Animal-Driven Rotational Grazing Patterns on Seasonally Grazed New Mexico Rangeland

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Research Note

Animal-Driven Rotational Grazing Patterns on Seasonally Grazed New Mexico Rangeland

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Abstract

Global positioning system (GPS) data collected over a 4-yr period on 52 crossbred young cows grazing a 146-ha pasture were used to determine whether cattle establish patch-scale rotational patterns within pastures. Cow positions at 5-min intervals were recorded during 20 d in late winter/early spring. Estimated per capita forage allowance (PCFA) was 347 kg herbage $\cdot$ cow^{-1}, 438 kg herbage $\cdot$ cow^{-1}, 1 104 kg herbage $\cdot$ cow^{-1}, and 1 884 kg herbage $\cdot$ cow^{-1} in 2004, 2005, 2006, and 2007, respectively. Cumulative winter/early spring precipitation (CPPT) was low in 2004 and 2006 (35 mm and 30 mm, respectively) and high in 2005 and 2007 (119 mm and 112 mm, respectively). Structured query language codes developed for this study were used to 1) select grazing GPS points with movement velocities between 1 m $\cdot$ min^{-1} and 20 m $\cdot$ min^{-1}, 2) overlay location data on a pasture map subdivided into 30 $\times$ 30 m pixels, and 3) calculate percentage of grazed pixels (% GP), pixel residence time (RT), revisit rate (RR), and return interval (RI) for each animal. Cows grazed 31% $\pm$ 5.9 SEM of all pixels for 21 min $\pm$ 3.7 SEM, visited grazed pixels 1.6 times $\pm$ 0.18 SEM, and returned to grazed pixels after 5 D $\pm$ 2 SEM. As PCFA increased, % GP decreased (r=–0.42) and RI increased (r=0.73) significantly ($P < 0.01$); however, RT decreased (r=–0.46) and RR increased (r=0.6) significantly ($P < 0.01$) with increasing CPPT. Pixel attributes (elevation, aspect, slope, percentage of tree cover, and distance from water, roads, and fences) failed to explain variation in pixel RT (R^2=0.28) regardless of PCFA. The same predictors explained most of the variation in pixel RR and RI when PCFA was high (R^2=0.86 and R^2=00.76, respectively). Cows appear to establish their own patch-scale rotational patterns within pastures. Nonforage pixel attributes appear to have a strong influence on such patterns.

Key Words: cattle, GPS, patch grazing

INTRODUCTION

Early rotational grazing systems (RGS) on rangelands endeavored to reproduce ecosystem benefits promoted by ungulate migratory patterns observed in the wild (Coughenour 1991). Although this notion continues to be intuitively appealing, emulation of desirable components of wild ungulate movement patterns has been extremely difficult to achieve in RGS (Coughenour 1991; Holechek et al. 1999; Briske et al. 2008). Coughenour (1991) pointed out that "livestock may create smaller scale grazing systems of their own within paddocks" (p. 535) so even if movements are not controlled (e.g., under continuous grazing) "individual animals or groups can nevertheless rotate" (p. 535). Two decades later, despite recent advances in livestock telemetry tools and methods, this phenomenon has not been adequately studied. Understanding the mechanisms that underlie animal-driven patch reuse patterns within a paddock could improve the likelihood of achieving the elusive goal of developing livestock grazing systems/strategies that partially reproduce wild ungulate movement patterns.

We reanalyzed global positioning system (GPS) data collected over 4 yr in two previous studies (Black-Rubio et al. 2008; Wesley et al. 2012) to determine 1) whether cattle establish patch-scale rotational patterns within a pasture and 2) which patch-related factors influence such patterns. We hypothesized that as per capita forage allowance increased (lower stocking rate), cattle would graze fewer patches, would revisit each patch less often, and would graze each patch for a longer period of time during each visit. We also hypothesized that patch revisit patterns would be influenced by patch accessibility (distance from roads, fences, and drinker), patch vegetation type (woodland vs. grassland) and topography (ridges vs. swales).

MATERIALS AND METHODS

Study Site

Our data were collected at New Mexico State University Corona Range and Livestock Research Center (CRLRC; lat 34°15′36″N, long 105°24′36″W) approximately 22.5 km east of Corona, New Mexico. The CRLRC covers an area of 11,285 ha with elevations ranging from 1 743 m to 2 042 m. The climate is semiarid, with warm summers and cold winters and an average of 188 frost-free days. Mean annual precipitation is about 400 mm. Soils of the CRLRC area range from sandy loams to clays overlying caliche hardpan. Vegetation is composed of perennial shortgrasses with an overstory of sparse

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