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Author(s): J. Derek Scasta, John R. Weir, David M. Engle, and J. D. Carlson
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Research Note

Combustion of Cattle Fecal Pats Ignited by Prescribed Fire

J. Derek Scasta,[1] John R. Weir,[2] David M. Engle,[3] and J. D. Carlson[4]

Authors are [1]Graduate Research Associate, [2]Research Associate, and [3]Regents Professor, Dept of Natural Resource Ecology and Management, and [4]Associate Researcher, Department of Biosystems and Agricultural Engineering, Oklahoma State University, Stillwater, OK 74078, USA.

Abstract

Cattle fecal pats readily ignite, are a common source of spot fires, and release extreme amounts of energy when burning. Moreover, dung-dependent livestock parasites can be reduced by combusting fecal pats in prescribed burns. We conducted a study to identify factors that influence combustion of cattle fecal pats. Fifty fecal pats were located in each burn unit before 10 prescribed fires and then rated for combustion after each fire. Combustion of cattle fecal pats was highly variable across fires, with average proportion of combustion of individual pats from the 10 fires ranging from 2 ± 2 to $98 \pm 1\%$ (mean $\pm$ SE). Of 10 fecal pat, fuel, and weather variables assessed, only fecal pat condition, 10-h time-lag dead fuel moisture (DFM), and fuel load entered as variables in a stepwise selection method of constructing a multiple regression model of combustion of fecal pats ($R^2=0.94$, $P<0.01$). Condition of fecal pats (a function of elapsed time since deposition, fuel moisture, and decomposition) explained the greatest variation of pat combustion (partial $R^2=0.75$), followed by 10-h DFM (partial $R^2=0.12$) and fuel load (partial $R^2=0.07$). Combustion was $<10\%$ when 10-h DFM exceeded 13% regardless of pat condition. For every 1 $Mg \cdot ha^{-1}$ increase in fuel load, combustion of older and drier fecal pats increased by about 7%, but combustion of fresh fecal pats always averaged $<20\%$ and was unrelated to fuel load. Our results demonstrate that combustion of pats can be managed to meet a variety of ecological and production goals.

Key Words: disturbance, ecology, fuel, grazing, parasites, weather

INTRODUCTION

Combustion of cattle fecal pats has a wide range of implications for fire management, ecological effects on soil and plant resources, and livestock production on rangelands. Fecal pats readily ignite and are a source of spot fires in semiarid grasslands, and smoldering pats should be moved from the perimeter to the interior of burn units (Bunting and Wright 1974; Weir 2009). The historical interaction of wildfire and ungulate grazing in central North America suggests a fecal pat-fire interaction may be an important ecological disturbance of grasslands (Wallace and Crosthwaite 2005). The extreme heat released by burning bison pats (as much as 74 $MJ \cdot m^{-2}$ compared to 15 $MJ \cdot m^{-2}$ for herbage-fueled fires) may also influence landscape heterogeneity (Crockett and Engle 1999).

Fecal pats serve as a habitat resource for horn flies (*Haematobia irritans*), brown stomach worm (*Ostertagia ostertagia*), and other internal and external livestock parasites (Rossanigo and Gruner 1995; Temeyer 2009). Patch-burning reduced horn fly numbers attributed to the alteration of fecal resources, grazing patterns, and biological cycles (Scasta et al. 2012). However, managers need to know the factors that influence fecal pat combustion so they can manipulate prescribed fire conditions to increase or decrease combustion to meet various goals. Furthermore, previous studies noted that fecal pat age confounded the relationship between fecal pat combustion and fuels, fire weather, and season of burning (Crockett and Engle 1999). Quantifying fecal pat combustion, as influenced by fecal pat age and condition, will enhance our understanding of the impact of fire on dung-dependent parasites, fire management, and disturbance ecology.

The goal of the research reported herein was to identify factors that influence combustion of fecal pats on grazed rangelands. The primary objectives of this project were to 1) quantify combustion of fecal pats, 2) determine the relationship of fecal pat combustion with fire weather, dead fuel moisture, fecal pat characteristics, and fuel load, and 3) construct a predictive model of fecal pat combustion.

METHODS

Data were collected at the Oklahoma State University Range Research Station in north-central Oklahoma, USA (36°03′N, 97°13′W), in four grazed pastures ranging in size from 12 to 46 ha. Three of the pastures (SE, 17, and 9) were managed with patch-burning by burning two patches each year, with each patch being one-sixth of the pasture. Burns conducted in these three pastures represented 9 of the 10 fires in this study. The fourth pasture (CTER) had not been grazed for over a year. Angus cow-calf pairs were stocked at 2.3 to 2.8 $AUM \cdot ha^{-1}$ year round. Cattle diets were grass based, supplemented with dried distiller's grains at 5.4 $kg \cdot head^{-1} \cdot wk^{-1}$ during periods of low forage quality, from late summer through the winter.

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Correspondence: J. Derek Scasta, Dept of Natural Resource Ecology and Management, Oklahoma State University, 008 Agricultural Hall, Stillwater, OK 74078, USA. Email: scasta@okstate.edu

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