Consume 5 Command Line Instructions

The Consume 5 calculator module contains the consumption equations that were recently published in:
Prichard et al. 2017. Predicting forest floor and woody fuel consumption from prescribed burns in southern and western pine ecosystems of the United States. Forest Ecology and Management 405:328-338.

The Consume source code was written in Python and can be cloned from GitHub repository
https://github.com/pnwairfire/fera-apps-consume.

Consume5 is packaged within the Fuel and Fire Tools (FFT) application and can be run after adding a few input files to the same directory as the python calculator (C:\FuelFireTools\Consume).

1. Open a command prompt. In Windows, you can type "**cmd**" in the search box of the Start menu, and a command prompt will open.

2. If working with Fuel and Fire Tools, change directories to the Consume calculator folder:
   - ➢ `cd C:\FuelFireTools\Consume`

3. Fuel and Fire Tools (FFT) comes with the required version of python. You can specify it directly by typing in the path "C:\FuelFireTools\bin\python.exe" before launching the consume batch calculator.
   - ➢ `C:\FuelFireTools\bin\python.exe`

   To run the Consume python calculator, you must already have a loadings file (e.g., fccs_loadings.csv). There is a loadings file for the standard fuelbeds in C:\FuelFireTools\Consume\consume\input_data\fccs_loadings.csv. You can also generate a loadings file by running FCCS from the command line (by default it is named consume_loadings.csv). The consume_loadings.csv is written to C:\FuelFireTools\FCCS. Regardless, it is convenient to copy fccs_loadings.csv (or consume_loadings.csv) into the main folder of Consume: C:\FuelFireTools\Consume\fccs_loadings.csv.

   You are also required to specify the following:
   - Burn type (activity or natural)
   - Environmental inputs file (e.g., input_western.csv, sample_activity_inputs.csv, sample_natural_inputs.csv).
     Note: each fuelbed has to have a corresponding input line.
   - Consume loadings file (e.g., -f fccs_loadings.csv file – an FCCS output)

   Optional

- output file format (e.g., -x output_feps.csv) recommendation is to use default
- output file name (e.g., -o my_results.csv) default output file name is consume_results.csv

Examples:

- ➢ `C:\FuelFireTools\bin\python.exe consume_batch.py natural sample_natural_input.csv –f fccs_loadings.csv`

- ➢ `C:\FuelFireTools\bin\python.exe consume_batch.py activity sample_activity_input.csv –f fccs_loadings.csv –x output_summary.csv -o my_results.csv`

Variable	Sample arguments	Definitions
Burn type	activity natural	Activity refers to a burn in recent logging slash and Natural refers to a burn in natural fuels that have not been influenced by recent logging or other disturbances (e.g., wind throw)
Environmental inputs file	input_western.csv, sample_activity_inputs.csv, sample_natural_inputs.csv	The environmental input file specifies environmental variables listed in the table below for each fuelbed listed in the fccs_loadings.csv file.
Consume loadings file	-f fccs_loadings.csv	Consume loadings by fuelbed stratum. This file is a standard output of FCCS calculations (either batch or within the FFT).

Environmental input file (sample natural inputs)

Variable	Definitions
fuelbeds	Fuelbed ID (one per row)
area	Default units = acres
fm_duff	Duff fuel moisture (%)
fm_1000hr	1000-hr fuel moisture (%)
can_con_pct	Percent canopy consumption (%)
shrub_black_pct	Percent of shrub stratum blackened by fire (%)
pile_black_pct	Percent pile consumption (%)
ecoregion	western, southern
fm_litter	Litter fuel moisture (%)
season	fall, spring, summer, winter (need to confirm)
duff_pct_available	% duff available for consumption, 0-100%
sound_cwd_pct_available	% sound coarse woody debris available for consumption, 0-100%
rotten_cwd_pct_available	% rotten coarse woody debris available for consumption, 0-100%

Environmental input file (sample activity inputs)

Variable	Definition
fuelbeds	Fuelbed ID
area	Area in acres
fm_duff	Fuel moisture of duff layers
fm_1000hr	Fuel moisture of 1000-hr downed wood
can_con_pct	Percent of canopy stratum blackened by fire
shrub_black_pct	Percent of shrub stratum blackened by fire
pile_black_pct	Percent consumption of piles
ecoregion	Boreal, Southern, Western
slope	Slope gradient (%)
windspeed	Windspeed (mph)
days_since_rain	Number of days since significant rainfall (> ¼ inch)
length_of_ignition	Minutes to ignite burn unit.
fm_type	Type of fuel moisture (MEAS-Th or NFDRS)
fm_10hr	Fuel moisture of 10-hr wood
season	fall, winter, spring, summer
duff_pct_available	% duff available for consumption, 0-100%
sound_cwd_pct_available	% sound coarse woody debris available for consumption, 0-100%
rotten_cwd_pct_available	% rotten coarse woody debris available for consumption, 0-100%

Example terminal output (natural):

```
C:\FuelFireTools2023\Consume>C:\FuelFireTools2023\bin\python.exe
consume_batch.py natural sample_natural_input.csv -f
fccs_loadings.csv
```

```
Success!!! Results are in
"C:\FuelFireTools2023\Consume\consume_results.csv"

C:\FuelFireTools2023\Consume>C:\FuelFireTools2023\bin\python.exe
consume_batch.py natural sample_natural_input.csv -f
fccs_loadings.csv -o consume_results2.csv

Success!!! Results are in
"C:\FuelFireTools2023\Consume\consume_results2.csv"

C:\FuelFireTools2023\Consume>C:\FuelFireTools2023\bin\python.exe
consume_batch.py natural sample_natural_input.csv -f
fccs_loadings.csv -x output_feps.csv -o consume_results3.csv

Success!!! Results are in
"C:\FuelFireTools2023\Consume\consume_results3.csv"

C:\FuelFireTools2023\Consume>
```

Example terminal output (activity):

```
C:\FuelFireTools2023\Consume>C:\FuelFireTools2023\bin\python.exe
consume_batch.py activity sample_activity_input.csv -f
fccs_loadings.csv
C:\FuelFireTools2023\Consume\consume\con_calc_activity.py:40:
RuntimeWarning: divide by zero encountered in log
  fm_flux * (np.log(heat_flux_crx) / math.log(2.0)))

Success!!! Results are in
"C:\FuelFireTools2023\Consume\consume_results.csv"

C:\FuelFireTools2023\Consume>C:\FuelFireTools2023\bin\python.exe
consume_batch.py activity sample_activity_input.csv -f
fccs_loadings.csv -o consume_results2.csv
C:\FuelFireTools2023\Consume\consume\con_calc_activity.py:40:
RuntimeWarning: divide by zero encountered in log
  fm_flux * (np.log(heat_flux_crx) / math.log(2.0)))

Success!!! Results are in
"C:\FuelFireTools2023\Consume\consume_results2.csv"

C:\FuelFireTools2023\Consume>C:\FuelFireTools2023\bin\python.exe
consume_batch.py activity sample_activity_input.csv -f
fccs_loadings.csv -x output_feps.csv -o consume_results2.csv
C:\FuelFireTools2023\Consume\consume\con_calc_activity.py:40:
RuntimeWarning: divide by zero encountered in log
```

```
        fm_flux * (np.log(heat_flux_crx) / math.log(2.0)))

Success!!! Results are in
"C:\FuelFireTools2023\Consume\consume_results2.csv"
```

Example terminal output (mismatched burn type and input file):

```
C:\FuelFireTools2023\Consume>C:\FuelFireTools2023\bin\python.exe
consume_batch.py natural sample_activity_input.csv -f
fccs_loadings.csv -x output_feps.csv -o consume_results2.csv

Error: invalid input file for this burn_type
The following columns are not required:
        windspeed
        slope
        fm_type
        days_since_rain
        length_of_ignition
        fm_10hr

C:\FuelFireTools2023\Consume>C:\FuelFireTools2023\bin\python.exe
consume_batch.py activity sample_natural_input.csv -f
fccs_loadings.csv -o consume_results2.csv

Error: invalid input file for this burn_type
The following columns are missing:
        fm_10hr
        length_of_ignition
        days_since_rain
        windspeed
        slope
        fm_type

C:\FuelFireTools2023\Consume>
```

Example terminal output (fccs_loadings.csv and input file mismatch. For example, remove a row from fccs_loadings.csv so fuelbed 1 is missing, save as fccs_loadings_bdtest.csv. The sample_natural_input.csv contains fuelbed 1, but fccs_loadings_bdtest.csv does not.

```
C:\FuelFireTools2023\Consume>C:\FuelFireTools2023\bin\python.exe
consume_batch.py natural sample_natural_input.csv -f
fccs_loadings_bdtest.csv -o consume_results2.csv
  File "C:\FuelFireTools2023\Consume\consume\emissions.py", line
396, in results
    self._calculate()
  File "C:\FuelFireTools2023\Consume\consume\emissions.py", line
```

```
529, in _calculate
    self._cons_object._calculate() # to generate consumption
values
  File
"C:\FuelFireTools2023\Consume\consume\fuel_consumption.py", line
1123, in _calculate
    self._consumption_calc()
  File
"C:\FuelFireTools2023\Consume\consume\fuel_consumption.py", line
1228, in _consumption_calc
    LD =
self._get_loadings_for_specified_files(self._settings.get('fuelb
eds'))
  File
"C:\FuelFireTools2023\Consume\consume\fuel_consumption.py", line
1191, in _get_loadings_for_specified_files
    assert False, "Error: Invalid fuelbed specified"
Error: Invalid fuelbed specified

C:\FuelFireTools2023\Consume>
```