FCCS records minimum, modal and maximum values for numeric inputs. Most fuelbeds in the FCCS national library represent a range of actual site conditions. The minimum and maximum inputs represent minimum and maximum values for a particular fuelbed. The modal value represents the most common value for a particular fuelbed.

## ***Scientific Names***

The FCCS requires many inputs by plant species. Because common names can vary by region and apply to multiple species, the FCCS uses scientific names.

If you are not familiar with scientific names, you can look up a common name using the Common/scientific name lookup tool. Click on the Common/scientific name lookup tool button at the bottom of any editor screen to access this tool.

To find the scientific name for a common plant name (or vice versa) click Common/scientific name lookup at the bottom of any editor screen. To switch between common name and scientific name searches, click on the appropriate radio button.

Scroll down and select a name from the left panel. If you select a scientific name, common name and out-moded scientific name matches are listed on the right panel. If you select a common name, scientific name and outmoded scientific names are listed.

### ***Not Present Checkboxes***

If you are modifying an FCCS national fuelbed in which some strata or categories are designated as “Not Present”, you can click the Not Present check box and replace the “Not Present” inputs with actual data.

### ***Screen-by-Screen Instructions***

The following sections provide detailed instructions for each editor screen. Not every input will be applicable to your fuelbed. For example, if you are creating a grassland fuelbed, you can simply click the Not Present check box in the Canopy and Shrub screens.

#### ***Canopy Stratum***

The **Canopy stratum** has three categories, including Trees, Snags and Ladder fuels, each of which is represented by an icon. The Tree category of the Canopy stratum is the first screen displayed in the FCCS editor. A tool tip appears as you position your mouse on each illustrated tab. Click on individual tabs to switch between canopy screens. If necessary, use the right vertical scroll bar to view the lower contents of the screen.

#### ***Tree Category***

The **Tree** category has 4 subcategories:

**Total Canopy Cover:** Total percent cover by crown projection of all tree layers.

**Overstory trees:** Uppermost canopy layer, including emergent, dominant and codominant trees.

**Midstory trees:** Intermediate canopy layer, including trees below the overstory and above the understory layer.

**Understory trees:** Lowermost canopy layer including seedlings, saplings and other small trees.

The screenshot shows the 'Edit Fuelbed' application window. The title bar indicates the file path: 'C:\Documents and Settings\Susan\Desktop\FCCS\_20050705\_1355\FCCS\conf\Fuelbeds\Fuelbed\_023.xml'. The interface is divided into several sections:

- Canopy stratum - Trees: live tree > 4.5 feet in height:**
  - Total Canopy Cover:** A table with columns 'Mode', 'Min', and 'Max'. The 'Total percent cover (%)' row shows values 50.0, 10.0, and 100.0.
  - Not Present
- Overstory:**
  - Table with columns 'Mode', 'Min', 'Max' for various metrics: Percent cover (%), Height (ft.), Height to live crown (ft.), Live foliar moisture content (%), Density (#/acre), and Diameter at breast height (in.).
  - Table with columns 'Scientific Name' and 'Relative Cover'. One entry is 'Pinus contorta' with a relative cover of 100.00.
  - Total relative cover (%) is 100.
  - 100% required for Relative Cover.
  - Buttons: add, delete, clear.
  - Not Present
- Midstory:**
  - Table with columns 'Mode', 'Min', 'Max' for various metrics, all of which are currently 'Not Present'.
  - Table with columns 'Scientific Name' and 'Relative Cover' is empty.
  - Total relative cover (%) is 0.
  - 100% required for Relative Cover.
  - Buttons: add, delete, clear.
  - Not Present
- Understory:**
  - Table with columns 'Mode', 'Min', 'Max' for Percent cover (%) and Height (ft.).

At the bottom of the window, there is a status bar with 'winfuel: 1.0 ( 2005 C703 1245 )' and several buttons: 'Back', 'Common/Scientific Name Lookup', 'Save As...', 'Help', 'Exit', and 'Calculate'.

Many FCCS national fuelbeds do not have a tree category or will be missing one or two layers. In these cases, some or all panels are grayed out and the "Not Present" button is checked.

#### Editing tips:

- If your fuelbed has only one tree canopy layer, enter it in the Overstory and click "Not Present" in the Midstory and Understory.
- Midstory tree layers are only applicable to fuelbeds with all three canopy layers.
- Remember to enter Total canopy cover in addition to tree layer information.

### Tree Input Definitions

Variable	Definition	Options	Units (hard limits)
Total percent cover	Total percent cover by crown projection of all trees, including overstory, midstory and understory canopy layers.	Min: minimum % cover Mode: most common % cover Max: maximum % cover	Percent (0-100 %)
Percent cover	Percent cover by crown projection of each canopy layer.	Min: minimum % cover Mode: most common % cover Max: maximum % cover	Percent (0-100 %)
Height	Height of each canopy layer.	Min: minimum height Mode: most common height Max: maximum height	Feet (0-400 ft)
Height to live crown	Height from ground to bottom of live canopy for each canopy layer.	Min: minimum height to live crown Mode: most common height to live crown Max: maximum height to live crown	Feet (0-250 ft)
Live foliar moisture content	Live foliar moisture content of each canopy layer.	Min: minimum live foliar moisture content Mode: most common live foliar moisture content Max: maximum live foliar moisture content	Percent (0-700 %)
Density	Number of trees per unit area for each canopy layer.	Min: minimum density Mode: most common density Max: maximum number density	# per acre (0-50,000 / ac)
Diameter at breast height	Diameter at breast height for each canopy layer.	Min: minimum diameter Mode: most common diameter Max: maximum diameter	Inches (0-200 in)
Scientific name	Scientific name of species in each tree canopy class.	Latin name of tree species. Maximum of 10 species allowed per canopy class.	
Relative cover	Relative percent cover of each species in each tree canopy class. Must sum to 100%.	Min: minimum % cover Mode: most common % cover Max: maximum % cover	Percent (0-100 %)

## Snag Category

There are four subcategories of snags in the Snag screen:

**Decay class 1 with foliage:** Recently dead conifers that still have most of their foliage in addition to bark, branches and tree top.

**Decay class 1 without foliage:** Recently dead trees that still have bark, branches and top intact.

**Decay class 2:** Snags that have shed fine branches but retain coarse branches and bark.

**Decay class 3:** Snags with extensive heartwood decay and that no longer have bark, branches or a tree top.

Not all categories may apply to specific fuelbeds. Unused snag subcategories are grayed out and the "Not Present"; button is checked.

Canopy stratum - Snags: standing dead trees > 4.5 feet in height.  
Decay class 1 snags include recently dead trees; top intact  
Decay class 2 snags have coarse branches and bark present.  
Decay class 3 snags are rotten, branches and bark not present.

**Decay class 1 - foliage present**

	Mode	Min	Max
Density ( #/acre )	150.0	0.0	500.0
Diameter ( in. )	7.5	1.5	16.0
Height ( ft. )	58.0	4.0	120.0

Scientific Name	Relative Cover
Pinus contorta	100.00

Total relative cover ( % ) 100  
100% required for Relative Cover

Not Present

**Decay class 1 - foliage absent**

	Mode	Min	Max
Density ( #/acre )	Not Present	Not Present	Not Present
Diameter ( in. )	Not Present	Not Present	Not Present
Height ( ft. )	Not Present	Not Present	Not Present

Scientific Name	Relative Cover
-----------------	----------------

Total relative cover ( % ) 0  
100% required for Relative Cover

Not Present

**Decay class 2 - branches & bark present**

	Mode	Min	Max
Density ( #/acre )	150.0	0.0	500.0
Diameter ( in. )	7.5	1.5	16.0
Height ( ft. )	58.0	10.0	120.0

Scientific Name	Relative Cover
Pinus contorta	100.00

Not Present

**Decay class 3 - rotten; no branches & bark**

	Mode	Min	Max
Density ( #/acre )	30.0	0.0	100.0
Diameter ( in. )	7.7	1.5	16.0
Height ( ft. )	40.0	4.0	100.0

Scientific Name	Relative Cover
Pinus contorta	100.00

Not Present

VERSION: 1.0 ( 2005 C703 1245 )

### Snag Input Definitions

Variable	Definition	Options	Units (hard limits)
Density	Number of snags per acre for each class.	Min: minimum density Mode: most common density Max: maximum density	# per acre (0-10,000 / ac)
Diameter	Diameter at breast height, or highest point if broken below breast height, of snags for each class.	Min: minimum diameter Mode: most common diameter Max: maximum diameter	Inches (0-200 in)
Height	Height of snags for each class.	Min: minimum height Mode: most common height Max: maximum height	Feet (0-400 ft)
Scientific name	Scientific name of species in each snag class.	Latin name of snag species. Maximum of 2 species allowed per snag class.	
Relative cover	Relative percent cover of each species in each snag class. Must sum to 100%.	Min: minimum % cover Mode: most common % cover Max: maximum % cover	Percent (0-100 %)

## Ladder Fuels Category

Ladder fuels provide vertical continuity between surface fuels and crown fuels and contribute to torching and crowning potentials. In forests where ladder fuels are present, the Ladder Fuels screen displays data on ladder fuel types and dimensions.

In cases where ladder fuels provide continuity between the lower strata and canopy, the "Is there vertical continuity between the canopy and lower strata?" box is checked. In non-forested fuelbeds, or in forested fuelbeds in which ladder fuels do not occur, the "Not Present" button is checked and the ladder fuels area is grayed out.

Canopy strata - Ladder fuels:  
provide vertical continuity between surface and crown fuels.

Ladder fuels:

	Mode	Min	Max
Minimum height ( ft )	2.5	0.0	40.0
Maximum height ( ft )	12.0	1.0	80.0

Is there vertical continuity between the canopy and lower strata?  
Include needle drape in your assessment.

Type: Arboreal lichens & moss

Not Present

### Ladder Fuels Input Definitions

Variable	Definition	Options	Units (hard limits)
Minimum height	Height from ground to base of ladder fuels.	Min: minimum height to base Mode: most common height to base Max: maximum height to base	Feet (0-75 ft)
Maximum height	Height from ground to top of ladder fuels.	Min: minimum height to top Mode: most common height to top Max: maximum height to top	Feet (0-300 ft)
Is vertically contiguous	Are certain fuels plentiful enough to provide vertical continuity between tree crowns and lower strata?	Yes or No	
Type	Type of ladder fuel (8 options).	Arboreal lichens & moss Climbing ferns & other epiphytes Dead branches Leaning snags Profuse epicormic sprouting Stringy or fuzzy bark Tree regeneration Vines / lianas	

## Shrub Stratum

The **Shrub stratum** describes shrubs in primary and secondary layers. Some shrub strata are covered in needle litter that can contribute to fire behavior. In these cases, the "Is needle drape sufficient to affect fire behavior?" box is checked. Not all fuelbeds contain a Shrub stratum or both shrub layers.

**Primary shrub layer:** Main shrub layer distinguished by height, form, species composition or any other user-defined characteristic.

**Secondary shrub layer:** Secondary user-defined vegetation layer.

Edit Fuelbed: C:\Documents and Settings\Susan\Desktop\fccs-20050705\_1305\fccs\conf\fuelbeds\fuelbed\_023.xml

Canopy | Shrubs | Non-woody fuels | Woody fuels | Litter/lichen moss | Ground fuels | Customize fuelbed

**Shrub stratum - Shrubs:**  
contains shrubs and needle drapes.  
Primary layer includes the most abundant shrubs in a horizontal stratum.  
Secondary layer is optional and includes shrubs in a different horizontal stratum.

Is needle drape sufficient to affect fire behavior?

Primary layer (most abundant)

	Mode	Min	Max
Percent cover (%)	38.0	5.0	60.0
Height (ft.)	0.4	0.1	1.0
Percent live (%)	75.0	25.0	100.0
Live foliage moisture content (%)	120.0	70.0	300.0

Scientific Name	Relative Cover
Vaccinium scoparium	75.00
Arctostaphylos uva-ursi	25.00

Total relative cover (%) 100  
100% required for Relative Cover

add delete clear

Not Present

Secondary layer (optional)

	Mode	Min	Max
Percent cover (%)	Not Present	Not Present	Not Present
Height (ft.)	Not Present	Not Present	Not Present
Percent live (%)	Not Present	Not Present	Not Present
Live foliage moisture content (%)	Not Present	Not Present	Not Present

Scientific Name	Relative Cover
-----------------	----------------

Total relative cover (%)  
100% required for Relative Cover

add delete clear

Not Present

**Editing tips:**

- If your fuelbed has only one shrub layer, enter it into the primary shrub layer and check the "Not Present" button in the secondary shrub layer.
- You can define the two shrub layers by any number of characteristics including shrub layer height, form, or species composition.
- Percent live refers to the percent biomass that is alive in the shrub layer, not simply the percent of individuals that are alive.

**Shrub Input Definitions**

Variable	Definition	Options	Units (hard limits)
Is needle drape sufficient to affect fire behavior?	Is the needle drape on the shrub component sufficient to affect the rate of spread (fire behavior)?	Yes or No	
Percent cover	Percent cover by crown projection in each shrub layer.	Min: minimum % cover Mode: most common % cover Max: maximum % cover	Percent (0-100 %)
Height	Height of vegetation in each shrub layer.	Min: minimum height Mode: most common height Max: maximum height	Feet (0-75 ft)
Percent live	Percentage of biomass that is live in each shrub layer.	Min: minimum % live Mode: most common % live Max: maximum % live	Percent (0-100 %)
Live foliar moisture content	Live foliar moisture content in each shrub layer.	Min: minimum live foliar moisture content Mode: most common live foliar moisture content Max: maximum live foliar moisture content	Percent (0-700 %)
Scientific name	Scientific name of species in each shrub layer.	Latin name of shrub species. Maximum of 10 species allowed for each shrub layer.	
Relative cover	Relative % cover of species in each shrub layer. Must sum to 100%.	Min: minimum % cover Mode: most common % cover Max: maximum % cover	Percent (0-100 %)

## Nonwoody Fuels Stratum

The **Nonwoody Fuels stratum** describes herbaceous vegetation including grasses, sedges, rushes, and forbs in primary and secondary layers. Not all fuelbeds contain a Nonwoody stratum or both nonwoody layers.

**Primary nonwoody layer:** Main vegetation layer distinguished by height, form, species composition or any other user-defined characteristic.

**Secondary nonwoody layer:** Secondary user-defined vegetation layer.

### Editing tips:

- If your fuelbed has only one nonwoody vegetation layer, enter it into the primary layer and check the "Not Present" button in the secondary nonwoody vegetation layer.
- You can define the two nonwoody vegetation layers by any number of characteristics including height, form, and/or species composition. For example, forbs and grasses are generally placed in separate nonwoody layers.
- Percent live refers to the percent biomass that is alive in the stratum, not simply the percent of individuals that are alive. Percent live should reflect growing season conditions unless the fuelbed is specific to another season.

**Nonwoody Fuels stratum:**  
contains grasses, sedges, and herbs.  
Primary layer includes the most abundant species.  
Secondary layer is optional and includes nonwoody fuels in a different horizontal stratum.

**Primary layer (most abundant)**

	Mode	Min	Max
Percent cover ( % )	17.0	4.0	55.0
Height ( ft )	0.7	0.1	5.0
Percent live ( % )	70.0	5.0	100.0
Live foliar moisture content ( % )	75.0	70.0	900.0
Loading ( tons/acre )	0.17	0.0	3.0

Scientific Name	Relative Cover
Carex geyeri	40.00
Calamagrostis rubescens	30.00
Fragaria spp.	15.00
Arnica cordifolia	15.00

Total relative cover ( % ) 100  
100% required for Relative Cover  
add delete clear

Not Present

**Secondary layer (optional)**

	Mode	Min	Max
Percent cover ( % )	Not Present	Not Present	Not Present
Height ( ft )	Not Present	Not Present	Not Present
Percent live ( % )	Not Present	Not Present	Not Present
Live foliar moisture content ( % )	Not Present	Not Present	Not Present
Loading ( tons/acre )	Not Present	Not Present	Not Present

Scientific Name	Relative Cover
-----------------	----------------

Total relative cover ( % )  
100% required for Relative Cover  
add delete clear

Not Present

### Nonwoody Input Definitions

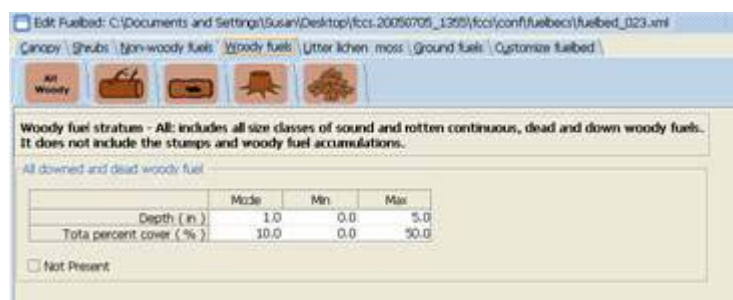
Variable	Definition	Options	Units (hard limits)
Percent cover	Percent cover of nonwoody fuels by crown projection of each nonwoody vegetation layer.	Min: minimum % cover, Mode: most common % cover Max: maximum % cover	Percent (0-100 %)
Height	Height of vegetation of each nonwoody vegetation layer.	Min: minimum height, Mode: most common height, Max: maximum height	Feet (0-10 ft)
Percent live	Percentage of biomass that is live in each shrub layer.	Min: minimum % live Mode: most common % live Max: maximum % live	Percent (0-100 %)
Live foliar moisture content	Live foliar moisture content in each nonwoody vegetation layer.	Min: minimum live foliar moisture content Mode: most common live foliar moisture content Max: maximum live foliar moisture content	Percent (0-700 %)
Loading	Fuel loading (biomass) of nonwoody vegetation for each layer.	Min: minimum loading Mode: most common loading Max: maximum loading	Tons per acre (0-15,000 tons/ac)
Scientific name	Scientific name of each species in each nonwoody vegetation layer.	Latin name of nonwoody species. Maximum of 10 species allowed for each nonwoody layer.	
Relative cover	Relative % cover of species in each nonwoody vegetation layer. Must sum to 100%.	Min: minimum % cover Mode: most common % cover Max: maximum % cover	Percent (0-100 %)

## Woody Fuels Stratum

The **Woody fuels stratum** has 5 categories: all downed and dead wood, sound wood, rotten wood, stumps, and woody fuel accumulations. A tool tip appears as you position your mouse on each illustrated tab. Click on the illustrated tabs to switch between woody category screens. If necessary, use the right vertical scroll bar to view the lower contents of the screen.

### All Downed and Dead Wood Category

The **All Downed and Dead Wood** category describes the depth and percent cover of continuous downed and dead sound and rotten woody fuels. Stumps and woody fuel accumulations are not included in this category.



### All Downed and Dead Wood Input Definitions

Variable	Definition	Options	Units (hard limits)
Depth	Average depth of continuous sound and rotten downed woody fuels.	Min: minimum depth Mode: most common depth Max: maximum depth	Feet (0-10 ft)
Total percent cover	Total percent cover of continuous sound and rotten downed woody fuels based on linear coverage.	Min: minimum % cover Mode: most common % cover Max: maximum % cover	Percent (0-100 %)

## Sound Wood Category

The **Sound wood category** displays loadings (tons/acre) data for a range of size classes of downed sound woody debris. Species designations and relative cover apply to all sound wood size classes in two groupings: 0-3 inches diameter and > 3 inches diameter.

Edit Fuelbed: C:\Documents and Settings\Susan\Desktop\fccs.20050705\_1305\fccs\conf\fuelbeds\fuelbed\_023.xml  
 Canopy | Shrubs | Non-woody fuels | **Woody fuels** | Litter/lichen/moss | Ground fuels | Customize fuelbed

All Woody

**Woody fuels stratum - Sound :**  
**sound wood category of the downed and dead woody fuels.**

Loadings: 0 - 3 inches diameter ( tons/acre )

	Mode	Min	Max
0 - 1/4 inch diameter	0.2	0.0	3.0
1/4 - 1 inch diameter	1.1	0.0	3.0
1 - 3 inches diameter	1.6	0.0	8.0
Sum	2.9	0.0	14.0

Not Present

Loadings: > 3 inches diameter ( tons/acre )

	Mode	Min	Max
3 - 9 inches diameter	9.7	0.0	50.0
9 - 20 inches diameter	8.7	0.0	50.0
> 20 inches diameter	1.0	0.0	20.0
Sum	19.4	0.0	120.0

Scientific Name	Relative Cover
Pinus contorta	100.00

Total relative cover ( % ) 100  
 100% required for Relative Cover

Not Present

### Sound Wood Input Definitions

Variable	Definition	Options	Units (hard limits)
Loadings zero to three inches	Loadings in very fine to medium sound wood categories.		
Zero to quarter inch	Loading of $\leq 1$ inch sound wood.	Min: minimum loading Mode: most common loading, Max: maximum loading	Tons per acre (0-50 tons/ac)
Quarter inch to one inch	Loading of $> \frac{1}{4}$ to $\leq 1$ inch sound wood.	Min: minimum loading Mode: most common loading Max: maximum loading	Tons per acre (0-100 tons/ac)
One to three inches	Loading of $> 1$ to $\leq 3$ inch sound wood.	Min: minimum loading Mode: most common loading Max: maximum loading	Tons per acre (0-200 tons/ac)
Loadings greater than three inches	Loadings in large sound wood categories.		
Three to nine inches	Loading of $> 3$ to $\leq 9$ inch sound wood.	Min: minimum loading Mode: most common loading Max: maximum loading	Tons per acre (0-500 tons/ac)
Nine to twenty inches	Loading of $> 9$ to $\leq 20$ inch sound wood.	Min: minimum loading Mode: most common loading Max: maximum loading	Tons per acre (0-1000 tons/ac)
Greater than twenty inches	Loadings of huge $> 20$ inch sound wood.	Min: minimum loading Mode: most common loading Max: maximum loading	Tons per acre (0-1000 tons/ac)
Scientific name	Scientific name of species in all sound wood categories.	Latin name of sound wood species. A maximum of 10 species are allowed.	
Relative cover	Relative % cover of species in all sound wood categories.	Min: minimum % cover Mode: most common % cover Max: maximum % cover	Percent (0-100 %)

## ***Rotten Wood Category***

The Rotten wood category displays loading (tons/acre) data for a range of size classes. Species designations and relative cover apply to all rotten wood size classes.

Woody fuels stratum - Rotten :  
rotten wood category of the downed and dead woody fuels.

Loading: > 3 inches diameter ( tons/acre )

	Mode	Min	Max
3 - 9 inches diameter	3.3	0.0	10.0
9 - 20 inches diameter	2.3	0.0	40.0
> 20 inches diameter	1.0	0.0	5.0
Sum	6.6	0.0	55.0

Scientific Name	Relative Cover
Pinus contorta	100.00

Total relative cover ( % ) 100  
100% required for Relative Cover

Not Present

### Rotten Wood Input Definitions

Variable	Definition	Options	Units (hard limits)
Loadings greater than three inches	Loadings in large to huge rotten wood categories.		
Three to nine inches	Loading of > 3 to ≤ 9 inch rotten wood.	Min: minimum loading Mode: most common loading Max: maximum loading	Tons per acre (0-500 tons/ac)
Nine to twenty inches	Loading of > 9 to ≤ 20 inch rotten wood.	Min: minimum loading Mode: most common loading Max: maximum loading	Tons per acre (0-1000 tons/ac)
Greater than twenty Inches	Loading of > 20 inch rotten wood.	Min: minimum loading Mode: most common loading Max: maximum loading	Tons per acre (0-1000 tons/ac)
Scientific name	Scientific name of species in all rotten wood categories.	Latin name of rotten wood species. A maximum of ten species are allowed.	
Relative cover	Relative % cover of species in all rotten wood categories. Must sum to 100%.	Min: minimum % cover Mode: most common % cover Max: maximum % cover	

## Stump Category

The **Stump** category has three subcategories:

**Sound:** Stumps composed of sound wood.

**Rotten:** Stumps composed of rotten wood.

**Lightered:** Stumps with resin-soaked heartwood.

In cases in which some or all stump types are not present, the "Not Present" box is checked and panels are grayed out.

Woody Fuels stratum - Stumps:  
contains dead stems < 4.5 feet in height.

**Sound**

	Mode	Min	Max
Density ( #/acre )	1.0	0.0	20.0
Diameter ( in )	6.0	4.0	24.0
Height ( ft )	2.0	0.0	4.5

Scientific Name	Relative Cover
Pinus contorta	100.00

Total relative cover ( % ) 100  
100% required for Relative Cover  
add delete clear

Not Present

**Rotten**

	Mode	Min	Max
Density ( #/acre )	1.0	0.0	50.0
Diameter ( in )	6.0	4.0	24.0
Height ( ft )	2.0	0.0	4.5

Scientific Name	Relative Cover
Pinus contorta	100.00

Total relative cover ( % ) 100  
100% required for Relative Cover  
add delete clear

Not Present

**Lightered pitchy**

	Mode	Min	Max
Density ( #/acre )	Not Present	Not Present	Not Present
Diameter ( in )	Not Present	Not Present	Not Present
Height ( ft )	Not Present	Not Present	Not Present

Scientific Name	Relative Cover
-----------------	----------------

Total relative cover ( % )

version: 1.0 ( 2005 0703 1245 ) Back Common/Scientific Name Lookup Save As ... Help Exit Calculate

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**Stump Input Definitions**

Variable	Definition	Options	Units (hard limits)
Density	Number of stumps per unit area in each category.	Min: minimum density Mode: most common density Max: maximum density	# per acre (0-5000/ac)
Diameter	Diameter of stumps in each category.	Min: minimum diameter Mode: most common diameter Max: maximum diameter	Inches (0-200 in)
Height	Height of stumps in each category.	Min: minimum height Mode: most common height Max: maximum height	Feet (0-4.5 ft)
Scientific name	Scientific name of species in each stump category.	Latin name of stump species. A maximum of ten species are allowed.	
Relative cover	Relative % cover of species in all rotten wood categories. Must sum to 100%.	Min: minimum % cover Mode: most common % cover Max: maximum % cover	

## Woody Fuel Accumulation Category

The **Woody fuel accumulation category** has three subcategories:

**Jackpots:** Natural accumulation and concentration of woody debris.





**Piles:** Woody debris that is formed into a pile for future burning.

**Windrows:** Woody debris that is piled and left following timber harvesting.

In cases in which some or all woody fuel accumulation types are not present, the "Not Present" box is checked and panels are grayed out.

☐ Edit Fuelbed: C:\Documents and Settings\Susan\Desktop\FCCS-20050705\_1305\FCCS\conf\Fuelbeds\Fuelbed\_023.xml

Canopy | Shrubs | Non-woody Fuels | **Woody Fuels** | Litter/lichen, moss | Ground Fuels | Customize Fuelbed

All Woody    

**Woody Fuels stratum - Woody Fuels Accumulations:**  
contains piles, jackpots, and windrows.

**Piles:**

	Mode	Min	Max
Width ( ft )	Not Applicable	Not Applicable	Not Applicable
Length ( ft )	Not Applicable	Not Applicable	Not Applicable
Height ( ft )	Not Applicable	Not Applicable	Not Applicable
Density ( #/acre )	Not Applicable	Not Applicable	Not Applicable

Not Present

**Jackpots:**

	Mode	Min	Max
Width ( ft )	5.0	1.0	15.0
Length ( ft )	5.0	1.0	15.0
Height ( ft )	3.0	1.0	7.0
Density ( #/acre )	6.0	0.0	50.0

Not Present

**Windrows:**

	Mode	Min	Max
Width ( ft )	Not Present	Not Present	Not Present
Length ( ft )	Not Present	Not Present	Not Present
Height ( ft )	Not Present	Not Present	Not Present
Density ( #/acre )	Not Present	Not Present	Not Present

Not Present

**Woody Fuel Accumulation Input Definitions**

<b>Variable</b>	<b>Definition</b>	<b>Options</b>	<b>Units (hard limits)</b>
Width	Width of piles, jackpots, and windrows.	Min: minimum width Mode: most common width Max: maximum width	Feet (0-50 ft)
Length	Length of piles, jackpots, and windrows.	Min: minimum length Mode: most common length Max: maximum length	Feet (0-210 ft)
Height	Height of piles, jackpots, and windrows.	Min: minimum height Mode: most common height Max: maximum height	Feet (0-50 ft)
Density	Number of piles, jackpots, and windrows per unit area.	Min: minimum density Mode: most common density Max: maximum density	# per acre (0-300/ac)

## ***Litter-Lichen-Moss Stratum***

The **Litter-lichen-moss stratum** describes each of the following layers:

**Litter:** The top layer of the forest or rangeland floor; composed of loose debris of dead sticks, branches, twigs, dead grass, and recently fallen leaves or needles that has been minimally altered by decomposition.

**Lichen:** Ground lichens occurring on rocks, bare ground or low vegetation.

**Moss:** Low-growing bryophytes; usually occurring in moist habitats.

Many FCCS national fuelbeds do not have a Litter-lichen-moss stratum or are missing one or more layers. In these cases, the missing layers are grayed out and the "Not Present" button is checked.

### **Editing tips:**

- Percent cover and depth are required for each layer.
- The litter layer also requires users to select an overall litter arrangement and enter relative cover by litter type(s).
- The moss layer also requires users to designate a moss type (other moss or sphagnum moss).

Edit Fuelbed: C:\Documents and Settings\Susan\Desktop\Fci-20090705\_1359\Fci\conf\Fuelbed\Fuelbed\_023.xml  
 Canopy | Shrubs | Non-woody fuels | Woody fuels | Litter lichen moss | Ground fuels | Customize fuelbed

**Litter, Lichen, and Moss strata:**  
 consists of top layer of forest or rangeland floor

**Ground lichen**

	Mode	Min	Max
Depth (in)	0.1	0.1	2.0
Percent cover (%)	1.0	0.0	5.0

Not Present

**Moss**

	Mode	Min	Max
Depth (in)	0.2	0.1	3.0
Percent cover (%)	5.0	0.0	50.0

Type:

Not Present

**Litter**

	Mode	Min	Max
Depth (in)	0.5	0.0	3.0
Percent cover (%)	50.0	0.0	100.0

Arrangement:

LitterType	Relative Cover
Short needle pine	95.00
Long needle pine	
Other conifer	
Broadleaf deciduous	
Broadleaf evergreen	
Palm frond	
Grass	5.00

Total relative cover (%)

Not Present

**Litter-Lichen-Moss Input Definitions**

<b>Variable</b>	<b>Definition</b>	<b>Options</b>	<b>Units (hard limits)</b>
Depth	Total depth of litter, lichen or moss layer.	Min: minimum depth Mode: most common depth Max: maximum depth	Inches (0-30 in)
Percent cover	Total percent cover of litter, lichen or moss layer based on linear coverage.	Min: minimum % cover Mode: most common % cover Max: maximum % cover	Percent (0-100 %)
Moss type	Type of moss (2 options).	Sphagnum moss Other moss (e.g., feathermoss)	
Litter arrangement	Spatial arrangement of litter (3 options).	Fluffy (freshly fallen), Normal Perched (on grass or forb)	
Litter type	Type of litter.	Short needle pine Long needle pine Other conifer Broadleaf deciduous Broadleaf evergreen Palm fronds Grass	
Relative cover	Relative percent cover of each litter type. Must sum to 100%	Min: minimum % cover Mode: most common % cover Max: maximum % cover	Percent (0-100 %)

## ***Ground Fuels Stratum***

The **Ground fuels** stratum has three categories:

**Duff:** Partially to fully decomposed organic material between the LLM stratum and mineral soil. Duff is described in two layers: an upper (Fermentation) layer and a lower (Humus) layer.

**Squirrel middens:** Mounds of litter, tree cones and other plant material accumulated by squirrels; only applicable to a few forested fuelbeds to boreal spruce-dominated forests in Alaska.

**Basal accumulations:** Accumulations of bark, downed woody debris, litter and duff surrounding tree trunks.

Many FCCS national fuelbeds may not have a ground fuels stratum or will be missing one or two categories. In these cases, some or all panels are grayed out and the "Not Present" button is checked.

## Duff Category

Duff is partially to fully decomposed organic material and is generally located between litter and mineral soil. Duff is described in two layers: an upper duff layer (equivalent to the Oe organic soil horizon) and a lower duff layer (equivalent to the Oa organic soil horizon).

### Editing tips:

- Percent rotten wood is estimated for both duff layers.
- Within each duff layer, Depth and Percent Cover are displayed along with a Derivation type, selected from a toggle list.

Edit Fuelbed: C:\Documents and Settings\Susan\Desktop\FCCS-20050705\_1350\FCCS\conf\Fuelbeds\Fuelbed\_023.xml  
 Canopy | Shrubs | Non-woody fuels | Woody fuels | Litter/lichen moss | Ground fuels | Custom fuelbed

**Ground fuels stratum - Duff:**  
 organic material above the mineral soil that includes the F (fermentation) and H (humic) layers

Percent rotten wood ( % )

	Mode	Min	Max
Percent rotten ( % )	9.0	0.0	25.0

Not Present

Upper duff layer ( Fermentation )

	Mode	Min	Max
Depth ( in )	0.5	0.0	3.0
Percent cover ( % )	50.0	0.0	100.0

Derivation:

Not Present

Lower duff layer ( Humic )

	Mode	Min	Max
Depth ( in )	0.5	0.0	3.0
Percent cover ( % )	50.0	0.0	100.0

Derivation:

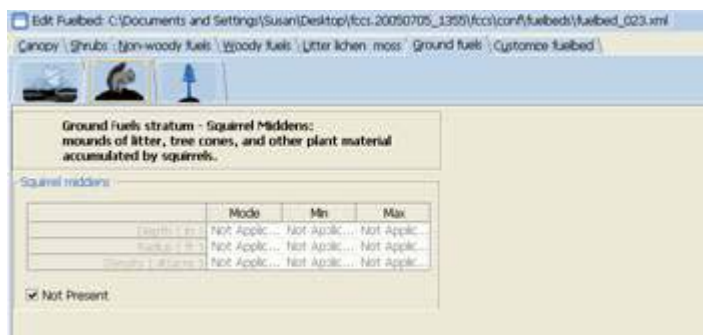
Not Present

### Duff Input Definitions

Variable	Definition	Options	Units (hard limits)
Percent rotten	Percent rotten wood in all duff layers.	Min: minimum % rotten wood Mode: most common % rotten wood Max: maximum % rotten wood	Percent (0-100 %)
Depth	Depth of upper or lower duff layer.	Min: minimum depth Mode: most common depth Max: maximum depth	Inches (0-200 in)
Percent cover	Percent cover of the upper or lower duff layers based on linear coverage.	Min: minimum % cover Mode: most common % cover Max: maximum % cover	Percent (0-100 %)
Derivation	Derivation of upper duff layer or lower duff layers (2 options each).	<u>Upper duff</u> Dead moss and litter Fibric peat (sphagnum or sedge) <u>Lower duff</u> Humic peat Humus or muck	

## Squirrel Midden Category

Squirrel middens are mounds of litter, tree cones, and other plant material accumulated by squirrels. They are generally found in boreal spruce-dominated forests in Alaska and will not be applicable in most fuelbeds.



### Squirrel Midden Input Definitions

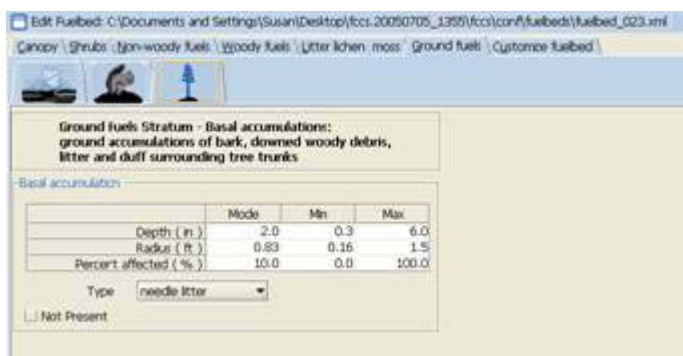
Variable	Definition	Options	Units (hard limits)
Radius	Radius of squirrel midden.	Min: minimum radius Mode: most common radius Max: maximum radius	Feet (0-50 ft)
Depth	Depth of squirrel midden.	Min: minimum depth Max: maximum depth Max: maximum depth	Inches (0-120 in)
Density	Number of squirrel middens per acre.	Min: minimum density Mode: most common density Max: maximum density	# / acre (0-20 / ac)

## Basal Accumulation Category

Basal accumulations are mounds of bark, downed woody debris, litter and duff surrounding tree trunks.

### Editing tips:

- The radius of a basal accumulation is measured from the outer edge of the tree trunk to the outer edge of the accumulation.



### Basal Accumulation Input Definitions

Variable	Definition	Options	Units (hard limits)
Depth	Depth of basal accumulation of ground fuels around tree trunks.	Min: minimum depth Mode: most common depth Max: maximum depth	Inches (0-50 in)
Radius	Radius of basal accumulation of ground fuels around tree trunks.	Min: minimum radius Mode: most common radius Max: maximum radius	Feet (0-20 ft)
Percent affected	Percentage of trees with basal accumulations of ground fuels.	Min: minimum % of trees affected Mode: most common % of trees affected Max: maximum % of trees affected	Percent (0-100 %)
Basal accumulation type	Type of basal accumulation (7 options).	Bark slough Branches Broadleaf evergreen Broadleaf deciduous Grass Needle litter Palm fronds	

## ***Customizing Fuelbeds***

To create a custom fuelbed from your own dataset, you must first select an FCCS national fuelbed to modify. It will probably be most efficient to select a fuelbed that has similar vegetation and fuelbed structure to your custom fuelbed. You may also open **fuelbed\_888.xml** to modify a blank fuelbed.

### ***Modifying fuelbed data***

Because you must create a custom fuelbed from an existing fuelbed in the FCCS National Fuelbed Database, it is important that you review every stratum, category, and subcategory screen to tailor them to your fuelbed.

#### **To change existing data:**

- Single click on any white data entry space
- Type in your data.
- Press ENTER or single click on another white data entry space to complete your entry.

The FCCS editor validates your data upon entry. If your entry exceeds soft minimum and maximum values, you will receive a **warning message** but the entry will be recorded. If your entry exceeds hard minimum and maximum limits, you will receive an **error message**, and the entry will *not* be recorded.

### ***Min, Mode and Max Entries***

The FCCS calculator only requires mode inputs for all fuel characteristics. You may wish to enter minimum and maximum values to represent the range of fuel conditions for the area or site you are representing.

## ***Not Present Checkboxes***

If you are modifying a FCCS national fuelbed in which some strata or categories are designated as “Not Present”, you can click the Not Present check box and replace the “Not Present” inputs with actual data. The FCCS calculator requires inputs only in the Mode column; you do not need to enter Min and Max data unless you wish to have them for future reference.

## ***Common / Scientific Name Lookup Tool***

Tree, shrub and nonwoody vegetation species names are listed as scientific names in the FCCS editor. To find common name matches for a scientific name or to look up a scientific name by common name, click on the **Common/scientific name lookup** button at the bottom of any editor screen.

Click on the **Scientific name radio button** to search scientific names or the **Common name radio** button to search common names.

Scroll down and select a name from the left panel. If you select a scientific name, common name and outmoded scientific name matches are listed in the right panel. If you select a common name, scientific name and outmoded scientific name matches are listed.

## ***Saving Customized Fuelbeds***

Click **Save As** at the bottom of any editor screen to save your customized fuelbed.

In the Save window:

- Enter a filename and click **Save**.
- For future use of a customized fuelbed in the FCCS, you should keep your customized fuelbed in the default **user\_fuelbeds** directory.
- Backing up the **user\_fuelbeds** directory outside of the main FCCS directory is highly recommended. FCCS upgrades may overwrite **user\_fuelbeds** with a blank directory.

## Customize Fuelbed Screen

The **Customize fuelbed screen** allows users to enter fuelbed descriptions and source information for their custom fuelbeds. Because customized fuelbeds are created by modifying fuelbed prototypes, you must replace the existing description with one that fits your fuelbed.

The customize fuelbed screen is divided into a fuelbed description section and a user information section.

**Customize fuelbed**

If you choose to customize a fuelbed, you can complete this screen in order to document your work. The User information section is optional unless you would like to submit your customized fuelbed to the FCCS national database for consideration.

**Fuelbed**

SiteName: Lodgepole pine forest

Fuelbed Description: Lodgepole pine forests occur in mid-montane forests throughout Washington, Oregon and the Rocky Mountains. This stand is over 80 years old, and has been attacked by pine bark beetles less than 5 years ago.

Ecoregion: Mediterranean-260

CoverType: SAF 001: Jack Pine, SAF 005: Balsam Fir, SAF 012: Black Spruce, SAF 013: Black Spruce-Tamarack, SAF 014: Northern Pin Oak

Vegetation: Conifer Forest

Change Agent: Fire Exclusion

Structural Class: Old-Forest Single Story, Natural Fire Regime: 4, Condition Class: Class 2, DataQualityRanking: , Photo Series ID: For Future Implementation

**User Info ( optional )**

Date: 2003-09-17, Name: , Phone: , Email: , Affiliation: , Address: , Notes:

version: 1.0 ( 1.71 200510251345 ) Back Common/Scientific Name Lookup Save As . . . Help Exit Calculate

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## ***Fuelbed Section***

The Fuelbed section records the following descriptor variables:

**Fuelbed name:** User-defined name of fuelbed. The FCCS does not require unique names or any particular naming protocol for user fuelbeds. FCCS national fuelbeds are named under the following guidelines:

- Species occurring in the uppermost strata are listed first, followed successively by those in lower strata. For example: a "Western hemlock - Douglas-fir - Western redcedar / Vine maple forest" indicates western hemlock, Douglas-fir and western redcedar are the dominant species in the canopy and vine maple is in the shrub stratum.
- The order of species names generally reflects decreasing levels of dominance. In cases where there is a dominant herbaceous layer with a scattered woody layer, fuelbed names can be based on species found in the herbaceous layer and/or the woody layer, whichever is more diagnostic of the type.
- Vegetation type (forest, shrubland, grassland, etc) is listed following the species names.

**Description:** User-defined description of the fuelbed. Descriptions for the FCCS national fuelbeds generally include geographic representation, vegetation and disturbance and/or management history.

**Ecoregion(s):** There are 13 Bailey Ecoregion divisions. A map of these divisions is provided in the Fuelbed Selection screen (Appendix A). Site-specific fuelbeds generally only have one ecoregion, whereas modal fuelbeds are likely to span multiple ecoregions.

**Vegetation form:** Most of the seven vegetation forms are self-explanatory, with the exception of the "mixed forest" category. Mixed forests are defined as forests in which evergreen and deciduous species each generally contribute 25 to 75 percent of total tree cover in both the overstory and midstory strata.

**Cover Type:** Select applicable forest and/or rangeland cover types. Multiple cover types may apply to an individual fuelbed.

**Change Agent(s):** Select from a list of natural or management-induced activities that have altered your fuelbed. Multiple change agents may apply.

**Structural class:** Applies to forested fuelbed only. Select one structural class from a list of seven forest vegetation forms describing the number of canopy layers, relative size of trees, stage of understory development and relative degree of stand closure. Graphical depictions of forest structural classes are provided in the **Fuelbed Selection screen**.

**Natural fire regime:** Select one of five natural fire regime classifications:

- 1: 0 – 35 year frequency and low severity (most commonly associated with surface fires) to mixed severity (in which less than 75% of the dominant overstory vegetation is replaced.)
- 2: 0 – 35 year frequency and high severity (stand replacement; greater than 75% of the dominant overstory vegetation is replaced).
- 3: 35 – 200+ year frequency and mixed severity (< 75% of dominant overstory vegetation is replaced).
- 4: 35 – 200+ year frequency and high severity (stand replacement).
- 5: 200+ year frequency and high severity (stand replacement).

If you do not know the natural fire regime for your fuelbed, select unknown.

**Fire Regime Condition Class:** Select one of three qualitative measures describing the degree of departure from historical fire regimes.

Class 1: Fire regimes are within the natural (historical) range, and the risk of losing key ecosystem components is low. Vegetation attributes (species composition, structure and pattern) are intact and functioning within the natural (historical) range.

Class 2: Fire regimes have been moderately altered from their natural (historical) range. Risk of losing key ecosystem components is moderate. Fire frequencies have departed from natural frequencies by one or more return intervals (either increased or decreased). This results in moderate changes to one or more of the following: fire size, intensity and severity, and landscape patterns. Vegetation and fuel attributes have been moderately altered from the natural (historical) range.

Class 3: Fire regimes have been substantially altered from their natural (historical) range. The risk of losing key ecosystem components is high. Fire frequencies have departed from natural frequencies by multiple return intervals. Dramatic changes occur to one or more of the following: fire size, intensity, severity and landscape patterns. Vegetation attributes have been substantially altered from their natural (historical) range.

**Data Quality Ranking:** The default data quality ranking for user fuelbeds is zero. FCCS National Fuelbeds contain an overall rating for the quality of the data used for creating the fuelbed. The rankings are as follows:

- 1: No data (no hard numbers for any data value) - created from experience and/or ecological literature
- 2: Partial data - less than 35% of modal data from literature, photo series, or peer-reviewed data source
- 3: Partial data - 35-85% of modal data from literature, photo series, or peer-reviewed data source
- 4: Data driven - 85-100% of modal data from photo series or peer-reviewed data source
- 5: Data driven - 85-100% of all data (min, max, mode) from photo series or peer-reviewed data source

**Photo Series ID:** This feature is currently not implemented in the FCCS national fuelbeds but can be entered in customized fuelbeds. Photo series ID provides a reference for the particular photo series that were used as source data to create some or all of the custom fuelbed.

## ***User Information Section***

The User Info section allows users to record information for their own file management as well as to provide us with contact information if users wish to submit fuelbeds to the FCCS administrator at [pnw\\_fccshelp@fs.fed.us](mailto:pnw_fccshelp@fs.fed.us) for consideration as additional prototypes. Optional entries include:

- Date
- Name
- Email
- Phone
- Affiliation
- Address
- Notes

## ***Printing Input Data***

To print input data for a fuelbed, you can create an Input report. See "[Creating Reports](#)" for more information.

FCCS does not support a print option of actual data entry screens. If you wish to print individual data entry screens, you can create a screen capture by using the print screen command on your keyboard and paste the screen capture into Microsoft Word, Microsoft Powerpoint or another application for printing.

## ***Managing Fuelbed Files***

The FCCS National Fuelbeds are stored within the FCCS folder at `...\fccs\conf\fuelbeds\`. To locate the fccs folder, you will need to remember where you unzipped the program. If you installed FCCS on your c: drive, for example, the files will be stored at: `c:\fccs\conf\fuelbeds`.

Customized fuelbeds are stored in a subdirectory of the fuelbed folder: `...\fccs\conf\fuelbeds`.

To share a custom fuelbed file with another user, locate the fuelbed (e.g., `fuelbed1.xml`) from the `user_fuelbeds` folder and send it as an attachment in an email or save it to a transferable medium such as a compact disc or flash drive.

## ***Backing Up and Restoring Fuelbeds***

If you are building a library of custom fuelbeds, you should include the ...\\fccc\\conf\\fuelbeds\\user\_fuelbeds in your regular backups.

If you reinstall or update the FCCS, and you have any customized fuelbeds in the ...\\fccc\\conf\\fuelbeds\\user\_fuelbeds directory, copy them to a location outside the FCCS before reinstalling the program. Otherwise, your customized fuelbeds will be automatically deleted.

# Creating and Interpreting Reports

Click **Calculate** at the bottom of any editor screen to initiate the FCCS calculator and enter the Calculator results screen. You can select any one of the following report types by clicking on the corresponding radio button:

- **Potentials:** the FCCS fire potentials
- **General:** summary of basic fuel characteristics
- **Strata & categories:** fuelbed characteristics by stratum and category
- **Combustion:** fuelbed characteristics by combustion environment (*Under Development*)
- **Input:** summary of input data

Calculator results for fuelbed: C:\Documents and Settings\Susan\Desktop\fccs\conf\fuelbeds\fuelbed\_023.xml:1.0 (1.71 08291000)

Select type of report:

Potential  General  Strata & Categories  Combustion  Input

**Potentials Report - FCCS V1.0 Output**

<b>Author:</b> FCCS National Fuelbed <b>Date:</b> Sep 12 2005 - 11:12 AM <b>Site Name:</b> Lodgepole pine forest <b>Fuelbed number:</b> 23 <b>Data quality ranking:</b> 2 <b>Fire behavior fuel model (closest match):</b> ***not implemented***	<b>Description:</b> Lodgepole pine forests occur in mid-montane forests throughout Washington, Oregon and the Rocky Mountains. This stand is over 80 years old, and has been attacked by pine bark beetles less than 5 years ago.
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FIRE POTENTIAL RATINGS (0-9)

<b>Fire Behavior Potential</b>	<b>2</b>	
Reaction Potential	2.4	Approximates the potential reaction intensity (energy released per unit area and time).
Spread Potential	1.3	Proportional to the no-wind rate of spread in surface fuel (distance per unit time).
Flame Length Potential	2.2	Proportional to fireline intensity or flame length.
<b>Crown Fire Potential</b>	<b>1</b>	
Torching Potential	3.5	Potential for fire to reach canopy layer.
Dependent Crownfire Potential	.8	Potential for fire to reach and carry through a canopy.
Independent Crownfire Potential	0	Potential for fire to carry through a canopy independent of surface fire.

Format Output:

CustomCodes  Consume

Back Print and View PDF Help Exit

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## ***FCCS Fire Potentials Report***

The **Potentials Report** includes calculated Fire Potential Ratings and their definitions.

<b><i>Author</i></b>	FCCS National Fuelbed or Name given in the User Info section of the Customize Fuelbed tab for custom fuelbeds. If you create a custom fuelbed but do not fill out the Name field, the Author will be blank.
<b><i>Date</i></b>	Date and time the report was created.
<b><i>Site name</i></b>	Name of the fuelbed. If this is a custom fuelbed, this is the site name specified in the Customized Fuelbed screen.
<b><i>Fuelbed number</i></b>	Assigned number of the FCCS National Fuelbed. If this is a customized fuelbed, the fuelbed number will be blank.
<b><i>Data quality ranking</i></b>	Data quality ranking of the fuelbed. 1 = No data - created from experience and/or ecological literature 2 = Partial data - less than 35% of modal data from literature, photo series, or peer-reviewed data source 3 = Partial data - 35-85% of modal data from literature, photo series, or peer-reviewed data source 4 = Data driven - 85-100% of modal data from photo series or peer-reviewed data source 5 = Data driven - 85-100% of all data from photo series or peer-reviewed data source
<b><i>Fire behavior fuel model</i></b>	Closest match of the calculated fuelbed characteristics to fire behavior fuel models (Scott and Burgan 2005). This feature has not yet been implemented.
<b><i>Description</i></b>	Fuelbed description.
<b><i>Fire Behavior Potential</i></b>	Summary potential equal to Flame Length

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	Potential.
<b><i>Reaction Potential</i></b>	Approximates the potential reaction intensity (energy released per unit area and time).
<b><i>Spread Potential</i></b>	Proportional to the no-wind rate of spread in surface fuel (distance per unit time).
<b><i>Flame Length Potential</i></b>	Proportional to fireline intensity or flame length.
<b><i>Crown Fire Potential</i></b>	Summary index of the potential for fire to reach and carry through a forest canopy.
<b><i>Torching Potential</i></b>	Potential for fire to reach canopy layer.
<b><i>Dependent Crownfire Potential</i></b>	Potential for fire to reach and carry through a canopy.
<b><i>Independent Crownfire Potential</i></b>	Potential for fire to carry through a canopy independent of surface fire.
<b><i>Available Fuel Potential</i></b>	Summary potential calculated as the sum of Flame Available Fuel, Smoldering Available Fuel and Residual Available Fuel Potentials.
<b><i>Flame Available Fuel</i></b>	Sum of fuel loadings expected to be consumed in all flaming phases of fire.
<b><i>Smoldering Available Fuel</i></b>	Sum of fuel loadings expected to be consumed in all smoldering phases of fire.
<b><i>Residual Available Fuel</i></b>	Sum of fuel loadings expected to be consumed in all residual smoldering phases of fire.
<b><i>FCC Code</i></b>	Three-digit code comprised of the Fire Behavior, Crown Fire and Available Fuel Potentials (each rounded to the nearest whole number).

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## **General Report**

The **General Report** displays the basic fuel characteristics of the fuelbed.

<b>Author</b>	FCCS National Fuelbed or Name given in the User Info section of the Customize Fuelbed tab for custom fuelbeds. If you create a custom fuelbed but do not fill out the Name field, the Author will be blank.
<b>Date</b>	Date and time the report was created.
<b>Site name</b>	Name of the fuelbed. If this is a custom fuelbed, this is the site name specified in the Customized Fuelbed screen.
<b>Fuelbed number</b>	Assigned number of the FCCS National Fuelbed. If this is a customized fuelbed, the fuelbed number will be blank.
<b>Data quality ranking</b>	Data quality ranking of the fuelbed. 1 = No data - created from experience and/or ecological literature 2 = Partial data - less than 35% of modal data from literature, photo series, or peer-reviewed data source 3 = Partial data - 35-85% of modal data from literature, photo series, or peer-reviewed data source 4 = Data driven - 85-100% of modal data from photo series or peer-reviewed data source 5 = Data driven - 85-100% of all data from photo series or peer-reviewed data source
<b>Fire behavior fuel model</b>	Closest match of the calculated fuelbed characteristics to fire behavior fuel models (Scott and Burgan 2005). This feature has not yet been implemented.
<b>Description</b>	Fuelbed description.
<b>Percent cover</b>	Percent cover of each fuel layer.
<b>Fuel loading</b>	Weight per unit area (tons/acre) of fuels.

<b><i>Fuel area index (FAI)</i></b>	Total fuel surface area per unit ground area (dimensionless).
<b><i>Optimum packing ratio (<math>\beta_{opt}</math>)</i></b>	The packing ratio (noted as $\beta_{opt}$ in equations) that would occur if fuel particles were optimally spaced. Applicable to stratum totals only.

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## ***Strata & Categories Report***

The **Strata & Categories Report** summarizes calculated and input fuelbed characteristics by stratum and category.

<b><i>Author</i></b>	FCCS National Fuelbed or Name given in the User Info section of the Customize Fuelbed tab for custom fuelbeds. If you create a custom fuelbed but do not fill out the Name field, the Author will be blank.
<b><i>Date</i></b>	Date and time the report was created.
<b><i>Site name</i></b>	Name of the fuelbed. If this is a custom fuelbed, this is the site name specified in the Customized Fuelbed screen.
<b><i>Fuelbed number</i></b>	Assigned number of the FCCS National Fuelbed. If this is a customized fuelbed, the fuelbed number will be blank.
<b><i>Data quality ranking</i></b>	Data quality ranking of the fuelbed. 1 = No data - created from experience and/or ecological literature 2 = Partial data - less than 35% of modal data from literature, photo series, or peer-reviewed data source 3 = Partial data - 35-85% of modal data from literature, photo series, or peer-reviewed data source 4 = Data driven - 85-100% of modal data from photo series or peer-reviewed data source 5 = Data driven - 85-100% of all data from photo series or peer-reviewed data source
<b><i>Fire behavior fuel model</i></b>	Closest match of the calculated fuelbed characteristics to the ?? fire behavior fuel models (Scott ???). This feature has not yet been implemented.
<b><i>Description</i></b>	Fuelbed description.
<b><i>Percent cover (%)</i></b>	Percent cover of each fuel layer.

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	<b>DBH:</b> diameter at breast height of trees
	<b>Live loading:</b> weight per unit area (tons/acre) of live fuels
	<b>Dead loading:</b> weight per unit area (tons/acre) of dead fuels
	<b>FAI:</b> fuel area index or total fuel surface area per unit ground area (dimensionless)
	<b>Packing ratio:</b> the proportion of fuelbed volume occupied by fuel particles (dimensionless)
	<b>Optimum packing ratio:</b> the packing ratio that would exist if fuel particles were optimally spaced.
<b>Depth (ft)</b>	Depth (feet) of fuelbed category or stratum.
<b>Diameter (in)</b>	Diameter at breast height (inches) of trees and snags.
<b>Live Loading</b>	Weight per unit area (tons/acre) of live fuels.
<b>Dead loading</b>	Weight per unit area (tons/acre) of dead fuels.
<b>FAI</b>	Fuel area index or total fuel surface area per unit ground area (dimensionless).
<b>Height to live crown (ft)</b>	Height to live crown (feet) of trees.
<b>Live foliar moisture content (%)</b>	Percent moisture content of live vegetation (applicable to trees, shrubs and nonwoody vegetation).
<b>Fuel area index (FAI)</b>	Total fuel surface area per unit ground area (dimensionless).
<b>Optimum packing ratio (<math>\beta_{opt}</math>)</b>	The packing ratio (noted as $\beta_{opt}$ in equations) that would occur if fuel particles were optimally spaced. Applicable to stratum totals only.

## ***Combustion Report***

The **Combustion Report** lists input and calculated fuel characteristics by combustion environment.

*Under Development*

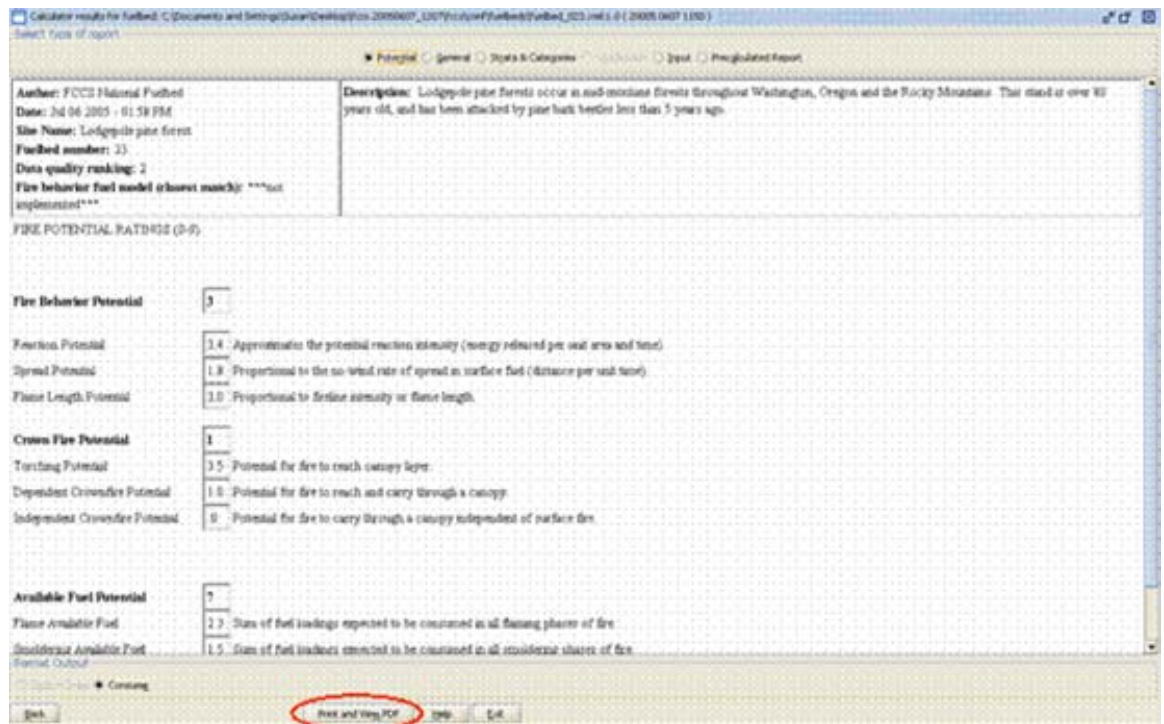
## ***Input Report***

The input report summarizes fuelbed input data in a printable table.

## Printing Reports

The best way to print output reports from the FCCS is in Adobe Reader ®.

- Click **Print and View PDF** to launch Adobe Reader ® directly from the FCCS.
- If you do not have Adobe Reader ® already installed on your machine, go to <http://www.adobe.com> for a free download.
- To print the report in Adobe Reader ®, Select **Print** from the File menu or toolbar.



## ***Saving Reports***

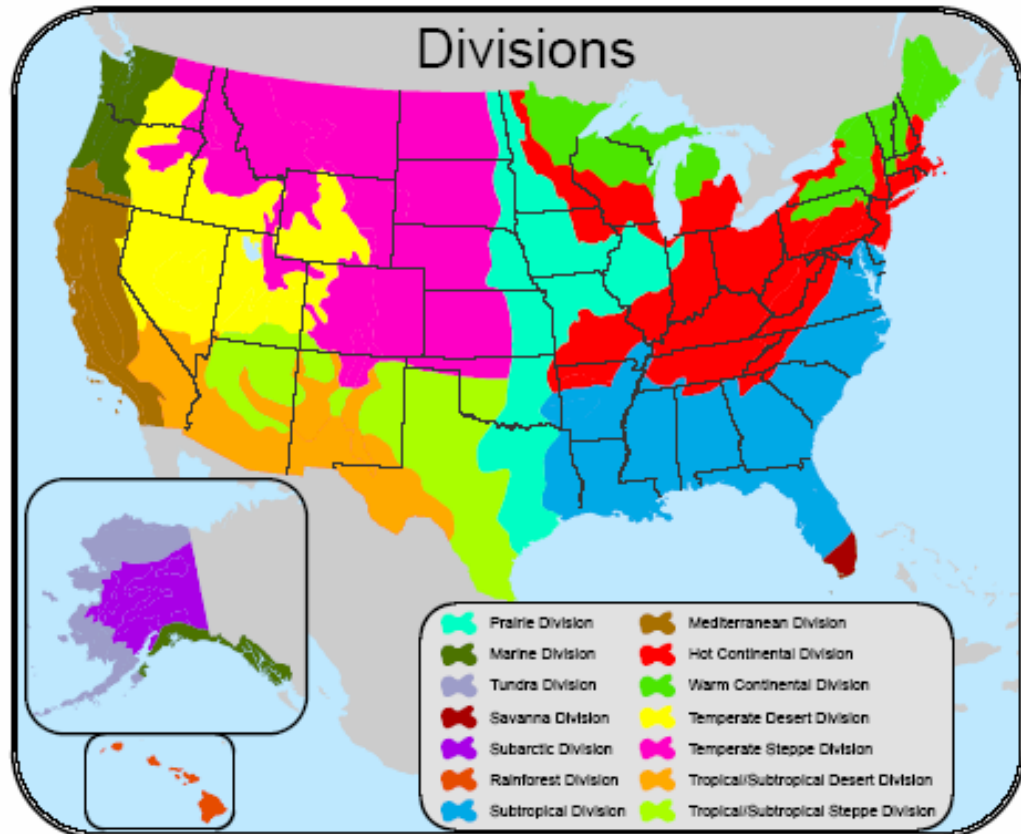
Once calculations are complete, all reports are saved in pdf and html format in the fccs\results\tmp folder. This folder is temporary and will be overwritten with a new calculation. You may wish to copy these reports to a folder outside the fccs folder for future reference.

## ***Exporting Fuelbed Results to Consume 3.0***

Whenever you calculate results for a custom fuelbed, FCCS automatically saves two **Consume** 3.0 output reports (*filename\_intermediate.xml* and *filename\_input.xml*) in the fccs\results\Consume folder.

To access your custom fuelbed data in Consume 3.0, please refer to the Consume 3.0 User's Guide or Consume 3.0 online help for detailed instructions on importing custom FCCS fuelbeds.

## Appendix A: Bailey Ecoregion Divisions



## Appendix B: FCCS National Fuelbeds

The following table lists the FCCS national fuelbeds by region of the United States. More fuelbeds are under development and will be included in periodic updates of the FCCS.

Region	Fuelbed ID	Fuelbed Name	Change Agent
<b>Alaska</b>			
	85	Black spruce / Lichen forest	None
	86	Black spruce / Feathermoss forest	None
	87	Black spruce / Feathermoss forest	None
	88	Black spruce / Sphagnum moss forest	None
	89	Black spruce / Sheathed cottonsedge woodland	None
	91	White spruce / Prickly rose forest	None
	92	Aspen - Paper birch - White spruce - Black spruce forest	None
	93	Paper birch - Trembling aspen forest	None
	94	Balsam poplar - Trembling aspen forest	None
	95	Willow - Alder shrubland	None
	97	Cottongrass grassland	None
	98	Marsh Labrador tea - Lingonberry tundra shrubland	None
	99	Bluejoint reedgrass grassland	None
	100	Altai fescue grassland	None
	101	White spruce forest	None
	102	White spruce forest	Insects and Disease
	103	White spruce - Paper birch forest	None
	104	White spruce - Paper birch forest	Insects and Disease
	105	Paper birch - Trembling aspen - White spruce forest	None
<b>Hawaii</b>			
	71	Ohia / Florida hopbush - Kupaoa forest	None
	72	Ohia / Uluhe forest	None
	73	Koa / Pukiawe forest	None
	74	Mamane - Naio savanna	None
	75	Slash pine / New Caledonia pine forest	Introduction of Exotic Species
	76	Slash pine / Molasses grass forest	Introduction of Exotic

Region	Fuelbed ID	Fuelbed Name	Change Agent
			Species
	77	Eucalyptus plantation forest	Introduction of Exotic Species
	78	Florida hopbush - Mauna Loa beggarticks shrubland	None
	79	Pili grass - Broomsedge bluestem grassland	Grazing, Introduction of Exotic Species
	80	Fountain grass grassland	Introduction of Exotic Species
	81	Columbia bluestem / Pukiawe grassland	Introduction of Exotic Species
	82	White leadtree / Guinea grass shrubland	Introduction of Exotic Species
	83	Molasses grass grassland	Introduction of Exotic Species
	84	Ohia / Broomsedge bluestem savanna	Introduction of Exotic Species
	260	Ohia / Uluhe Forest	Wildfire
	261	Pili grass - Broomsedge bluestem grassland	Wildfire
	262	Molasses grass grassland	Wildfire
	263	Ohia / Broomsedge bluestem savanna	Wildfire
<b>Northeast</b>			
	106	Red spruce - Balsam fir forest	Insects and Disease
	107	Pitch pine / Scrub oak forest	Fire Exclusion, None
	109	Eastern white pine - Northern red oak - Red maple forest	Fire Exclusion, None
	110	American beech - Yellow birch - Sugar maple forest	Selection Cut
	124	Pitch pine - Oak forest	None
	125	Oak - Hickory - Pine - Eastern hemlock forest	None
	138	Red pine - White pine forest	Fire Exclusion
	140	Jack pine / Black spruce forest	Fire Exclusion
	142	Trembling aspen - Paper birch forest	None
	146	Jack pine forest	None
	147	Jack pine savanna	None
	148	Jack pine forest	Wildfire
	152	Red pine - White pine forest	Windthrow
	155	Red spruce - Balsam fir forest	None
	243	Pitch pine / Scrub oak shrubland	Wildfire
	267	American beech - Yellow birch - Sugar maple - Red	None

Region	Fuelbed ID	Fuelbed Name	Change Agent
		spruce forest	
	274	American beech - Sugar maple forest	None
	279	Black spruce - Northern white cedar - Larch forest	None
	287	Eastern white pine - Eastern hemlock forest	None
<b>Pacific Northwest</b>			
	1	Black cottonwood - Douglas fir - Quaking aspen riparian forest	None
	2	Western hemlock - Western redcedar - Douglas-fir forest	None
	3	Douglas fir forest	Thinning
	4	Douglas fir / Ceanothus forest	Prescribed Fire, Clearcut
	5	Douglas fir - White fir forest	Fire Exclusion
	6	Oregon white oak - Douglas-fir forest	Selection Cut
	7	Douglas fir - Sugar pine - Tanoak forest	Fire Exclusion
	8	Western hemlock - Douglas-fir - Western redcedar / Vine maple forest	None
	9	Douglas fir - Western hemlock - Western redcedar / Vine maple forest	Clearcut
	10	Western hemlock - Douglas fir - Sitka spruce forest	None
	11	Douglas fir / Western hemlock - Sitka spruce forest	Clearcut
	13	Mountain hemlock - Pacific silver fir forest	Wildfire
	18	Douglas fir / Oceanspray forest	Prescribed Fire
	24	Pacific ponderosa pine - Douglas fir forest	Fire Exclusion, Grazing
	38	Douglas fir - Madrone / Tanoak forest	Fire Exclusion
	39	Sugar Pine - Douglas-fir - Oak forest	None
	41	Fescue - Wheatgrass grassland	Fire Exclusion, Grazing
	52	Douglas-fir - Pacific ponderosa pine / Oceanspray forest	Fire Exclusion Fire Exclusion, Insects and
	53	Pacific ponderosa pine forest	Disease
	54	Douglas-fir - White fir - Interior ponderosa pine forest	Fire Exclusion
	62	Vaccinium - Heather shrublands	Wildfire
	63	Showy sedge - Alpine black sedge grassland	None
	208	Grand fir - Douglas fir forest	Fire Exclusion
	212	Pacific ponderosa pine forest	Selection Cut
	215	Douglas fir - Madrone / Tanoak forest	Wildfire Prescribed Fire,
	221	Wheatgrass - Ryegrass grassland	Restoration Work

Region	Fuelbed ID	Fuelbed Name	Change Agent
	235	Idaho fescue - Bluebunch wheatgrass grassland	Wildfire
	237	Vaccinium - Heather shrublands	None
	238	Pacific silver fir - Mountain hemlock forest	None
	239	Douglas fir - Sugar pine - Tanoak forest	Wildfire
<b>Rocky Mountain and Central US</b>			
	21	Lodgepole pine forest	Wildfire
	22	Lodgepole pine forest	None
	23	Lodgepole pine forest	Insects and Disease
	26	Interior Ponderosa pine - Limber pine forest	Fire Exclusion
	28	Ponderosa pine savanna	None, Wildfire
	42	Trembling aspen / Engelmann spruce forest	Fire Exclusion
	56	Sagebrush shrubland	Fire Exclusion, Grazing, Introduction of Exotic Species
	57	Wheatgrass - Cheatgrass grassland	Grazing, Introduction of Exotic Species
	58	Western juniper / Sagebrush savanna	Prescribed Fire
		Subalpine fir - Engelmann spruce - Douglas fir -	
	59	Lodgepole pine forest	None
	60	Sagebrush shrubland	Prescribed Fire
	61	Whitebark pine / Subalpine fir forest	Insects and Disease
	66	Bluebunch wheatgrass - Bluegrass grassland	None
	67	Interior Ponderosa pine - Douglas fir forest	Fire Exclusion
	69	Western Juniper / Sagebrush - Bitterbrush shrubland	Fire Exclusion
		Subalpine fir - Lodgepole pine - Whitebark pine -	
	70	Engelmann spruce forest	Fire Exclusion
	90	White oak - Northern red oak forest	None
		Trembling aspen - Paper birch - White spruce -	
	143	Balsam fir forest	None
	154	Bur oak savanna	Fire Exclusion
	210	Pinyon - Juniper forest	Fire Exclusion, Grazing Introduction of Exotic Species, Prescribed Fire
	213	Wheatgrass - Cheatgrass grassland	Species, Prescribed Fire
	224	Trembling aspen forest	Fire Exclusion
	225	Trembling aspen forest	Prescribed Fire
	228	Interior Ponderosa pine - Limber pine forest	Prescribed Fire
	265	Balsam fir - White spruce - Mixed Hardwoods forest	None
	266	Sugar maple - Basswood forest	None

Region	Fuelbed ID	Fuelbed Name	Change Agent
	268	American beech - Yellow birch - Sugar maple - Eastern hemlock forest	None
	284	Green ash - American elm - Silver maple - Cottonwood forest	Insects and Disease, None
	286	Interior Ponderosa pine - Limber pine forest	Fire Exclusion
<b>Sierra Nevada</b>			
	12	Red fir - Mountain hemlock - Lodgepole pine - White pine forest	None
	14	Black oak woodland	None
	15	Jeffrey pine - Red fir - White fir / Greenleaf manzanita - Snowbrush forest	Fire Exclusion, Selection Cut
	16	Jeffrey Pine - Ponderosa Pine - Douglas fir - Black oak forest	Fire Exclusion
	17	Red fir forest	Fire Exclusion
	19	White fir - Giant sequoia - Sugar pine forest	Fire Exclusion
	20	Western juniper / Mountain mahogany woodland	Fire Exclusion
	36	Live oak - Blue oak woodland	Fire Exclusion, Grazing
	37	Ponderosa pine - Jeffrey pine forest	Fire Exclusion, Grazing
	44	Scrub oak - Chaparral shrubland	None
	46	Chamise chaparral shrubland	None
	47	Redwood - Tanoak forest	Fire Exclusion
	48	Douglas fir - Tanoak - Madrone - California bay forest	None
	51	Coastal sage shrubland	None
	65	Purple tussockgrass - California oatgrass grassland	Fire Exclusion, Grazing
	214	Giant sequoia - White fir - Sugar pine forest	Prescribed Fire
<b>Southeast</b>			
	114	Virginia pine - Pitch pine - Shortleaf pine forest	Fire Exclusion
	115	Rhododendron - Blueberry - Mountain laurel shrubland	None
	120	Oak - Pine / Mountain laurel forest	Fire Exclusion
	121	Oak - Pine / Mountain laurel forest	Insects and Disease
	123	White oak - Northern red oak - Black oak - Hickory forest	Fire Exclusion
	129	Green ash - American elm forest	None, Insects and Disease
	131	Bluestem - Indian grass - Switchgrass grassland	Prescribed Fire
	133	Tall fescue - Foxtail - Purple bluestem grassland	Introduction of Exotic Species, None

Region	Fuelbed ID	Fuelbed Name	Change Agent
	134	White oak - Northern red oak - Hickory forest	Clearcut
	135	Eastern redcedar - Oak / Bluestem savanna	None
	156	Slash pine plantation forest	Thinning
	157	Loblolly pine - Shortleaf pine - Mixed hardwoods forest	None
	158	Loblolly pine - Shortleaf pine - Mixed hardwoods forest	Insects and Disease
	161	Loblolly pine - Slash pine forest	None
	162	Loblolly pine - Slash pine forest	Thinning
	164	Sand pine forest	None
	165	Longleaf pine / Three-awned grass - Pitcher plant savanna	Prescribed Fire
	166	Longleaf pine / Three-awned grass - Pitcher plant savanna	Fire Exclusion
	168	Little gallberry - Fetterbush shrubland	None
	170	Pond pine / Little gallberry - Fetterbush shrubland	None
	173	Live oak / Sea oats savanna	None
	174	Live oak - Sabal palm forest	None
	175	Smooth cordgrass - Black needlerush grassland	None
	176	Smooth cordgrass - Black needlerush grassland	Introduction of Exotic Species
	178	Loblolly pine - Shortleaf pine forest	None, Clearcut
	180	Red maple - Oak - Hickory - Sweetgum forest	Selection Cut
	181	Pond pine forest	None
	182	Longleaf pine - Slash pine / Saw palmetto - Gallberry forest	Fire Exclusion
	183	Loblolly pine - Shortleaf pine forest	Thinning
	184	Longleaf pine / Turkey oak forest	Fire Exclusion
	185	Longleaf pine / Turkey oak forest	Prescribed Fire
	186	Turkey oak - Bluejack oak forest	Fire Exclusion
	187	Longleaf pine / Yaupon forest	Thinning
	188	Sand pine - Oak forest	None
	189	Sand pine - Oak forest	Insects and Disease
	190	Slash pine - Longleaf pine / Gallberry forest	Fire Exclusion
	191	Longleaf pine - Slash pine / Gallberry forest	Prescribed Fire
	196	Loblolly pine / Bluestem forest	None, Clearcut
	203	Sawgrass - Muhlenbergia grassland	None
	240	Saw palmetto / Three-awned grass shrubland	Fire Exclusion, None, Clearcut

Region	Fuelbed ID	Fuelbed Name	Change Agent
	241	Longleaf pine - Loblolly pine forest	Windthrow
	242	Longleaf pine - Loblolly pine forest	Prescribed Fire
	264	Post oak - Blackjack oak forest	Fire Exclusion, Grazing
	269	Sugar maple - Yellow poplar - American beech - Oak forest	None Insects and Disease,
	270	Red spruce - Fraser fir / Rhododendron forest	Windthrow
	272	Red mangrove - Black mangrove forest	None
	275	Chestnut oak - White oak - Red oak forest	Fire Exclusion
	276	Oak - Pine - Magnolia forest	Fire Exclusion, None
	280	Bluestem - Gulf cordgrass grassland	Fire Exclusion, None
	281	Shortleaf pine - Post oak - Black oak forest	Fire Exclusion, None
	282	Loblolly pine forest	None
	283	Willow oak - Laurel oak - Water oak forest	None
	288	Bald-cypress - Water tupelo forest	None
	289	Pond-cypress / Muhlenbergia - Sawgrass savanna	None
	291	Longleaf pine - Slash pine / Saw palmetto forest	Fire Exclusion
<b>Southwest</b>			
	25	Pinyon - Juniper forest	Fire Exclusion, Grazing
	27	Ponderosa pine - Twoneedle pinyon - Utah juniper Forest	Fire Exclusion
	29	Interior Ponderosa pine - Engelmann spruce - Douglas fir forest	Selection Cut
	30	Turbinella oak - Mountain mahogany shrubland	None
	32	Ponderosa pine / Pinyon pine - Juniper forest	Fire Exclusion, Grazing
	33	Gambel oak / Sagebrush shrubland	Wildfire
	34	Interior Douglas fir - Interior Ponderosa pine / Gambel oak forest	Fire Exclusion Grazing, Introduction of
	40	Tobosa - Grama grassland	Exotic Species
	43	Arizona white oak - Gray oak - Emory oak woodland	Fire Exclusion, Grazing
	45	Pine - Oak forest	Fire Exclusion, Grazing
	49	Creosote bush shrubland	Fire Exclusion, Grazing
	55	Western juniper / Sagebrush savanna	Fire Exclusion
	211	Interior ponderosa pine forest	Fire Exclusion
	216	Gambel oak - Bigtooth maple forest	Fire Exclusion
	217	Gambel oak - Bigtooth maple forest	Prescribed Fire
	218	Gambel oak / Sagebrush shrubland	Fire Exclusion

<b>Region</b>	<b>Fuelbed ID</b>	<b>Fuelbed Name</b>	<b>Change Agent</b>
	219	Ponderosa pine - White fir / Trembling aspen forest	Fire Exclusion
	220	Ponderosa pine - White fir / Trembling aspen forest	Prescribed Fire
	222	Interior ponderosa pine forest	Prescribed Fire
	223	Douglas-fir - White fir - Interior ponderosa pine forest	Wildfire
	226	White fir - Gambel oak forest	Fire Exclusion
	227	White fir forest	Prescribed Fire
	229	Ponderosa pine / Juniper forest	Prescribed Fire
	230	Pinyon - Juniper forest	Prescribed Fire
	231	Gambel oak - Juniper - Ponderosa pine forest	Fire Exclusion, Grazing
	232	Mesquite savanna	Fire Exclusion, Grazing
	233	Sagebrush shrubland	Fire Exclusion
	234	Sagebrush shrubland	Prescribed Fire
	236	Tobosa - Grama grassland	None
		Engelmann spruce - Douglas-fir - White fir - Interior	
	273	Ponderosa pine forest	Fire Exclusion

## References

- Agee, J.K. 1993. Ecology of Pacific Northwest Forests. Washington, DC: Island Press. 493 p.
- Albini, F.A. 1976. Estimating wildfire behavior and effects. USDA For. Serv. Gen. Tech. Rep. INT-30.
- Bailey, R.G. 1989. Explanatory supplement to ecoregions map of the continents. *Environmental Conservation* 16: 307-309.
- Byram 1959. Chapter Three, Combustion of Forest Fuels. *in* Davis, .K.P., Forest Fire: Control and Use. McGraw-Hill. New York.
- Eyre, F.H. (ed.) 1980. Forest cover types of the United States and Canada. Washington, DC: Society of American Foresters.
- Grossman, D.H., D. Faber-Langendoen, A.W. Weakley, M. Anderson, P. Bourgeron, R. Crawford, K. Goodin, S. Landaal, K. Metzler, K.D. Patterson, M. Pyne, M. Reid, and L. Sneddon. 1998. International Classification of Ecological Communities: Terrestrial Vegetation of the United States. Volume I: The National Vegetation Classification System: Development, Status, and Applications. The Nature Conservancy, Arlington, VA. 126 p.
- Heinselman, M.L. 1981. Fire and succession in the conifer forests of northern North America. In *Forest Succession: concepts and application* (Eds. DC West, HH Shugart and DB Botkin). pp. 374-405. Springer-Verlag, New York.
- Integrated Taxonomic Information System. 2004. Integrated taxonomic information system. <http://www.itis.usda.gov/index.html>.
- Scott, J.H. and R. E. Burgan. 2005. Standard fire behavior fuel models: A comprehensive set for use with Rothermel's surface fire spread model. Rocky Mountain Research Station General Technical Report RMRS GTR-153. Ft. Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 72 p.

- Scott J.H. and E.D. Reinhardt 2005. Stereo photo guide for estimating canopy fuel characteristics in conifer stands. Rocky Mountain Research Station General Technical Report RMRS GTR-145. Ft. Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 49 p.
- Shiflet, T.N. (ed). 1994. Rangeland cover types of the United States. Denver, CO: Society for Range Management.
- Van Wagner, C. E. 1977. Conditions for the start and spread of crown fires. Canadian Journal of Forest Research 7:23-34.

# Glossary

**Accelerant shrub:** A shrub that has a higher combustion potential because of flammable chemicals within the leaves and stems.

**Activity fuels:** Fuels resulting from, or altered by, forestry practices such as timber harvest or thinning, as opposed to naturally created fuels.

**Adjusted crown volume:** The volume of the overstory and midstory tree crowns and class 1 snag crown foliage that is flammable. This is used in determining crown fire potential.

**Available fuel potential:** The relative value of combustible biomass under oven-dry moisture conditions during the flaming, smoldering, and residual combustion stage, calculated as a multiple of the total fuel loading of all fuel elements within a set depth from the surface of the fuel component.

**Avalanche:** Change agent (natural event) in which a mass of snow and ice slides down an incline and pushes over trees and shrubs.

**Basal accumulation:** Needles, twigs, bark pieces, litter, and duff that accumulate and form over time at the base of trees creating a deeper organic layer than exists in the surrounding area.

**Broadleaf:** A conventional term applied to trees and shrubs of the flowering plant class Angiospermae, in contrast to the generally needle-leaved cone-bearing plant class Gymnospermae.

**Broadleaf forest:** A forest dominated by deciduous trees with a percentage canopy cover of greater than 60% and height exceeding 6 feet.

**\*Btu (British Thermal Unit):** Amount of heat required to raise 1 pound of water 1 degree Fahrenheit (from 59.50 to 60.50 F), measured at standard atmospheric pressure.

**Bulk density:** The weight per unit volume of wood or foliage that includes the bulk air space between individual pieces of wood or foliage (lbs/ft<sup>3</sup>).

**Canopy:** More or less continuous cover of branches and foliage formed collectively by crowns of adjacent trees.

**Canopy cover:** The proportion of area covered by a vertical projection of the outermost perimeter of the natural spread of trees, including small openings within the canopy.

**Canopy midstory:** Intermediate and co-dominant trees in the canopy. The FCCS calculator uses the midstory and overstory data in calculating the torching potential.

**Canopy overstory:** Dominant and emergent trees in the canopy. The FCCS uses the midstory and overstory data in calculating the torching potential.

**Canopy reaction efficiency:** The reaction intensity (energy release per unit area per unit time) from the canopy fuels expressed as the ratio to the optimum reaction intensity (<1).

**Canopy stratum:** The fuel layer within the FCCS that characterizes fuels in the tree, snag, and ladder fuel categories.

**Canopy understory:** Tree seedlings and saplings in the canopy layer separated from the overstory and midstory by a gap.

**Change agent:** Natural or management-induced activity that alters certain fuelbed characteristics and creates a new combustion environment. Change agent categories include: fuel treatments, prescribed fire, natural events, wildfire, change over time, land use change, vegetation treatments, and timber harvest.

**Chipping:** Change agent (fuel treatment) in which woody fuels are broken into small pieces.

**Clearcut:** A change agent (vegetation treatment/timber harvest) in which all, or nearly all, trees in a stand of timber are cut in one operation.

**Co-dominant:** Trees in the upper canopy that receive light from above but relatively little from the sides. Codominant crowns can share growing space with dominant trees but generally in a lower position in the canopy.

**Combustion environment:** Groupings of fuelbed categories that combust similarly for a particular fire characteristic. For example, the residual combustion environment fuelbed component would consider only the abundance of the large woody fuels, duff, and basal accumulation.

**Comma separated file:** File extension used for an ASCII file consisting of items of data separated by commas (.csv). Each line of data is separated by a carriage return.

**Common name:** The nonscientific name(s) of a plant that can vary by region, often resulting in more than one common name for the same plant.

**Condition class:** See Fire Regime Current Condition Class.

**Conifer forest:** A forest dominated by needle-leaf trees with a percentage canopy cover of greater than 60% and height exceeding 6 feet.

**Continuous fuels:** Fuels that are continuous along a horizontal plane. For example, closed tree canopies (>80% canopy cover) are considered a continuous fuel.

**Cover class or type:** The existing vegetation of an area based on the Society of American Foresters forest cover types (Eyre 1980) and the Society for Range Management rangeland cover types (Shiflet 1994).

**Crown:** The part of a tree or woody plant bearing live branches and foliage.

**Crown bulk density:** The density of the tree crowns including the bulk air space between branches and foliage (lbs/ft<sup>3</sup>).

**Crown cover:** The extent to which crowns of trees and shrubs are within general contact with each other. Crown cover is determined by the horizontal projection of crown perimeters and commonly expressed as a percentage of total ground area.

**\*Crown fire:** A fire that advances from top to top of trees or shrubs more or less independent of a surface fire. Crown fires are sometimes classed as running or dependent to distinguish the degree of independence from the surface fire.

**Custom fuelbed:** A fuelbed in which the assigned variables have been changed by the user of the FCCS.

**Data quality ranking:** The quality of data representing each fuelbed ranked into 5 categories: 1) no data, expert opinion only, 2) less than 35 percent data for modal values, 3) 35 to 85 percent data for modal values, 4) greater than 85 percent data for modal values, and 5) greater than 85 percent data for modal, minimum, and maximum values.

**Density:** Amount per unit area. For example, the number of trees per acre.

**Dependent crown fire potential:** Probability that a forested area will sustain a crown fire from heat generated only from burning fuels beneath the canopy.

**Depth:** The extent downward, backward, or inward. For example, the depth of duff or downed woody fuels.

**Diameter:** The length of a straight line passing through the center of a circle and connecting two points on the circumference.

**Diameter at breast height (dbh):** A standard measurement of tree diameters 4.5 feet above the average ground level.

**Discontinuous fuel:** Fuel that is discontinuous along a horizontal plane. For example, tree stumps and woody fuel accumulations are generally widely spaced along the ground surface and are considered discontinuous.

**Ditching/drainage:** A change agent (land use change) that channels water away from an area, often creating a drier combustion environment.

**Dominant tree:** A tree that receives full sunlight from above and partial light from the sides of its crown, which is positioned above the general level of the canopy.

**Downed woody fuel:** Dead, woody fuel that lies on the ground.

**Duff:** The partially decomposed organic material above mineral soil that lies beneath freshly fallen twigs, needles, and leaves and is often referred to as the O soil horizons (Oi, Oe and Oa) or the F (fermentation) and H (humus) layers.

**Duff derivation:** The parent material from which duff was derived. Examples of the parent material include needles, leaves, moss, bark flakes, or woody debris.

**Ecoregion division:** Subdivision of Bailey (Bailey 1989) domains that are classified by differing vegetation and regional climates. The FCCS ecoregion divisions include: tundra, subarctic, warm continental, hot continental, subtropical, prairie, marine, Mediterranean, tropical/subtropical steppe desert, tropical/subtropical desert, temperate steppe, temperate desert, savanna, and rainforest. Fuelbeds are organized geographically into Bailey ecoregion divisions. More than one ecoregion may apply to each fuelbed.

**Evergreen:** Plants that remain green all year by retaining at least some of their leaves at all times.

**FCCS:** Fuel Characteristic Classification System. A catalog of inherent physical properties of wildland fuelbeds and associated calculations of fuel characteristics and fire potentials.

**Fermentation layer:** Decomposing organic layer of the duff lying directly between the litter layer and humic layer. Individual pieces of the parent material can often be identified. Often referred to as the "F" layer or the Oi soil horizon.

**\*Fire behavior:** The manner in which a fire reacts to the influences of fuel, weather, and topography.

**Fire behavior fuel model:** The formulation of fuelbed inputs into fuel models that allow realistic estimation of fire behavior. There are 13 original fuel models with an additional 42 recent additions (Scott and Burgan 2005).

**Fire exclusion:** A change agent (change over time) in which fires have been either actively suppressed or removed from an area through land use changes and/or cessation of aboriginal burning.

**Fire potential:** A set of relative values that rate the intrinsic physical capacity of any wildland fuelbed to release energy, spread, crown, consume, and smolder under extremely dry conditions. These potentials are calculated from the loading, heat content, bulk density, and characteristic thickness of fuel elements without consideration of moisture content or environmental conditions. This is the same as fuelbed potentials.

**\*Fire regime:** Description of the patterns of fire occurrences, frequency, size, severity, and sometimes vegetation and fire effects as well, in a given area or ecosystem. A fire regime is a generalization based on fire histories at individual sites. Fire regimes can often be described as cycles because some parts of the histories usually get repeated, and the repetitions can be counted and measured, such as fire return interval.

**\*Fire regime current condition class:** Depiction of the degree of departure from historical fire regimes, possibly resulting in alternations of key ecosystem components. These classes categorize and describe vegetation composition and structure conditions that currently exist inside the Fire Regime Groups. Based on the coarse-scale national data, they serve as generalized wildfire rankings. The risk of loss of key ecosystem components from wildfires increases from Condition Class 1 (lowest risk) to Condition Class 3 (highest risk).

**Fire behavior potential:** A combination of reaction potential, spread potential, and flame length potential scaled to between 0 and 10.

**Flame available fuel:** Fuel available for consumption during the flaming combustion phase.

**Flame length potential:** The potential flame length of a fuelbed. Proportional to fireline intensity or flame length, and derived from the normalized product of the reaction potential and the spread potential.

**\*Flaming phase:** Phase of a fire in which the fuel is ignited and consumed by flaming combustion.

**Flood:** Change agent (natural event) in which large volumes of water collapse trees and shrubs often concentrating biomass creating large fuel accumulations.

**Foliar moisture content:** Quantity of moisture in live leaves and needles expressed as a percentage of dry weight.

**\*Fuel:** combustible material.

**Fuel area index (FAI):** Total fuel surface area per unit ground area (ft<sup>2</sup>/ft<sup>2</sup>)

**Fuelbed:** The inherent physical characteristics of fuels that contribute to fire behavior and effects. The **FCCS** describes fuelbeds in 6 horizontal layers including canopy, shrub, nonwoody vegetation, woody fuels, litter - lichen - moss, and ground fuels. Each layer, or stratum, is further divided into one or more categories to represent the complexity of wildland and managed fuels. A fuelbed can represent any scale that the user considers to be mostly uniform.

**Fuelbed categories:** Groupings of fuels within a fuel stratum that share common combustion characteristics. For example, the woody fuel stratum contains five categories: all woody debris, sound wood, rotten wood, stumps, and woody fuel accumulations. There are 16 fuelbed categories in total.

**\*Fuel continuity:** The degree or extent of continuous or uninterrupted distribution of fuel particles in a fuel bed thus affecting a fire's ability to sustain combustion and spread. This applies to aerial fuels as well as surface fuels.

**Fuelbed depth:** Average height of surface or canopy fuels contained in the combustion zone of a spreading fire front.

**Fuelbed ID:** The identification code for a specific fuelbed.

**Fuel loading:** The dry weight per unit area of combustible material (tons/acre).

**Fuel loading class:** A category of woody fuels based on six diameter classes: 0 to ¼ inches, ¼ to 1 inches, 1 to 3 inches, 3 to 9 inches, 9 to 20 inches and greater than 20 inches.

**Fuelbed potentials:** See Fire Potential.

**Fuelbed prototypes:** Prepared fuelbed descriptions within the FCCS national fuelbed database designed to include most major fuelbed types throughout the United States.

**Fuelbed strata:** Vertical layers within the fuelbed that represent unique combustion characteristics. Six layers are recognized: tree, shrub, nonwoody vegetation, woody fuel, litter, lichen, and moss, and ground. The use of fuelbed strata facilitates the creation of spatial data layers and allows the user to include, combine, or exclude as much detail as needed to suit a particular application.

**Fuelbed subcategories:** Further grouping of fuels within a fuelbed category with common combustion characteristics. For example, snags are further divided into the following subcategories: Class 1 snags with foliage, Class 1 snags without foliage, Class 2 snags, and Class 3 snags.

**Gap:** A separation in fuel continuity that affects the progression of the flames between fuel elements.

**General Report:** A report in the FCCS that displays commonly used fuelbed characteristics.

**Gradient variables:** Quantitative variables needed to characterize the amount of fuel in each category. For example, the Nonwoody Fuel Stratum includes the gradient variables percent cover, height, percent live, live foliar moisture content, and loading.

**Grass:** Member of the family *Gramineae* and characterized by hollow stems and circular cross sections and bladelike leaves arranged on the culm or stem in two ranks.

**Grassland:** Landscapes characterized by grasses and other erect herbs, usually without trees or shrubs.

**Grazing:** A change agent (land use change) in which cattle and other herbivores are allowed to feed on grass and herbaceous plants.

**Ground fire:** A fire that burns low-growing vegetation, litter, and organic material in the soil layer.

**Ground fuel stratum:** Fuel layer within the FCCS that characterizes the duff, squirrel midden, and basal accumulation fuel categories.

**Hard maximum:** Maximum value allowed for a particular gradient variable. If an entry exceeds a hard maximum, users will receive an error message and the entry will not be recorded.

**Hard minimum:** Minimum value allowed for a particular gradient variable. If an entry is smaller than a hard minimum, users will receive an error message, and the entry will not be recorded.

**Heat flux:** The amount of heat transferred across a surface area in a unit of time. Also known as “thermal flux”

**\*Heat of combustion:** The heat energy resulting from the complete combustion of a fuel, expressed as the quantity of heat per unit weight of fuel (btu/lb).

**Height:** Distance from the base to the top of a fuel type. For example, the height of a tree would be the distance from the base of the tree to the top of the tree.

**Height to live crown:** Distance from the ground surface to the continuous portion of tree crowns, including the branches and foliage.

**Herb:** A plant that lacks a permanent woody stem and dies back to the ground each year.

**Historic fire regime:** The historical periodicity and pattern of naturally-occurring fires in a particular area or vegetative type, described in terms of frequency, biological severity, and aerial extent.

**HTML (Hypertext Markup Language):** A formatting language used for documents on the World Wide Web. HTML files are plain text files with formatting codes that instruct browsers to display text, position graphics and form items, and display links to other pages.

**Humic layer:** Often referred to as the “H” layer, the humic layer is a highly decomposed organic duff layer that lies between the fermentation duff layer and mineral soil. Individual pieces of the parent material generally cannot be identified in this layer.

**Humic peat:** Accumulation of partially decomposed plant material.

**Ice storm:** A change agent (natural event) in which rain freezes and coats vegetation with ice, causing trees and shrubs to collapse and creating large fuel accumulations.

**Independent crown fire potential:** The probability that a forested area will sustain a fire that advances in the tree crowns alone without energy from the surface fire to sustain combustion or movement.

**Inferred variables:** Fuelbed characteristics (e.g. surface to volume ratio, heat of combustion, flammability rating, and particle density) inferred by species or other fuel attributes. Inferred variables are for internal checking and evaluation of the system’s calculation function and cannot be viewed or modified by the users.

**Input Report:** A report in the FCCS that displays the input values and associated soft minimum and maximum values associated with a fuelbed.

**Insect and disease:** A change agent (natural event) in which insects and diseases attack and kill vegetation, causing a build-up of dead fuels.

**Introduction of exotic species:** A change agent (change over time) in which foreign species invade a native ecosystem.

**Jackpot:** National accumulation and concentration of woody debris. Jackpots are a subcategory of Woody Fuel Accumulations.

**Java:** A programming language developed by Sun Microsystems©. JAVA is the platform language of the FCCS.

**Large fuels:** Dead wood debris consisting of sound or rotten round wood greater than 3 inches in diameter.

**\*Ladder fuels:** Fuels which provide vertical continuity between strata, thereby allowing fire to carry from surface fuels into the crowns of trees or shrubs with relative ease. They help initiate and assure the continuation of crowning. There are 8 ladder fuel types in the FCCS system including arboreal lichens and moss, climbing ferns, and other epiphytes, dead branches, profuse epicormic sprouting, stringy or fuzzy bark, tree regeneration, and vines-lianas.

**Ladder fuel maximum height:** Maximum height of the surface fuels including the shrubs, nonwoody, woody fuel strata from the ground.

**Ladder fuel minimum height:** Minimum height of the surface fuels including the shrubs, nonwoody, and woody fuel strata from the ground.

**Landslide:** Change agent (natural event) in which a mass of rock and mud slides down a hillslope and disturbs existing vegetation.

**Lichen:** A composite plant typically consisting of an alga and a fungus living together in a mutually beneficial relationship. The Litter-Lichen-Moss Stratum in the FCCS includes ground lichen only.

**Lightered stumps:** Stumps that contain concentrations of pitch and other resinous volatiles and burn vigorously.

**\*Litter:** The top layer of forest floor, composed of loose debris of dead sticks, branches, twigs, and recently fallen leaves or needles; little altered in structure by decomposition.

**Litter arrangement:** The distribution of the litter layer. The FCCS includes three litter arrangement categories including fluffy, normal, and perched.

**Litter, lichen and moss stratum:** The fuel layer within the FCCS that characterizes the litter, (ground) lichen and moss fuel categories.

**Live foliar moisture content:** Water content of a live fuel (e.g. stems and leaves) expressed as a percentage of dry weight of the fuel.

**Logging methods-equipment damage:** A change agent (vegetation treatment/timber harvest) in which vegetation is damaged from mechanical fuel treatments and/or timber harvests.

**Lop and scatter:** A change agent (fuel treatment) in which woody fuels are cut into smaller pieces and scattered across a treated unit.

**Lower duff layer:** The lower half of the duff layer, generally containing a majority of the humic or highly decayed material. The lower duff layer is denser than the upper duff layer.

**Mastication:** A change agent (fuel treatment) in which woody fuels are ground into smaller pieces and scattered across the area, altering woody fuel structure and loading.

**Midstory:** The middle layer of trees, in a multistoried forest.

**Mixed forest:** A mixed forest is one in which evergreen and deciduous species each generally contribute 25 to 75 percent of total tree cover in both the overstory and midstory tree layers.

**Mode:** A statistic defined as the most frequently occurring data value.

**Moss:** A plant in the phylum Bryophyta; usually occurring in a wet habitat.

**Moss type:** The type of moss (e.g. sphagnum or other moss) that comprise the majority of mosses for a particular fuelbed.

**Muck:** Black, well-decomposed organic material accumulated under conditions of imperfect drainage. Muck contains more mineral matter and is generally darker and more fully decomposed than peat.

**\*Natural fuels:** Fuels resulting from natural processes and not directly generated or altered by land management practices. Generally, an area is considered composed of natural fuels if there has been no mechanical treatment of fuels for ten years or more.

**Natural fire regime:** General classification of the role fire would play across a landscape in the absence of modern human mechanical intervention, but including the influence of aboriginal burning. The FCCS uses seven fire regime classifications based on the historic characteristics of disturbance defined by Agee (1993) and Heinselman (1981).

**Needle drape:** Needles that fall and hang in shrubs or tree branches and provide vertical continuity between the surface fuels and crown fuels in a forested stand, thus contributing to the ease of torching and crowning.

**Neutral shrub:** A shrub with average combustion potential.

**Nonwoody fuel stratum:** The fuel layer within the FCCS that characterizes grasses, sedges and other herbaceous fuels.

**Overstory:** The portion of the trees forming the upper canopy layer in a forest stand.

**Overstory torching potential:** The potential for fire to reach the overstory canopy layer.

**Optimum packing ratio:** The packing ratio that would occur if fuel particles were optimally spaced (i.e., when the fuel particles each had 0.08 - 0.11 feet of air space from which to draw oxygen). Optimal fuel particle spacing for fine fuels is approximately 0.08 feet and 0.11 feet for coarse fuels such as wood.

**\*Packing ratio:** The fraction of a fuel bed occupied by fuels, or the fuel volume divided by bed volume.

**Particle density:** The density of wood or foliage that does not include the bulk air space between individual pieces of wood or foliage (lbs/ft<sup>3</sup>).

**Paving:** A change agent (land use change) in which paving an area alters fuel characteristics.

**PDF (Adobe® Portable Document File):** A file type that can be read and printed in Adobe® Reader, which is freely downloadable at <http://www.adobe.com>.

**Peat:** A general duff derivation consisting largely of organic residues originating under more or less water-saturated conditions through the incomplete decomposition of plant and animal constituents. See fibric peat and humic peat for more specific definitions.

**Percent cover:** The percent of a surface area covered by a fuelbed category. In the FCCS, percent cover is used to express the relative importance of a fuelbed category within a fuelbed type.

**Percent live:** The percentage of a plant that is living.

**Percent rotten:** The percentage of downed, dead woody debris, snags, or duff that is composed of rotten, or partially decayed, material.

**Photo series:** A collection of data and photographs that collectively displays a range of physical characteristics of fuelbeds. Photo series data were used to populate a portion of the fuelbed prototypes of the FCCS.

**Physiognomic variables:** Variables that capture qualitative features of a category, including morphological, chemical, and physical features. For example, the litter category includes litter type and arrangement.

**Physiognomy:** The general outward appearance of a plant community, determined by the life form of the dominant species.

**Piles:** A woody fuel accumulation formed into a pile for future burning.

**Pile and burn:** A change agent (fuel treatment) in which logging slash or naturally accumulated debris is arranged into individual piles and burned.

**Potential Report:** A report in the FCCS that displays the nine fire potentials of a fuelbed.

**Prescribed burn:** A change agent (fuel treatment) in which a controlled fire is applied to wildland fuels to obtain planned objectives for silviculture, wildlife habitat management, grazing, and fire hazard reduction.

**Primary nonwoody layer:** The main layer of vegetation within the nonwoody fuelbed stratum. Users can determine the primary layer based on a number of selection criteria including species, height, mass, etc.

**Primary shrub layer:** The main layer of vegetation within the shrub fuelbed stratum. Users can determine the primary layer based on a number of selection criteria including species, height, mass, etc.

**Pruning:** A change agent (vegetation treatment) in which lower branches of trees and shrubs are removed, reducing ladder fuels.

**Radius:** The length of a line segment between the center and circumference of a log or tree bole.

**Reaction efficiency:** An index proportional to the reaction intensity of a fuelbed (energy released per unit area per unit time).

**Reaction potential:** The reaction intensity of a fuelbed (energy release per unit area per unit time). It is a function of fuel surface area per unit ground surface, depth of the surface fuelbed stratum, heat of combustion, and a scaling factor based on flammability.

**Relative cover:** The relative percentage (0-100%) of a fixed area covered by a species or fuelbed category.

**Relative packing ratio:** Proportion of fuelbed space that is occupied relative to the optimum packing ratio (packing ratio/optimum packing ratio).

**Residual available fuel:** The fuel available for consumption during the residual phase of combustion.

**Residual fertilization:** A change agent (vegetation treatment/timber harvest) in which soil nutrient amendments cause an increase in vegetation loading.

**Residual phase:** The phase of combustion following the smoldering stage. Sometimes termed the “glowing phase”. Residual phase consumption may last for an extended period of time and generally involves woody fuels larger than 2 inches in diameter.

**Restoration work:** A change agent (vegetation treatment/timber harvest) in which an area is restored to a “natural fire regime condition” by removing or treating fuels through a variety of management practices such as prescribed burning, chipping, or mastication.

**Retardant shrub:** A shrub with a lower than average combustible potential due to retardant type compounds present within the leaves and stems.

**Rotten wood:** Partially decomposed wood debris with obvious signs of decay such that the material falls apart when kicked. The three rotten wood diameter classes are 3 to 9 inches, 9 to 20 inches, and > 20 inches.

**Salvage:** A change agent (vegetation treatment/timber harvest) in which dead and in some cases live trees are removed from an area that has been burned by a wildfire.

**Savanna:** A tropical or subtropical plant community characterized by trees and shrubs scattered among a cover of grasses, herbs and forbs. Savannas have sparse (5-24%) tree or shrub cover with continuous grass cover.

**Scientific name:** A formal Latin name applied to a taxonomic group of plants. A species scientific name is a binomial consisting of genus and species.

**Secondary nonwoody layer:** Optional nonwoody layer with a different species composition and/or height than the primary nonwoody layer.

**Secondary shrub layer:** Optional shrub layer with a different species composition and/or height than the primary shrub layer.

**Selection cut:** Change agent (vegetation treatment/timber harvest) in which individual trees of all size classes are removed more or less uniformly throughout the stand to maintain an uneven-aged stand and achieve other stand structural objectives. The activity generally reduces tree density and alters the canopy fuel categories.

**Sedge:** A grasslike plant of the *Cyperaceae* family with a triangular stem, often growing in wet areas.

**Seedlings:** Young trees that have grown beyond the stage at which they have just emerged from the soil but less than 3.5 inches in diameter or under 4.5 feet in height. Seedlings are included in the understory tree layer or can be considered an overstory if they are the only tree layer in the fuelbed.

**Shrub:** A woody perennial plant differing from a tree by its low stature and by generally producing several basal stems instead of a single bole.

**Shrubland:** A landscape characterized by shrubs with little if any tree cover.

**Shrub stratum:** Fuel layer within the FCCS that characterizes the shrub fuels.

**\*Slash:** Debris resulting from such natural events as wind, fire, or snow breakage; or such human activities as road construction, logging, pruning, thinning, or brush cutting. It includes logs, chunks, bark, branches, stumps, and broken understory trees or brush.

**Smoldering phase:** The phase of combustion in which the overall reaction rate of combustion has diminished to a point at which concentrations of combustible gases above the fuel are too low to support a persistent flame envelope. The smoldering phase follows the flaming phase of combustion and is often characterized by large amounts of smoke.

**\*Snags:** A standing dead tree or part of a dead tree from which at least the leaves and smaller branches have fallen > 4.5 ft in height. Snags are classified into four decay class categories: snag class 1 with foliage, snag class 1 without foliage, snag class 2, and snag class 3.

**Snag decay class 1 - foliage present:** Standing, recently dead trees greater than 4.5 feet tall, predominantly sound with fine and coarse branches, top and foliage intact.

**Snag decay class 1 - foliage absent:** Standing, recently dead trees greater than 4.5 feet tall, predominantly sound with fine and coarse branches, but with no foliage present.

**Snag decay class 2 - branches and bark present:** Standing dead trees greater than 4.5 feet tall with coarse branches and bark intact.

**Snag decay class 3 - rotten, no branches and bark:** Standing dead trees greater than 4.5 feet tall that are predominantly rotten with no bark intact.

**Soft Maximum:** Recommended maximum data entry limits specific to each fuelbed in the FCCS National Fuelbed Database. If an entry exceeds a soft minimum, users will receive a warning message but the entry will be accepted.

**Soft minimum:** Recommended minimum data entry limits specific to each fuelbed in the FCCS National Fuelbed Database. If an entry is smaller than a soft minimum, users will receive a warning message but the entry will be accepted.

**Sound wood:** Woody debris that has minimal decay. The six sound wood diameter classes in FCCS include 0 to ¼ inch, ¼ to 1 inch, 1 to 3 inches, 3 to 9 inches, 9 to 20 inches, and >20 inches.

**Spread potential:** The potential for fire to spread in a fuelbed, calculated as a function of reaction potential and the abundance of very fine fuels less than 1 inch in diameter.

**Squirrel middens:** A mound of cone scales and other cone debris accumulated over time from squirrels extracting seeds. The mounds are composed exclusively of organic matter that can burn for extended periods of time. Squirrel middens are a ground fuel category in the FCCS.

**Strata and category reports:** A report in the FCCS that displays the input and calculated characteristics for a fuelbed by fuel stratum and category.

**Structure:** The spatial distribution pattern of life forms in a plant community, especially with regard to their height, abundance, or coverage within individual layers.

**Structural class:** The classification of the form or appearance of a plant community. The FCCS uses the stand structural class of forest vegetation forms (USDA Forest Service 1999). The seven classes describe the number of canopy layers, relative size of trees, stage of understory development, and relative degree of stand closure.

**Stump:** The remaining part of a tree after a trunk is cut.

**Stumpwooding:** A change agent (vegetation treatment/timber harvest) in which stumps or wood from the stumps are removed or harvested.

**Taxonomic serial number (TSN):** A species-specific identification number from the Integrated Taxonomic Information System (Integrated Taxonomic Information System 2004).

**Thinning:** A change agent (vegetation treatment/timber harvest) in which individual trees are removed throughout the stand to increase growth, decrease ladder fuels, or achieve other stand structural objectives. This activity reduces tree density.

**Torching potential:** The probability that a forested area will sustain only the burning of individual tree crowns.

**Tree:** A tall, perennial woody plant greater than 4.5 feet having a main trunk and branches forming a distinct elevated crown; includes both gymnosperms and angiosperms.

**Tree crown:** The upper portion of a tree including the branches and foliage.

**TSN:** See Taxonomic serial number.

**Turpentining:** A change agent (vegetation treatment/timber harvest) in which turpentine is collected from pine trees. Turpentining generally causes scarring and pitching on the bole of trees.

**Understory:** The lowest canopy layer in a multistoried forest

**Upper duff layer:** The upper half of the duff layer that generally contains a fermentation (F) layer and may contain a portion of the humic (H) layer. The upper duff layer is less dense than the lower duff layer.

**Vegetation form:** A physiognomic level of classification based on the "formation class" level in the United States National Vegetation Classification (Grossman et al. 1998) that represents the general shape and structure of vegetation. Vegetation forms are based on relative cover of the dominant life form. The seven general vegetation forms in the FCCS include conifer forest, hardwood forest, mixed forest, shrubland, grassland, savanna, and slash.

**Windrow:** Woody debris that has been piled into a continuous row.

**Woody fuel accumulation:** The accumulation of woody debris as a result of land use activities (e.g., timber harvest, thinning) and natural events (e.g., wind, avalanche, wildfire). The three subcategories of woody fuel accumulation in the FCCS include jackpots, piles, and windrows.

**Woody fuel stratum:** A fuel layer within the FCCS that characterizes sound and rotten woody fuels, stumps, and woody fuel accumulations.

\* Reference taken from the National Wildland Fire Coordinating Group Glossary of Wildland Fire Terminology 2006 (<http://www.nwcfg.gov/pms/pubs/glossary>)

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