Purpose: Summarize and report measured data from the Washington Department of Natural Resources Forest Resiliency Burning Pilot (FRBP) project completed on July 30, 2017. Additionally, evaluate the performance of Consume 5.0 relative to measured data and to other versions of Consume (2.0 and 4.2). All results will be presented as a poster at the Association for Fire Ecology (AFE) conference in Orlando, Florida in November 2017.

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File Structure:

All files during analysis are located: C:\\Users\\jrestaino\\Documents\\R

Directory:

**DNR\_Overstory Mortality\_inputs**

Input file is located at: C:\\Users\\jrestaino\\Documents\\R

There is one input file used for the overstory mortality figure for the AFE poster.

1. OvertsoryR.csv --- contains overstory data for all 6 units (combined) that were burned in 2016/2017.

The .csv input file was derived from the FERA Data Entry Database (feraDataEntry\_20171024.zip), located in Google Drive. The Access database is managed by Paige Eagle (paigeeagle@gmail.com).

“OverstoryR.csv” describes 15 columns of overstory data:

1. epShort: “PRE” or “POST”. All overstory data is listed as “PRE.”
2. samplingStartDate: Calendar date (i.e., “dd-mm-yyyy”) of initial overstory sampling.
3. plot: Number of plot that contains an individual tree (i.e., 1-20).
4. treeTagNo: Number of tree tag that is mounted on the individual tree for identification.
5. scientificName: Scientific name of the individual tree species (i.e., Pinus ponderosa).
6. dbh\_in: Diameter at breast height (DBH = 4.5 feet above ground) of individual tree, measured to the nearest tenth of an inch (i.e., 29.1 inches DBH).
7. ht\_ft: Total height, measured to the nearest foot, of an individual tree.
8. htlc\_ft: Height to live crown, measured to the nearest foot, of an individual tree. Height to live crown is defined by the distance from the ground to the point where continuous live foliage is observed in the individual tree crown.
9. cbh\_ft: Crown base height, measured to the nearest foot, of an individual tree. Crown base height is defined by the distance from the ground to the point where continuous branching (live or dead) is observed in the individual tree crown.
10. status: “L” or “D”. Identification of whether the individual tree is live or dead.
11. crownScorch\_%: Percentage of crown volume that was scorched by Rx fire (i.e., 1-100 %)
12. maxScorchHt\_ft: Maximum extent of continuous scorch height from Rx fire, measured in feet.
13. minBoleChar\_ft: Minimum extent of charring from Rx fire that appears on the bole of the sample tree, measured in feet.
14. maxBoleChar\_ft: Maximum extent of charring from Rx fire that appears on the bole of the sample tree, measured in feet.
15. burnSeverity: Severity rank of burn intensity experienced at each tree (i.e., 1-5 ranking system created by National Park Service).
16. For the poster figure, a subset of the “OverstoryR.csv” was used for analysis.
17. Only trees measured to have “crownScorch\_%” = “100,” were used in the analysis.
18. Defines trees that were specifically observed to be killed during Rx fire (n=187).
19. 1-2 additional years of observation will be required to confirm overstory mortality.
20. See R code for details regarding the creation of the poster figure for overstory mortality.

**DNR\_Fuel Moisture\_inputs**

Input file is located at: C:\\Users\\jrestaino\\Documents\\R

There is one input file used for the fuel moisture figure for the AFE poster.

1. FuelMoistureALL.csv --- contains fuel moisture data for all 6 units that were burned in 2016/2017.

The .csv input file was derived from the FERA Data Entry Database (feraDataEntry\_20171024.zip), located in Google Drive. The Access database is managed by Paige Eagle ([paigeeagle@gmail.com](mailto:paigeeagle@gmail.com)).

“FuelMoistureALL.csv” describes 4 columns of fuel moisture data:

1. unitName: Name of burn unit (i.e., Angel, 25 Mile, Sherman Creek, Chumstick ZUI, Paradise 90, Orion 2)
2. clipPlotMat: Category of fuel sampled (i.e., 1000hr, 100hr, grass, shrub).
3. Season: “Spring” or “Fall.” Designates whether the burn occurred in Fall 2016 or Spring 2017.
4. Fmpercent: Fuel moisture (%) of sample.
5. One outlier for 1000hr fuel moisture was removed, “Sherman Creek/1000hr/Spring/1388.7”
6. 1388% is considered an outlier
7. See R code for details regarding the creation of the poster figure for fuel moisture.

**DNR\_Loadings\_inputs**

Input file is located at: C:\\Users\\jrestaino\\Documents\\R

There are two input files used for the loadings figure for the AFE poster.

1. loadings\_fall.csv --- contains fuel moisture data for the 4 units that were burned in Fall 2016.
2. loadings\_spring.csv --- contains fuel moisture data for the 2 units that were burned in Spring 2017.

The .csv input file was derived from the FERA Data Entry Database (feraDataEntry\_20171024.zip), located in Google Drive. The Access database is managed by Paige Eagle ([paigeeagle@gmail.com](mailto:paigeeagle@gmail.com)).

“loadings\_fall.csv” and “loadings\_spring.csv” each describe the same 4 columns of loadings data:

1. unit:Name of burn unit (i.e., Angel, 25 Mile, Sherman Creek, Chumstick ZUI, Paradise 90, Orion 2)
2. Category: Category of fuel sampled (i.e., 1000hr, 100hr, grass, shrub).
3. Episode: “Pre” or “Post.” Indicates whether the loadings measurement was taken before or after Rx fire.
4. Loading: Mean loading (tons/acre) of a given fuel category at a given unit.
5. See R code for details regarding the creation of the poster figure for fuel moisture.

**DNR\_Data variability\_inputs**

Input file is located at: C:\\Users\\jrestaino\\Documents\\R

There is one input file used for the pre-fire loading variability table for the AFE poster.

1) DNR\_variability.csv

The DNR\_variability.csv file is created from:

The .csv input files were derived from the FERA Data Entry Database (feraDataEntry\_20171024.zip), located in Google Drive. The Access database is managed by Paige Eagle ([paigeeagle@gmail.com](mailto:paigeeagle@gmail.com)).

“DNR\_variability.csv” describes 9 columns of consumption data:

1. Burn Unit
2. Duff: Derived from “DNR\_Var\_SMDuff.xls”, column Q = “PreLoading\_ta\_CV%”
3. Litter: Derived from “DNR\_Var\_SMDuff.xls”, column Q = “PreLoading\_ta\_CV%”
4. 1hr: Derived from “DNR\_Var\_FWD.xls”
5. 10hr: Derived from “DNR\_Var\_FWD.xls”
6. 100hr: Derived from “DNR\_Var\_FWD.xls”
7. 1000hr: Derived from “DNR\_Var\_CWD.xls”
8. Herb: Derived from “DNR\_Var\_ClipPlots.xls”
9. Shrub: Derived from “DNR\_Var\_ClipPlots.xls”

**DNR\_Modeled vs. Measured Consumption\_inputs**

All input files, and associated files, are located at: C:\\Users\\jrestaino\\Documents\\R

There is one input file used for the Modeled vs. Measured figure for the AFE poster.

1. DNR\_Consume\_ALL.csv – contains all model outputs for each category of consumption (tons/ac), for each burn unit, and for each version of CONSUME.
   1. DNR\_Consume\_ALL.csv summarizes model outputs from:
      1. DNR\_Consume5.0.csv – All CONSUME 5.0 runs.
      2. DNR\_Consume4.2.csv – All CONSUME 4.2 runs.
      3. DNR\_ForestResiliencyBurningPilot\_FERA\_Appendix.pdf – All CONSUME 2.1 runs. CONSUME 2.1 outputs were then manually entered into “DNR\_Consume\_ALL.csv”.

“DNR\_Consume\_ALL.csv” describes 13 columns of consumption data:

1. unitName: Name of burn unit (i.e., Angel, 25 Mile, Sherman Creek, Chumstick ZUI, Paradise 90, Orion 2)
2. Model: “5”, refers to model outputs from CONSUME 5.0. “4.2”, refers to model outputs from CONSUME 4.2. “2.1”, refers to model outputs from CONSUME 2.1. “0”, refers to measured consumption. All units are in tons/acre.
3. c\_total: Total consumption (tons/acre) of all categories combined.
4. c\_shrub: Consumption (tons/acre) of all shrub species.
5. c\_herb: Consumption (tons/acre) of all forb and grass species.
6. c\_wood\_1hr: Consumption (tons/acre) of 1hr (0-0.25” diameter) woody fuels.
7. c\_wood\_10hr: Consumption (tons/acre) of 10hr (0.25-1.0” diameter) woody fuels.
8. c\_wood\_100hr: Consumption (tons/acre) of 100 hr (1.0-3.0” diameter) woody fuels.
9. c\_wood\_1000S: Consumption (tons/acre) of sound 1000hr (3”+ diameter) woody fuels.
10. c\_wood\_1000R: Consumption (tons/acre) of rotten 1000hr (3”+ diameter) woody fuels.
11. c\_wood\_1000hr: Consumption (tons/acre) of ALL 1000hr (3”+ diameter) woody fuels.
12. c\_littter: Consumption (tons/acre) of litter.
13. c\_duff: Consumption (tons/acre) of duff.

**DNR\_Model discrepancy\_inputs**

All input files, and associated files, are located at: C:\\Users\\jrestaino\\Documents\\R

There are seven input files used for the model discrepancy figure for the AFE poster.

1. discR\_f5.csv – contains discrepancy values for the Fall average of CONSUME 5.0 runs.
2. discR\_s5.csv -- contains discrepancy values for the Spring average of CONSUME 5.0 runs.
3. discR\_f4.2.csv – contains discrepancy values for the Fall average of CONSUME 4.2 runs.
4. discR\_s4.2.csv -- contains discrepancy values for the Spring average of CONSUME 4.2 runs.
5. discR\_f2.1.csv – contains discrepancy values for the Fall average of CONSUME 2.1 runs.
6. discR\_s2.1.csv -- contains discrepancy values for the Spring average of CONSUME 2.1 runs.
7. DNR\_Consume\_ALL.csv – contains all model outputs for each category of consumption (tons/ac), for each burn unit, and for each version of CONSUME.
   1. DNR\_Consume\_ALL.csv summarizes model outputs from:
      1. DNR\_Consume5.0.csv – All CONSUME 5.0 runs.
      2. DNR\_Consume4.2.csv – All CONSUME 4.2 runs.
      3. DNR\_ForestResiliencyBurningPilot\_FERA\_Appendix.pdf – All CONSUME 2.1 runs. CONSUME 2.1 outputs were then manually entered into “DNR\_Consume\_ALL.csv”.