LETTER TO THE EDITOR

Missing the grassland for the cows: Scaling grass-finished beef production entails tradeoffs—Comment on “Grazed perennial grasslands can match current beef production while contributing to climate mitigation and adaptation”

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In a recent commentary article, Randall Jackson (2022) claims that U.S. maize croplands currently growing cattle feed can be converted to perennial pastures without incurring either a loss of beef production or agricultural expansion. Grass-finished cattle fatten up slower and reach lower slaughter weights than grain-finished cattle (Pelletier et al., 2010). Therefore, to support present beef production using only pastures, more finishing cattle must be raised and slaughtered. The author recognizes this and attempts to quantify whether current maize production regions could instead grow sufficient perennial grasses and forages. He finds that an additional 7.6 million finishing cattle must be raised to produce exclusively grass-fed beef. He then calculates that 4.9 million ha of maize croplands growing cattle feed could, instead, grow sufficient grass to support these cattle.

However, the author makes a fundamental oversight—that 7.6 million additional finishing cattle must come from somewhere; they need mothers. Finishing cattle are supported on the “back end” by large cow-calf and stocker herds on pastures, who replace the current finishing cattle when they are slaughtered. Unlike pigs and chickens who can have many offspring per year, cows have long gestation periods of 9 mo, like humans, birthing at most one offspring each year. Cow gestation periods are so long and cattle maturity is so slow that cattle on pastures outnumber finishing cattle in feedlots by nearly five to one (Figure 1).

To raise 7.6 million more grass-finished cattle, U.S. ranchers would need to raise 7.7 million more cows, along with 7.8 million more calves and stocker cattle on pastures. Altogether, an exclusively grass-finished system requires 23.1 million (30%) more cattle to produce the same quantity of beef (Table 1), not 7.6 million (10%) more as the author models. We published these findings in a study that was cited by the author (Hayek & Garrett, 2018), but he missed this central finding.

1 | GRASS-FINISHED BEEF PRODUCTION REQUIRES MORE LAND

Larger grass-finished cattle herds require additional resources. Optimistically, a maximum of 71% of current production could be met if the United States shifted its maize feed crops for finishing cattle to perennial forages (Hayek & Garrett, 2018). We assumed a similar potential forage yield on current maize croplands of 10.3 dry matter (DM) ha⁻¹ yr⁻¹, which lies within the author’s range of 8–12 DM ha⁻¹ yr⁻¹. Maintaining these yields requires fertilizer inputs: we assumed forages were produced using conventional hay and alfalfa production, and the author’s range of 8–12 DM ha⁻¹ yr⁻¹ is derived from a study of U.S. Upper Midwest pastures that applied fertilizer at a rate of 57 kg N ha⁻¹ yr⁻¹ (Oates et al., 2011). These findings are...
FIGURE 1 Left: approximately 63 million cattle are reared in pastures throughout the United States in cow-calf and stocker herds, which supply new cattle for feedlot finishing operations. Right: finishing cattle spend an average of 7 months on feedlots, containing approximately 13 million cattle. Data taken from the 2012 USDA NASS agricultural census and visualized by the author, consistent with RJ22 and Hayek and Garrett (2018)

TABLE 1 Production rates and populations of cattle in millions for the current U.S. grain-finishing beef system (top) and for shifting to exclusively grass-finishing system (bottom) assuming present levels of beef demand

| Production method       | Slaughter weight | Annual placement & slaughter rate | Finishing cattle population | Cow-calf & stocker herds population |
|-------------------------|------------------|-----------------------------------|-----------------------------|-------------------------------------|
| Feedlot grain-finished  | 1,386a            | 21,864,000                        | 13,328,000                  | 63,493,000                          |
| Pasture grass-finished  | 1,115b            | 27,185,000                        | 20,876,000                  | 78,946,000                          |

Note. All estimates are from Hayek and Garrett (2018) and are consistent with Jackson (2022) except for the increased cow-calf & stocker herd population required for grass-finished beef production.

aCalculated from USDA 2012 agricultural census by Hayek and Garrett (2018).
bPelletier et al. (2010).

consistent with multiple other studies, which demonstrate that grass-finished beef land requirements are 40–150% higher than conventional (Capper, 2012; Pelletier et al., 2010; Rowntree et al., 2020; Stanley et al., 2018). Some of these studies were cited by the author, but the major discrepancies in land use requirements within these findings were not acknowledged.

2 | INADEQUATE EMISSIONS ACCOUNTING

Jackson (2022) also underestimates grass-finished beef’s greenhouse gas emissions. The author models a 29% increase in enteric fermentation methane for larger finishing cattle populations and increased roughage in their diets. Correctly accounting for the increase in cow-calf and stocker herds raises this amount to 43% (Hayek & Garrett, 2018). Furthermore, the author unrealistically assumes that there are zero fossil fuel emissions associated with fertilizer production and on-farm equipment in grass-finished pasture beef systems. The author has conducted prior studies of intensively grazed pasture systems, from which he derived the high pasture yield assumptions for the present analysis, where fertilizers and equipment were in fact used (Oates et al., 2011).

3 | AGRICULTURAL POLICY MUST ACCOUNT FOR IMPACTS OFF OF THE FARM

Agricultural and environmental policy analysis must account for impacts across interconnected systems. While Jackson (2022) correctly reasons that perennial grasslands may confer local benefits and support additional finisher cattle, the analysis did not account for higher upstream demand for more cows, calves and stocker cattle. Shifts to grass-fed beef must therefore be accompanied by a reduction of beef demand to avoid land clearing. Specifically, demand must decrease by 29–73%, depending on the assumed land use for grazing and forage production (Hayek & Garrett, 2018).

More broadly, agricultural incentives that alter demand or displace production can lead to land clearing elsewhere (Meyfroidt et al., 2018; Searchinger et al., 2018). For instance, maize-derived ethanol fuel production emits fewer greenhouse gases than gasoline when considering inputs,
production, and consumption, but adding carbon emissions from the land clearing that was triggered by ethanol fuel mandates and demand increases the emissions footprint of maize ethanol to be greater than gasoline (Lark et al., 2022).

Due to historical and ongoing demand for ruminant meat and dairy, over 6 million km$^2$ of native forests have been displaced and are continuously maintained as livestock pastures (Hayek et al., 2021), while most native grasslands are maximally or overgrazed (Erb et al., 2018; Fetzel et al., 2017; Hilker et al., 2014). Scientific consensus, as reflected in “high confidence” positions within the IPCC 2019 report on Climate Change and Land chapter on food security and climate (chapter 5), points to an urgent need to reduce land use pressures through (a) sustainable intensification (i.e., producing more food efficiently on a given amount of land) and (b) demand shifts (e.g., reducing food waste and shifting toward plant-rich diets; IPCC, 2019).

4 ASSUMPTIONS THAT SUPPORT PRESELECTED POLICY POSITIONS

Lastly, a major problem throughout Jackson (2022) lies in its framing. In the introduction, the author states “This is not an exhaustive literature review, nor is it a replacement for a proper life cycle analysis. Rather, the exploration is meant to stoke the imagination of the reader to consider the possibilities of a transformed beef production system.” Despite the soft introduction, the conclusion authoritatively claims that converting cropland for pasture-finished beef “does not require displacing food production. It does not require more land to be converted to agriculture. And it will improve our quality of life overall.” These are not imaginative musings, but declarative statements of fact, proclaiming that such shifts will create net benefits. This framing, and the faulty assumptions that underpin it, erase real environmental risks and tradeoffs.

The author’s conclusions mirror policy recommendations of his organization, Grassland 2.0. Policy memos and position papers on their website date back to 2020—including a letter lobbying the USDA to fund (a) cropland conversion to pasture, (b) slaughter operations, and (c) government procurement of pasture-raised meats—but not to lessen meat and dairy consumption (Grasslandag.org, 2021). These positions overlap the conclusions of the author, suggesting that the analysis was not performed in a completely objective manner.

Jackson (2022) ends on an inspiring note, proclaiming “We must envision an agriculture that provides for our needs now while building the capacity of future generations to do the same.” Such an envisioning should not just selectively support one’s preferred interventions in isolation. Scientific and policy analysis must critically evaluate difficult tradeoffs and find cobenefits in a systematic manner.

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