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Windrow Burning Project – Site Description and Data Collection in 2017

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Background

Exploratory research was conducted during the fall of 2016 for the windrow burning project by FPInnovations and Alberta Agriculture and Forestry (AAF) personnel.[2] The objective of the research was to establish project testing methods and to complete a detailed project plan over the winter. The objectives for 2017 were to identify a new research site, gather site data between April and September of 2017, and review smoke models—one of which would be selected to simulate the smoke dispersion based on actual or predicted weather conditions and the amount of debris burned.

Study area

All of our research windrows were burned over the winter; therefore, AAF and FPInnovations worked to identify a new study area. We located an area with on-going agricultural land clearing of aspen forest where new windrows had been constructed. The new site is located approximately 90 km east of High Level, Alberta, and consists of four sections of recently purchased Crown land. This new site is just to the south of our 2016 exploratory research site.

Work completed

Three detailed project plan objectives have been either completed or initiated by FPInnovations and AAF staff since the last Info Note on this topic (Baxter et al. 2016. Windrow Burning – exploratory research Beaver Ranch, Alberta. FPInnovations November 2016 – no. 15):

1. Identifying a new study area through government and landowner consultation (AAF High Level Wildfire Management Area).
2. Identifying study windrows and collecting pre-burn data.
3. Providing site monitoring to determine burn trial readiness.

Additional work on the use of smoke modeling to simulate potential smoke dispersal has also been conducted.

[1] Alberta Agriculture and Forestry, High Level Forest Management Area
[2] http://wildfire.fpinnovations.ca/Research/ProjectPage.aspx?ProjectNo=177

Methods

Four stand-density plots were established in an adjacent uncleared forest stand to document original forest cover and fuel type. Three windrows were also selected for moisture data collection (Figure 1). Land clearing and windrow construction dates, along with windrow orientation and size, were recorded. Five sets of data were collected at each sampling point on both sides of each windrow (every 50 m over a 350 m distance). Data collected at each sampling point include sample species, diameter, and moisture content. Windrow height and width were also documented. The site was visited in April, July, and September for data collection.

Figure 1. Study area plots and windrows (east–west windrow orientation).

Sampling results

Four stand density plots were set up within the uncleared forest stand adjacent to the clearing. The mean stand basal area for the four plots was 26.3 m^2/ha. The primary species was aspen (99%). These data were collected close to the opened blocks to estimate windrow biomass. FPInnovations' BiOS™ program will be used to convert stand basal area to tonnes/ha of burnable biomass.

The mean diameter at breast height (dbh) within the windrows differed slightly from that of the overall stand due to stem access, orientation, and random sample selection.

Table 1. Moisture content for three sample periods based on windrow aspects

Moisture content (%)						
Collection period	**Windrow 1**		**Windrow 2**		**Windrow 3**	
	North	South	North	South	North	South
April	32.6	37.4	39.3	42.0	42.3	47
July	33.3	31.4	22.8	31.7	36.4	28.2
September	35.4	30.9	35.8	39.8	41.1	39.4

Moisture content decreased by 10% from the end of April to the end of July (Table 1). The stems were still frozen on the north side; therefore, they had lower moisture content than the south side. This changed dramatically for the July measurements, as the south side had long exposure to the sun and decreased its moisture contents faster than the on north side. September moisture values rose back up to those collected in April. This rise in moisture content may be the result of the amount of rain the site received over the summer (Figure 2) and the lag time of heavy fuels to either gain or lose moisture (there is a 53-day lag time for the Drought Code (DC) which would represent the stems).

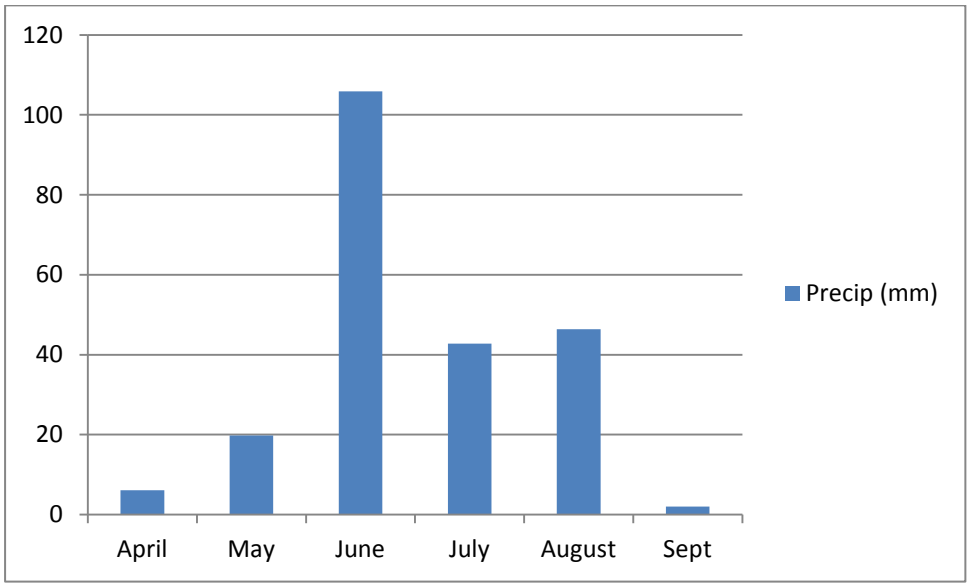

Figure 2. Summary of monthly precipitation data taken from the Fort Vermilion weather station.

Smoke model

The Canadian Playground smoke model was used to predict smoke dispersal from the study area. It estimated 50 tonnes/windrow based on the following windrow dimensions: 1000 m long, 5 m high and 13 m wide.

The user guide for the smoke model states that “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.” (DeWinter, et al. April 15, 2015. Playground Canada User’s Guide Version 2 Sonoma Technology Inc. CA).

The projection (Figure 3) was based on the burning of 30 windrows on October 13, 2016—the day we conducted our exploratory testing and burnt two windrows. The model used the weather from that day for that location. The smoke concentrations shown in the model were those that were predicted on the ground and, thus, can show how they impact the highways. Scenarios were run for 3, 30, 100, 300, and 1000 windrows.

This model can be used to predict smoke dispersal based on the forecast and also as a planning tool.

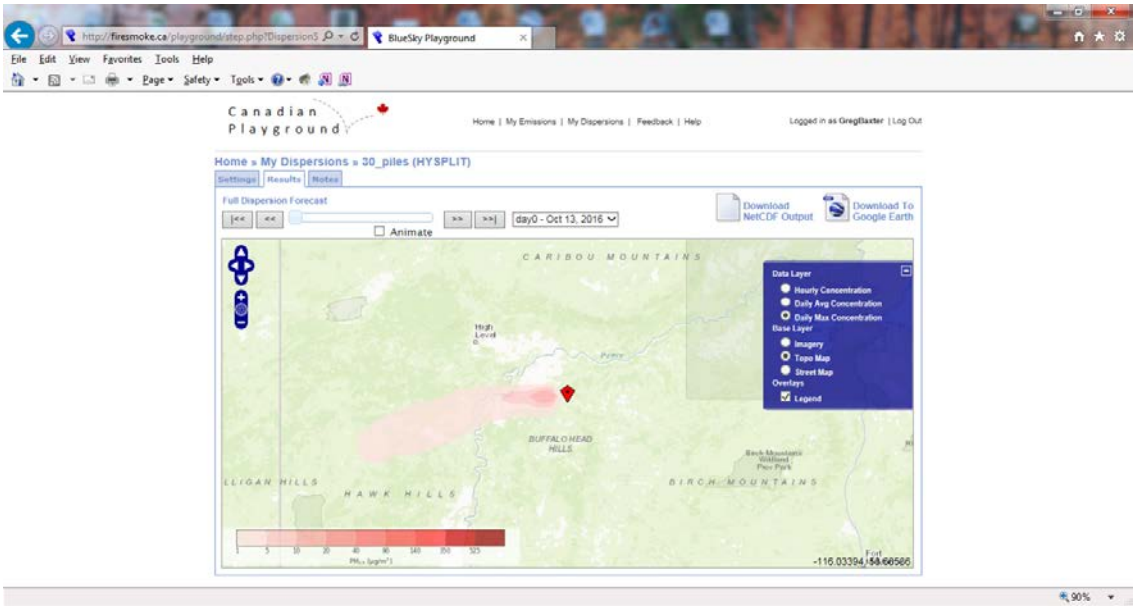

Figure 3. Smoke dispersal scenario for the burning of 30 windrows on October 13, 2016.

Future work

Three site visits were made during the spring and summer to document the moisture content over the drying season. We will return to the site to burn two of the three windrows and to document smoke dispersal to compare with smoke model predictions. The third windrow will be kept for another season of data collection on moisture contents.

More land is to be cleared over the winter of 2017/18. We will collect stand density data prior to this clearing and discuss with the landowner the possibility of having windrows set up in north–south and east–west orientations. The data collected this summer were on windrows with an east–west orientation and, thus, we could not compare the effect of windrow orientation on moisture content.