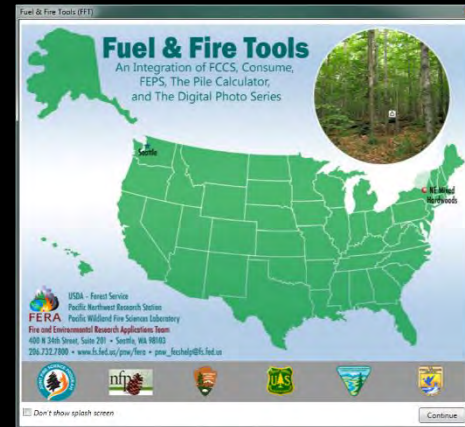


FCCS & Consume Exercise

Using Fuel and Fire Tools- FFT
Mixed Conifer/Stand Replacement
Prescribed Burn





FFT Exercise



Mixed Conifer



Mixed conifer following
Stand replacement Rx



Difference??

Step 1: Find a representative fuel bed:

- Open the Fuel and Fire Tools (FFT)
- Select the Baileys ecoregion (Temperate Desert 340)
- Select vegetation form (conifer)
- Search for fuelbeds





Fuel & Fire Tools

An Integration of FCCS, Consume,
FEPS, The Pile Calculator,
and The Digital Photo Series



USDA - Forest Service
Pacific Northwest Research Station
FERA Pacific Wildland Fire Sciences Laboratory

Fire and Environmental Research Applications Team
400 N 34th Street, Suite 201 • Seattle, WA 98103
206.732.7800 • www.fs.fed.us/pnw/fera • pnw_fccshelp@fs.fed.us



Don't show splash screen

Continue

You can create your set of fuelbeds in three ways:

1. Select from the list below. Filter list of all fuelbeds by: Clear all filters

Ecoregion: Temperate Desert X

Vegetation Form: Conifer Forest X

Cover Type: X

Structural Class: X

Change Agent: X

2. Browse your file system to select fuelbed (.xm LANDFIRE fuelbed list (.lf) files:

Browse to file(s)...

3. Load a saved unit:

ManningCreek | 1000 | 2 fuelbed(s)

Richfield | 1000 | 7 fuelbed(s)

Richfield2 | 1000 | 2 fuelbed(s)

List of all fuelbeds:30 Right-click on selected fuelbed to make copies

- 21: Young lodgepole pine forest
- 22: Mature lodgepole pine forest
- 23: Mature lodgepole pine forest with bark beetle damage
- 24: Pacific ponderosa pine-Douglas-fir forest
- 25: Pinyon-Utah juniper forest
- 26: Interior ponderosa pine-limber pine forest
- 27: Ponderosa pine-two needle pinyon-Utah juniper forest
- 29: Interior ponderosa pine-Engelmann spruce-Douglas-fir forest
- 34: Interior Douglas-fir-interior ponderosa pine/gambel oak forest
- 53: Pacific ponderosa pine forest
- 59: Subalpine fir-Engelmann spruce-Douglas-fir-lodgepole pine forest
- 59u1: Subalpine fir-Engelmann spruce-Douglas-fir-lodgepole pine forest
- 61: Whitebark pine/subalpine fir forest
- 67: Interior ponderosa pine-Douglas-fir forest
- 70: Subalpine fir-lodgepole pine-whitebark pine-Engelmann spruce forest
- 70u1: Subalpine fir-lodgepole pine-whitebark pine-Engelmann spruce forest
- 70u2: Subalpine fir-lodgepole pine-whitebark pine-Engelmann spruce forest
- 208: Grand fir-Douglas-fir forest
- 210: Pinyon-Utah juniper woodland
- 227: White fir forest

Selected Fuelbeds:

Save/edit this unit

Delete this unit

Start over/ Create new unit

For this exercise we will select mixed
conifer FCC Fuelbed 273 Engelmann
spruce-Douglas-fir-white-fir-ponderosa
pine forest



You can create your set of fuelbeds in three ways:

1. Select from the list below. Filter list of all fuelbeds by:

Clear all filters

Ecoregion: X

Vegetation Form: X

Cover Type: X

Structural Class: X

Change Agent: X

2. Browse your file system to select fuelbed (.xm LANDFIRE fuelbed list (.lf) files:

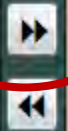
Browse to file(s)...

3. Load a saved unit:

ManningCreek | 1000 | 2 fuelbed(s)
 Richfield | 1000 | 7 fuelbed(s)
 Richfield2 | 1000 | 2 fuelbed(s)

List of all fuelbeds:23 *Right-click on selected fuelbed to make copies*

- 24: Pacific ponderosa pine-Douglas-fir forest
- 25: Pinyon-Utah juniper forest
- 26: Interior ponderosa pine-limber pine forest
- 27: Ponderosa pine-two needle pinyon-Utah juniper forest
- 29: Interior ponderosa pine-Engelmann spruce-Douglas-fir forest
- 34: Interior Douglas-fir-interior ponderosa pine/gambel oak forest
- 53: Pacific ponderosa pine forest
- 59: Subalpine fir-Engelmann spruce-Douglas-fir-lodgepole pine forest
- 61: Whitebark pine/subalpine fir forest
- 67: Interior ponderosa pine-Douglas-fir forest
- 70: Subalpine fir-lodgepole pine-whitebark pine-Engelmann spruce forest
- 208: Grand fir-Douglas-fir forest
- 210: Pinyon-Utah juniper woodland
- 227: White fir forest
- 228: Interior ponderosa pine-limber pine forest
- 230: Pinyon-Utah juniper forest
- 273: Engelmann spruce-Douglas-fir-white fir-ponderosa pine forest
- 285: Limber pine-ponderosa pine forest
- 304: Engelmann spruce-subalpine fir / horsetail forest
- 314: Limber pine-bristlecone pine forest



Selected Fuelbeds:

(Empty area for selected fuelbeds)

Save/edit this unit

Delete this unit

Start over/
Create new unit

Help

Use metric units

Edit fuelbeds

Next: Specify Environmental Inputs >

Make 1 copy of FCCS 273 and move to right box

The screenshot displays the Fuelbed Selector application window. The interface is divided into three main sections for creating fuelbeds:

- 1. Select from the list below:** Includes filters for Ecoregion (Temperate Desert), Vegetation Form (Conifer Forest), Cover Type, Structural Class, and Change Agent.
- 2. Browse your file system:** A "Browse to file(s)..." button is present.
- 3. Load a saved unit:** Lists existing units: CampFire (11 fuelbeds), carr_fire_2018 (8 fuelbeds), and Richfield (2 fuelbeds).

A "Copy fuelbed to:" dialog box is open, showing the following details:

Original Filename:	New Filename:
FB_0273_FCCS.xml	FB_273_Rx
Original Fuelbed Description:	New Fuelbed Description:
Engelmann spruce-Douglas-fir-white fir-ponderosa pi	Stand replacement prescribed burn

The background window shows a list of reference fuelbeds (23 total), with fuelbed 273, "Engelmann spruce-Douglas-fir-white fir-ponderosa pine forest", highlighted in green. The bottom right of the window has a "Next: Specify Environmental Inputs" button.

Step 1. Customize the one fuelbed to represent Rx stand replacement fire

Mixed conifer



Stand replacement
prescribed fire



You can create your set of fuelbeds in three ways:

1. Select from the list below. Filter list of all fuelbeds by:

Clear all filters

Ecoregion: Temperate Desert

Vegetation Form: Conifer Forest

Cover Type:

Structural Class:

Change Agent:

2. Browse your file system to select fuelbed (.xml LANDFIRE fuelbed list (.lfi) files:

Browse to file(s)...

3. Load a saved unit:

ManningCreek | 1000 | 2 fuelbed(s)
Richfield | 1000 | 7 fuelbed(s)
Richfield2 | 1000 | 2 fuelbed(s)

List of all fuelbeds:24 *Right-click on selected fuelbed to make copies*

- 24: Pacific ponderosa pine-Douglas-fir forest
- 25: Pinyon-Utah juniper forest
- 26: Interior ponderosa pine-limber pine forest
- 27: Ponderosa pine-two needle pinyon-Utah juniper forest
- 29: Interior ponderosa pine-Engelmann spruce-Douglas-fir forest
- 34: Interior Douglas-fir-interior ponderosa pine/gambel oak forest
- 53: Pacific ponderosa pine forest
- 59: Subalpine fir-Engelmann spruce-Douglas-fir-lodgepole pine forest
- 61: Whitebark pine/subalpine fir forest
- 67: Interior ponderosa pine-Douglas-fir forest
- 70: Subalpine fir-lodgepole pine-whitebark pine-Engelmann spruce forest
- 208: Grand fir-Douglas-fir forest
- 210: Pinyon-Utah juniper woodland
- 227: White fir forest
- 228: Interior ponderosa pine-limber pine forest
- 230: Pinyon-Utah juniper forest
- 273: Engelmann spruce-Douglas-fir-white fir-ponderosa pine forest
- 273u1: Engelmann spruce-Douglas-fir-white fir-ponderosa pine forest
- 286: Limber pine-ponderosa pine forest
- 304: Engelmann spruce-subalpine fir / horsetail forest



Selected Fuelbeds:

- 273: Engelmann spruce-Douglas-fir-white fir-ponderosa pine forest
- 273u1: Engelmann spruce-Douglas-fir-white fir-ponderosa pine forest

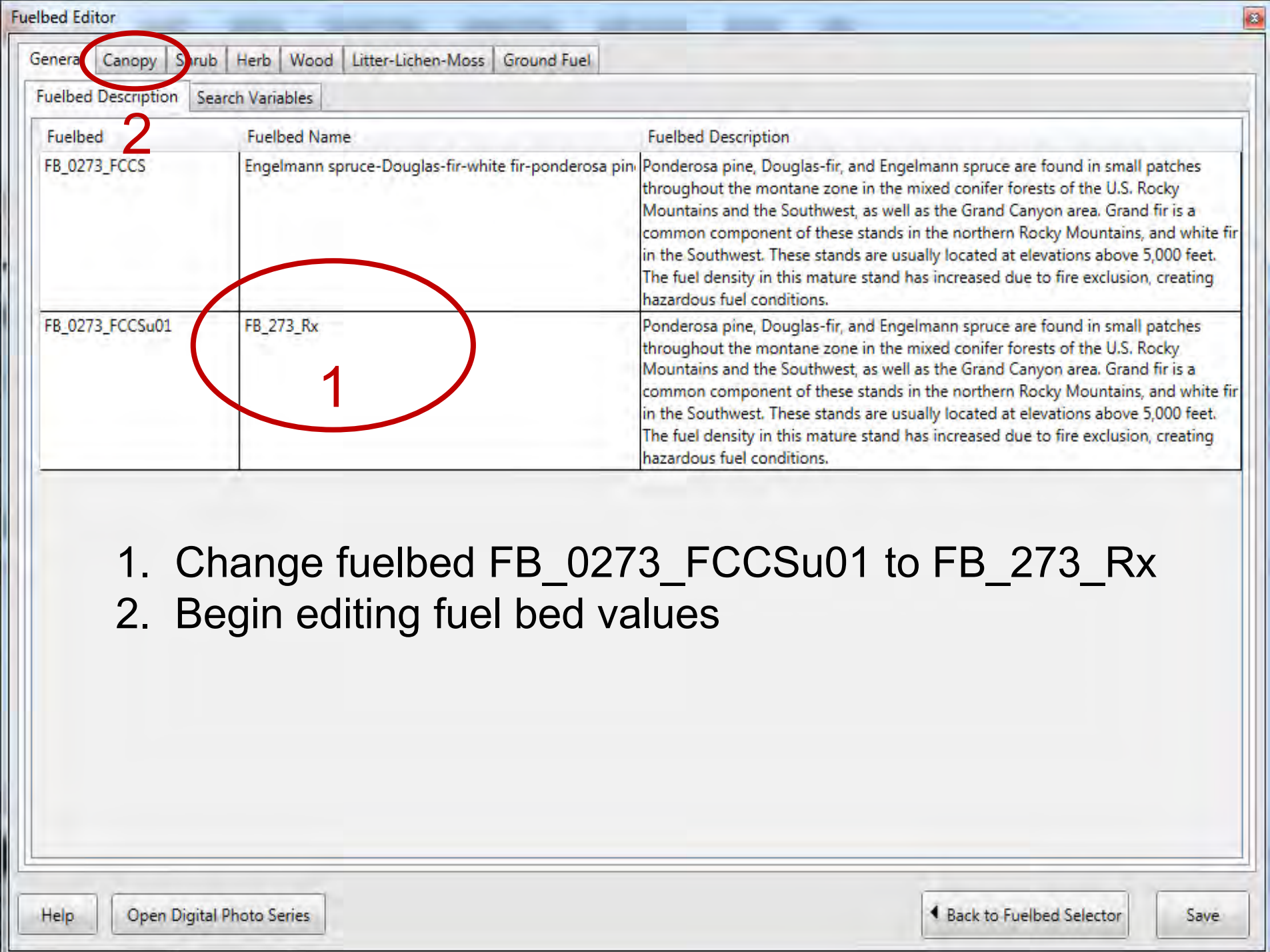
Save/edit this unit
Delete this unit
Start over/
Create new unit

Help

Use metric units

Edit fuelbeds

Next: Specify Environmental Inputs



General **Canopy** Scrub Herb Wood Litter-Lichen-Moss Ground Fuel

Fuelbed Description Search Variables

Fuelbed	Fuelbed Name	Fuelbed Description
FB_0273_FCCS	Engelmann spruce-Douglas-fir-white fir-ponderosa pin	Ponderosa pine, Douglas-fir, and Engelmann spruce are found in small patches throughout the montane zone in the mixed conifer forests of the U.S. Rocky Mountains and the Southwest, as well as the Grand Canyon area. Grand fir is a common component of these stands in the northern Rocky Mountains, and white fir in the Southwest. These stands are usually located at elevations above 5,000 feet. The fuel density in this mature stand has increased due to fire exclusion, creating hazardous fuel conditions.
FB_0273_FCCSu01	FB_273_Rx	Ponderosa pine, Douglas-fir, and Engelmann spruce are found in small patches throughout the montane zone in the mixed conifer forests of the U.S. Rocky Mountains and the Southwest, as well as the Grand Canyon area. Grand fir is a common component of these stands in the northern Rocky Mountains, and white fir in the Southwest. These stands are usually located at elevations above 5,000 feet. The fuel density in this mature stand has increased due to fire exclusion, creating hazardous fuel conditions.

1. Change fuelbed FB_0273_FCCSu01 to FB_273_Rx
2. Begin editing fuel bed values

Help

Open Digital Photo Series

Back to Fuelbed Selector

Save

Input Data for FB 273 and FB 273_Rx

Trees

Overstory	Total Cover	Cover (%)	Height (ft)	HLC (ft)	Density (trees/acre)	DBH (in)
FB 273	50	20	100	40	30	25
FB 273_Rx	10	5	100	40	2	25
Midstory	Total Cover	Cover (%)	Height (ft)	HLC (ft)	Density (trees/acre)	DBH (in)
FB 273		40	60	30	110	12
FB 273_Rx		1	60	30	5	12
Understory	Total Cover	Cover (%)	Height (ft)	HLC (ft)	Density (trees/acre)	DBH (in)
FB 273		25	5	0	4500	2
FB 273_Rx		1	5	0	20	2

Ladder Fuels

Ladder Fuels	Vertical Continuity
FB 273	Yes
FB 273_Rx	No

Snags

Snag 1-Foliage	Height (ft)	Density (trees/ac)	DBH (in)
FB 273	60	12	12
FB 273_Rx	NP	NP	NP
Snag 1-No Foliage	Height (ft)	Density (trees/ac)	DBH (in)
FB 273			
FB 273_Rx	60	133	12

Species

Tree Species	Cover (%)
White fir	20
Ponderosa pine	20
Douglas-fir	30
Engelmann spruce	30

Input Data for FB 273 and FB 273_Rx

Shrub

Shrubs	Cover (%)	Height (ft)	Live (%)	Needle Drape	Loading (t/a)
FB 273	5	7	95	N	
FB 273 Rx	1	1	0	N	

Herb

Grass	Cover (%)	Height (ft)	Live (%)	Loading (t/ac)
FB 273	3	2	95	0.2
FB 273 Rx	1	1	0	0

Wood

Sound Wood	Fine Wood Cover	Fine Wood Depth	1-hr (t/a)	10-hr (t/a)	100-hr (t/a)	1000-hr	1000+-hr
FB 273	65	3	0.25	1.5	3	5	4.5
FB 273 Rx	5	1	0.1	0.1	1	1	0

Litter

Duff

Litter/Duff	Cover (%)	Depth (in)	Cover (%)	Depth (in)
FB 273	50	1	80	1.6
FB 273 Rx	1	0.05	5	0.05

Fuelbed	Fuelbed Name	Fuelbed Description
FB_0273_FCCSu01	FB_273_Rx	Ponderosa pine, Douglas-fir, and Engelmann spruce are found in small patches throughout the montane zone in the mixed conifer forests of the U.S. Rocky Mountains and the Southwest, as well as the Grand Canyon area. Grand fir is a common component of these stands in the northern Rocky Mountains, and white fir in the Southwest. These stands are usually located at elevations above 5,000 feet. The fuel density in this mature stand has increased due to fire exclusion, creating hazardous fuel conditions. This fuelbed has been burned as a stand replacement fire.
FB_0273_FCCSu02	FB_273	Ponderosa pine, Douglas-fir, and Engelmann spruce are found in small patches throughout the montane zone in the mixed conifer forests of the U.S. Rocky Mountains and the Southwest, as well as the Grand Canyon area. Grand fir is a common component of these stands in the northern Rocky Mountains, and white fir in the Southwest. These stands are usually located at elevations above 5,000 feet. The fuel density in this mature stand has increased due to fire exclusion, creating hazardous fuel conditions.

Step 1. Save customized Fuelbed
Step 2. Go back to Fuelbed selector

2

1

FCCS Instructions for Fire Behavior Outputs

Step 2: Specify environmental variables (keep defaults)

Environmental Inputs -- NewUnit

Select Environmental Scenario for 'NewUnit' (an FCCS-only unit):

- FCCS Benchmark Inputs
- Greenhouse_High_Severity
- Greenhouse_Low_Severity
- Greenhouse_Moderate_Severity

Edit Selected Environmental Scenario:

Environmental Scenario Name: _____

FCCS Benchmark Inputs **1**

Select tool/pathway:

FCCS

Fuel Moistures (%): [\[Select FM Scenario\]](#)

Herbaceous:	60
Shrub:	90
Crown:	90
1-hr:	6
10-hr:	7
100-hr:	8
Slope (%):	0
Windspeed (mph):	4

2

Consume (FCCS > Consume)

Fuel Moistures (%):

1000-hr:

Duff:

Shrub Consumption (%):

Canopy Consumption (%):

Pile Consumption (%):

Inputs needed for activity-fuels only:

Days Since Rain:

Length of Ignition (min.):

Source of 1000-hr FM:

Harvest w/in past 3 months?:

[\[Save unit to run Consume\]](#)

FEPS (FCCS > Consume > FEPS)

	Min	Max
Air Temp (°F):	<input type="text"/>	<input type="text"/>
Relative Humidity (%):	<input type="text"/>	<input type="text"/>
Midflame Windspeed (mph):	<input type="text"/>	<input type="text"/>
Transport Windspeed (mph):	<input type="text"/>	<input type="text"/>
Fire Shape:	<input type="text"/>	
Sunrise (0-23 hr):	<input type="text"/>	<input type="text"/>
Midday (0-23 hr):	<input type="text"/>	<input type="text"/>
Sunset (0-23 hr):	<input type="text"/>	<input type="text"/>
Fire Start (0-23 hr):	<input type="text"/>	<input type="text"/>
Fire Stop (1-71 hr):	<input type="text"/>	<input type="text"/>

[\[Save unit to run FEPS\]](#)

FCCS **Consume** FEPS**Print-friendly Reports (.pdf)**

Fuelbed

[FCCS Potentials](#)
[Surface Fire Behavior](#)
[Fuel Loading](#)
[Carbon](#)

Unit

[Fuel and Carbon Loading by Stratum](#)**Graphs (.png)**

Fuelbed

[FCCS Summary Potentials](#)
[Rate of Spread](#)
[Flame Length](#)
[Reaction Intensity](#)
[Fuel Loading](#)
[Carbon](#)**Output Tables (.csv)**[All Results](#)
[Fuel Characteristics](#)
[FCCS Potentials](#)
[Surface Fire Behavior](#)

Help

◀ Back to Environmental Inputs

Fire Potentials

Variable	Fuelbed 273	Fuelbed 273_Rx
	Potentials (0-9)	Potentials (0-9)
Surface Fire Behavior Potential	4	1
Reaction	3.5	1.7
Spread	3.9	0.9
Flame length	3.2	1.1
Crown Fire Potential	4	1
Crown fire initiation	3.2	0.9
Crown-to-crown transmissivity	5.8	0.0
Crown fire spread	4.0	0.5
Available Fuel Potential	7	3
Flame Available	2.8	0.7
Smolder Available	1.4	0.2
Residual Available	2.4	2.0
FCC Potential	447	113

Surface Fire Behavior Potential at Benchmark Conditions

Variable	Fuelbed 273	Fuelbed 273_Rx
Rate of Spread (ft/min)	3.8	0.2
Flame Length (ft)	2.5	0.3
Reaction Intensity BTUs/ft ² -min	1892	430
FBPS (original 13)	9 (Timber)	8 (Timber)
Standard 40	TL6 (Timber-Litter)	TL1 (Timber-Litter)

Fire Behavior Assessment

Fire behavior index: 448

ROS: 3.8

FL: 2.5

RI: 1892

Fire behavior index: 114

ROS: 0.2

FL: 0.3

RI: 430



Consume 4.2:

Predicting consumption & emissions



Create a unit to run Consume

Unit Fuelbed Selector Version: 2.0.972

You can create your set of fuelbeds in three ways:

1. Select from the list below. Filter list of all fuelbeds by:
2. Browse your file system to select fuelbed (.xml LANDFIRE fuelbed list (.lf) files):
3. Load a saved unit: Richfield_workshop | 1000 | 2 fuelbed(s)

List of all fuelbeds:361 *Right-click on selected fuelbed to make copies*

- 262: Molasses grass grassland
- 263: Ohia/broomsedge bluestem savanna
- 264: Post-blackjack oak forest
- 265: Balsam fir-white spruce-mixed hardwood forest
- 266: Sugar maple-basswood forest
- 267: American beech-yellow birch-sugar maple-red spruce forest
- 268: American beech-yellow birch-sugar maple-eastern hemlock forest
- 269: Sugar maple-yellow poplar-American beech-oak forest
- 270: Red spruce-Fraser fir/rhododendron forest
- 272: Mangrove forest
- 273: Engelmann spruce-Douglas-fir-white fir-ponderosa pine forest
- 273u1: FB_273_Rx
- 273u2: FB_273
- 274: American beech-sugar maple forest
- 275: Chestnut-white-northern red oak forest
- 276: Oak-pine-magnolia forest
- 279: Black spruce-northern white cedar-larch forest
- 280: Bluestem-Gulf cordgrass grassland
- 281: Shortleaf pine-post oak-black oak forest
- 282: Loblolly pine forest
- 283: Willow-laurel-water oak forest
- 284: Green oak-American elm-silvercherry-cottonwood forest

Selected Fuelbeds:

- 273u1: FB_273_Rx
- 273u2: FB_273

Use metric units

Consume Instructions

Step 1: Create a burn unit (Richfield)

- Size = 1000 acres
- Click Save unit



Save/Edit Unit

Unit Properties

*Name: 1

*Size (ac.): 1000

*Burn type: Prescribed

Burn date: (mm/dd/yyyy)

Permit No.:

Project:

Notes:

Select the consumption equation sets that are most representative of your burn unit (activity = recent logging slash, boreal = boreal fuelbeds, southern = southeastern fuelbeds, and western = western pine)

Apply selected consumption equation to all fuelbeds:

Fuelbed	% Area	Consumption Equation
273: Engelmann spruce-Douglas-fir-white fir-ponderosa pine forest	50	Natural (Western)
273u1: FB-273_Rx	50	Natural (Western)

*Required to run Consume and FEPS

Total Percent: 100

Recalculate percents

Help Save unit Cancel

2

Consume Instructions

Step 2: Specify environmental variables

FCCS	INPUT
Herb FM (%)	30
Shrub FM (%)	60
Crown FM (%)	60
1-hr FM (%)	6
10-hr FM (%)	8
100-hr FM (%)	10
Slope (%)	40
Wind (mph)	4

CONSUME	INPUT
1000-hr FM (%)	20
Duff FM (%)	30
Litter FM (%)	10
Shrub % cons	100
Canopy % cons	80
Pile cons (%)	90
Season	Spring
Days since rain	--
Length ignition (min)	--
Source 1000-hr FM	--
Harvest within 3 months?	--

Consume Instructions

Step 3:

- Save Environmental Scenario as Richfield
- Run Consume

Environmental Inputs -- Richfield

Select Environmental Scenario for 'Richfield':

Environmental Scenario Name: 1

Select tool/pathway:

FCCS

Fuel Moistures (%): [\[Select FM Scenario\]](#)

Herbaceous:

Shrub:

Crown:

1-hr:

10-hr:

100-hr:

Slope (%):

Windspeed (mph):

Consume (FCCS > Consume)

Fuel Moistures (%):

1000-hr:

Duff:

Litter:

Shrub Consumption (%):

Canopy Consumption (%):

Pile Consumption (%):

Season:

Inputs needed for activity-fuels only: [\[Enable\]](#)

Days Since Rain:

Length of Ignition (min.):

Source of 1000-hr FM:

Harvest w/in past 3 months?:

FEPS (FCCS > Consume > FEPS)

Air Temp (°F): Min Max

Relative Humidity (%):

Midflame Windspeed (mph):

Transport Windspeed (mph):

Fire Shape:

Sunrise (0-23 hr):

Midday (0-23 hr):

Sunset (0-23 hr):

Fire Start (0-23 hr):

Fire Stop (1-71 hr):

2

Fuel and Fire Tools Results

FCCS **Consume** FEPS

Print-friendly Reports (.pdf)

Fuelbed

- [FCCS Potentials](#)
- [Surface Fire Behavior](#)
- [Fuel Loading](#)
- [Carbon](#)

Unit

[Fuel and Carbon Loading by Stratum](#)

Graphs (.png)

Fuelbed

- [FCCS Summary Potentials](#)
- [Rate of Spread](#)
- [Flame Length](#)
- [Reaction Intensity](#)
- [Fuel Loading](#)
- [Carbon](#)

Output Tables (.csv)

- [All Results](#)
- [Fuel Characteristics](#)
- [FCCS Potentials](#)
- [Surface Fire Behavior](#)

Help

◀ Back to Environmental Inputs

Fuel Consumption

Variable	FB_273	FB_273_Rx
Preburn loading (tons/acre)	89.97	28.35
Total Consumption (tons/acre)	28.24	11.63
Canopy (tons/acre)	12.23	7.77
Shrub (tons/acre)	0.14	0.02
Herb (tons/acre)	0.06	0.05
Wood (tons/acre)	9.47	3.80
LLM (tons/acre)	0.92	0.00
Ground fuels (tons/acre)	5.32	0.00

Pollutant Emissions

Variable	FB_273	FB_273_Rx
CH4 (lbs/acre)	238	114
CO (lbs/acre)	5102	2367
CO2 (lbs/acre)	90348	36636
NMHC (lbs/acre)	181	83
PM total (lbs/acre)	925	422
PM 10 (lbs/acre)	658	305
PM 2.5 (lbs/acre)	602	281

Questions?



16 2:53 PM