Science Societies

Don’t Blame Cattle for Carbon Cycle Disruption

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SCIENCE

"Without ruminants, we could not make use of two-thirds of all agricultural land. What's happening on that land is nothing short of a miracle because [ruminants] can take something nobody else can digest and convert it into food we highly desire."

Cattle consume forage on landscapes that are otherwise hostile to cultivated agriculture—places like the shrubby sagebrush-covered expanses of the Western states, the high-country prairies in the upper Great Plains, and the sun-soaked ranges of Texas and Oklahoma. Cattle dotted along federal and private rangeland often represent the livelihoods of those who could not farm row crops or vegetables, who work in conditions with far too little water for rainfed corn or soybean.

In America, a changing climate is clawing its way through the beef industry, upending routine production for producers whose families may have worked the land with their cows for decades or more. Increasing temperatures and unpredictable weather patterns are challenging the traditional method of grazing cattle by changing how much food is available for those cows on the landscape and whether the cattle can survive extended periods of unusually high or low temperatures.

What does beef production look like under a changing climate? A recent article published in *Agrosystems, Geosciences & Environment* (AGE) by a suite of researchers from across the western United States sought answers (https://doi.org/10.1002/agg2.20356). The authors, spanning Wyoming, Idaho, Colorado, and Nebraska, provided practical tips for grazing under climate change, hinging on flexibility and novel cooperation. Let's dig in.

Opposite page: Cattle grazing on the plains near the USDA-ARS High Plains Grasslands Research Station in Cheyenne, WY. Photo by David Augustine, USDA-ARS.

Beef Production

Of all agricultural land in the United States, grazing land makes up two-thirds (http://bit.ly/489JC0I). Rangeland—or land that supports natural, native ecosystems rather than highly maintained pastures—covers 21% of the U.S.'s surface area.

"Without ruminants, we could not make use of two-thirds of all agricultural land," says Frank Mitloehner, a University of California–Davis (UC-Davis) professor and director of the CLEAR Center (who was not a coauthor on the AGE study). "What's happening on that land is nothing short of a miracle because [ruminants] can take something nobody else can digest and convert it into food we highly desire."

In the United States, beef production starts with cow-calf operations. Ideally, every year, a mother cow gives birth to a calf weighing somewhere between 60 and 100 lb. Kept in cow-calf pairs, ranchers send the cows out on grazing land where the mother cow feeds on forage and the calf drinks mother's milk for the first eight or nine months of its life. Then the rancher weans the calves when they're about 600 lb. Some female calves (usually about a third) are kept, becoming mother cows the next year; the rest are sent out in their own herds and called yearlings or stockers.

Yearlings feed on forages until they reach 800 to 1000 lb between 14 and 20 months of age. At this point, 97% of cattle are sold by producers to feedlots for a final "finishing" or "feeding" phase where they are fed grain instead of grass until they reach a desired finished weight, averaging about 1,400 lb before harvest. The diet change from grass to grain gives beef its distinctive marbling. The more marbling, the higher the USDA grade of beef (https://bit.ly/3P2y10M).

"Your whole livelihood depends on whether or not, on that day, your cattle sell well," says Justin Derner, co-author of the AGE study and rangeland scientist for the USDA-ARS High Plains Grasslands Research Station in Cheyenne, WY. The economic inputs for producers are myriad—selling price and input costs are often out of their control. "There's no guaranteed check every year or every month, and you don't control your input costs—feed supply, interest rates, gas prices."

Nor do you control the weather.

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Dear Editor: I am prompted to write because of two recent articles: “The Supply and Demand of Green Eating” by Kristen Coyne (November 2023; https://doi.org/10.1002/csan.21149) and “Grazing in the Western United States Under Climate Change” by DJ May (December 2023; https://doi.org/10.1002/csan.21181). The very important thing to remember about the increase in greenhouse gases over the last 150 + years is that it is because we have upset the carbon cycle. Agriculture is a small and not insignificant part of greenhouse gas emissions, but even when the potency of methane is taken into account, it is not the main source of the problem (https://bit.ly/3SAJbNJ).

We have upset the carbon cycle by cutting down forests and oxygenating soil organisms through mechanized agriculture, which in turn increases the rate of organic matter decomposition. The deforestation also warms the soil with the same effect. Both of these have increased the release of oldish (hundreds to thousands of years old) carbon back to the atmosphere. Don’t blame cattle, however, because they are eating current carbon, belching current carbon, and producing meat, milk, and manure with current (a few years old) carbon. Cattle have not upset the carbon cycle because the greenhouse gas is recycled, i.e., no net change. If you consider the use of mechanized agriculture and forestry, the amount of fossil fuel use is small (https://bit.ly/4biBnYb).

The much more important change in the carbon cycle over the last 150 years is the release of ancient carbon to the atmosphere by combustion of fossil fuels. According to the University of Calgary’s Energy Education, Oil Formation page, 70% of the petroleum is 66 to 252 million years old and 20% is 65 million years old with the remaining 10% being 251 to 541 million years old (https://bit.ly/3vX3rAg).

Note that this carbon had been in the atmosphere in ancient times. When we now use it for transportation, heating, production of electricity, etc., we are upsetting the carbon cycle because it is not being created at the same rate that we are burning it. I hate to see meat and dairy production, or even agriculture, be demonized when the real culprit is the use of ancient (hence “fossil”) fuels.

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