PROJECT REPORT

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Productivity assessment for a Caterpillar D7 dozer: a case study at a fuel treatment near the Mitsue Industrial Park

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INTRODUCTION

Mulching is the conventional fuel treatment method used in northern Alberta, but it can be quite costly. In areas where trees have little commercial or aesthetic value, removal of the entire stand using heavy equipment, such a dozers, may be an economical alternative.

Dozers are commonly used to convert forested land to farmland and have been used to prepare burned stands for reforestation (Cormier and Warren 1998). Generally, a dozer with a blade attachment knocks down standing timber and then pushes the debris into a pile or windrow. Sometimes called the blade-and-pile method, it is not typically used for fuel treatments because it leaves behind large piles, or windrows, of dead and drying woody debris, which can become a fire and smoke hazard. Nevertheless, the Alaskan government has been using dozers to clear large tracts of Black Spruce to mitigate the threat of wildfire (Butler *et al.* 2013, Ott 2005).

To determine whether the blade-and-pile method would be a viable option for Alberta, ESRD used the method to remove the trees from three blocks within the Mitsue Industrial Park FireSmart Project. ESRD contracted a Caterpillar D6 dozer with a blade attachment to knock down trees. The felled stems were later piled using a D7 dozer equipped with a brush rake. ESRD plans to burn the piles at a later date. This report summarizes the productivity of the Caterpillar D7 dozer during piling operations.

METHODS

Machine Description

The Caterpillar D7G dozer (Figure 1) is a 149 kW (200 hp) unit with a ground pressure of 71 kPa (10.3 psi). The dozer was equipped with a 3.5 m brush rake. We attached a MultiDAT[1] to the dozer and used the data to calculate its productivity rate and utilization rate.

[1] MulitDAT is a system for recording and reporting information about the activities of forestry machines.

Figure 1. The Caterpillar D7G dozer with a brush rake attachment.

Study Site

The Mitsue Industrial Park FireSmart Project is 10 km east of the town of Slave Lake, Alberta and consists of numerous treatment blocks. Three of these blocks (totalling 9 ha) were used for the blade-and-pile method.

The three blocks were flat and dominated by Black Spruce (*Picea mariana*) with a small deciduous component. At the time of this study, the ground was frozen with soft sections adjacent to the water treatment settling ponds. The snow cover was approximately 50 cm.

Fuel Treatment Activities

The D7 dozer pushed felled stems and other woody debris into windrows and piles in the centre of the blocks (Figure 2).

Figure 2. Piled stems. Note the minimal ground disturbance.

RESULTS

We collected data from the D7 dozer during the piling operations over three days from February 18 to 20, 2014. Figure 3 shows the GPS track of the D7 in one of the three blocks. The utilization rate is equal to productive machine hours (PMH) divided by total scheduled machine hours (SMH) multiplied by 100:

$$(\text{PMH}/\text{SMH} \times 100)$$

The average productivity rate for the three blocks was 0.48 ha/PMH and the utilization rate was 73%.

Figure 3. GPS track (bright yellow) of the piling operation for the D7 dozer on February 18, 2014.

DISCUSSION

Effective productive time (EPT) is when the dozer is travelling forward and pushing stems into the windrow. Although we did not collect the detailed timing data needed to calculate EPT, it was clear that a considerable amount of time was spent backing up (Figure 3). This is an inherent inefficiency in creating windrows, which reduces productivity.

One of the blocks had been partially windrowed by the D6 dozer, which was equipped with a blade. Fuels managers had concerns about snow being packed into the windrows and the

potential ground disturbance caused by using the blade for piling. Our post-treatment observations in June 2014 revealed little difference in ground disturbance between the blocks where the D7 with a brush rake piled the debris and where the D6 with a straight blade piled the debris. We will assess the compaction and ease of burning in these windrows during the burning operations.

Pre-treatment stand inventories were not conducted prior to the blading operations; therefore, we could not determine the volume of biomass treated. However, windrow and pile measurements may yield reasonable estimates of processed volume. The volume of the timber treated will be a valuable metric for assessing the efficiency of blade-and-pile operations.

Although the objective of this study was to assess the productivity of the D7 dozer with a brush rake in a piling operation, it will be important to include these findings in an overall assessment of the cost-effectiveness of the entire fuel treatment. The cost of blading, piling, and burning operations will determine the viability of a blade-and-pile fuel removal treatment.

Conclusion

This assessment provides a snapshot of the potential productivity of the Caterpillar D7G dozer in a piling operation in a Black Spruce stand. We caution readers against relying on these results to estimate the cost of their fuel treatment project, or to expect a certain production rate from their equipment. Generally, productivity assessments are conducted over much longer periods, but because forest fuel treatments are small and variable this is difficult to achieve. We continue to look for opportunities to conduct these assessments for different machines and in different types of fuel treatments.

References

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