

# Playground Canada User's Guide

## Version 2

**Canadian Playground** Home | My Emissions | My Dispersions | Feedback | Help Logged in as jdewinter | Log Out

**Home**

Welcome to the Canadian BlueSky Playground!

Use the Canadian Playground to model your fires, estimate pollutant emissions, and:

- To get started, create one or more *emissions scenarios* to model your fires. You fire, then you can choose to accept defaults, or you can modify specific details: emissions scenario, you can choose to create a dispersion scenario.
- Creating a *dispersion scenario* allows you to choose associated fires, meteorologic a map of the predicted hourly PM<sub>2.5</sub> concentrations.

**Create New Emissions Scenarios**  
Model your fire's emissions.

**View Existing Emissions Scenarios**  
View and edit your saved emissions scenarios, or create dispersion s

**View Existing Dispersion Scenarios**  
View and edit your saved dispersion scenarios.

The output of Canada Pla Parks Canada, the British Operations, Natural Resoi Playground, which was de USDA Forest Service.

**Home » My Emissions » my burn 0225 (Broadcast)**

Latitude: 50.01969285231 Longitude: -118.813476562

**Outputs**

Fire Weather Index	90
Fine Fuel Moisture Code	90
Duff Moisture Code	70
Drought Code	300
Initial Spread Index	7.10
Buildup Index	88.42
Fire Weather Index	23.41

**Fire Behavior Prediction**

Rate of Spread	0.95	m/min
Surface Fuel Consumption	1.40	kg/m <sup>2</sup>
Total Fuel Consumption	1.40	kg/m <sup>2</sup>
Head Fire Intensity	398.38	kW/m

**Emissions**

PM <sub>2.5</sub>	7.46	tonnes
PM <sub>10</sub>	8.80	tonnes
CO	88	tonnes
CO <sub>2</sub>	949	tonnes
NO <sub>x</sub>	1.04	tonnes
GHGs	1144	tonnes CO <sub>2</sub> e

**Home » My Dispersions » lg wildfire (HYSPLIT)**

Full Dispersion Forecast day0 - Mar 23, 2015

Download NetCDF Output Download To Google Earth

**Data Layer**

- Hourly Concentration
- Daily Avg Concentration
- Daily Max Concentration

**Base Layer**

- Imagery
- Topo Map
- Street Map
- Overlays
- Legend

Scale: 0 10 20 40 80 160 320 640 PM<sub>2.5</sub> (µg/m<sup>3</sup>)

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# Terms

Term	Definition
BSF	BlueSky Framework
BUI	Buildup Index
DC	Drought Code
DMC	Duff Moisture Code
FCCS	Fuel Characteristic Classification System
FEER FRE	Fire Energetics and Emissions Research Fire Radiative Energy emissions model
FEPS	Fire Emission Production Simulator
FFMC	Fine Fuel Moisture Code
FINN	Fire Inventory of the National Center for Atmospheric Research
FLAMBE	Fire Locating and Modeling of Burning Emissions
FWI-FBP	Fire Weather Index System – Fire Behavior Prediction System
Hardy	Revised NFDRS fuels map for the western U.S. developed by Colin Hardy
HYSPLIT	Hybrid Single-Particle Lagrangian Integrated Trajectory model
ISI	Initial Spread Index
NFDRS	National Fire Danger Rating System
SEV Plume Rise	Sofiev, Ermakova, and Venkevich Plume Rise model
SmartFire	Satellite Mapping Automated Reanalysis Tool for Fire Incident Reconciliation
VSMOKE	VSmoke Model
WRAP	Western Regional Air Partnership
WRF	Weather Research and Forecasting
WSU FRP	Washington State University Fire Radiative Power emissions model

# 1. About Playground Canada

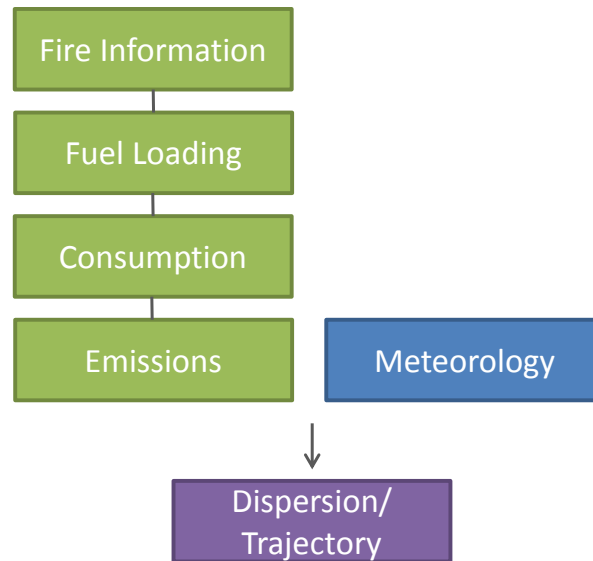
Playground Canada is a web application that enables land managers and air quality researchers to explore emissions from fires and to understand how smoke from fires will be dispersed over time. Playground Canada supports three different pathways for estimating emissions from different fire types:

- wildfires
- broadcast burns
- pile burns

These three pathways can be used to build emissions scenarios that describe the fire location, size, fuel type, consumption of fuels, and emissions of different pollutants. The emissions scenarios can be linked together or modeled separately in dispersion scenarios, which can be used to predict downwind smoke concentrations and to understand historical smoke impacts. The Playground Canada web application utilizes the BlueSky Framework to model both emissions and dispersion scenarios.

# 2. About the BlueSky Framework

The BlueSky Framework (BSF) is a modeling framework that facilitates the use of diagnostic and predictive models to simulate emissions from forest, agricultural, and range fires and thus helps land managers understand the cumulative smoke impacts of fires on air quality. The BSF links a variety of independent, state-of-the-science models of fire information, fuel loading, fuel consumption, fire emissions, plume rise, and smoke dispersion and trajectories. It is not a model, but a model management system whose architecture allows multiple, varied models to communicate with each other in a modular, user-driven environment. Though many valid scientific models have existed for some time, users were required to run the models independently and find a way to pass the relevant information between the models. The BSF facilitates running different models in a seamless manner. There are five primary steps in the BSF modeling process; each step uses models to answer a set of questions in the following sequence in order to estimate fire emissions and smoke concentrations ([Figure 1](#) and [Table 1](#)).



**Figure 1.** Generalized BSF model progression. Meteorology and fire information are run through a sequence of modeling steps to estimate fire emissions and smoke concentrations.

**Table 1.** Modeling steps and questions in the BSF.

Modeling Step	Question
Fire Information	Where and how big are the fire(s)?
Fuel Loading	What is the fuel available to be burned?
Consumption	How much fuel is consumed?
Emissions	What emissions are produced?
Dispersion/Trajectory	Where do the emissions go?

The BSF can run any sequential subset of the steps in Figure 1 independently if the necessary input information is provided. Once basic fire information about the fire location and size is input, the BSF runs models to determine fuel loadings and moisture conditions, and to calculate consumption and total emissions. These emissions then drive the dispersion and trajectory models. The important components of fire modeling in the context of the BSF are described in general, below; the specific information modeled at each step in the BSF process depends on the models that are run.

**Fire Information** – The BSF requires information about the fire location (latitude and longitude) and fire size (acreage). Fire information can be hand-entered into an input file or downloaded from SmartFire, a system that assembles and reconciles fire information from disparate sources.

**Fuel Loading** – Information about the composition and quantity of surface and canopy fuels that may be burned is needed to model fire behavior and fuels consumption. In the BSF, this information



is processed in the Fuel Loading step. In general, fuel loading information is intended to represent a uniform area on a landscape that will burn in a manner that is distinct from another area that has different fuel characteristics. Fuel loading values indicate the amount of surface woody materials for different vegetation types (e.g., pine versus fir), as well as the amount of litter, duff, grasses, shrubs, trees, and canopy, that are available to be burned; ultimately the BSF calculates a total fuels density ( $\text{kg}/\text{m}^2$ ) for each fire. Fuel loadings may be input directly by the user or obtained via fuelbed reference tables. The default fuel loadings map is the Fuel Characteristic Classification System (FCCS) version 2.<sup>1</sup>

**Consumption** – After fuel loadings are determined, the BSF runs another model to determine how much fuel was consumed during each phase of the fire (flaming, smoldering, and residual); total consumption (for each day of the fire) indicates the fraction of the available fuels that was actually burned during the fire and depends on the characteristics of the fuels and the type of fire. The default model for these calculations is the CONSUME model, version 4.<sup>2</sup> After the amount of total fuel consumed is calculated, the consumption is allocated over time using a *time profile*, which describes the diurnal rate of consumption through the total time period of the fire. The BSF includes two models (FEPS and WRAP) for applying a time profile to consumption; both of these models use relatively simple, idealized profiles or curve fits for the time profile sub-step.

**Emissions** – Emissions are calculated by applying an emissions factor that represents the quantity of a pollutant that is emitted per unit of fuel that is consumed; emissions factors are typically based on laboratory and/or field experiments for different fuel and fire types. The BSF has several models to calculate fire emissions, but the most commonly used is the FEPS model.<sup>3</sup> FEPS calculates emissions of CO, CO<sub>2</sub>, CH<sub>4</sub>, and PM<sub>2.5</sub>. In addition, FEPS calculates the heat released by a fire, necessary for plume rise calculations.

**Plume Rise** – Before modeling smoke plume concentrations and dispersion, the BSF must run a model to calculate plume rise, or the height to which a plume of smoke rises. Plume height is determined by the buoyancy of the plume, which is a function of thermal energy released as fuel is consumed (and meteorology). Commonly, the FEPS or WRAP models are used to estimate plume rise in the BSF.

**Meteorology** – The BSF uses three-dimensional spatially and temporally gridded meteorological information on an hourly time step to run dispersion models. Commonly, the WRF model is run to provide meteorological data files to the BSF.

**Dispersion and Trajectories** – The default trajectory and dispersion model in the BSF is the HYSPLIT model.<sup>4</sup> Smoke dispersion is simulated by using the HYSPLIT three-dimensional particle-puff model.

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<sup>1</sup> <http://www.fs.fed.us/pnw/fera/fft/fccsmodule.shtml>.

<sup>2</sup> <http://www.fs.fed.us/pnw/fera/research/smoke/consume/index.shtml>.

<sup>3</sup> <http://www.fs.fed.us/pnw/fera/feps/>.

<sup>4</sup> <http://ready.arl.noaa.gov/HYSPLIT.php>.

**Table 2** summarizes the commonly-used models that are available in the BSF for each step in the modeling process. Section 3 of this guide describes the specific models in the BSF that are used by Playground Canada to estimate emissions for wildfires and broadcast burns. The models used in Playground Canada are noted in bold with an asterisk (\*), and are described in Section 3 of this Guide.

**Table 2.** Models available in the BSF; acronyms are defined in the List of Terms.

Fuel Loading	Consumption	Time Profile	Emissions	Plume Rise	Trajectory	Dispersion
<b>FWI-FBP*</b>	<b>FWI-FBP*</b>	<b>FEPS*</b>	FEER FRE	<b>FEPS*</b>	HYSPLIT	<b>HYSPLIT*</b>
FCCS	CONSUME	<b>WRAP*</b>	<b>FEPS*</b>	SEV		VSMOKE
FINN	FEPS		FINN	WRAP		
FLAMBE	FINN		FLAMBE			
Hardy	FLAMBE		WSU FRP			
NFDRS						

\* Models used in Playground Canada.

### 3. BlueSky Framework Models Used by Playground Canada

Playground Canada supports emissions scenarios for three different fire types: wildfires, broadcast burns, and pile burns. The BlueSky Framework models both the wildfire and broadcast burn emissions scenarios using a similar combination of models, although the specific inputs and model setup are different for each pathway; pile burn emissions are not modeled by the BlueSky Framework, but are calculated in the web application. All pathways use FEPS to model plume rise and the HYSPLIT model to simulate smoke dispersion; trajectories are not modeled for Playground Canada. **Table 3** gives an overview of the BSF models used by Playground Canada.

For wildfires and broadcast burns, fire information (location and size), fuel type information, and meteorological information are first provided by the user via Playground Canada’s website. Then the FWI-FBP model is run in the BSF to estimate fuel loading and consumption. The WRAP (for wildfires) or FEPS (for broadcast burns) models are run to apply a time profile. For all three pathways, FEPS is used in the BSF to calculate emissions and to model plume rise, which is used by the HYSPLIT model in the BSF to model dispersion. Section 3.1 describes each model in more detail.

For pile burn emissions scenarios, the fire location and daily activity (number of piles to be burned) are provided by the user, as well as the time period for the burn (start and end time on a single day). The user must provide additional information regarding the pile shape, geometry, and fuel types.

Fuel loading, consumption, and emissions for pile burns are estimated using a set of equations developed by the U.S. Department of Agriculture (USDA) Forest Service (not in a BSF model). Section 3.1 provides additional information about the pile burn calculations.

**Table 3.** Models in the BSF used by Playground Canada.

Modeling Step	Wildfire	Broadcast	Piles
Fire Information	User input	User input	User input
Fuel Loading	FWI-FBP	FWI-FBP	Pile burn equations
Consumption	FWI-FBP	FWI-FBP	Pile burn equations
Time Profile	WRAP	FEPS	None
Emissions	FEPS	FEPS	Pile burn equations
Plume Rise	FEPS	FEPS	FEPS
Dispersion	HYSPLIT	HYSPLIT	HYSPLIT

### 3.1 Wildfire and Broadcast Burn Scenarios

Playground Canada requires that the user provide basic fire information (latitude, longitude, and size) to set up a wildfire or broadcast burn emissions scenario. The user also provides additional information regarding fuel type and meteorology, which is used to run the FWI-FBP model. The wildfire pathway uses the WRAP time profile to allocate consumption over the time period of the fire. For a broadcast burn, the user must provide a fire size, start time, and end time for each day of the burn; the FEPS time profile model allocates the consumption over the time period of the broadcast burn. Both pathways also use FEPS to model emissions. The FWI-FBP, FEPS, and WRAP models are described in more detail below.

**FWI-FBP** – The FWI-FBP model in the BSF implements portions of the model and methods developed by Natural Resources Canada to produce the Canadian Forest Fire Danger Rating System.<sup>5</sup> The FWI-FBP model includes two main components: (1) the Canadian Forest Fire Weather Index System (FWI), and (2) the Canadian Forest Fire Behavior Prediction System (FBP). The FWI uses fuel moisture content (fine fuel moisture, duff moisture, and drought) and weather (wind speed, temperature, relative humidity, and rainfall) to estimate fire danger; the output calculated by FWI includes three numeric indices, defined below, which describe daily fire danger. The Weather Guide for the Canadian Forest Fire Danger Rating System defines the moisture codes and weather indices as follows:

<sup>5</sup> <http://fire.ak.blm.gov/content/weather/2008%20CFFDRS%20Weather%20Guide.pdf>

**Fine Fuel Moisture Code (FFMC)** – a numeric rating of the moisture content of litter and other cured fine fuels. The FFMC is an indicator of the relative ease of ignition and flammability of fine fuels.

**Duff Moisture Code (DMC)** – a numeric rating of the moisture content of loosely compacted organic (duff) layers of moderate depth. The DMC is an indicator of fuel consumption in moderate duff layers and medium-sized downed woody material.

**The Drought Code (DC)** – a numeric rating of the moisture content of deep, compact organic layers. The DC is an indicator of seasonal drought effects on forest fuels and the amount of smoldering in deep duff layers and large logs.

**Initial Spread Index (ISI)** – a numeric rating of the expected rate of fire spread. The ISI combines the effects of wind and the FFMC on rate of spread without the influence of variable quantities of fuel.

**Buildup Index (BUI)** – a numeric rating of the total amount of fuel available for combustion. It combines the DMC and the DC.

**Fire Weather Index (FWI)** – a numeric rating of fire intensity. It combines the ISI and the BUI. The FWI is suitable as a general index of fire danger throughout the forested areas of Canada.

The indices are used as inputs, along with fuel type and slope, to the FBP system, which models fire behavior. The FBP outputs include fire rate of spread, head fire intensity, and total consumption. In order to run FWI, the Playground Canada user must provide the FFMC, DMC, DC, wind speed, and wind direction. In order to run FBP, the user must select a fuel type from a drop-down menu containing 17 vegetation types,<sup>6</sup> and enter the slope and aspect.

**WRAP (Time Profile)** – The WRAP model in the BSF is based on the recommendations for a wildfire diurnal profile<sup>7</sup> developed by the Western Regional Air Partnership and is used to apply a time profile to the total consumption for a wildfire. In this time profile consumption steadily increases until peak consumption occurs at 4:00 p.m. local time (**Figure 2**). **Table 4** shows the percentage of acres burned per hour from midnight to 11:00 p.m. for a wildfire. In this profile, 68% of the total consumption is allocated to a five-hour time period in the afternoon when wildfires are the most active (1300-1700 hours local time); a smoldering/residual component also extends throughout the evening and early morning. Wildfires begin at 9:00 a.m. and end at 6:00 p.m. local time; the start and end times are not configurable by the user.

**FEPS (Time Profile)** – The FEPS model in the BSF is used to apply a time profile to the total consumption results for the broadcast burn emissions scenario. The time profile specifies the rate of consumption throughout the course of a day and is different for flaming, smoldering, and residual phases of consumption. FEPS allocates flaming consumption in equal percentages throughout the

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<sup>6</sup> <http://cwfis.cfs.nrcan.gc.ca/background/fueltypes/c1>.

<sup>7</sup> <http://www.wrapair.org/forums/fejf/documents/emissions/WGA2018report20051123.pdf>.

duration of the fire (Figure 3a). A user specifies a start time and end time for each day of the fire. FEPS also includes an extended rise and decay curve for low-level smoldering/residual consumption that peaks at the beginning of the burning period and may decay for several days after the end time of the flaming component of the fire, depending on the fire size<sup>8</sup> (Figure 3b).

**FEPS (Emissions)** – The FEPS model is used to calculate total and hourly emissions for both the wildfire and broadcast burn pathways in Playground Canada. The FEPS methodology is based on combustion efficiency of the burn; the combustion efficiency calculation and emissions factors for CO, CO<sub>2</sub>, CH<sub>4</sub>, and PM are described in the FEPS reference documentation.

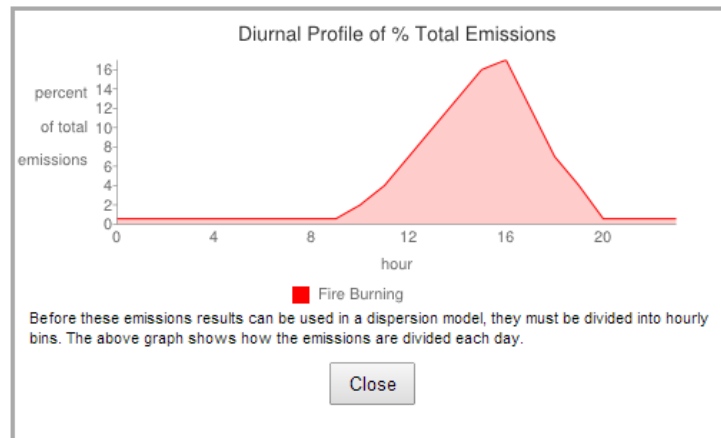


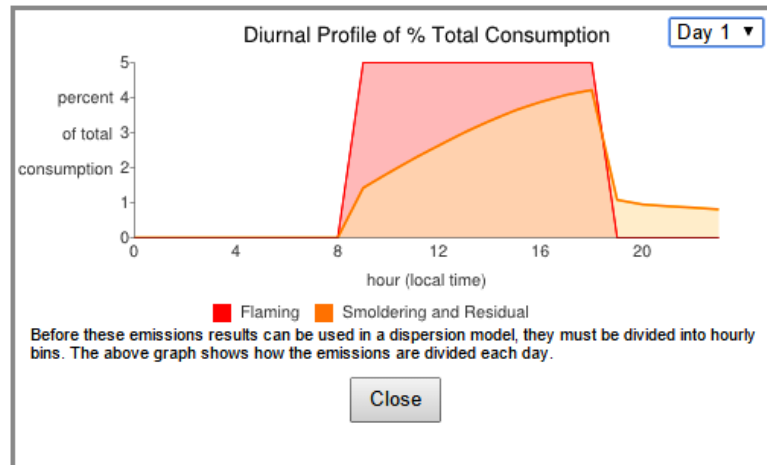
Figure 2. WRAP time profile example for flaming combustion during a wildfire.

Table 4. Wildfire diurnal fraction of consumption in WRAP (area fraction for each hour of the day).

Time	Area Fraction	Time	Area Fraction	Time	Area Fraction
24:00	0.0057	8:00	0.0057	16:00	0.17
1:00	0.0057	9:00	0.0057	17:00	0.12
2:00	0.0057	10:00	0.02	18:00	0.07
3:00	0.0057	11:00	0.04	19:00	0.04
4:00	0.0057	12:00	0.07	20:00	0.0057
5:00	0.0057	13:00	0.1	21:00	0.0057
6:00	0.0057	14:00	0.13	22:00	0.0057
7:00	0.0057	15:00	0.16	23:00	0.0057

<sup>8</sup> [http://www.fs.fed.us/pnw/fera/feps/FEPS\\_users\\_guide.pdf](http://www.fs.fed.us/pnw/fera/feps/FEPS_users_guide.pdf)

(a)



(b)

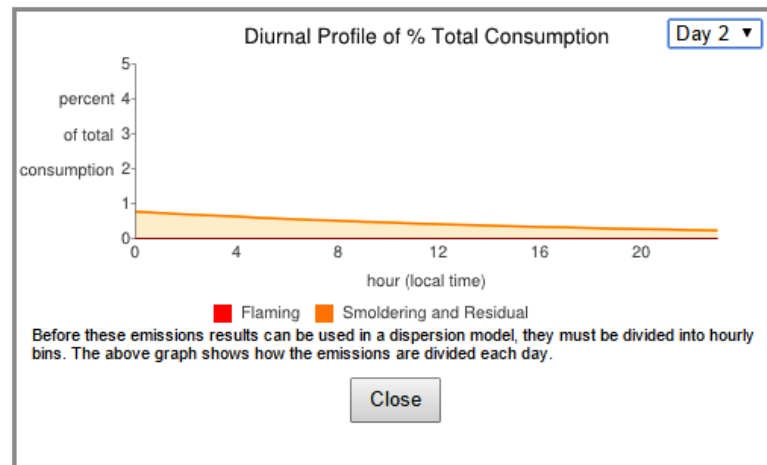


Figure 3. FEPS time profile example for flaming, smoldering, and residual combustion during a broadcast burn on Day 1 (a) and Day 2 (b).

## 3.2 Pile Burn Scenarios

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Unlike the wildfire and broadcast burn emissions scenarios, the pile burn emissions scenario in Playground Canada does not utilize the models in the BSF. Instead, the Playground Canada pile burn pathway is calculated in the web application. This pathway reflects the methodologies for hand-piled and machine-piled burns developed by the USDA Forest Service; information about each methodology is available online.<sup>9</sup> Pile burning emissions estimates for hand piles and machine piles follow similar approaches but were developed separately; each uses a different set of empirical equations.

**Table 5** compares the generalized six-step approach used in both methods. Both methods begin with an estimate of gross pile volume based on pile geometry (Step 1). Seven different pile shapes can be selected; the pile geometry (height, length, and/or width) are defined by the user for each shape. Gross volume is then scaled down to an effective volume of burnable biomass (adjusted volume) (Step 2). The meaning of “effective volume” is different for each pile type. For hand piles, the algorithm uses an empirically derived relationship to adjust the gross volume to observed true volume. For machine piles, the algorithm considers that much of the gross volume of a pile is occupied by air; the ratio of gross volume to actual pile volume is called the “packing ratio.” Therefore, the gross pile volume is multiplied by an appropriate packing ratio to determine the true volume of woody material in a pile.

For machine piles only, the biomass density is calculated by using the average density of one or more tree species (Step 3). The total fuel loading for hand piles is calculated by using an empirical exponential equation that varies for two types of hand piles (conifer-dominated and shrub/hardwood-dominated) (Step 4). The total fuel loading for machine piles is calculated by multiplying the adjusted volume by the biomass density (Step 4). In each method, consumption is simply a fraction of total fuel loading, with a default of 90% consumed (Step 5). For the pile burn emissions scenario, the flaming, smoldering, and residual consumption is evenly distributed throughout the time period of the burns; no other time profile is applied. Emissions are estimated by applying an emission factor for each species to the consumption (Step 6). For machine piles, the percentage of the pile that consists of soil affects the particulate emission factors. Hand piles use the same species-specific emission factors as machine piles, but the hand pile calculations assume 0% soil.

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<sup>9</sup> Documentation is available online for the hand pile ([www.fs.fed.us/pnw/pubs/pnw\\_gtr805.pdf](http://www.fs.fed.us/pnw/pubs/pnw_gtr805.pdf)) and machine pile ([www.fs.fed.us/pnw/publications/pnw\\_gtr364](http://www.fs.fed.us/pnw/publications/pnw_gtr364)) calculations developed by the Forest Service.

**Table 5.** Step-by-step comparison of hand-piled and machine-piled emissions estimates.

Step	Hand-Pile	Machine-Pile
1. Gross Pile Volume (m <sup>3</sup> )	Standard volume calculation e.g., the half sphere is $\frac{(\pi \times h \times w^2)}{6}$	Standard volume calculation
2. Adjusted Volume (m <sup>3</sup> )	If gross vol. < 1, adj. vol. = $\exp^{(0.2106)} \times \text{gross. vol.}$	Gross vol. x packing ratio (10%, 20%, or 25 %)
	If gross vol. ≥ 1, adj. vol. = $\exp^{(0.2106 + 0.7691 \times \ln(\text{gross vol.}))}$	
3. Biomass Density (kg/m <sup>3</sup> )	Not Applicable	Oven-dry density of fuel species (or weighted average oven-dry density for 2+ species)
4. Total Fuel Loading (tonnes)	If conifer, fuel loading = $\exp^{(4.4281 + 0.8028 \times \ln(\text{adj. vol.}))}$	Adjusted volume x biomass density
	If shrub/hardwood, fuel loading = $\exp^{(3.0393 + 1.3129 \times \ln(\text{adj. vol.}))}$	
5. Consumption (tonnes)	Fraction of total fuel loading	Fraction of total fuel loading
6. Emissions (tonnes)	Consumption x emission factor (assumes soil percent = 0)	Consumption x emission factor (varies by percent soil in pile)

## 4. Running Playground Canada

Playground Canada is available online at <http://firesmoke.ca/playground/>; a user account is required and can be created from the login page. Section 4.1 of this guide provides step-by-step instructions for building a new emissions scenario for wildfires, broadcast burns, and pile burns. Section 4.2 of this guide provides step-by-step instructions for setting up a dispersion scenario and reviewing the results.



## 4.1 Building Emissions Scenarios

From the Playground Canada home page, you can create a new emissions scenario or quickly navigate to existing emissions or dispersion scenarios.

Navigation links to access the home page, emissions or dispersion scenarios, provide feedback, and get help.

Create a new emissions scenario, or view an existing scenario.

View existing dispersion scenarios.

The screenshot shows the Canadian Playground website interface. At the top, the logo "Canadian Playground" is on the left, and navigation links "Home | My Emissions | My Dispersions | Feedback | Help" are in the center, with "Home" circled in red. On the right, it says "Logged in as jdewinter | Log Out". Below the navigation is a "Home" section with a welcome message and instructions. A list of actions is provided: "Create New Emissions Scenarios", "View Existing Emissions Scenarios", and "View Existing Dispersion Scenarios". Red arrows point from the text on the left to these three links. At the bottom, there is a paragraph of text about the project's experimental nature and funding.

Canadian Playground

Home | My Emissions | My Dispersions | Feedback | Help

Logged in as jdewinter | Log Out

Home

Welcome to the Canadian BlueSky Playground!

Use the Canadian Playground to model your fires, estimate pollutant emissions, and predict downwind smoke concentrations.

- To get started, create one or more *emissions scenarios* to model your fires. You simply specify the size, type, and location of the fire, then you can choose to accept defaults, or you can modify specific details about fuel loading, moisture, etc. After creating an emissions scenario, you can choose to create a dispersion scenario.
- Creating a *dispersion scenario* allows you to choose associated fires, meteorological data, and the date of the fire(s) to generate a map of the predicted hourly PM<sub>2.5</sub> concentrations.

[Create New Emissions Scenarios](#)  
Model your fire's emissions.

[View Existing Emissions Scenarios](#)  
View and edit your saved emissions scenarios, or create dispersion scenarios.

[View Existing Dispersion Scenarios](#)  
View and edit your saved dispersion scenarios.

The output of Canada Playground considered experimental. Canadian Playground is an ongoing research project supported by: Parks Canada, the British Columbia Ministry of the Environment, the British Columbia Ministry of Forests, Lands and Natural Resource Operations, Natural Resources Canada, and the University of British Columbia. The Canadian Playground is based on the BlueSky Playground, which was developed by the USDA Forest Service AirFire team and Sonoma Technology, Inc. under funding from the USDA Forest Service.

After clicking [Create New Emissions Scenarios](#) from the home page, you can set up a new emissions scenario for a broadcast burn, pile burn, or wildfire. All scenarios require the fire information (latitude, longitude, size) to be input at this step; the pile burn scenario requires the number of piles instead of the size.

Enter a name for the new emissions scenario.

Select the type of fire to be modeled (broadcast, piles, or wildfire).

Canadian Playground

Home | My Emissions | My Dispersions | Feedback | Help

Logged in as jdewinter | Log Out

Home » My Emissions

### New Emissions

Name

Emissions type

- Broadcast
- Piles
- Wildfire

Latitude

Longitude

Target Size (hectares)

My Emissions WF 032814	Wildfire	03/28/2014 10:32:53 AM	03/28/2014 10:32:59 AM
My Emissions 032814	Broadcast	03/28/2014 09:05:07 AM	03/28/2014 09:05:54 AM

Enter the fire coordinates and size in hectares. Pile burn scenarios require the number of piles.

Click **Go** to build the scenario.

**Broadcast Burn:** After clicking **Go**, you will see the consumption and emissions output generated by the FWI-FBP and FEPS models in the BSF. From this page, you can modify the inputs and re-run the BSF to recalculate the emissions outputs. Choose **Create Dispersion** to create a new dispersion scenario using the emissions results.

Canadian Playground

Home | My Emissions | My Dispersions | Feedback | Help

Logged in as jdewinter | Log Out

Home » My Emissions » test large broadcast (Broadcast)

Emissions | Notes

Latitude: 49.3648578957  
Longitude: -118.066406245

**Fuels & Consumption**

Fuels: C7 - Ponderosa pine-Douglas fir

Fine Fuel Moisture Code: 90  
Duff Moisture Code: 70  
Drought Code: 300  
Slope: 5 %  
Aspect: 250 deg  
Windspeed: 10 km/hr  
Wind Direction: 45 deg

**Timing Inputs**

Size (ha): 100000  
Day 1: 8 AM - 6 PM MST (PDT)

Buttons: Add a Day, Fire Timing Info

**Outputs**

**Fire Weather Index**

Fire Weather Index	90
Duff Moisture Code	70
Drought Code	300
Initial Spread Index	7.10
Buildup Index	88.42
Fire Weather Index	23.41

**Fire Behavior Prediction**

Rate of Spread	1.54	m/min
Surface Fuel Consumption	3.00	kg/m <sup>2</sup>
Total Fuel Consumption	3.00	kg/m <sup>2</sup>
Head Fire Intensity	1387.95	kW/m

**Emissions**

PM <sub>2.5</sub>	15981.60	tonnes
PM <sub>10</sub>	18858.29	tonnes
CO	188421	tonnes
CO <sub>2</sub>	2033645	tonnes
NO <sub>x</sub>	2224.27	tonnes
GHGs	2450776	tonnes CO <sub>2</sub> e

Buttons: Discard Changes, Apply, Create Dispersion

Select the fuel type and provide the moisture and drought codes, slope, aspect, wind speed and wind direction.

View the output from the FWI-FBP and FEPS models.

Specify the size, start time and end time, and time zone for each day of the fire (up to 3 days). Click **Fire Timing Info** to view a graph of the time profile results.

Discard changes, apply new changes (reruns the BSF), or create a dispersion scenario.

**Wildfire:** After clicking **Go**, you will see the consumption and emissions output generated by the FWI-FBP and FEPS models in the BSF. From this page, you can modify the inputs and rerun the BSF to recalculate the emissions outputs. Choose **Create Dispersion** to create a new dispersion scenario using the emissions results.

Select the fuel type and provide the moisture and drought codes, slope, aspect, wind speed and wind direction.

The screenshot shows the 'Canadian Playground' website interface for a wildfire simulation. The page title is 'Home » My Emissions » Test Large Burn (Wildfire)'. The interface is divided into several sections:

- Inputs:** Latitude (49.393468503), Longitude (-117.80273437), Target Size (100000 ha).
- Map:** A topographic map of the Thompson Plateau region in British Columbia, Canada, with a red diamond marker indicating the burn location.
- Fuels:** A dropdown menu set to 'C1 - Spruce-lichen woodland'.
- Parameters:**
  - Fine Fuel Moisture Code: 90
  - Duff Moisture Code: 70
  - Drought Code: 300
  - Slope: 5 %
  - Aspect: 250 deg
  - Windspeed: 10 km/hr
  - Wind Direction: 45 deg
- Buttons:** 'Discard Changes', 'Apply', and 'Create Dispersion' (circled in red).
- Fire Timing Info:** A button with an upward-pointing red arrow.
- Outputs:**
  - Fire Weather Index:**

Fine Fuel Moisture Code	90
Duff Moisture Code	70
Drought Code	300
Initial Spread Index	7.10
Buildup Index	88.42
Fire Weather Index	23.41
  - Fire Behavior Prediction:**

Rate of Spread	0.95	m/min
Surface Fuel Consumption	1.40	kg/m <sup>2</sup>
Total Fuel Consumption	1.40	kg/m <sup>2</sup>
Head Fire Intensity	398.38	kW/m
  - Emissions:**

PM <sub>2.5</sub>	7459.12	tonnes
PM <sub>10</sub>	8801.76	tonnes
CO	87942	tonnes
CO <sub>2</sub>	949166	tonnes
NO <sub>x</sub>	1038.14	tonnes
GHGs	1143854	tonnes CO <sub>2</sub> e

View the output from the FWI-FBP and FEPS models.

Discard changes, apply new changes (reruns the BSF), or create a dispersion scenario.

Click **Fire Timing Info** to view a graph of the time profile results.

**Pile Burn:** After clicking **Go**, you will see the fuel loading, consumption, and emissions output based on the equations provided in Table 4. From this page, you can modify the inputs and rerun the BSF to recalculate the emissions outputs. Choose **Create Dispersion** to create a new dispersion scenario using the emissions results. The pile burn scenario includes elements that are consistent with the broadcast and wildfire pathways (i.e., start and end times and time zone), but it requires several unique inputs to describe the shapes and characteristics of the piles.

Click **Fire Timing Info** to view a graph of the time profile results.

Select the pile shape and input the dimensions.

Specify the pile type (machine or hand).

Specify the fuel species and percent consumption.

Discard changes, apply new changes, or create a dispersion scenario.

View the output from the pile burn calculations.

Canadian Playground

Home | My Emissions | My Dispersions | Feedback | Help

Logged in as jdewinter | Log Out

Home » My Emissions » My Emissions (Piles)

Emissions Notes

**Inputs**

Latitude: 47.320590804465  
 Longitude: -113.12255859279  
 Daily Activity (Number of Piles): 100  
 Start: 10 AM Timezone: PST  
 End: 6 PM

**Fire Timing Info**

**Pile Shape**: Half Sphere  
 Height: 10 m

**Pile Type**:  Hand-Piled  Machine-Piled  
 Details: Percent Soil: 0%, Packing Ratio: 10% (long-needle or broadleaf)

**Fuel Species**: Wood Species Consumed: Ailanthus 100%  
 Fuel Consumed: Percent Consumption: 90%

**Outputs**

**Fuels**

Wood Density	37.00	lbs/m <sup>3</sup>
Pile Volume	2094.40	m <sup>3</sup>
Adjusted Volume	209.44	m <sup>3</sup>
Total Loading	1.18	tonnes/pile

**Consumption**

	By Pile	Total	
Flaming	2.44	244	tonnes
Smoldering	0.52	52	tonnes
Residual	0.52	52	tonnes
<b>Total</b>	<b>3.48</b>	<b>348</b>	<b>tonnes</b>

**Emissions**

PM	3.81	tonnes
PM <sub>2.5</sub>	2.35	tonnes
PM <sub>10</sub>	2.70	tonnes
CO	13.20	tonnes
CO <sub>2</sub>	579.04	tonnes
CH <sub>4</sub>	0.97	tonnes
NO <sub>x</sub>	0	tonnes
GHGs	616.588	tonnes CO <sub>2</sub> e
NMHC	0.79	tonnes

Discard Changes Apply Create Dispersion

## 4.2 Building Dispersion Scenarios

After choosing [Create Dispersion](#), you will see the dispersion scenario setup screen. One or more emissions scenarios can be included in a dispersion scenario; if multiple emissions scenarios are included, each one is modeled as a separate fire by HYSPLIT.

Specify a name for the dispersion scenario.

Canadian Playground

Home | My Emissions | My Dispersions | Feedback | Help

Logged in as jdewinter | Log Out

Home » My Emissions

New Copy Delete Create Dispersion from Selected

**New Dispersion**

Name

Meteorology Data Source (HYSPLIT)  
 National 40-km NWS (1/1/97 - present)

Emissions Scenarios Selected  
Test Large Burn  
test large broadcast

Cancel Next

<input type="checkbox"/>	My Emissions 032814b	Broadcast	03/28/2014 10:36:37 AM	03/28/2014 10:39:45 AM	
<input type="checkbox"/>	My Emissions WF 032814	Wildfire	03/28/2014 10:32:53 AM	03/28/2014 10:32:59 AM	
<input type="checkbox"/>	My Emissions 032814	Broadcast	03/28/2014 09:05:07 AM	03/28/2014 09:05:54 AM	

View the selected emissions scenario(s) to be modeled.

Select the meteorological data source.

Click **Next** to select the dates and run length for dispersion.

After clicking **Next**, you will be able to specify the start date and run length for the dispersion scenario. The HYSPLIT dispersion model will be run (within the BSF) from the start date (in UTC) to the end date that encompasses the run length selected by the user; run length can be one, two, or three days. However, the emissions that will be modeled depend on the start time and end time of the selected emissions scenario(s). If the emissions scenario is a one-day broadcast burn, then the dispersion scenario will only include fresh emissions on the start date; any additional days in the dispersion scenario (if the run length is more than one day) will not include fresh emissions.

Specify the start date and run length.

Canadian Playground

Home | My Emissions | My Dispersions | Feedback | Help

Logged in as jdewinter | Log Out

Home » My Emissions

New Copy Delete Create Dispersion from Selected

**New Dispersion**

National 40-km NWS (1/1/97 - present)

Settings

Start Date (UTC)  
Please select a date...

Run Length  
1 day

The Run Length is the number of days to be displayed in the dispersion results, regardless of how long the fire itself lasts.

Back Go

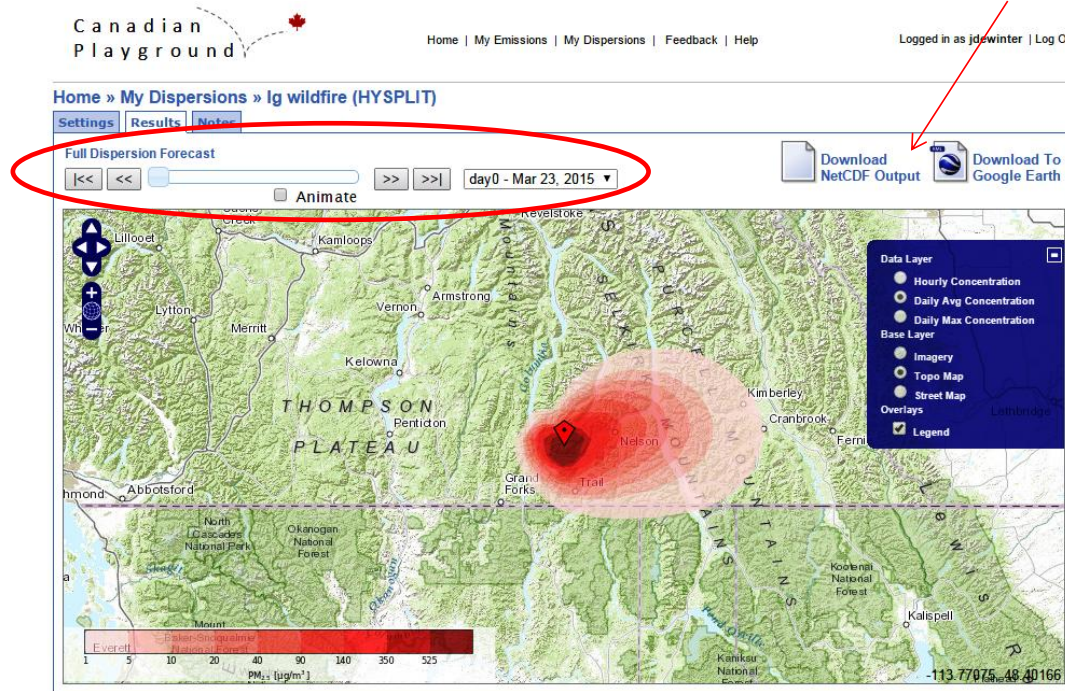
My Emissions	Broadcast	10/08/2014 07:47:50 PM	10/08/2014 07:48:22 PM
My Emissions	Broadcast	07/14/2014 01:13:42 PM	07/14/2014 01:13:50 PM
My Emissions	Broadcast	05/22/2014 09:23:40 AM	05/22/2014 09:23:49 AM
My Emissions 04182014	Broadcast	04/18/2014 02:55:49 PM	04/18/2014 02:55:56 PM
My Emissions WF 032814d	Wildfire	03/28/2014 01:51:55 PM	03/28/2014 01:52:13 PM
My Emissions 032814c	Broadcast	03/28/2014 01:15:04 PM	03/28/2014 02:15:16 PM
My Emissions 032814b	Broadcast	03/28/2014 10:36:37 AM	03/28/2014 10:39:45 AM
My Emissions WF 032814	Wildfire	03/28/2014 10:32:53 AM	03/28/2014 10:32:59 AM
My Emissions 032814	Broadcast	03/28/2014 09:05:07 AM	03/28/2014 09:05:54 AM

Click **Go** to create the dispersion scenario (runs the BSF).

The BSF will then run HYSPLIT; you can view the status by clicking [My Dispersions](#) at the top of any screen in Playground Canada. Once the dispersion results are ready, you can choose the dispersion scenario from the [My Dispersions](#) page and view the results. The dispersion results include a map display of smoke concentrations; you can set the data layer and time period of the display. Results can be downloaded in either NetCDF or Google Earth file formats.

Download the results as a NetCDF or Google Earth file.

Use the time slider or drop-down to change the time period of results that are displayed on the map.



Toggle the data layer to view the hourly, daily average, or maximum concentrations.