



By Matt Germino

# Browsing the Literature

For the first edition of Browsing the Literature for 2022, searches on “grazing OR livestock OR rangelands” revealed a set of papers on environmental impacts of livestock published in non-SRM journals in the last few weeks, in addition to a paper that I missed from earlier in 2021. Notably, the papers tended to emphasize domestic grazing effects on soil carbon, with an important review/opinion by Reinhart et al. regarding shortcomings of existing literature on the problem, and two other papers that directly (Zubieta et al., Mosier et al.) or indirectly (Döbert et al.; greater infiltration should increase carbon gain per unit rainfall) evaluate how modifications to livestock grazing might mitigate the problem. Wells et al. and Merdas et al. describe impacts of livestock grazing to plant communities in different African rangelands.

In our next edition of Browsing the Literature, we will be modifying the format to provide more digested and succinct highlights of recent literature in both SRM journals in addition to our usual emphasis on non-SRM journals.

Best wishes for the New Year!

-Matt Germino

## Environmental impacts of livestock

### Ruminating on the science of carbon ranching

Reinhart, K.O., Sanni Worogo, H.S. and Rinella, M.J. 2021. *Journal of Applied Ecology*. <https://doi.org/10.1111/1365-2664.14100>.

A review of the literature on soil organic carbon in rangelands reveals the evidence is highly flawed, and relies on unrealistic or overly simplified treatments, experimental design problems, and inadequate measures of soil carbon. The authors propose some guidelines (e.g., Figure 1) for studies that could rectify the data gaps for this pressing, societally important problem in our era of Greenhouse gas-induced climate warming. In the figure below, green points are impact, blue lines are control, white and grey areas are before and after grazing, respectively, dashed horizontal lines are pre-treatment soil organic carbon (SOC) stocks, and error bars show where replication provides a measure of uncertainty (reproduced without modification; copyright is in the public domain).

Design	Treatment replication	Snapshot sampling regime	Design quality
Control-impact (CI)	No		Poor (bias likely)
Randomised controlled trial (RCT)	Yes		Great (statistical power will relate to replication, experiment duration, etc.)
Before-after randomised controlled trial (BA-RCT)	Yes		Greatest

### Does grazing management provide opportunities to mitigate methane emissions by ruminants in pastoral ecosystems?

Zubieta, A.S., Savian, J.V., de Souza Filho, W., Wallau, M.O., Gomez, A.M., Bindelle, J., Bonnet, O.J.F. and de Faccio Carvalho, P.C. 2021. *Science of the Total Environment*, 754, p.142029. <https://doi.org/10.1016/j.scitotenv.2020.142029>.

This review and concept paper suggests that adjustments of grazing practices in C3/C4 pastures in tropical regions could reduce methane emissions by over half. Specifically, calculations suggest managing grazing to maintain live weight gain of sheep to 0.14 kg/day or cattle to 0.7 kg/day would strongly reduce methane production, limiting it to 0.2 kg/kg live weight gain.

### Adaptive multi-paddock grazing enhances soil carbon and nitrogen stocks and stabilization through mineral association in southeastern US grazing lands

Mosier, S., Apfelbaum, S., Byck, P., Calderon, F., Teague, R., Thompson, R. and Cotrufo, M.F., 2021. *Journal of Environmental Management*, 288, p.112409. <https://doi.org/10.1016/j.jenvman.2021.112409>.

Five pastures using short-duration rotational livestock grazing had 13% more soil carbon to 1 m depth than did paired conventional grazing along a latitudinal gradient from Kentucky to Mississippi, USA. Additionally, nitrogen was 9% greater and reduced relative abundance of the isotope  $^{15}\text{N}$  indicated greater nutrient retention with rotational grazing. The pastures for sampling were selected from nearly 100 candidates.

### Adaptive multi-paddock grazing improves water infiltration in Canadian grassland soils

Döbert, T.F., Bork, E.W., Apfelbaum, S., Carlyle, C.N., Chang, S.X., Khatri-Chhetri, U., Sobrinho, L.S., Thompson, R. and Boyce, M.S. 2021. *Geoderma*, 401, p.115314. <https://doi.org/10.1016/j.geoderma.2021.115314>.

On 52 ranches in the western Great Plains of Canada, water infiltration rates where short-duration rotational multi-paddock grazing occurred were compared to ranch pastures where conventional grazing was used. Infiltration was positively related to rest-to-grazing time ratios in the first half of each calendar year, and infiltration was positively related to increased litter mass in pastures using adaptive rotational grazing.

### At high stocking rates, cattle do not functionally replace wild herbivores in shaping understory community composition

Wells, H.B., Porensky, L.M., Veblen, K.E., Riginos, C., Stringer, L.C., Dougill, A.J., Namoni, M., Ekadeli, J. and Young, T.P. 2021. *Ecological Applications*, p.e2520. <https://doi.org/10.1002/eap.2520>.

Moderate stocking rates of cattle are known to impact understory plant communities similar to wild herbivores, but this study demonstrates this concept does not transfer to high stocking rates. The evidence comes from plant community outcomes of different combinations of cattle and wild herbivore grazing made possible with a long-term enclosure of large wild herbivores in Kenya. The type of herbivore was a particularly important variable for plant community outcomes.

### Livestock grazing-induced large-scale biotic homogenization in arid Mediterranean steppe rangelands

Merdas, S., Kouba, Y., Mostephaoui, T., Farhi, Y. and Chenchouni, H. 2021. *Land Degradation & Development*. <https://doi.org/10.1002/ldr.4095>.

In the arid steppe of North Africa, specifically northern Algiers, plant diversity increased among transects but decreased between sites (beta diversity) in areas where semi-nomadic sheep grazing occurred compared to paired areas where grazing is excluded. This scale-dependence was related to a homogenization effect, in which perennials with specialist growth strategies that confer avoidance or tolerance of grazing pressures result in their local dominance.