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Existing Accessible Modeling Tools Offer Limited Support to Evaluation of Impact Investment in Rangeland Ecosystem Services

Beatrice L. Gordon[1], Virginia A. Kowal[2], Ambika Khadka[3], Rebecca Chaplin-Kramer[2], Roy Roath[4] and Benjamin P. Bryant[1,2]*

[1] Water in the West, Woods Institute for the Environment, Stanford University, Stanford, CA, United States, [2] The Natural Capital Project, Woods Institute for the Environment, Stanford University, Stanford, CA, United States, [3] Department of Built Environment, Aalto University, Espoo, Finland, [4] Warner College of Natural Resources, Colorado State University, Fort Collins, CO, United States

Privately owned rangelands in the western US support many ecosystem services and are threatened by financial incentives favoring conversion to housing development and more intensive forms of agriculture. Recognizing this threat, the impact investment community has identified rangeland management as a potential investing strategy to produce financial returns while preserving or enhancing the ecosystem services provided by intact rangelands. This strategy is based primarily on the notion that a capital-intensive conversion from continuous to rotational grazing can financially sustain rangelands through a combination of increased productivity and potentially monetized ecosystem service flows. The potential for these gains is supported by compelling anecdotal evidence, yet a robust body of scientific literature based on rigorous field experiments has not supported those claims, nor produced transferrable estimates of the benefits provided by rotational grazing of livestock (particularly cattle in the western US). Therefore, to demonstrate investment viability and measure investment success, impact investors will likely need to address these well-documented disconnects through some combination of monitoring and process-based modeling. This study examines the extent to which existing modeling tools are up to this task, by assessing the ability of two process-based models to represent four specific rotational grazing benefits put forth by impact investors, using a ranch in northeastern Wyoming as a case study. Using the Soil Water Assessment Tool, we simulated high magnitude changes in the water balance from surface runoff to evapotranspiration, which may be a benefit or negative impact depending on context (Benefit 1). We simulated a decrease in soil water storage under rotational grazing, which directly contradicts the outcome assumed in investment literature (Benefit 2). Using the InVEST beta Rangeland Production Model (based on the Century ecosystem model), we simulated increased biomass productivity (Benefit 3) under rotational grazing, which enhanced animal performance under some management parameters but negatively impacted it in others (Benefit 4). We conclude that the impact investing community will likely find greater success through a shift to objective-oriented ranch management, rather than a specific focus on rotation, and will also need additional investment in science and monitoring to demonstrate benefits.

Keywords: impact investment, ecosystem services, grazing management, forage productivity, water availability

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****Correspondence:***
Beatrice L. Gordon
blgordon@stanford.edu

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