Industrial Agriculture and Rural Poverty

Nagwa Awad,
MPD Graduate Candidate, Harvard University
Nsa1963@gmail.com
(732) 267-3667
5 Etzkorn Ct, Lincroft, NJ 07738

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Abstract

Humans began manipulating and domesticating plants in the 1800ôs[1]. Today, farming is an industry. This trend in agriculture led too much use of fossil fuel, too little access to water and an imbalance of food security. Other problems resulting from such policies are hunger and poverty. There doesnôt seem to be a balance to access to nutritious food. With poverty and hunger being the first two goals of the United Nations Sustainable Development Goals (SDG)[2], and with 86% of the worldôs energy source coming from fossil fuel[3], examining farms and the farming industry here in the United States to determine where the shortfalls and gaps exist that lead to an imbalance in the nexus of food, water and energy can help. We have turned food into non-food essentials while children go to bed hungry. This paper will first present data about the state of large and small farms and then conclude by addressing ways in which we can use farming to provide more food to the poor, conserve water and reduce energy emissions.

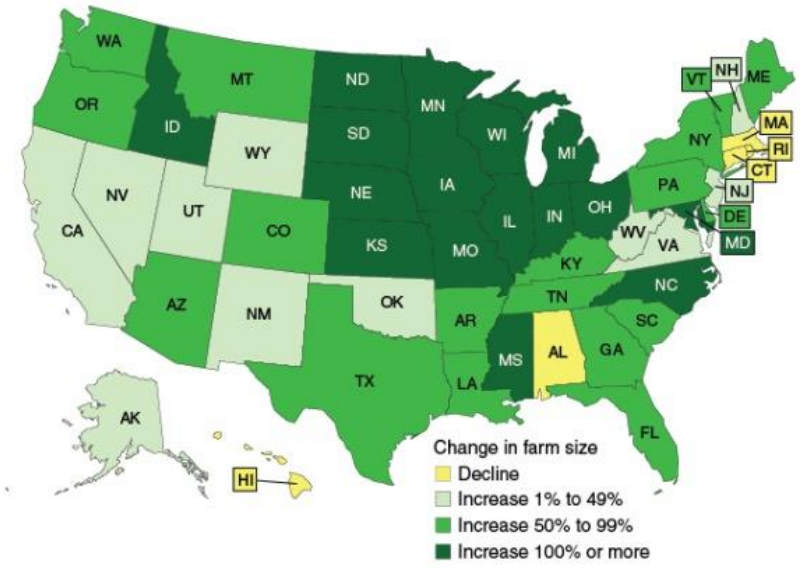
[1] "National Agricultural Library." *United States Department of Agriculture*. 2010. https://www.nal.usda.gov/agricultural-history.

[2] Sustainable Development Goals. 2018. https://www.un.org/sustainabledevelopment/sustainable-development-goals/.

[3] ñWorld Energy Council." World Energy Resources, 2016: 1028.

Industrial Agriculture Economic Evaluation

Agriculture worldwide has a 3.8% share of the Gross Domestic Product (GDP)[4]. It is the single largest employer in the world with 40% employed in agriculture[5]. One third to one half of the world population are income and wealth poor farmers who rely on farming and herding for their livelihood while 3 to 4% of the worldôs agriculture population are industrialized and technology advanced farms that represent roughly 66% of the value of world agricultural output between 1995-1997[6]. About 500 million rain-fed farms provide 80% of food in developing countries[7]. With more than 50,000 edible plants, only wheat, rice and corn directly or indirectly provide 80-90% of all the calories that humans consume[8]. Since the 1900ôs 75% of crop diversity has been lost[9].



Note: Estimates are midpoint acreages. Half of all cropland acres are on larger farms, and half are on smaller.
Source: USDA, Economic Research Service calculations from unpublished Census of Agriculture records, 1982 and 2007.

Figure 1: Percentage increase in farm sizes across the nation

Currently, the world is producing less of such as wheat, rice and nuts and a fractional increase of between 0.2% and 1% of corn, oats and barley[10]. This cannot sustain a world growing at a rate of 1.1%[11]. The only crop being grown at a rate keeping pace with population growth is soybean which America currently dominates[12], but given current political climates, this might not be the case next year.

Agriculture and related industries, in America, such as food processing and manufacturing contribute $992 billion to the Gross Domestic Product (GDP) in 2015, about 5.5%[13].Small farms, those who have gross cash farm income (GCFI) of less than $350,000 account for about 90% of U.S. farms and contribute about one fourth of the value of

[4] "The World Bank." *Agriculture, value (% of GDP).* 2015
[5] "United Nations Sustainable Development Goals." *United Nations.* 2017. http://www.un.org/sustainabledevelopment/sustainable-development-goals/.
[6] de Vries, Bert J. M. *Sustainable Science.* New York: Cambridge University Press, 2013.
[7] "United Nations Sustainable Development Goals." *United Nations.* 2017
[8] Bourne, Jr, J.K. *The End of Plenty: The Race to Feed a Crowded World.* New York: W.W. Norton & Company, 2015.
[9] "United Nations Sustainable Development Goals." *United Nations.* 2017.
[10] "World Agricultural Production." *United States Agricultural Department.* July 2018. https://apps.fas.usda.gov/psdonline/circulars/production.pdf.
[11] *United Nations.* September 25, 2015. http://www.un.org/sustainabledevelopment/sustainable-development-goals/.
[12] "World Agricultural Production." *United States Agricultural Department.* July 2018. https://apps.fas.usda.gov/psdonline/circulars/production.pdf.

[13] *USDA.* October 18, 2017. https://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/ag-and-food-sectors-and-the-economy/.

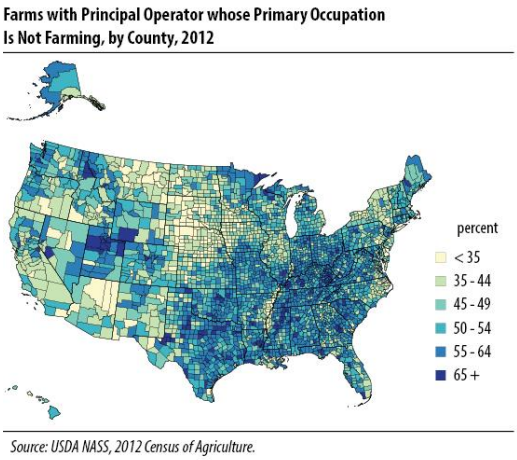


Figure 2: Percent of farmers supplementing farm income.

production while large farms with a GCFI of $1 million or more account for less than 3% of U.S. farms and contribute 45% of the value of production[14]. Small farms have to rely on off-farm income and micro- farms (those producing less than $10,000 in farm income) actually see a negative rate of investment (ROI) where their off-farm income is greater than their total income[15]. About 82% of farm income comes from off-farm employment[16]. Figure 1 shows the concentration of those working off the farm by age. Small farms and farm land is vanishing. A decline in the number of farms (2.2 million in 2007 vs 2.1 million in 2012) and farm land (922million acres in 2007 vs 914million acres in 2012) is indicative of a trend towards less open spaces[17]. Yet farm sizes are increasing from 418 average acres per farm in 2007, to 434 average acres per farm in[18] 2012. Farm land value is also increasing from an average farm land value of $790,000 in 2007 to and average land value of $1.1 *million in[19] 2012*. Industrialization and commercialization of farms have pushed land value beyond the reach of farmers and towards large corporations as the average per acre value increased from $1900 in 2007 to $2500 in 2012[20]. Figure2 shows increase in farm sizes.

As of 2012, Corn and soybean accounted for 50% of total farm output[21]. There was as an increase in 2012 of corn for silage and soybean for export totaling 40%, while food produced for consumption, such as rice, barley and vegetables fell by 55%[22]. Corn, wheat and soybean account for 90% of American crops[23]

. The US has 96 million acres of corn and is the leading corn producer[24] with 32% of the worldôs output of corn, 50% of the worldôs output of soybean and places third in global[25] wheat output. However, in 2012 corn harvest was hit with an intense heat wave that affected global

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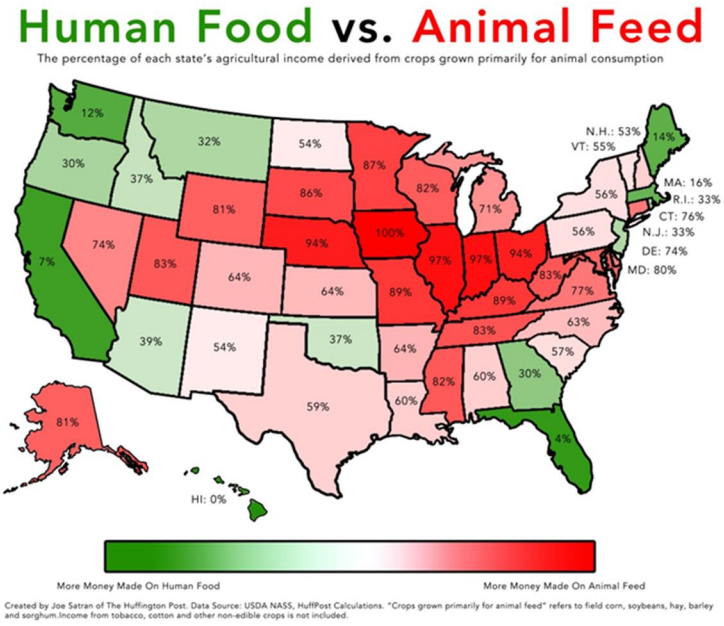
[14] *United States Agricultural Department.* November 29, 2017. https://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/farming-and-farm-income/.
[15] Ibid
[16] Bunge, Jacob, and Jesse Newman. "To Stay on the Land, American Farmers Add Extra Jobs." *The Wall Street Journal.* February 25, 2018. https://www.wsj.com/articles/to-stay-on-the-land-american-farmers-add-extra-jobs-1519582071.
[17] *United States Department of Agriculture.* 2012. https://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_2_US_State_Level/st99_2_008_008.pdf.
[18] Ibid
[19] Ibid
[20] Ibid
[21] "Census of Agriculture." U.S. Department of Agrigulture. September 2014. https://www.agcensus.usda.gov/Publications/2012/Online_Resources/Highlights/Farms_and_Farmland/Highlights_Farms_and_Farmland.pdf.
[22] Ibid
[23] "World Agricultural Production." *United States Agricultural Department.* July 2018. https://apps.fas.usda.gov/psdonline/circulars/production.pdf.
[24] Brown, Lester R. *Full Planet, Empty Plates.* New York: W.W. Norton & Co, 2012.
[25] "National Agricultural Library." *United States Department of Agriculture.* 2010. https://www.nal.usda.gov/agricultural-history.

food prices[26]. The world grain reserves fell by one third while world grain prices more than doubled between 2007 and 2008[27]. Despite America having stock reserve, in the past, and idled farms, currently the nation does not have stock reserve and very few land for idling, which contributes to spikes in food prices even though corn yield has not yet plateaued[28]. In 2012, for the second year in a row, the global food price index rose by 1.1%[29]. Currently, however, the US is the largest importer of vegetables and it is expected that the countryôs imports will be greater than its exports by 2050[30]. To avoid a recurrence of the 1980 farm financial collapse[31], farms are heavily subsidized by the government. With the looming trade war that would affect Americaôs soybean export, and given the heavily government subsidized agricultural industry, the nationôs farms are doomed to repeat the agricultural collapse that ended in 1981 that had shaped the farming industry as a government dependent, industrial sized farms that predominantly produce cattle feed grain and biofuel instead of human feed grain[32]. Figure 3 shows farm output by state.

Figure 3: Farms producing food for humans and farms producing food for feed by state

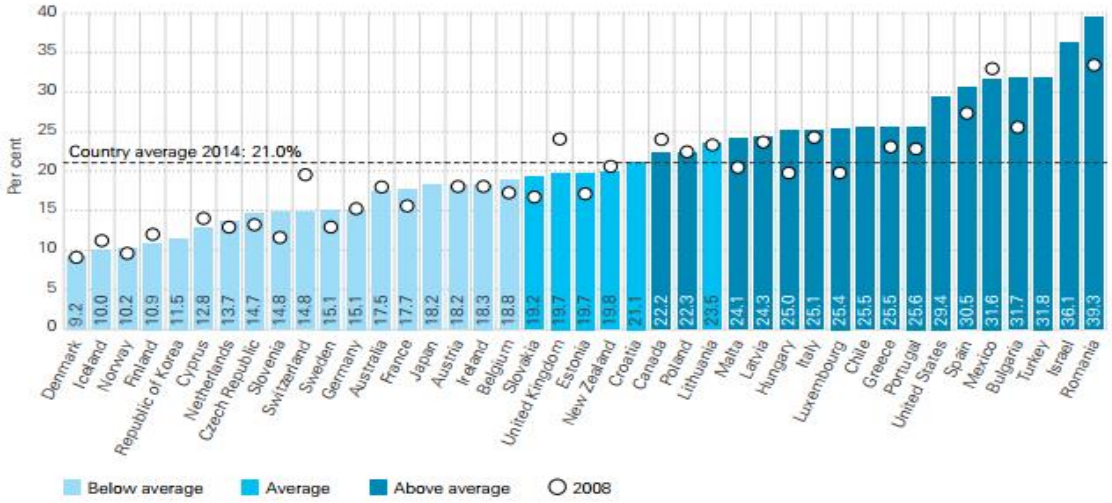


Industrial Agriculture and Poverty

A byproduct of current economic agricultural trends is the rise in poverty and hunger. Poverty is defined as the inability to afford basic needs such as food, clothing and shelter[33]. Income Poverty is *ñwhen a family's income fails to meet a federally established threshold*ò[34] such as the case for small farms in America. Interestingly, the US ranks 7th in citizens living

[26] Brown, Lester R. *Full Planet, Empty Plates.* New York: W.W. Norton & Co, 2012.
[27] Ibid
[28] Ibid
[29] "United Nations Sustainable Development Goals." *United Nations.* 2017. http://www.un.org/sustainabledevelopment/sustainable-development-goals/
[30] "CLIMATE CHANGE GLOBAL FOOD SECURITY amd the AND U.S. FOOD SYSTEM." *USDA.ORG.* December 2015. https://www.usda.gov/oce/climate_change/FoodSecurity2015Assessment/FullAssessment.pdf.
[31] "National Agricultural Library." *United States Department of Agriculture.* 2010. https://www.nal.usda.gov/agricultural-history.
[32] Ibid
[33] *UNESCO.* 2017. http://www.unesco.org/new/en/social-and-human-sciences/themes/international-migration/glossary/poverty/.
[34] Ibid,1

below the poverty line with poverty rate of 29.4% (Graph 1)[35]. As previously stated, one third to one half of the worldôs populations are income and wealth poor farmer. Yet in America, farming accounts for only 2.8% of the labor market[36], while farm sizes are getting larger; leading one to conclude that industrial farming has caused the drop in farming labor. For farmers, crop provides subsistence and income and agriculture drives rural development[37]. Farming as a means of support has led to poverty among farmer.



Graph 1: A list of rich countries and the percentage of children under 18 that fall below the country's poverty lines.[38].

The U.S. Census Bureau reports 12.7% poverty in the U.S. with a poverty threshold of $24,339 for a family of 2 adults and 2 children for 2016[39]. Notably this figure is much lower than UNICEFôs figure of 29.4%. As previously discussed, small farms account for 90% of farms in America, but only produce less than 25% of output. Small farms rely on off-farm income as they attempt to compete with large industrialized farms. This also adds stress to the labor market as farmers compete for jobs in all sectors. Only about half of the farms in America are owned[40]. Net income from farms peaked at $50,000 a year in 2012, but has since been declining to about $38,000 a year[41], which is close to the $25,000 poverty line for a family of four. This does not take into account the projected increase in fertilizer and seed cost[42] that will further reduce the net income from farms. According to studies, people living in poverty spend 50-70% of their income on food[43]. When prices rise, hunger is the end result with currently 20% of Americans

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[35] Bruckauf, Zlata, Yekaterina Chzhen, Jose Cuesta, Dominic Richardson, and Emilia Toczydlowska. Florence, Italy: UNICEF Office of Research Innocenti, 2017

[36] "National Agricultural Library." *United States Department of Agriculture.* 2010. https://www.nal.usda.gov/agricultural-history.

[37] Peralta, Genandrialine L., and Joseph Michael Hunt. *A Primer on Helath Impacts of Development Programs.* Asian Development Bank, 2003.

[38] Bruckauf, Zlata, Yekaterina Chzhen, Jose Cuesta, Dominic Richardson, and Emilia Toczydlowska. Florence, Italy: UNICEF Office of Research Innocenti, 2017

[39] *U.S. Census Bureau.* 2016. https://www.census.gov/topics/income-poverty/poverty.html.

[40] "Census of Agriculture." *U.S. Department of Agrigulture.* September 2014. https://www.agcensus.usda.gov/Publications/2012/Online_Resources/Highlights/Farms_and_Farmland/Highlights_Farms_and_Farmland.pdf.

[41] Bunge, Jacob, and Jesse Newman. "To Stay on the Land, American Farmers Add Extra Jobs." *The Wall Street Journal.* February 25, 2018. https://www.wsj.com/articles/to-stay-on-the-land-american-farmers-add-extra-jobs-1519582071.

[42] Ibid

[43] Brown, Lester R. *Full Planet, Empty Plates.* New York: W.W. Norton & Co, 2012

struggling to provide food for their families[44]. Just like the poor and due to the depletion of food reserves, the world is living one year to the next[45]. Compounding the situation is the fact that 35% of harvested grains are used for cattle feed and not fit for human consumption which further causes severe food price inflation[46]. Itôs well known that poverty inhibits the ability to produce income which increases poverty[47]. It is also a fact that the poor are more likely to be harmed by poor quality of air, food and water[48]. Overall, an estimated 815 million people are poor and undernourished with that number projected to increase to two billion by 2050[49]. Figure 4 shows poverty throughout America.

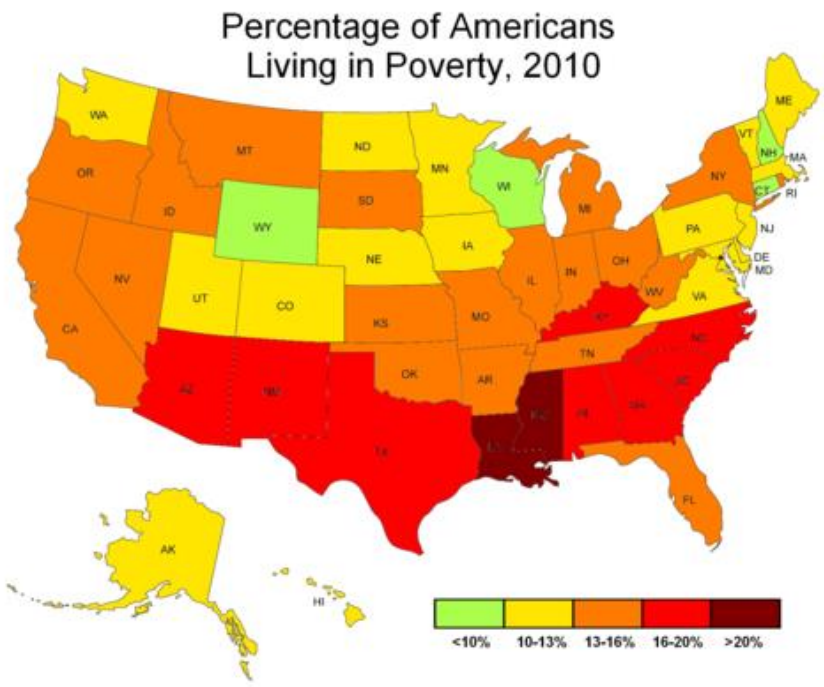

Figure 4: Percentage of American living in poverty state

Children are affected by poverty more poignantly than adults. Children experience poverty as an environment that is damaging to their mental, physical, emotional and spiritual development[50]. Poverty in children leads to going without a nutritious meal that would contribute to a healthy growth, or being subjected to hazardous labor that prevents access to education among other things, thus, preventing stimulation or emotional support that can inhibit potential[51]. About an average of 20% of children in rich countries live in Relative Poverty and more than 10% either go hungry or donôt get a nutritious meal[52]. An estimated 25% of childrenôs growth is stunted by poverty and about half of deaths in children under the age of five are attributed to malnutrition[53]. Children born into poverty are twice as likely to die by age five[54].

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[44] Hanlon, Peter, Robin Madel, Kai Olson-Sawyer, Kyle Rabin, and james Rose. "Fodd, Energy, Water: Know the Nexus." January 2013.
[45] Brown, Lester R. *Full Planet, Empty Plates.* New York: W.W. Norton & Co, 2012.
[46] Ibid
[47] Peralta, Genandrialine L., and Joseph Michael Hunt. *A Primer on Helath Impacts of Development Programs.* Asian Development Bank, 2003.
[48] Ibid
[49] "United Nations Sustainable Development Goals." *United Nations.* 2017. http://www.un.org/sustainabledevelopment/sustainable-development-goals/.
[50] "UNICEF." *United Nations Emergency Fund.* 2005. https://www.unicef.org/sowc05/english/povertyissue.html
[51] Ibid
[52] Edmond, Charlotte. "WEF." *The Rich Countries have High Childhood Poverty .* June 28, 2017. https://www.weforum.org/agenda/2017/06/these-rich-countries-have-high-levels-of-child-poverty/.
[53] "United Nations Sustainable Development Goals." *United Nations.* 2017. http://www.un.org/sustainabledevelopment/sustainable-development-goals/
[54] Ibid

Industrial Agriculture and Health Impact

Food technology innovations introduced the world to Genetically Modified Organisms in 1996 (GMOs) which are defined by the World Health Organization (WHO) as biotechnology that alters food in a way that does not occur naturally[55]. One of the purposes was to increase crop production by introducing disease resistant plants[56]. Such undesirable control by a few chemical companies led to their dominance of agricultural development and an unsustainable agricultural economy[57]. Other concerns pertain to human health issues. WHO reported three areas of particular concerns: allergenicity or the transfer of genes from allergic organism to non-allergic organism; gene transfer from GMôs to the human body might impact human health, and outcrossing or the migration of GM plants into conventional crops[58]. GMOôs were also intended to produce insect and disease immune crops, but looking at statistical output indicates a negative output. These agricultural economics and human health concern render these trends in the global agro-food systems unsustainable, and with food production decreasing while the world population is increasing, this can lead to collapse in several societies globally. In 1996, biotechnological advances introduced genetically engineered (GE) seeds for crops that led to a use in most crops of 90%[59]. GE crops are defined by the Economic Research Services (ESR) of the United States Agricultural Department (USDA) as õplants with genetic material that has been alteredö[60]. GE crops are herbicide-tolerant, insect-resistant crops that can lead to a reduction of farmersôagricultural expenses[61]. While GE crops seem to save the American farmer resources, there is a down side. A study found that GEôs or Genetically Modified (GM) foods toxically stress human organs and can lead to *"toxic effects such as hepatic, pancreatic, renal, or reproductive effects and may alter the hematological, biochemical, and immunologic parameters"*[62].

Industrial Agriculture and Water

Water is a vital aspect of the agricultural system dynamic which is essential for humans, crops and animals and for many industrial processes[63]. According to International Atomic Energy Agency (IAEA), 70% of the world is covered by water but only 2.5% of it is fresh, only 1% of fresh water is available for human and ecosystem use and only about 0.3% is easily accessible[64]. About 70% of fresh water is used for agriculture and another 8% is used for domestic consumption (Figure 5); it is estimated that about 85% of rainwater does not reach crops[65]. With rising temperatures, globally, we are experiencing soil erosion and water shortages[66]. Additionally, over 80% of waste water discharge into surface water is unfiltered[67].

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[55] *World Health Organization.* May 2014. http://www.who.int/foodsafety/areas_work/food-technology/faq-genetically-modified-food/en/.
[56] Ibid
[57] Ibid
[58] Ibid
[59] *USDA.* August 22, 2016. https://www.ers.usda.gov/topics/farm-practices-management/.
Water Security: The Water-Food-Energy Nexus. Washington, D.C.: Island Press, 2011
[60] McFadden, Jonathan. *USDA.* 2017. https://www.ers.usda.gov/amber-waves/2017/august/although-small-markets-have-been-expanding-for-ge-crops-with-traits-that-increase-nutrient-content-or-improve-taste/
[61] Ibid
[62] Dona, Artemis, and Ioannis S. Arvanitoyannis. "National Center for Biotechnology Information." *U.S. National Library of Medicine.* January 2010. https://www.ncbi.nlm.nih.gov/pubmed/18989835.
[63] *Water Security: The Water-Food-Energy Nexus.* Washington, D.C.: Island Press, 2011
[64] "Internationa Atomic Energy Agency." *IAEA.* September 2011.
https://www.iaea.org/sites/default/files/publications/magazines/bulletin/bull53-1/53105911720.pdf.
[65] Ibid
[66] Brown, Lester R. *Full Planet, Empty Plates.* New York: W.W. Norton & Co, 2012.

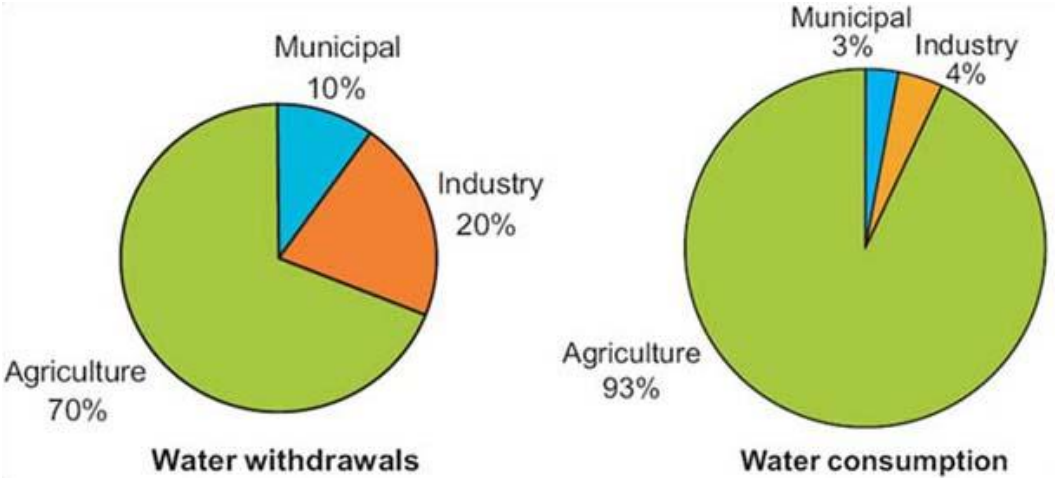

Figure 5: Water consumption in America by sector

In America itôs estimated that agriculture accounts for 80% of the overall nationôs water consumption and about 90% in the Western States[68]. Of course with higher percentage than the worldwide of 70%, efforts are being made by the USDA into improving farm water management, dry-year water banks and adopting irrigation technologies that can stem the impact of irrigated production[69]. Such statistics lead towards an unsustainable model of farming and water usage. Natural disasters, such as the dust bowl, can further stress water resources. The Dust Bowl was a series of dust storms following extreme drought in the Midwest and Southern Plains between 1931 and 1939[70]. Stress to the agricultural system didnôt end until the rains came[71]. Industrial agriculture has led to excessive irrigation and water salinity[72]. America currently is one of the leading nations in over pumping of aquifers[73].

Industrial Agriculture and Fossil Fuel

Figure 6: Flow diagram of agriculture process

Figure 6 shows the need for energy in all steps of

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tment." *Economic Reseach Services.*
rrigation-water-use.aspx.

/features/dust-bowl-surviving-dust-

), 2012.

industrial agriculture. As previously stated, about two-thirds of the worldôs agricultural output is by about 3-4% of farms. Such farms are at the center of the world in their advancement in industrial economies, but their relationship with natural ecosystems has almost vanished[74]. One of the key characteristics of Industrial agriculture is intensive use of external inputs such as fossil fuel[75]. Non-renewable minerals and fossil fuel are two vital resources to industrialization[76]. Currently 86% of energy source worldwide comes from fossil fuel[77]. Less than 3% of American farms produce almost 50% output. Coupled with the shrinkage of the farm sizes, previously discussed, leads to the conclusion that small labor centered farms are being replaced with large industrialized, centralized farms. With industrialization comes fossil fuel causing air pollution emitted from machinery causing health risks and contributing to global warming[78]. Currently the U.S. generates 65% of electricity using fossil fuel and only 15% come from solar energy[79]. Fossil fuel as a source is high in energy and crucial to humanity. But due to the growing trend of industrial farming, more Green House Gasses (GHG) are emitted into the air leading to rising temperatures which cause rising food prices [80] in addition to health problems. Such policies lead to climate change which would affect food security[81].

Table 1
Environmental Systems Statistics Worldwide

Agriculture	Water	Fossil Fuel
3.8% of GDP from agriculture	70% of the world is covered by water	Industrialized farms rely on fossil fuel
25% live in agricultural villages	2.5% of the water is fresh; 1% is available, 0.3% accessible	Fossil fuel is finite and is depleted upon exploitation
30% depend on farming & herding for livelihood	1 billion people donô have access to safe drinking water	Supplies 86% of world energy
50% of farmers are poor	70% of fresh water used for agriculture; 8% for domestic consumption	Environmental sinks are finite
3-4% of industrialized farms	85% of rain water does not	

[74] Morris, Ian. *Foragers, Farmers and Fossil Fuel.* Princeton: Princeton University Press, 2015.
[75] Ibid
[76] de Vries, Bert J. M. *Sustainable Science.* New York: Cambridge University Press, 2013
[77] "World Energy Organization." *World Energy Resources*, 2016: 1028.
[78] "Grace Communications Foundation." *Sustainable Table.* 2016. http://www.sustainabletable.org/265/environment.
[79] "U.S. Energy Information Administration." May 10, 2017. https://www.eia.gov/energyexplained/index.cfm?page=electricity_in_the_united_states#tab2
[80] Brown, Lester R. *Full Planet, Empty Plates.* New York: W.W. Norton & Co, 2012
[81] "CLIMATE CHANGE GLOBAL FOOD SECURITY amd the AND U.S. FOOD SYSTEM." *USDA.ORG.* December 2015. https://www.usda.gov/oce/climate_change/FoodSecurity2015Assessment/FullAssessment.pdf.

produce 66% of output	reach crops.	

Table 1: Summarizes key points that lead to agriculture, water and fossil fuel systems being unsustainable.

Table 2 Environmental Systems Statistics in America		
Agriculture	Water	Fossil Fuel
$992B or 5.5% of GDP from agriculture	80% used for irrigation nation wide	Over use of machinery leads to air pollution
90% farms with GCFI < $350K >3% GCFI >= $1M produce 45% of output GCFI =< $10K rely on off-farm income with a negative ROI	90% used for irrigation in Western States.	65% of electricity source
Farms 2007: 2.2M 2012: 2.1M Acres 2007:922M 2012:914M		
90% corn crop is GE seeds		

Table 2: Summarizes key points that lead to agriculture, water and fossil fuel systems being unsustainable.

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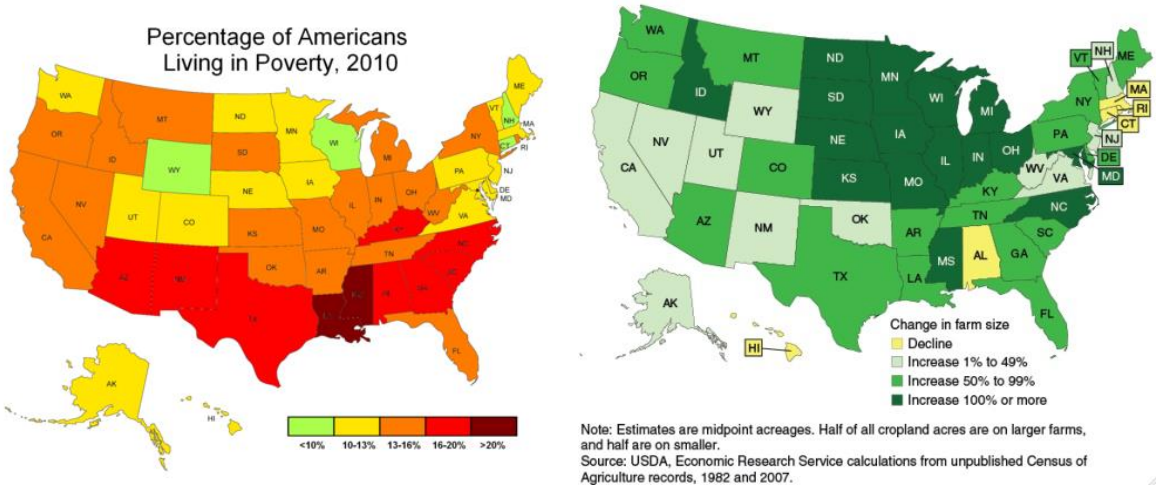

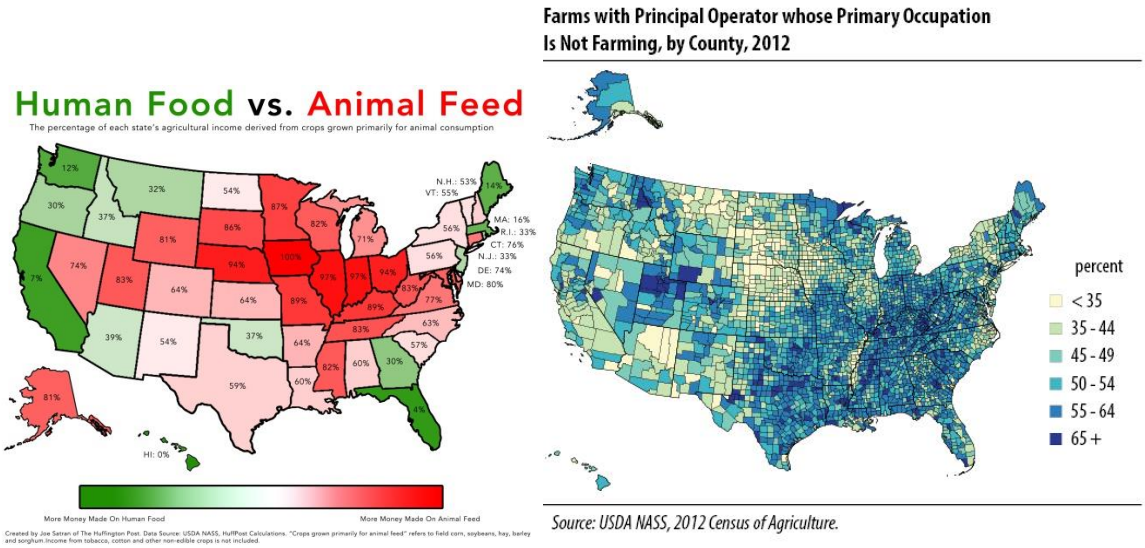

Figure 7: Side by side comparison of poverty, farm size, farm output and farm supplemental income

Conclusion & Recommendations

There is no doubt that there has been a rapid increase of industrial farming since 1960. It is evident that industrial agriculture has a direct impact on rural poverty. Looking at the maps of America side by side (Figure 7) shows a direct correlation between poverty, farm size and farm type (crop for feed or crop for humans). The economic impact industrial farming has on small rural farms has been devastating. But with the US imposing more stringent auto fuel efficiency, this can lead to more use for electric cars on the farm at a cost of $0.80 a gallon[82]. Such measures can lead to economic benefits such as more food for humans being harvested and lower food prices[83]. Other examples of government stepping in, is that oversight agencies have been established to manage water use in states such as California[84]. These policies would ultimately lead to small farmers experiencing better economic prosperity. There are positive aspects of industrial farming and the use of GMO. With new technologies, industrial farming can mass produce food fortified with iron and zinc[85]. Such is the case with golden rice which is fortified with beta-carotene[86]. These measures can reduce health issues with malnutrition and reduce hunger. Other positive steps would be to address issues with food waste. Currently, 150-300 billion pounds of food is wasted per year costing $165 billion annually[87]. Food waste makes up 40% of total food output at the processing and consumer level in industrial countries[88]. But if we wasted 5% less we can feed 4 million more Americans

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[82] Brown, Lester R. *Full Planet, Empty Plates.* New York: W.W. Norton & Co, 2012
[83] Ibid
[84] Hanlon, Peter, Robin Madel, Kai Olson-Sawyer, Kyle Rabin, and james Rose. "Fodd, Energy, Water: Know the Nexus." January 2013. http://www.gracelinks.org/media/pdf/knowthenexus_final_051513.pdf
[85] Peralta, Genandrialine L., and Joseph Michael Hunt. *A Primer on Helath Impacts of Development Programs.* Asian Development Bank, 2003
[86] Bourne, Jr, J.K. *The End of Plenty: The Race to Feed a Crowded World.* New York: W.W. Norton & Company, 2015.
[87] Hanlon, Peter, Robin Madel, Kai Olson-Sawyer, Kyle Rabin, and james Rose. "Fodd, Energy, Water: Know the Nexus." January 2013. http://www.gracelinks.org/media/pdf/knowthenexus_final_051513.pdf
[88] "United Nations Sustainable Development Goals." *United Nations.* 2017. http://www.un.org/sustainabledevelopment/sustainable-development-goals/

per year, and wasting 15% less food would feed 25 million more people annually[89]. Other options would be to encourage women farmers which would reduce hunger by half[90]. When food insecurity diminishes, global economic productivity increases by 2-3% annually[91].

Ending industrial agriculture requires studies beyond the scope of this paper, but we looked at ways to work with the existing system. We discussed ways to improve small farmersô economic position by managing water rights, reducing poverty and hunger. We presented ways to use industrial agriculture to improve the health impact. We identified measures the US is requiring to reduce emission output. All these policies, while seeming minor, would have a large impact on the farming industry, food, water resources and energy output.

[89] Hanlon, Peter, Robin Madel, Kai Olson-Sawyer, Kyle Rabin, and james Rose. "Fodd, Energy, Water: Know the Nexus." January 2013. http://www.gracelinks.org/media/pdf/knowthenexus_final_051513.pdf.
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