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China, Population and Lack of Sustainable Agriculture

China's Lack of Sustainable Agriculture Insufficient for Feeding its Large Population

Although China has the largest population of any single country in the world, China only possesses a very small amount of the world's arable land, especially given its incredibly large population, which is only growing. China's very low arable land per capita, combined with its decreasing area of farm land from desertification causes crop yields insufficient for sustaining its massive population, which will only grow larger in the coming years. While this problem has been known for a number of years, the recent focus on food sustainability provides a heightened level of attention for this great issue. Given the significant investment in time and resources necessary to reverse these challenges, it is imperative that action be taken as soon as possible. In order to combat this complex, multifaceted problem with many different causes, a multifaceted solution that addresses all of these problems is necessary.

The average family in China has a household income of about 21,586 Yuan (approximately \$3,111 USD), with a median of 18,371 Yuan (approximately \$2,648 USD), which means that "income inequality is not as severe in China as it is in the world" (Federal Reserve Bank of Saint Louis). The relatively high income average in the Chinese population could be linked to the high average literacy rate of 96%. The average family size is "3.17 people per household", which is comparatively large to the average of "2.52 people per household" in America (Statista Research Department). The Chinese government's strict policy regulations on children per household can be attributed to a decline in average inhabitants per household despite its higher than average rate. The legislation regarding the children per household number was first passed in the 1970s, mandating citizens to only be allowed to have two children, thus the name two child policy. Even before this was passed, the Chinese government promoted family planning and the use of birth control since about 1949 under the leadership of Mao Zedong, although these efforts were not mandated by the government and everything was based on citizen's choice, the birth rate decreased at a dramatic rate in a very short period of time. Under Mao's leadership, the population of China grew from 540 million to 940 million in just under 30 years because for much of his time as dictator, he believed that a large population brought strength to China. In the late 1970s, China's population was approaching one billion at a dramatic rate, and so in an effort to steady the population growth and prevent massive overpopulation, Deng Xiaoping allowed couples to only have one child per household. This legislation was given the name one child policy, and it started officially in 1980 with a letter published by the Central Committee of the Chinese Communist Party. Although the intent was that this could be applied universally across the entire Chinese population, it did not work out as such. About half of Chinese families were allowed to have two children. In the cities, this law was much more heavily enforced than in the countryside, and different ethnic groups were given allowances to have more children as well. (Pletcher) This one child policy lasted until 2015, when China relaxed its heavy regulations and reverted back to the two child policy. The Chinese government states that the one child policy prevented over 400 million births during its period of implementation. Although this policy helped This was all in an effort to curb the massive population growth, however China still has an incredibly large population that is estimated to only continue to grow and increase dramatically over time.

China's agricultural crisis can be attributed to several factors, among them the low area of farmland, high food waste, low crop yield, and the uptake in soybean consumption because of the rise of increasingly protein based diets. China's detrimentally low area of arable farmland per capita influences the lack of

food necessary to sustain its massive population. “China has only 7-9% of the world’s arable land, but more than 20% of the world’s population” (IPCC). This incredibly low land per capita ratio is significant because it is one of the main causes for why China cannot feed its massive population, which is only increasing with time. Compounding this problem, the amount of land used by China for pastoral and agricultural use steadily decreases due to conversion of land for industrial purposes and desertification. Rampant pollution throughout the country is a problematic byproduct of China’s economy relying increasingly upon manufacturing. As China’s manufacturing sector grows, the amount of land allocated for agricultural purposes decreases, exacerbating the already alarming insufficiency of crop yield at a potentially geometric rate. Further pressure on arable land is caused by a cultural shift to consume more protein-rich meals. Protein is more difficult to cultivate and yields less per acre as compared to more traditional crops. Soybeans are used as feed for the livestock because “soybeans are regarded as an excellent feed for pigs,” which causes problems because “soybeans are one of the most water intensive crops” and “soybean demand feeds through into deforestation” (Baldinger). Not only is it more difficult to produce large amounts of meat than plants, switching to a more protein heavy diet contributes to other larger problems China faces in regards to food such as climate change. Adding to these agricultural challenges, China also deals with food waste as high as “18 tonnes of food waste per year” (Baldinger), a staggering amount which further compounds China’s food self-sufficiency issue. At its core, China’s main problem deals with the amount of arable farmland not supporting the growing population. While these problems may be specific to China, the solutions can be applied to almost any nation in the upcoming decades, or even centuries, to come. Because of this, the world should view China as a global preview and an experiment on how to solve hunger in the modern world.

The history of a civilization generally shows a linear progression towards industrialization. In the early times of pastoralism, small groups of people settled very close to a water source with arable farmland sufficient for subsistence agriculture. With time, that group expands to form larger villages, which then become cities and industrial metropolises. There are of course exceptions to this general trend, most notably towns which had a specific purpose for a specific time period, for example the mining towns of the American West. However the truism of this general progression is that it results in land that’s highly suited to feed the early pastoralists, but it eventually turns into an industrial zone ill fitted for feeding a large population. When arable farmland must compete against industrialization, such is the case in China, industrialization ultimately triumphs. As such, this makes the case for modern cities to be planned with not only the concerns of the metropolis in mind, but also how it will affect the amount of farmland a country has. The solution may lie in finding suitable locations where farmland and industrialization will not meet and be forced to compete with one another.

Just as this problem arose from a variety of factors, its solution must contain multiple components, namely an investment in genetic modification and biotechnology, innovative ways to recycle food waste back into the food chain, and a governmental policy commitment to protect farmlands as natural resources. In order to sustain China’s large population, advancements must be made in areas of research and implementation of genetically modified crops. At the current rate of production in East Asia, “only 67 percent of food demand will be met by 2030,” making genetic engineering imperative to increase the crop yield enough to sustain China’s increasing population (Koba). The biotechnology available to us through genetic modification allows for an increase in annual crop yield as well as protection against pests. Public opinion must be taken into account as there are those who regard genetically modified foods and seeds as unsafe. Care must also be taken to find a feasible way to ensure these crops are no more detrimental to health than any other crops, and data supporting this conclusion must be made widely available publicly. It must be noted that currently, the Chinese government prohibits the use of genetically modified soybeans. While this paper has the luxury of approaching the problems facing China with respect to food

security academically and theoretically, thus contributing to the conclusion that GMO food products have the potential to be an overall boon for China due to the data confirming both the safety of genetic modification as well as its effectiveness in helping increase crop yields, something China desperately needs. From a practical perspective, the legislation governing China's policy on genetically modified crops must be addressed prior to implementation. Although no statement can be made about the likelihood of China changing its laws, no matter how much data is presented to them regarding the effectiveness and safety of genetically modified crops, research strongly suggests China should revisit its preexisting policy governing the use of genetically modified crops. Readily available data and success in other parts of the world could possibly convince the Chinese government to abolish, or at least mitigate, the regulations involving genetically modified crops and bioengineering. Although this solution is expensive in the short term and could foreseeably take large amounts of time and research, the potential crop yield increase from research into genetically modified crops could pay off significantly, because this could help maximize the low arable land to people ratio in order to make the most out of the relatively low amount of farmland China has. This investment stands a high likelihood of increasing crop yields per acre such that the research cost per future incremental yield will, in time, make such investments appear de minimus.

One Chinese researcher, Li Yanroung, proposed a way to curb the diet and food waste problem in China by using cockroaches. The excess waste China produces can be fed to large quantities of cockroaches, which will significantly decrease the wasted food since all of the cockroaches can consume it. Then, the cockroaches will be turned "into animal feed at the end of their one-year lifespan" (Baldinger). This is a viable solution because "cockroaches are highly efficient waste consumers" and cockroaches are "highly efficient in turning that waste into edible protein" (Baldinger). This solution would solve many of the more serious food sustainability issues China faces while costing very little to the Chinese government. Because the Chinese population consumes significantly more meat, a cost efficient way to sustain the increase in agriculture necessary to feed the population is required. Cockroaches could not only be the way to sustain the uptake in necessary livestock, but also help curb the problem of China's incredibly high food waste that only compounds the issue of an insufficient amount of food getting to the Chinese citizens. Since soybean is currently the main method of supporting China's livestock, cockroaches could be a viable and extremely beneficial replacement because of soybean's water intensive nature. By using cockroaches, water waste and food waste would be significantly decreased and the livestock would still be sufficiently maintained. This switch would also be financially beneficial and offer similar or better outcomes in terms of supporting the livestock population. The cost to benefit ratio of this solution increases the chances of implementation by the Chinese government significantly. The potential downside to this solution is that the public may fear what they consume. Although the citizens of China will not be directly consuming cockroaches, they will be used as feed for the meat they eat, which could be a cause for concern for many citizens. Despite this, this solution will offer a cost effective way to feed the livestock necessary to sustain the increasingly meat intensive diets of the Chinese population while significantly reducing the amount of food waste.

To combat the issue of China's "arid and semi arid regions," China is working to "improve forest cover... in three stages" (IPCC). Through the implementation of this method, "the area of degraded land decreased by 12,120 km² over a five year period" (IPCC). Not only that, but "wind erosion decreased by 33%" (IPCC) Because of the program's extremely high efficacy, continuing this should continue to yield positive results in helping decrease sandstorms and increase the area of land suitable for agricultural use. In just 5 years, this program made incredibly important advancements in reducing the amount of arid land and turning it into viable farmland. Only with a sufficient amount of farmland can China be able to produce enough food to sustain its population, so China must continue these efforts. In an effort to protect

this land and restrict it to agricultural use, China should pass legislation akin to those protecting the United States National Parks System. By treating arable farmland as a national resource, it would make them untouchable and unavailable for commercialization or industrialization. As China continues to rapidly expand, protecting farmland as a natural resource offers a way to deter the threat of expansion upon China's lacking arable land. A benefit of this solution includes its permanency because if it were to mirror the US system, the land set aside by the government will not be permitted to be impeded upon by major corporations in the present, nor in the future. This is highly feasible and beneficial, as it offers a long term solution that has been proven effective with similar legislation in the United States. This also does not cost the government significant amounts of funds like researching biotechnological advancements, which is another benefit to this method.

Because of the complexities of the many problems China faces in regards to sustainable food production, executing feasible solutions to deliver viable solutions to these issues will be challenging and costly. However, with leadership and ingenuity, we can collaborate to enact solutions that combat all of the issues China faces in order to give them sustainable food solutions. Many steps have already been made in finding adequate solutions, and by acting quickly, China's food sustainability challenges can be overcome within this generation.

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