Consumer Education Project of Milk SA
CEU Activity 2021
Article 13 = 1 CEU's

A World Without Cows

Imagine Waking Up One Day to a New Reality

Mitch Kanter, PhD
Donald Moore

Dairy cows descended from animals that have been providing nourishment to humans for thousands of years. If cows no longer inhabited the earth, humans would lose a key source of high-quality protein and numerous other nutrients, as well as a source of revenue, livelihoods, and security for millions of people globally. Although cows are net greenhouse gas emitters, improved breeding and technology practices continue to generate more efficient cows that will continue to bring the dairy sector closer to becoming net zero emitters. In this article, intended and unintended consequences of waking up to a world without cows are explored. Nutr Today. 2020;55(6):283–287

If the COVID-19 (coronavirus disease 2019) situation currently gripping the globe has taught us anything so far, it is that large-scale changes in human behavior can have a great impact on various environmental indicators. Early reports have shown declines approaching 25% in greenhouse gas emissions (GHG)s in large GHG emitter regions such as the United States, China, and the European Union during the first weeks of the pandemic, due mainly to drops in transportation usage, industry shutdowns, and the concomitant decline in the demand for oil.[1] While the impact these short-term emission changes ultimately have on global climate change remains to be seen, few people with an understanding of the issue would argue that if we are to meaningfully affect the growing climate crisis in a positive way in the future, human beings will need to alter their habits in the long term. Issues including the way we heat our homes, to the forms of transportation we employ, to the foods we eat are under heavier scrutiny than ever before, and rightly so. Self-reflection is a good first step toward change, so the hot debates taking place on several fronts will hopefully be instructive as we seek to aid our ailing planet.

Coupled with the growing realization that many human beings worldwide are suffering from collective malnutrition in all its forms—from stunting and wasting primarily (although not exclusively) in developing countries to morbid obesity elsewhere—many health authorities and organizations are taking a more critical view of our global food system, and the changes we will need to enact to improve the health of people as well as the environment. Surely the balance between human and climatic health is a delicate one, and seeking solutions will remain one of the major challenges of the 21st century.

With that as a backdrop, we thought it might be interesting to try a little thought experiment: What if you woke up tomorrow in a Twilight Zone episode and all the cows on earth were gone? They no longer grazed pastoral land in New Zealand, roamed freely in India, or provided sustenance for nomadic tribes in Africa or Mongolia or whole communities in Wisconsin. Certainly, this issue has become a fringe political battle cry in the United States, from activists storming the stage at presidential rallies with signs reading, "Death to Dairy," to politicians accusing their opponents of fomenting "a world without cows."

What if we woke up one day and all the cows on earth were gone?

NUTRITIONAL IMPLICATIONS OF A WORLD WITHOUT COWS

For city dwellers, the most noticeable effects would be seen in the grocery stores, in our refrigerators, and in our diets. Among other things, we would no longer have

Mitch Kanter, PhD, is the Technical Director for the Global Dairy Platform in Rosemont, Illinois. During his 30 year career in the food and agriculture industries he has served in various technical leadership roles for several multinational companies and organizations. Dr. Kanter started his career in academics, serving as an Asst Professor as well as an NIH Post-Doctoral Research Fellow at Washington University School of Medicine in St Louis, and he maintains an Adjunct Associate Professorship at the University of Minnesota.

Donald Moore, is the Executive Director of the Global Dairy Platform in Rosemont Illinois having joined the platform in 2010. He previously held senior roles in Marketing, Business Development and Strategy for one of the world leading dairy cooperatives. Prior to that as the CEO of New Zealand's largest independent business & information management consulting firm.

The authors are employees of the Global Dairy Platform.

Correspondence: Mitch Kanter, PhD, Global Dairy Platform 10255 W. Higgins Rd. Suite 820 Rosemont, IL 60018 (Mitch.kanter@globaldairyplatform.com).

DOI: 10.1097/NT.0000000000000441

access to choice cuts of beef many people prefer, but that is a story for another day. For the purposes of this thought experiment, we will hone in primarily on dairy cows (although it is worth noting that in some countries culled and surplus dairy cows may account for approximately 50% of the beef produced in those countries).[2]

If dairy cows ceased to inhabit the earth, we would no longer have access to milk or the countless dairy products it spawns. No more butter, cheeses, yogurts, kefirs, or ice creams, and recipes of many staple meals that require dairy for its functional benefits (texture, mouthfeel, taste, etc) would need to be altered. Globally, dairy provides 5% of the energy in the diet. Without it we would lose a key source of minerals and vitamins (several of which are underconsumed nutrients of public concern) including calcium; phosphorus; zinc; potassium; vitamins A and D (in regions of the world that fortify milk with vitamin D), riboflavin, and vitamin B_{12}; and high-quality protein,[3] as well as one of the least expensive nutrient-dense food sources in the diet.[4] And, particularly with respect to children's nutrition, it has been demonstrated that plant-based "milk" alternatives just would not measure up nutritionally to fill the void. A recent position paper from the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition[5] made it clear that plant-based beverages are poor substitutes for dairy, indicating that almond and rice milk contain 2% and 8%, respectively, of the protein equivalents found in a glass of cow's milk, among other things.

All that said, could we subsist nutritionally in a world without cows and still maintain health? Of course, many of us could if we had to. Some people choose not to consume dairy for personal or health/allergy reasons, and with careful diet planning, they can certainly live heathy lives full of choices.

For others, however, replacing dairy as a healthy dietary staple is not as easy as it may seem. Dairy is a key source of one of the highest quality and most accessible proteins in the human diet,[6] and in developing regions of the world where high-quality proteins are scarce, dairy can literally be a lifesaver. For the average person in most developed countries who lives in a nutritional "environment of plenty," this may be a difficult concept to grasp. But in countries such as India, where it is estimated that up to 70% of the population suffers some degree of protein calorie malnutrition, and 40% of the workforce experienced stunting as children,[7] this notion is all too real.

In developing countries that have access to safe, affordable dairy (ie, Kenya, Vietnam, Cambodia, Rwanda, Bangladesh), the rates of stunting and malnutrition are demonstrably lower than in countries that subsist primarily on plant- and grain-based diets,[8] mainly in regions of Eastern and Southern Africa, South-Central Asia (including India), and parts of Central America.[9] Protein quality matters; research indicates that essential amino acid requirements can be met with a lower caloric intake when amino acids are supplied via high-quality proteins as compared with lower-quality proteins,[10] with some researchers suggesting a person could consume about 20% to 30% less protein each day with dairy in the diet than with lower-quality grain-based staples or vegan diets.[11] More efficient calorie usage may have implications for agricultural land use as well.

What about the argument that cows are poor protein converters? Some estimates erroneously suggest that cows must ingest upward of 6 kg of protein to produce 1 kg of human-edible protein.[12] It must be remembered, however, that the protein cows tend to ingest—via the hay, grass, silage, and other fibrous products they scavenge while grazing—is largely inedible by humans and of far lower quality than the protein cows produce. In fact, it has been estimated that roughly 86% of the feed consumed by livestock is not consumed by humans.[13] As an example, in California, cows consume upward of 38 million pounds of almond hulls per year, a by-product of the almond industry that would otherwise end up in landfills. By doing so, cows not only save us from disposing of a largely inedible waste product, but they also help us to create a human nutrition "two-for-one." Not only can humans benefit from the almonds harvested in the process, but they also derive benefit from the milk produced by cows secondary to the consumption of the hulls.[14]

It should also be remembered that as animal genetics and management have advanced over the years, so too has the dairy cow's ability to convert inedible protein to high-quality, human-edible milk. Research indicates that as our ability to breed more efficient cows and create healthier feed options has improved, more of the feed consumed by cows is used for milk production rather than maintaining animal health and weight.[15] In much the same way a highly efficient automobile can travel longer distances with less fuel, more efficient cows can generate more milk with less feed and lower emission intensities. To be sure, this situation differs greatly from region to region. Dairy cows in North America, Europe, and Oceania are far more efficient and produce much more milk per unit GHG than cows in other parts of the world.[16] However, this situation will undoubtedly improve in the future, allowing developing counties to "catch up" as the technology becomes more available to them, which in turn will improve the global footprint of the dairy sector even further.

It is estimated that approximately only 3% of the land used globally by dairy cows is potential arable land.

ENVIRONMENTAL IMPLICATIONS OF A WORLD WITHOUT COWS

What of the notion that if cows no longer grazed on the land, as they do in many parts of the world, we would have millions more acres around the globe on which to grow crops? The fact is that roughly 70% of the land currently used worldwide to raise cows is permanent pastureland,[17] the type of land that because of topography, soil quality, or other factors would not serve as viable crop land under the best of circumstances. It has been estimated that approximately only 3% of the land used globally by dairy cows is potential arable land.[17] If cows disappeared from the planet, much of the land that is currently part of a vibrant and productive food system would essentially become unproductive and/or heavily reliant on manufactured fertilizers (as opposed to cow manure, which can effectively fertilize fields) to achieve viable crop production.

Many environmentalists point out that if cows no longer existed, we would rid ourselves of a key source of GHG. And while it is true that cows are a source of environmental methane, nitrous oxide, and carbon dioxide (CO_2), the amount and type of GHG produced by dairy cows need to be kept in context of total GHG emissions from all sources. It is also worth noting that the way GHG production is expressed can have a great impact on how an animal or species is perceived as an environmental threat. When emission intensities are expressed per kilogram of protein an animal produces (rather than the more often-used kg CO_2-eq, which does not account for the highly nutritious end products of dairy production), dairy cows fare quite well, more in line with chicken and pork production than with most small ruminants or beef cows.[18]

Globally, all of agriculture accounts for 24% of GHG emissions; within that dairy is responsible for 2.7% (3% if you factor the additional GHG produced when older cows are no longer able to produce milk efficiently and are sacrificed for meat).[16] However, according to the US Environmental Protection Agency's 2016 US and global reports,[19,20] the transportation sector in the United States accounts for ~28% of GHG emissions (14% globally), energy ~28% (25% globally), and industry ~22% (21% globally). Further, the EPA estimates that in the United States the impact of agriculture on GHG production is even lower than global estimates; all of US agriculture contributes 9% of GHG, with animal agriculture contributing 3.9%. Consequently, energy production in the United States (which encompasses electricity/heat production; transportation; manufacturing; and other sectors) accounts for roughly 4 to 6 times as much GHG emission as the agriculture sector. Globally, the number is closer to 3:1.[21] It is clear that dairy's contribution to global GHG emissions, although not inconsequential, is far lower than that of higher emitting industries.

Also worth noting is the often overlooked and misunderstood issue of the types of greenhouse gases emitted by various carbon-producing sources. According to many environmental experts, comparing GHGs from livestock to fossil fuels is an apple-to-orange comparison. The primary GHG produced by livestock is methane, a potent but relatively short-lived gas that is ultimately destroyed in the atmosphere. Carbon dioxide, the principal gas from fossil fuels, tends to accumulate in the atmosphere and exert a warming effect decades after it is emitted. In the long term, removal of fossil fuels from the ground and their subsequent usage as fuel are deemed by most to be far more damaging to the environment than the methane produced by livestock, much of which is ultimately destroyed or recycled in the atmosphere.

A growing body of evidence indicates that the primary GHG produced by cows, methane, has a significantly lower warming potential than the CO_2 produced by fossil fuels.

Further, the symbiotic relationship that exists between the cow and the land with respect to carbon cycling and nutrient management is often underappreciated. Not only do the grass and foliage where cows graze serve as a carbon sink that can sequester much of the carbon produced by cows,[22] but also the manure cows produce is itself a source of carbon sequestration; if it is added back to our agricultural lands, we can further store carbon. One cow produces roughly 64 L (17 gallons) of manure per day, enough fertilizer to grow approximately 38 kg (84 lb) of tomatoes. Without cows, farmers would have to rely even more heavily on synthetic fertilizers to help their crops grow, not an optimal situation environmentally (in fact, many of the emissions included in the dairy GHG calculation come from the contribution of synthetic fertilizers). Further, newer technologies such as anaerobic digester systems allow farmers and other entrepreneurs to generate electricity from manure and to fuel cars and trucks. A world without cows would deprive us of this often-underappreciated source of energy, as well as the organic fertilizer and nutrients it produces as well.

While we are being provocative, why is it that livestock, a source of human nutrition and other life sustaining qualities, is often singled out as a GHG “offender,”

whereas other species such as horses and house pets seem to get a free pass? There are 9 million dairy cows and horses[23] in the United States, but more than 160 million dogs and cats, and it has been estimated that these carnivorous creatures consume approximately 30% as much food and produce 30% as much feces as humans. It has been estimated that cats and dogs produce approximately 64 million tons of methane and nitrous oxide per year. Yet, most pet lovers would never consider the implications of living in a world without cats and dogs.

That said, we do not want to minimize the fact that cows currently are net GHG producers. But through breeding to produce more efficient cows, better farm management practices, and the advent of technologies that can lessen the amount of carbon cows emit and increase the quantity of carbon that is stored in the ground, the future of livestock and its impact on the environment look promising. With appropriate management, there is no reason why the dairy sector cannot become a net zero carbon producer over the next few decades, a situation that would certainly make it more palatable for humans and ruminants such as cows to live symbiotically on earth, as they have done almost since the dawn of man.

New technologies and farm practices can produce more efficient cows, which means more milk produced per unit GHG emitted.

CULTURAL AND ECONOMIC IMPLICATIONS OF A WORLD WITHOUT COWS

Finally, the areas where humans would most acutely feel the impact of a world without cows are the regions, mainly rural, where cows dot the landscape and serve as the primary source of income and a key cultural touchpoint for the community. These regions exist predominantly in developing countries (ie, India, Rwanda, Tanzania, Kenya, Bangladesh), but not exclusively so (ie, France, United States, China, New Zealand). Roughly 600 million people around the world live on approximately 133 million dairy farms, mostly small farms that house on average 2 to 3 cows. Another 400 million people in and outside these farming communities derive their livelihoods from the dairy industry. Imagine the effects on whole towns and regions if cows disappeared from the landscape. Communities that rely on cows would lose their vibrancy, as well as an "insurance policy" against failing crops or other catastrophes that require ready access to food or cash. And in areas of the developing world where women have few opportunities to own land but can own livestock and where dairy farming provides women a chance to develop and lead businesses and to generate daily cash flow, these options would be severely curtailed. Currently, 37 million women worldwide lead dairy farms, and roughly 80 million women are employed by the dairy sector. Issues such as these are often overlooked by people who live in nondairying and predominantly Western areas, but their implications are real.

Further, as the global population moves closer to 10 billion inhabitants by 2050, the need for high-quality protein and other highly nutritious food sources will become more of a premium than ever before. How would we make up this nutritional shortfall in a world without cows? In short, not easily. Even the authors of the recent EAT-Lancet report, a document that purports to be a global blueprint for how people should live and eat in the future to sustain both human and environmental health, indicate that in the absence of dairy and other animal-sourced foods people will need to take supplements to make up for nutritional shortfalls in plant-based diets.

CONCLUSION

What would a world without cows look like? On the positive side, GHG emissions might be lower, although as more and more dairy producers around the world make commitments to reducing emissions through a combination of better feed and feeding management, manure and fertilizer usage, smarter energy use on the farm, and improved animal health and husbandry practices, even that benefit will become smaller in the future. And while we all aspire to eat more sustainably, it is worth reminding ourselves that it is folly to think that selecting chickpeas flown to the grocer from halfway around the world versus a locally sourced cheese is a more sustainable choice.

On the negative side, a world without cows would undoubtedly make it more difficult for us to adequately feed a growing global population. The economies and cultures of whole communities, states, and countries would suffer tremendously if this important source of income and security was removed. Food products that add to the enjoyment of many people's lives would be no more.

As we seek creative ways to feed the earth's inhabitants in the future while minimally impacting the environment, we need to make sure we do not "throw the baby out with the bathwater." Curtailing what has been for thousands of years a form of high-quality nutrition and a way of life for millions of people would not likely occur without unintended consequences. If the COVID-19 pandemic has taught us anything, it is that we can exact great changes in global GHG emissions in a short period mainly by altering our energy usage habits, suggesting the need to push for dramatic changes in livestock production, although important, is relatively small in comparison.

Although the dairy industry (like all sectors that add to global emissions) has work to do, a world without cows is probably best left as a Twilight Zone episode, and not a reality show. The cost/benefit of losing this important source of nutrition and economic and cultural stability would be tremendously high.

REFERENCES

1. Nelson B. The positive effects of COVID-19. *BMJ*. 2020;369:m1785. https://doi.org/10.1136/bmj.m1785.
2. Opio C, Gerber P, Mottet A, et al (2013). Greenhouse gas emissions from ruminant supply chains—a global life cycle assessment. Food and Agriculture Organization of the United Nations (FAO), Rome.
3. Cifelli CJ, Houchins JA, Demmer E, et al. Increasing plant-based foods or dairy foods differentially affects nutrient intakes: dietary scenarios using NHANES 2007-2010. *Nutrients*. 2016;8:E422.
4. Drewnowski A. The contribution of milk and milk products to micronutrient density and affordability of the US diet. *JACN*. 2011;30: 422S–428S.
5. Merritt RJ, Fleet SE, Fifi A, et al. North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition position paper: plant based milks. *J Pediatr Gastroenterol Nutr*. 2020;71(2): 276–281.
6. Kanwar JR, Kanwar RK, Sun X, et al. Molecular and biotechnological advances in milk proteins in relation to human health. *Curr Protein Pept Sci*. 2009;10:308–338.
7. Kurian OC, Suri S. *ORF Occasional Paper, 193: Weighed Down by the Gains: India's Twin Burdens of Malnutrition and Disease*. New Delhi, India: Observer Research Foundation; 2019.
8. Dror DK, Allen LH. The importance of milk and other animal source foods for children in low-income countries. *Food Nutr Bull*. 2011;32:227–243.
9. Kinyoki DK, Osgood-Zimmerman AE, Pickering BV, et al. Mapping child growth failure across low- and middle-income countries. *Nature*. 2020;577:231–234.
10. Ertl P, Knaus W, Zollitsch W. An approach to including protein quality when assessing the net contribution of livestock to human food supply [published online May 10, 2016]. *Animal*. 2016;10: 1883–1889. https://doi.org/10.1017/S1751731116000902.
11. Peters S, Gerritsen J, Valkenburg J, et al. Putting protein transitions into perspective. *Voeding*. 2020;1:1–5.
12. Health Council of the Netherlands. *Guidelines for a Healthy Diet: The Ecological Perspective*. The Hague: Health Council of the Netherlands; 2011: Publication no. 2011/08E.
13. Mottet A, de Haan C, Falcucci A, et al. Livestock: on our plates or eating at our table? A new analysis of the feed/food debate. *Glob Food Sec*. 2017;14:1–8. doi:101016/j.gfs.2017.01.001.
14. Kendall A, Marvinney E, Brodt S, Zhu W. Assessment of energy use and greenhouse gas emissions in almond production, part I: analytical framework and baseline results. *J Ind Ecol*. 2015; 19(6):1008–1018. https://doi.org/10.1111/jiec.12332.
15. Dijkstra J, France J, Ellis A, et al. Production efficiency of ruminants: feed, nitrogen and methane. In: Kebreab E, ed. *Sustainable Animal Agriculture*. Wallingford, England: CAB International; 2013: 10–25.
16. Gerber P, Vellinga T, Opio C, et al (2010). Greenhouse Gas Emissions From the Dairy Sector. A Life Cycle Assessment. Report prepared by the Food and Agricultural Organization of the United Nations, Animal Production and Health Division.
17. Food and Agriculture Organization of the United Nations. *World Livestock 2011—Livestock and Food Security*. Rome, Italy: Food and Agriculture Organization of the United Nations; 2011.
18. Nijdam D, Rood T, Westhoek H. The price of protein: review of land use and carbon footprints from life cycle assessments of animal food products and their substitutes. *Food Policy*. 2012;37: 760–770.
19. US Environmental Protection Agency (2016). Global Greenhouse Gas Emissions Data. https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data
20. US EPA's Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2018. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks
21. Poore J, Nemecek T. Reducing food's environmental impacts through producers and consumers. *Science*. 2018;360(6392): 987–992.
22. Lorenz K, Lal R. Carbon sequestration in grassland soils. In: *Carbon Sequestration in Agricultural Ecosystems*. Cham, Switzerland: Springer Link; 2018:175–209.
23. Vialkely MK. *Do You Hear the Call?*. US Equestrian Federation; 2008:51.