



By Matt Germino

Browsing the Literature

For the April 2022 content of Browsing the Literature, I am introducing an updated format and content, in which I will hereafter highlight select contributions from *Rangeland Ecology & Management* and also include contributions from other readers along with the usual overview of papers revealed from a search on “Rangelands AND grazing AND livestock“. In this edition, I have contributions from a diverse team of early-career rangeland ecologists who have selected bits of very recent or forthcoming papers. Individuals in this group are either employed by or collaborate closely with the US Geological Survey’s Forest and Rangeland Ecosystem Science Center in Boise, Idaho, US. The team focuses on all aspects of the cheatgrass-wildfire cycle and restoration in sagebrush steppe rangelands.

-Matt Germino

Rangeland Ecology & Management Highlights

Virtual fencing effectively excludes cattle from burned sagebrush steppe

Boyd CS, O’Connor R, Ranches J, Bohnert DW, Bates JD, Johnson DD, Davies KW, Parker T, and Doherty KE. 2022. *Rangeland Ecology & Management* 81: 55-62

Herding of cows is an expensive but vital tool for adapting grazing practices to our changing rangelands. The ability to move livestock to areas where their impacts are either desired (e.g., for fuels reduction) or tolerated, and away from areas such as recent fire patches where plants are in a vulnerable recovery condition is a vital need for adapting livestock management to our changing landscapes. These authors tested GPS collars known as “Vences” that deliver stimuli to livestock to encourage their movements towards desired areas and away from exclusion zones. The technology appeared mostly successful in keeping cows away from recently burned patches, but some individual cows evaded the cyber herding (see [Figure 1](#), reproduced from the article).

Disturbance type and timing affect growth and tolerance strategies in grassland plant leaves

Henn JL, Ladwig LM, and Damschen EI. 2022. *Rangeland Ecology & Management*, 80: 18-25 <https://doi.org/10.1016/j.rama.2021.09.005>.

The resistance and tolerance of rangeland herbs to climate in a Wisconsin meadow was not static, but instead affected by land treatments and the time of year. Specific leaf area (cm^2/g) was less in plants that received fall burning (which removes litter) and greater for plants that received spring burning, indicating relatively greater and less morphological adaptation to abiotic stresses such as radiation extremes, respectively. Plants became more cold-tolerant in plots burned in spring. The authors propose a gradient of stress tolerance for the species evaluated (see [Figure 2](#))

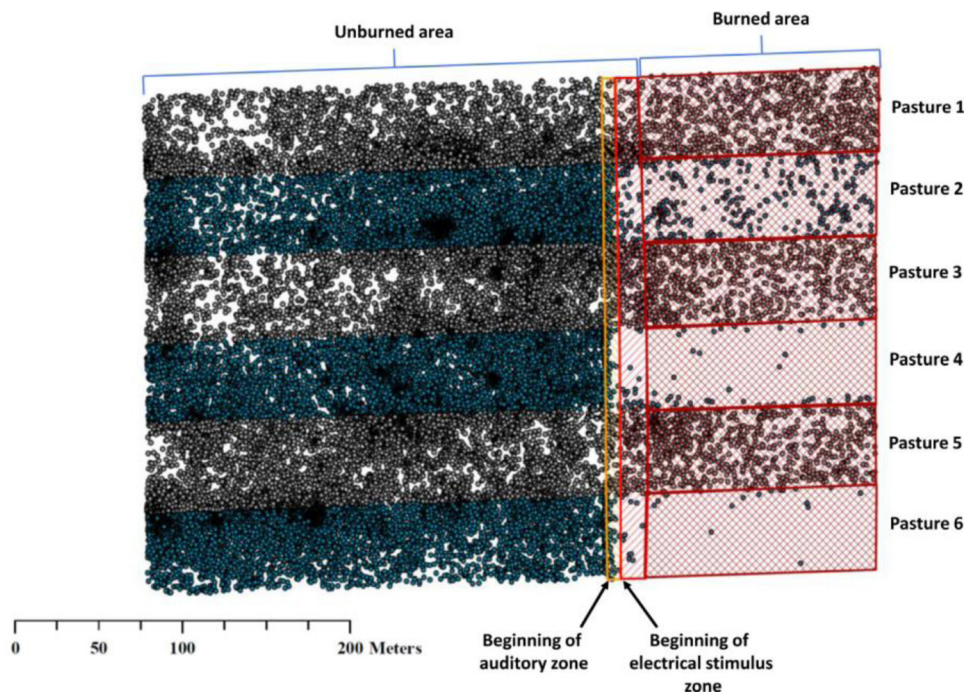


Figure 1. Diagram of 2.1-ha study pastures (numbered 1–6) used in a 14-d virtual fencing trial in southeast Oregon. In pastures 1, 3, and 5 (“Control”pastures), collars were only used to track cattle location (i.e., no auditory or electrical cues). In pastures 2, 4, and 6 (“Virtual fence”pastures), collars were used to track cattle location and administer auditory and electrical cues to discourage use of burned areas. For each pasture in the VF treatment, we employed an electrical stimulus zone that began 20 m from the junction of burned and unburned portions of each pasture. We set the auditory zone to extend inward toward the unburned an additional 10 m from the edge of the electrical stimulus zone. Dots in each pasture represent location data (5-min intervals) for 3 cows for the duration of the trial. Reproduced from Boyd et al. 2022 .

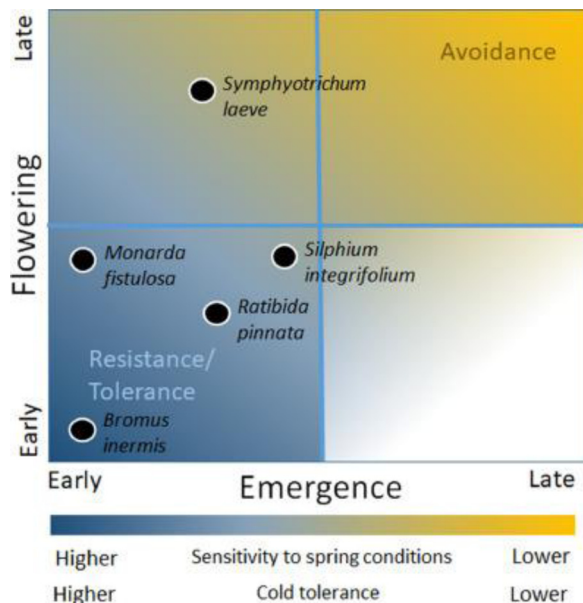


Figure 2. Hypothesized gradient in sensitivity to cold conditions during the spring and how it may depend on emergence and flowering timing in perennial herbaceous plants. Reproduced from Henn et al. 2022.

Regular contributions

Climate variability supersedes grazing to determine the anatomy and physiology of a dominant grassland species

Bachle S, and Nippert JB. 2022. *Oecologia*, In Press. DOI: 10.1007/s00442-022-05106-x

Photosynthesis and xylem traits were more responsive to drought than grazing in the C4 grass *Andropogon gerardii* in sites spanning a latitudinal gradient in the central Great Plains, USA, that were sampled in wet and dry years. In the drier conditions, the xylem cross-sectional area decreased and provided more resistance to hydraulic failure (i.e., cavitation), while photosynthesis correspondingly decreased, and water-use efficiency increased.

Contributor: Matt Germino

Quantifying herbivory in heterogeneous environments: Methodological considerations for more accurate metrics

Hines SL, Fulbright TE, Santos AO, Wester DB, Hewitt DG, Boutton TW, and Campbell T. 2022. *Journal of Arid Environments*, 199(104698). <https://doi.org/10.1016/j.jaridenv.2021.104698>

In grazing studies, standing crop can be greater in treated (grazed) compared to control (ungrazed) plots, which is referred to as a “negative consumption value”. This poses a problem for statistical analyses across heterogeneous plant communities. Linear mixed-effects models revealed that remov-

ing negative consumption values or setting them to zero can overestimate treatment effects. When negative consumption values are deleted, treatment effects are statistically weaker.

Contributor: Christopher R. Anthony, Wildlife ecologist

Weather explains differences in sagebrush-obligate songbird nest success under various grazing regimes

Schroeder VM, Robinson WD, Johnson DD, Bohnert DW, and Dinkins JB, 2022. *Global Ecology and Conservation*, 34(e02010). <https://doi.org/10.1016/j.gecco.2022.e02010>

Variation in precipitation and temperature have a greater effect on daily nest survival of sagebrush-obligate songbirds, Brewer's sparrow (*Spizella breweri*) and sagebrush sparrow (*Artemisioipiza nevadensis*) than moderate intensity grazing in a field study in eastern Oregon. Rotational, moderate, and dormant grazing reduced perennial bunchgrass cover, but this did not appear to affect daily nest survival.

Contributor: Christopher R. Anthony, Wildlife ecologist

Modelling chamise fuel moisture content across California: a machine learning approach

Capps SB, Zhuang W, Liu R, Rolinski T and Qu X. 2021. *International Journal of Wildland Fire*. <https://doi.org/10.1071/WF21061>

A 40-year record of fuel moisture available in the US National Fuel Moisture Database along with gridded weather records was used to create predictive models of fuel moisture in shrublands, specifically chapparal of southern California. The models had high regression coefficients ($r^2 > 0.6-0.8$).

Contributor: Sam "Jake" Price, Fire modeler

Interannual climate variability mediates changes in carbon and nitrogen pools caused by annual grass invasion in a semiarid shrubland

Mahood AL, Jones RO, Board DI, Balch JK, and Chambers JC. 2022. *Global Change Biology*, 28(1), pp.267-284. <https://doi.org/10.1111/gcb.15921>

Above average winter precipitation was related to decreased soil carbon and nitrogen across sites of varying stages of invasion by exotic annual grasses in the Great Basin, USA. This loss of soil resources was exacerbated by high invasive annual grass cover and attenuated by high native perennial grass cover. Litter with low nitrogen content (i.e., slow to decompose) was produced after above-average precipitation winters which can increase fuel bed loads for several years regardless of plant community, but with greater effects in sites dominated by invasive annual grasses. Management goals that seek to re-

duce invasive annual grasses and enhance perennial grass and shrub cover are also expected to enhance carbon sequestration.

Contributor: Dr. Toby M. Maxwell, Soil biogeochemist and Plant ecologist

Cyanobacterial soil crust responses to rainfall and effects on wind erosion in a semiarid environment, Australia: implications for landscape stability

Bullard JE, Strong CL, and Aubault HAP. 2022. *Journal of Geophysical Research: Biogeosciences*. <https://doi.org/10.1029/2021JG006652>

Timing of wetting and drought events is crucial to biocrust establishment and development. Greater rainfall amounts and higher temperatures allowed for greater photosynthetic responses of *in situ* natural cyanobacterial biological soil crusts (CBCs) during the dry season. Undisturbed CBCs were able to protect against wind erosion events even during times of prolonged drought. Although, prolonged drought may negatively affect the resilience of CBCs and increase their susceptibility to disturbance. Disturbed CBCs are more vulnerable to wind erosion, until biocrust reformation is commenced following a wetting event.

Contributor: Chad Kluender, Ecologist

Effects of grazing on plant communities and successional processes vary along an aridity gradient at a northern temperate grassland

Hamilton NP, Sanborn PT, and Burton PJ. 2021. *Plant Ecology*, pp.1-20. <https://doi.org/10.1007/s11258-021-01196-4>

This paper is an evaluation of the long-term effects of livestock grazing, grazing exclusion, and reduced grazing severity on plant community characteristics of 33 sites across an aridity gradient within the intermountain grasslands of British Columbia's Cariboo-Chilcotin region. In more arid sites, grazing reduced cover of late-seral native bunchgrasses (*Psuedoroegneria spicata*) and required long time periods to recover. In cool-wet sites, recovery from grazing was more rapid but correlated with an increased dominance of exotic species (*Poa pratensis* and *Trapogon pratensis*). Light grazing and restoration regimes also favored exotic species (*Poa pratensis*) at the expense of native needlegrasses (*Achnatherum* spp and *Hesperostipa* spp.). Grazing pressure can facilitate invasion and dominance of exotic species likely through reductions in native bunchgrasses.

Contributor: Bill Davidson, Ecologist