

Impact of climate change on industrial agriculture



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It's getting hot on the Farm, fam: A literature review

Climate change is one of the biggest concerns of the twenty first century and we are only beginning to understand the consequences. With many of the repercussions of global warming affecting agricultural areas, more attention is being given to farming and agriculture. The Intergovernmental Panel on Climate Change (IPCC) estimates that, " agriculture is responsible for 10-12% of total global anthropogenic emissions and almost a quarter of the continuing increase of greenhouse gas (GHG) emissions." (Bezner-Kerr et al 2011, p71) If you think about it, everybody eats - right? It's hard to even imagine the scope of agriculture with more than 37% of earth's land area and 70% of its fresh water dedicated to growing different crops and livestock (2016 State of the World's Forests; Postel et al 1996). Agriculture takes many forms and functions depending on geography, however, industrial agriculture is the dominant form of agriculture across the globe (McNeil 2012). Industrial agriculture makes it possible for people to have better access to immediately consumable calories, however research shows that there are many negative effects to this system (McNeil 2012).

Industrial agriculture uses monocultures of high yield, genetically modified staple crops, chemical fertilizers, pesticides, intensive irrigation and heavy machinery to produce bountiful, uniform harvests of highly processable products like corn or wheat (Matson et al 1997). In the past 6 decades, there has there been significant research surrounding the effects of human development and agricultural intensification (Woodhouse 2010; Matson et al 1997). The general consensus throughout the scientific community is that industrial agriculture is harming us more than helping, with most scholars

calling for the return of a more sustainable agricultural models (McNeil 2012; Woodhouse 2010). There has also been increased research on rural communities and the social impacts of industrial agriculture as the world continues on its path of urbanization (Bezner-Kerr et al 2012). The following discourse explores how industrial agriculture came to be the dominant force in agriculture around the world, looking at some of the prevalent conversations and debates regarding the social and environmental effects of this agricultural revolution.

The roots of industrial agriculture lie in 17th century Europe, where changes in crop rotation and crops variety led to higher food production, providing an opportunity for people to leave the farms and work in factories, however,

“..[i]ndustrial agriculture developed within a specifically American context of land abundance combined with robust industrial development and a government that actively shaped both the direction of agriculture and science research”

- McNeil 2012, pg 412

North America was seen as a land of infinite resources to early settlers. Fertile forests, raging rivers, and pristine prairies were some of the many natural resources harnessed by the early colonists to help build the US into a wealthy and powerful nation (Brosnan et al 2016). From the earliest days, colonizers and early industrialists sought to exploit these natural resources without regard for the consequences, cutting down the forest to plant rows of grain and tobacco (Brosnan et al 2016). The industrialized approach to agriculture was effective during slavery because of the vast free labor force, <https://assignbuster.com/impact-of-climate-change-on-industrial-agriculture/>

however in the reconstruction period after the American Civil War, 95% of people Americans lived in rural areas and worked on family farms for their livelihood (Brosnan et al 2016).

The introduction of the internal combustion engine at the turn of the 19th century marked the beginning of a period in American history of rapid urbanization as workers on the farm were replaced with machines and sent to the factory lines (Brosnan et al 2016). When the first World War increased the demand for wheat, American farmers expanded their fields to meet demand (Brosnan et al 2016). This creating a culture of agricultural expansion that continued until the mid-1930's, when droughts devastated the great plains areas and created a vast dust bowl, marking the point when most farmers turned their focus to yield per acre to meet demand instead of using more land (Brosnan et al 2016). This period in American history was pivotal for industrial agriculture because a number of government programs and regulatory agencies were created, designed to stabilize and regulate prices of agriculture products, and solidify agriculture as a staple of the American economy (Conkin 2008). After WWII had devastated European agriculture, demand for American produce and the incorporation of agrichemicals and machinery on the farm accelerated production and ensured the price of most American crops (Conkin 2008). As Europe recovered, the demand for American farm goods dropped, and from 1954 until the early 2000's (with the exception of a few years in the 70's) the US produced surpluses of most of their crops (Conkin 2008).

Historically, the success of industrial agriculture has been measured using simplistic indicators of economic success and efficiency, without accounting

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for the less tangible externalities like environmental health and social wellbeing (Kirschenmann 2010). Industrialized agriculture has made its mark across the globe, yet much of the world's population, especially in the global south, depend on subsistence farming to survive. The majority of farmers in the world live in low-income countries and make very little income, while a small group of farmers in high income countries make huge amounts of money. (Alston & Pardey 2014) The FAO (Food and Agriculture Organization of the UN) creates country level statistics on production and has shown that the geography of production has shifted from the US and Europe, to Asia and South America, with countries like China producing 23% of the world's agriculture products, one of the top four producers of every crop listed by the FAO (Alston & Pardey 2014). The US is the second most productive country (as of 2011) accounting for more than 10% of global agricultural production (Alston & Pardey 2014). Much of this increase in production in the rest of the world can be attributed to the dissemination of technology, and increased inputs, however, Alston & Pardey ultimately conclude that this shift in agricultural production is actually caused by high income countries spending more time and money on more high-level economic activities and transitioning to the higher rungs on the supply chain. (Alston & Pardey 2014). Yet for such an important part of the economy, only 2.8% of income earned worldwide came from agriculture in 2012. (McNeil 2012; World Bank 2012). This shows us how agriculture is generally perceived as lower level economic activity within the global community and demonstrates how countries with more access to capital, land, and technology have come to dominate the markets.

In the US, the food industry is controlled by a few huge agri-conglomerates, like Monsanto – the infamous poster child of greedy agribusinesses that has received considerable attention in the media in recent years. In *Agriculture, Food, and Environmental Policy* the authors discuss how we have become estranged from agricultural processes and have thus lost our appreciation for the environment that produces our food (Kalen 2011). Kalen discusses how the industrial agriculture system uses different techniques to corner the market, control prices, and run family farms out of business (Kalen 2011). Practices like vertical integration and consolidation of production have actually hurt farmers – Tyson and other chicken producers were sued recently because the consolidation of their production plants caused a huge amount of competition and the price of chicken to drop drastically (Kalen 2011). Anti-competitive practices of agribusiness have driven many farmers into debt and out of business, where little is done to accommodate the natural resources within the supply chain. (Kalen 2011) Kalen also discusses the shift in populations to urban centers, and the problems of modern geography from a food perspective; since food is so spatially oriented, there has been a rising trend in local consumption, and even the introduction of urban agriculture, and increased research into urban landscape design to account for the increase in urban populations. (Kalen 2011)

Agriculture has historically been something that is community oriented, and much of family and ancestral history has been passed down through agricultural practices (Lyson et al 2001). The transition in America to large scale industrialized agriculture has been proven to be negative influences on community welfare (Kalen 2011, Lyson et al 2001). In a study conducted on

the scale of agricultural production and community welfare, the authors found a definite correlation between the size of farms within the community and the overall welfare of its citizens, with the level of civic engagement being a correlative variable that relates the two. (Lyson et al 2001) Although the study had developed a rather complicated metric to delineate the relationship between scale, civic engagement, and community welfare, one interesting result that they found was, a well-educated, civically engaged, financially independent middle class was found to potentially assuage the negative effects of large-scale dominant farming on rural communities.

(Lyson et al 2001)

Labor is a huge part of the agriculture picture, and in some cases having the backing of a corporation can benefit employees. Most agricultural products (aside from livestock) are seasonal, and require copious amounts of work for part of the year, and then nothing for some time, agricultural workers are often left unemployed and displaced when working on small farms. The Kandilovs' research into agriculture and labor explores the outcomes of agricultural workers as they enter and exit the unemployment pool, showing how workers can benefit from large scale, corporate backed agriculture. They show that many of the logical variables that impact one's time on unemployment, whether you have a spouse nagging you to get a job, whether you are more skilled, how much education you have - all indicators of how long you will stay unemployed as an agricultural worker (Kandilov et al 2010). This article shows us how people's perception of industrial agriculture depends a lot on your position within the system, and the idea that small farms benefit everyone can be narrow.

The overwhelming body of research regarding industrial agriculture today revolves around sustainable models for agriculture. Scientists have shown that the conventional, industrial agriculture model is extremely inefficient and pollutes on a massive scale (Aktar et al 2009). Houser and a group of authors discuss agriculture from the perspective of climate change, and develop some basic metrics to measure the effects rising temperatures and increased carbon in the atmosphere will have on the agricultural system. One thing is certain, climate change affects all areas differently depending on geography, so the temperature rising a fraction of a degree in Oregon may not have the same effect as it does in Egypt. (Houser et al 2015) The study discusses how many areas and crops have become more productive, where increased rain and heat improve the crops conditions, while many crops like fruit and nut trees require a frost period in order to produce (Houser et al 2015). They develop a method to determine the correlative effect of heat, CO₂, fertilizer, and precipitation and found that although initially an increase in productivity will be seen in the US, there is a breaking point in the near future when the yield of most crops will be greatly reduced. (Houser et al 2015)

Sustainability has become the buzzword of the 21st century, and for good reason. Sustainable farming alternatives to industrial agriculture have become extremely popular, and there have been many trends to reverse the spread of industrial agriculture in the US (Brosnan 2016). With the emergence of documentaries like *Food Inc.* and *Super Size* meat production has come into the spotlight. Recent trends in American diets have shown that people are eating less red meat than Americans in the 70's however,

American's consume a huge amount of meat, 16 pounds a year more than the next largest consumer of meat in 2000 (Putnam et al 2002).

Industrial meat production has increased in recent years causing a massive amount of pollution, consuming huge amounts of energy and resources, and driving producers into inhumane practices to meet market demands. The article includes some astonishing figures, like how grains can produce 2-10 times as much protein per acre as livestock, and with legumes the ratio is even as high as 20:1 or that the US feeds 66% of the grain it grows to livestock (Horrigan et al 2002). It is estimated that 3% of hog farms produce 60% of US pigs, and in the beef industry, 40% of production comes from 2% of feedlots (Horrigan et al 2002). These figures demonstrate how the industrialized agriculture system consolidates production, and present quite a number of issues. The risk of disease is a huge concern for the top producers, so non-medical antibiotic use is commonplace to ensure the livestock don't get diseases, which presents a huge risk for humans because the use of antibiotics has the potential to create resistant strains of diseases. These facilities concentrate waste products and cause an enormous burden on surrounding ecosystems, and present the risk of spreading diseases like *e. coli* to surrounding environments. The authors essentially use the meat industry to unwrap the environmentally unfriendly practices of industrial agriculture, painting a grim future for food security if we continue our current practices (Horrigan et al 2002).

Another article discussed sustainable alternatives using diversified farming systems. This article proposes a systematic approach to sustainable

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agriculture that works from a wholistic perspective to balance all of the inputs and outputs that to grow not only food but relationships on and off the farm, promoting health ecology, economic benefits and social justice for all. They discuss how agroecology plays an important role in developing the diversified farming system (DFS) framework which goes directly in the face of the modern industrial agriculture system currently in place, using a hybrid of different techniques to minimize inputs and maximize waste reuse, making a system that feeds itself. What makes a DFS framework different than another sustainable model is the focus on social and environmental justice while still considering the economic variables. The authors go on to describe how a self-sustaining, diversified farm can provides ecological services, economic opportunities, and creates an equitable community. They also discuss alternatives to the current industrial food system like alternative agri-food networks (AAFNs) which work with farmers to help redistribute wealth throughout the supply chain. Within sustainability frameworks, social justice has gained considerable attention in recent years. Most agriculture research, and certainly every article in this paper, discusses on some level the effects of industrial agriculture on communities, and in South America, communities are fighting back (Kremen et al 2012).

Agroecology is an important aspect of the sustainability framework. “

Agroecology is providing the scientific, methodological, and technological basis for a new ‘ agrarian revolution’ worldwide (Altieri 2009, Wezel and Soldat 2009, Wezel et al. 2009, Ferguson and Morales 2010).” (Altieri et al 2011). Agroecology is an emerging field of study that considers the environmental, economic and social outcomes of agriculture, focusing on

practical farm experiments and social science more than laboratory experiments or lofty hypothetical extractions based on models to understand agri-food networks. Farmers have helped mitigate some of the negative effects of climate change while giving power and security back to marginalized agricultural communities, places like Cuba have benefited from this information, where political conflict forced people to develop and integrate sustainable agriculture practices because of their isolation from the west. Fertilizers and pesticides are not only damaging to the environment, but often trap people into a dependent relationship with big agri-businesses who sell them everything from the seeds to the fertilizers and pesticides (Altieri 2011).

India is a country with a long agricultural history, and like the United States much of the landscape is a patchwork of industrial farms. Cotton has been grown in India for hundreds of years, and is infamous for being susceptible to diseases and bugs. India introduced its first GMO cotton in 1999 and quickly became the largest producer of GMO cotton on the planet. Companies selling the seeds were able to charge more for the seeds, which were engineered to only last one generation, making it necessary to buy new seeds each season. Many smaller farmers felt the economic effects of this and many tried to link the introduction of GMOs to a rise in farmer and rural suicides, however the data would suggest that there is no direct link to the GMO itself, rather the culmination of social and economic events that has estranged farmers from their land or identity, which is an expression of Durkheim's theory on suicide. No matter how you look at it, the loss of farmers coupled with increasing agricultural outputs should be a sign that

the system is imbalanced, especially when suicide rates in rural areas continues to rise across the world (Mohanty 2005).

The deeper you dig into industrial agriculture, the more alarming information you end up finding. The broad scope of literature that involves industrial agriculture generally points in one direction; current conventional agriculture techniques are doing more harm than good. With the current projections of climate change, it is imperative that the research done by these great scholars is read and disseminated to the right audiences. Within the industrial agriculture equation, it is important to understand the underlying complexity of operating in a globalized economy with varying levels of technology and government assistance. It is important to understand the implication of industrialized agriculture from the plants to the people.

There is something awry in American agriculture. The use of Industrial agriculture techniques has given rise to an unsustainable system that is controlled by a few actors, which has significant repercussions for the rest of the people in the world. This literature has shown that the issues surrounding industrial agriculture are systemic and are rooted in a culture of greed, and while there are many things wrong with the current model, there are some benefits and simple solutions to help mitigate the negative effects of conventional farming. The next time you buy a sandwich from your favorite fast food joint, think about how that burger came to be on your plate.

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