

Evan Rabinowitz
Environmental Health
Independent project FD
03-03-16

The Dairy Dynamic: A Relationship between Animal Agriculture and Global Climate Change

Executive Summary:

Climate Change is overtaking our planet faster than we can anticipate as major corporations, industries, as well as individual citizens contribute to our global pollution. Humans, despite their inability to realize the fact, are some of the heaviest polluting animals in the world due to our interests in certain commodities. A majority of humans are conditioned to enjoy using animal products, and this is becoming a problem as climate change develops because animal agriculture is one of the leading causes of emissions of greenhouse gasses not just in the United States, but the entire world. Over 50 billion animals are raised as livestock globally each year, each one emitting waste which must be regulated. A smaller division of animal agriculture, the dairy industry, is one of the key sectors in which there is both a potential for very large yet very regulated emissions. Through proper practice of caring for the livestock and being conservative with the storage and distribution of milk, manure, and biomass, we can begin to make steps in reducing our impact on global climate change.

Introduction:

We live in a world where nothing ever quite stays exactly the same, not even for a moment; our cause and effect based reality by nature is always changing, based

on the conditions that are present in any observed situation. Choices are an inevitable action to be made in this world, and by nature they entail certain consequences based on the causes and conditions of the choice. Though some choices are more personal and apparent than others, there are choices to be found within every action imaginable; because of this, we are brought to face many conflicts brought upon us by our interests, consumption, and the many factors that are governed by our choices. One of the choices we make that may not be apparent to some is the raising of livestock animals and the consumption of animal products. Livestock agriculture is one of the leading causes of the production of green house gasses and climate change world wide, simply because of the sheer number of animals and the demands in place in order to have them able to produce product. Global climate change is beyond a doubt happening, as study after study confirms the massive differences in the global climate's chemical composition as compared to centuries and even decades ago; sea level and temperature are on the rise as well, leading to changes in season length and biodiversity. Globally, over 50 billion animals are raised each year for human consumption needs; the amount of aquatic animals being raised is not accounted for in this number, as it is harder to keep track of. With more livestock animals on the planet than humans themselves, it becomes clear how much of an impact they have on our climate as well. We may see humans as being big consumers of things like water and electricity, but these animals have equal if not larger demands for the same thing because of differences in mass and metabolism. With thirty percent of global land being used to rear livestock, it taking eight to ten percent more water to produce meats than cereals, and the fact that you

can produce two hundred fifty kilograms of beef in the same space as fifteen thousand kilograms of fruits and vegetables, our choices need to be taken into serious consideration.

Content:

One of the largest contributors to animal agriculture is the dairy industry. Dairy can be incredibly consumptive because it relies on sustaining the life and health of the cow in order to maximize production efficiency as well as nutritional content in things like milk. If humans are to retain their choice to consume animal products, sustainability must be at the forefront of any farming or livestock related endeavor. In order to have a sustainable dairy practice, a large amount of steps need to be taken during each part of the dairy farming and manufacturing process to ensure consistency, stability, and adaptability under a changing climate. The Dairy industry shares a very delicate relationship with the environment that is challenged by global climate change, and because of this humans either need to come up with a way to change the practice or their own consumption in order to find balance in the changing world.

In the United States alone, ten billion land animals are raised each year for human consumption. Since a large amount of this number is directed toward meat production, the United States dairy herd only accounts for nine million of these animals. Dairy in the United States has an impact on climate change because of the dynamic relationship between agriculture, livestock, and greenhouse gasses. “Ruminants such as cattle, sheep, and goats, usually have a stomach divided into four chambers and emit methane during digestion, which involves microbial

(enteric) fermentation of fibrous feeds and grains. An adult cow emits 80-110 kg of methane annually. Approximately 86 million tonnes of methane are released globally each year from enteric fermentation alone.” (Humane, 2011) Methane is created as a byproduct of digestion in ruminant creatures such as dairy cows, which creates a dynamic with the carbon dioxide that was emitted as a byproduct of growing the cereals to feed the cow through the use of fossil fueled machinery. This dynamic becomes larger as waste enters the picture; cow manure has the potential to emit the most potent of the greenhouse gasses, nitrous oxide. Nitrous oxide has a higher potential for global warming and it stays in the atmosphere much longer than methane. Along with nitrous oxide, carbon dioxide is being omitted heavily during the production of grains through the use of fossil fuel engines used in the manure distributing and harvesting processes.

Manure and fertilizers are controversial because when used correctly, they can be very beneficial to soil quality and sustainability. When used poorly, however, manure and fertilizers lead to a nitrogen imbalance in the soil; causes the emissions of nitrous oxide into the atmosphere. Along with the nitrous oxide comes the potential for chemicals like ammonia to form, which will cause the land to become unsuitable for use. Manure must be efficiently stored, used, or exported in order to avoid contaminating or over fertilizing particular areas. Due to our choice to partake in animal agriculture, nitrous oxide emissions cannot be avoided because of their relationship with growing high quality crops, which are needed to keep healthy livestock. In this case, to have no pollution would cause an unhealthier herd because of the large nutritional demand of the livestock. In having sustainable dairy

practices, a balance of these 3 emissions will be the natural result of well-done practices at the dairy farm as well as where the cereal and feed are being produced and transported from. Nitrous oxide will only become an issue through the mismanagement of manure, which has the potential to enter into water runoff as well as ground water sources. Excess manure runoff leads to an imbalance of nitrogen in the soil and has potential to change the chemical characteristics of the soil such as mineral content and pH.

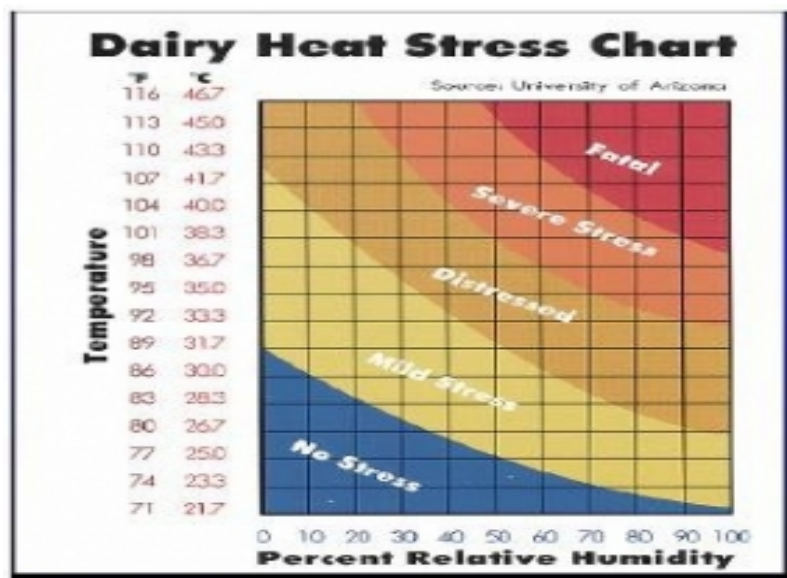
“In the United States alone, cattle, pigs, chickens, turkeys, and other animals raised on factory farms generate approximately 455 million tonnes of manure. When used to fertilize crops, manure enriches the soil and is a key input to healthy, sustainable farms and landscapes. The quantities of manure produced on factory farms, however, exceed the amount of land available to absorb it, transforming manure from a valuable agricultural resource into hazardous waste that threatens soil, water, and air quality.” (Humane, 2011)

Gas	Atmospheric Lifetime	Global Warming Potential (20 years)	Global Warming Potential (100 years)
Carbon dioxide (CO ₂)	Centuries to Millennia	1	1
Methane (CH ₄)	≈10 years	72	25
Nitrous oxide (N ₂ O)	114 years	289	298

Though contributors to climate change, dairy and rudimentary agriculture in the United States are doing relatively well at improving their amount of emissions. The world leader in methane and nitrous oxide emissions, despite most peoples perceptions, is actually India. The Indian cattle herd has three hundred million members, of which around fifty million are for dairy production. These dairy cattle produced approximately one hundred and twelve million metric tons of milk in 2010. India, despite its long history, is still developing to host its massive population of over 1 billion. In this development, the government has created incentives to increase milk production throughout the country in order to meet the demands of its people. This could be conflicting as climate change continues, as such a massive herd demands a massive amount of resources. As resources become limited, more choices will have to be made in regards to production and consumption. In India, there are some farms referred to as mega dairies, which have the potential to host anywhere for five thousand to forty thousand cattle. Such massive amounts of cattle require huge amounts of resources in order to be fed, kept cool, stay free of disease, and rear high protein product. With the way our climate is changing, everything is against unprepared the dairy farmer. With Indian dairies either being gigantic or miniscule, the problems of neglect from over-farming animals along with the ignorance of small scale operations opens the doors to an unnecessarily high rate of emissions of methane and nitrous oxide.

The trends that studies are showing in global climate change, for the most part, are likely to cause conflict with livestock agriculture and dairy as changes persist and develop. The most common assumptions being taken in regards to

climate change by agricultural industries are average temperature increase, less rainfall, heavier individual instances of rainfall, sea level rise, and longer frost free seasons. Each of these aspects of climate change has a significant impact on dairy productions efficiency and sustainability, and has to be addressed in a holistic way as the conflict relates to industry in both practices and economics. The most direct way global climate change will be affecting dairy is in its warming aspect, which will cause an increase in the average peak temperature as well as the possibility of more nighttime warming. Dairy cows are sensitive to heat, and they will succumb to heat stress by being in a warming environment for an extended period of time. If both nights and days become warmer, there is a larger risk of cattle becoming overheated.



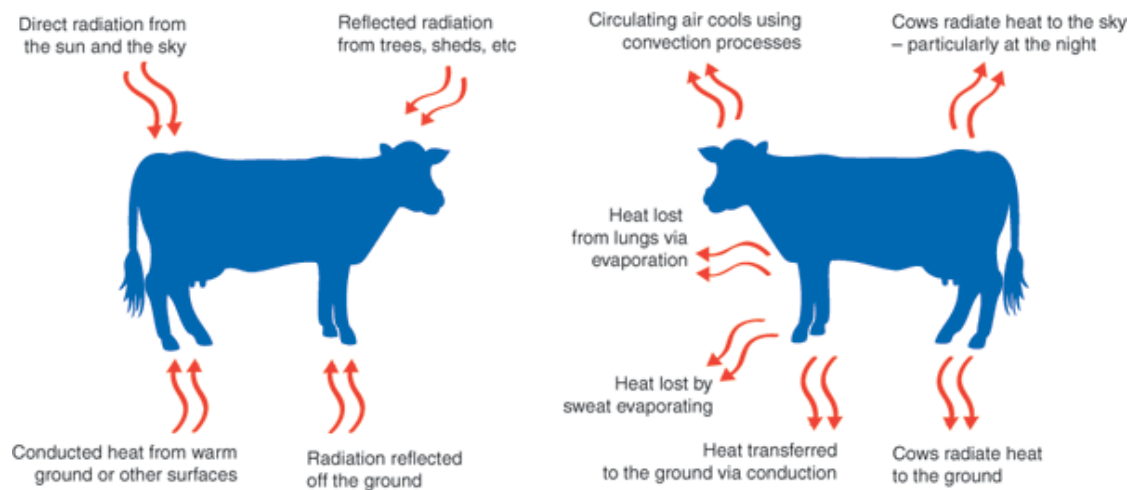
(Warner, 2013)

When cows are experiencing heat stress, they undergo metabolic changes that cause not only milk production to go down by as much as forty five percent, but

a lower overall protein and fat content in the product. This is caused by the metabolic changes in the cow pushing it toward a state of energy conservation, which cause a decreased food intake by the cow. This becomes more prominent the longer the cow is exposed to heat induced stress. As heat and humidity go up, milk production goes down. Not only is milk production effected but overall health, reproduction and the ability to harbor offspring are hampered as well. Higher temperatures relate to a higher rate of early embryonic death, miscarriage, adverse fetus growth, as well as weakened immune system in both the dairy cow and calf. The heat stress will also impact the pH balance of the cow itself, which can impact hormone balance and nutrient content of milk. Stressed cows tend to stand up and walk around more than non stressed cows, which is an issue that needs to be addressed in order to keep the cow healthy in a changing climate.

The dairy heat stress chart indicates that there's no stress between seventy-one and eighty six degrees Fahrenheit at low humidity, but this depends on the size and productivity of the cow. High producing cows may need as low as sixty-four degrees Fahrenheit in order to avoid heat stress. In an environment that is undergoing a continuous trend of warming, there is an inherent conflict in the ability to maintain low temperatures for healthy cows and high production efficiency. The only way to cool the cows is through the use of water and advanced air conditioning and ventilation systems. Investment into these systems can be expensive, and depending on how dairy farmers are being paid, they may not be easily implemented. The architecture of the barns and distribution of the land also come into play with the heat exchange involved among the cattle herd. Cows are

exchanging heat with the environment in a number of ways and if these are managed than a greater control over milk production and emissions can be gained.



(Dairy Australia, 2012)

Dairy is also being hit with some confusion because of the increase of frost-free seasons and variance in weather patterns, which can be an opportunity or a conflict depending on where one is located regionally. Longer frost-free seasons allow for the opportunity of stored manure to be used and for more grains to be produced. The draw back is that during the frost-free season, it is going to be wet instead of frosty. This returns to the issue of soil management and nitrous oxide emissions, which are very delicate and must be approached cautiously if one is to try and take advantage of the frost-free season. This wetness in the frost-free season is only projected for more northern areas, which will be the ones to likely face this

conflict. Rainfall on the other hand is not so much a problem for the cattle and crops but for manure storage and distribution. Due to a projected increase in extreme weather events, many farmers are adapting to different methods of storing manure that allow for the collection of rainwater, open storages with specially designed canopies, and so forth. Though warmer winters allow for the possibility of more rainfall events and cereal crop growth, along with the additional distribution of manure and fertilizer, the extra rainfall may not necessarily benefit when it comes to emissions. Along with Reduced snowpack in many regions, irrigation of water is likely to face some challenges as the natural flow of water experiences changes while the demand for water does as well. As things become more challenging, energy costs may increase. This will further complicate the dynamic directly on the farm level as money available for investment is one of the largest factors in having a sustainable, low emission farm practice.

The economy plays a role in influencing emission rates through the prices that are established for the goods the dairy farms are producing. When milk prices are low, farmers may feel pressured to increase milk production in order to sell more so they can reach the amount of profit they feel they need; this is counter productive because it inflates the stored amount of milk, further lowering the price. If farmers aren't getting fairly paid for their product, they are likely unable to invest in any sort of cooling system and waste treatment system that could dramatically increase the sustainability of their operations. Overproducing milk also creates not only a surplus to be stored, but the need for export in order to maintain steady and

consistent practice without becoming backed up at any point in the production process.

Conclusions:

In conclusion, it is clear that historically animal agriculture has had an impact on the amount of green house gasses in the atmosphere as well as a large local energy demand and consumption. As the world's civilizations industrialized, efficiency was held to be the greatest of ethics, and many of the risks and consequences that were not fully understood went mostly unquestioned. There is a clear correlation with the industrialization of society and the emergence of higher quantities of green house gasses, and industrialization hit animal agriculture through the advent of factory farming. Large scale farms create large scale demands and waste, which require large scale management and labor to maintain stability. With the compounding of greenhouse gasses, the planet is becoming warmer, experiencing variations in weather patterns, and hosting shorter frost-free periods, which brings new conflicts to animal agriculture and dairy production in specific. As humans continue to adapt and understand the power of their choices, one can only hope that issues such as this will come to full attention before a point of no return is reached. If humans are able to harness their ability to be aware of connections and communicate, the right steps can be taken towards sustainable animal agricultural practices.

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