



By Matt Germino

Browsing the Literature

For the December 2022 edition of Browsing the Literature, we have two papers that address global issues of emissions on rangelands or semiarid environments. The first, by Yu and Ginoux, reveals dust sources, a major aspect of climate change, are linked with wildfires. Post-fire wind erosion events have been a major issue on rangelands such as the sagebrush steppe in the USA, and this paper is the first global assessment of the problem. The second global paper reveals the uptick in methane emissions from livestock, which is highly problematic for greenhouse gas induced warming. An assortment of other forthcoming articles reveals the unique challenges and opportunities of southern-hemisphere rangelands, degradation in Mongolian rangelands, and the USA. Articles forthcoming in Rangeland Ecology and Management appear focused on wildfire, fuels, and invasive annuals in sagebrush steppe.

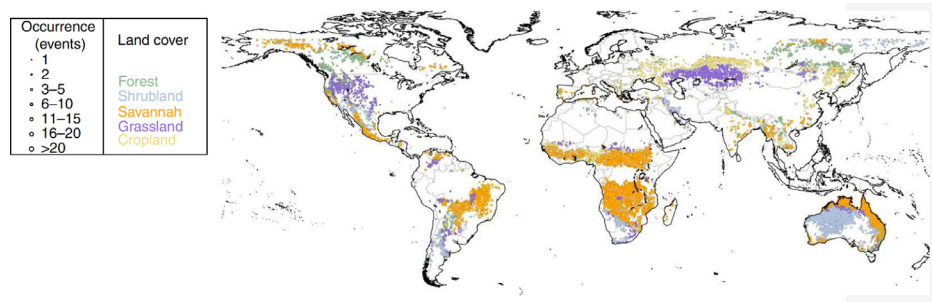
-Matt Germino, 31 October 2022

Papers with global scope

Enhanced dust emission following large wildfires due to vegetation disturbance

Yu, Y. and Ginoux, P., 2022. *Nature Geoscience*, pp.1-7. <https://doi.org/10.1038/s41561-022-01046-6>

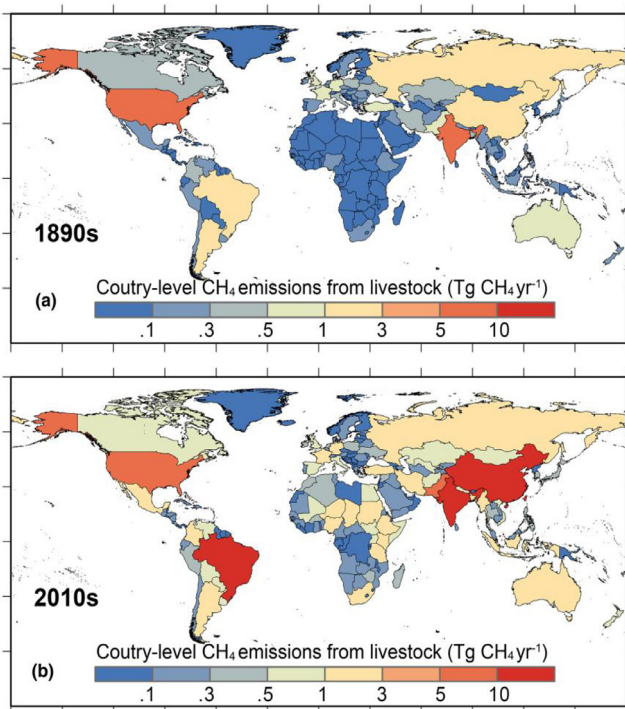
Wind erosion is a hallmark of desertification for most ecosystem types, globally, and is a major but rarely considered factor in the functioning of rangelands. Fires leave landscapes with no protective cover of vegetation and thus can increase vulnerability of soils to erosion. Soil erosion events lasting days to weeks were estimated to have occurred after about half of ~150,000 wildfires globally in the 17 years ending in 2020, based on assessments of from remote sensing (see map below, copyright clearance requested). More wildfires and drier conditions after fire have exacerbated the problem.



A 130-year global inventory of methane emissions from livestock: Trends, patterns, and drivers

Zhang, L., Tian, H., Shi, H., Pan, S., Chang, J., Dangal, S.R., Qin, X., Wang, S., Tubiello, F.N., Canadell, J.G. and Jackson, R.B., 2022. *Global Change Biology*, 28(17), pp.5142-5158. <https://doi.org/10.1111/gcb.16280>

Methane is estimated to have contributed to ~0.5 of a degree C of warming from 2010-2019 compared to 1850-1900, and livestock contribute to 1/3 of methane emissions. Methane emissions appear to have increased 4x in the past 130 years, particularly after 1950 and in South Asia, Brazil, North Africa, China, and the USA (see map below, copyright clearance requested).



From the southern hemisphere

Top-predator removal does not cause trophic cascades in Australian rangeland ecosystems

Castle, G., Smith, D., Allen, L.R., Carter, J., Elsworth, P. and Allen, B.L., 2022. *Food Webs*, 31, p.e00229. <https://doi.org/10.1016/j.fooweb.2022.e00229>

Predation management is increasing in many rangelands, globally. Mammal, reptile, and ground-dwelling bird responses were either greater or unresponsive to two massive, fenced dingo exclosures (2265 and 3763 km²) established in semi-arid Queensland, Australia, and observed for 5 years. Dingoes were the main apex predator excluded, and their abundances were negatively related to kangaroos, which had high variability inside exclosures. Removal of the dingoes did not appear to cause a trophic cascade in which lower-trophic predators were released.

Foraging behavior of Argentine Criollo and Angus cows grazing semi-desert rangelands in the Arid Gran Chaco region of Argentina

Conegliano, O.A.H., Blanco, L.J., Utsumi, S.A., Cibils, A.F., Cendoya, M.G., Jaimes, F., Moltoni, A.F. and Ricci, P., 2022. *Journal of Arid Environments*, 206, p.104827. <https://doi.org/10.1016/j.jaridenv.2022.104827>

An analysis of movements on GPS-collared Argentine Criollo (AC, a heritage breed) and Angus cows over a relatively wet 2016 and dry 2017 year revealed very different uses of the landscape. The AC cow appeared to have a greater ability to adapt to changing forage and could be used more to enhance resilience of livestock operations to climate change.

From Mongolia

Effects of free-ranging livestock on occurrence and inter-specific interactions of a mammalian community

Salvatori, M., Oberosler, V., Augugliaro, C., Krofel, M. and Rovero, F., 2022. *Ecological Applications*, p.e2644. <https://doi.org/10.1002/eap.2644>

Camera monitoring of 216 sites in the Mongolian Altai Mountains was used to assess the mammalian community including livestock. Larger native mammals such as snow leopard and Siberian ibex avoided livestock. Livestock have increased in the region and care is needed to avoid displacing key wildlife.

Rangeland degradation in Mongolia: A systematic review of the evidence

Sainnemekh, S., Barrio, I.C., Densambuu, B., Bestelmeyer, B. and Aradóttir, Á.L., 2022. *Journal of Arid Environments*, 196, p.104654. <https://doi.org/10.1016/j.jaridenv.2021.104654>

A review of 114 grey literature documents, such as those used to direct policy, revealed that 22-95% of Mongolian rangelands are considered degraded based most frequently on changes in vegetation or land cover, although there were rarely concise definitions of degradation. Most studies were in the desert to forest steppe of central Mongolia.

From the USA

Riparian vegetation composition and diversity shows resilience following cessation of livestock grazing in north-eastern Oregon, USA

Kauffman, J.B., Coleman, G., Otting, N., Lytjen, D., Nagy, D. and Beschta, R.L., 2022. *PLoS ONE*, 17(1), p.e0250136. <https://doi.org/10.1371/journal.pone.0250136>

Riparian vegetation in 11-pairs of grazed and 2 to >30 year grazing exclosures along stream reaches in northeastern Oregon revealed ungrazed areas had 1) greater diversity in ungrazed reaches, and 2) greater abundance of hydrophytic species, riparian-obligate shrub cover, native sedges and forbs,

fewer exotic species adapted to grazing such as *Poa pratensis* and *Trifolium repens*. Livestock grazing exacerbates those climate change effects also leading to warmer and drier conditions. Further, riparian-obligate shrub cover along the stream-bank was higher in 7 of 8 exclosures older than 5 years.

Estimating rangeland fine fuel biomass in Western Texas using high-resolution aerial imagery and machine learning

Li, Z., Angerer, J.P., Jaime, X., Yang, C. and Wu, X.B., 2022. *Remote Sensing*, 14(17), p.4360. <https://doi.org/10.3390/rs14174360>

Objective routines using random forests for classifying fuel types and predicting fine fuel biomass from 0.23-m resolution imagery had high accuracy in west Texas rangelands. A biomass model using fuel type, original spectral bands, and vegetation indices as explanatory variables had 95% accuracy,

while another model that contained a combination of the fuel type, original spectral bands, vegetation, and texture indices as explanatory variables, were assessed. This approach could be used in mapping fuels for fire management.

Incorporating temporal dynamics to enhance grazing management outcomes for a long-lived species

Larios, L. and Hallett, L.M., 2022. *Journal of Applied Ecology*. <https://doi.org/10.1111/1365-2664.14283>

Population models of the response of the perennial grass *Stipa pulchra* to grazing, drought, and El Nino were determined in California grasslands using transition matrices. Adult growth and survival were important for overall population growth and were enhanced in wet years by greater plant growth in response to grazing in wet years.