

Kate Armstrong  
Ankeny High School  
Ankeny, Iowa

### Resource Degradation, Water Scarcity, and Climate Change in China

The current population of Earth is 6,787,379,342 people, which means that there are 6,787,379,342 people to feed every day, with more than one billion of those people currently residing in China. Unfortunately, the truth is that almost half of those people will not receive the adequate nutrition they require; furthermore, twenty-seven to twenty-eight percent of the world's children are underweight or malnourished due to restricted food security in developing countries. The majority of the world's food supply and produce comes directly from subsistence farmers that live in rural areas of developing countries. Over half of these farmers that are responsible for the world's food security live significantly below the poverty line. Furthermore, the majority of the land that these farmers live on and are forced to work on is degraded. Land degradation is a problem that affects nearly one quarter of the world's land mass, and around forty percent of the world's agriculture land. Land degradation is caused by climate change, but moreover due to many years of poor farming conditions and farming practices. The most affected areas of the world that suffer from resource degradation such as this are countries in Southeast Asia, India, and China. These poor practices have caused the soil and the land to be barren and infertile. The only means of fixing these problems is implementing new types farming mechanisms and practices to gradually replenish the soil, which is hard because most farmers do not have the time or money to invest into such projects. However, if national governments and private organizations were to fund these projects it would make it possible for farmers to stop this problem and even improve the already affected areas.

Following the downfall of the collectivist system and the dissolution of communes in 1978 as part of the Four Modernizations Campaign, China returned to a family farm system, commencing the transformation to a market-oriented, family centered economy. Village officials still, however, have the power to distribute land according to family size and/or household need in order to avoid unequal distributions of wealth due to extreme land disparity. Families are now required to meet crop quotas, which, while still limiting, does give individual families substantially greater freedom than the communal arrangement. Though the family-farm system has undeniably surpassed the commune system in terms of efficiency, efficacy, and production, China still does not have the means to feed all of its highly populated country, even though the country ranks first in worldwide food output.

The main staple in diet in China is grain. Rice is the most commonly grown crop in the country and is often generally produced in the southern regions of China. Wheat, which is the second most commonly grown crop in the country, is usually cultivated in more northern regions of China, along with other crops, like sorghum, millet, and corn. In 1994, in order to encourage grain production to feed the mouths of an exponentially growing country, the Chinese government enacted policies that would limit grain imports and raise prices for grains, which ultimately increased grain production. Other crops grown in China include white potatoes, oats, sweet potatoes, cabbage, tea, bananas, oranges, and pineapples.

Improving farm agricultural activity and income is hindered by, but not limited to, three major obstacles: lack of internal infrastructure, lack of education for farmers, and lack of strong family farm forum to trade. China's lack of internal infrastructure allows for minimal trading of crops and/or other agricultural resources at nearby markets, due to the shortage of transportation for farmers. Despite the 1978 reforms of the Chinese government, including the allocation of necessary funds to build roads, the Chinese transportation system, or lack thereof, inhibits the advancement of modern farmers. Secondly, the

majority of farmers have little to no educational background. A study in 2006 found that of rural farmers living in China, the average amount of schooling was a little more than seven years. Only about nine percent of these rural farmers have any sort of formal agricultural schooling, and less than five percent have a secondary degree in agriculture. In order to advance the rural farmers of China, there needs to be more emphasis on agricultural education, so farmers can be instructed on standard practices. Lastly, in order to improve rural farmers' incomes, which according to the Chinese Academy of Social Science survey conducted in 2002, states that the net income per year was 1,260 yuan (there are about seven Chinese yuan to every U.S. dollar), communities need to standardize trade practices and set prices for crops to make trading more efficient.

Though there are these barriers which hinder individual advancement in China, there is one combination of factors above all that affects the individual, national, and global status of agriculture: natural resource degradation, water scarcity, and climate change. In China one of the greatest resources being degraded is land. Land degradation is defined by the over-farming or exhaustion of land by farming and by not using sufficient farming techniques. Generally speaking, land degradation causes land that was once farmable to no longer yield as many crops as it was able to in the past because of inefficient farming techniques and mechanisms. Though nearly forty percent of all arable land in China is degraded, the problem is extremely prevalent in the nation because the country has twenty-two percent of the world's population living within its borders, yet it has only about seven percent of the world's farmland and a little less than six percent of the world's water sources. As land becomes more degraded in China, crop yield decreases, reducing the number of people who can be fed within the country and around the world.

Currently, two-thirds of the farmland which is being used in rural China is not being farmed efficiently; arable land is not being farmed with methods that will increase the overall yield. Around 40% of the available farmland in China is being affected by land degradation, including water and wind erosion, loss from grazing, deforestation, over-drafting, salination, and land pollution from industrial waste. Despite China's massive territorial area of 9,598,094 square km, only fourteen percent of this land is suitable for cultivation. There is obviously an unfortunate relationship between the amount of land available for farming and the enormous population; the less land available, the fewer amount of people can be fed. As land degradation continues to increase within China and around the world, there will be less suitable farmland, decreasing food security on a national and global front. Presently, ninety percent of the nation's impoverished live in areas affected by land degradation, illustrating the positive correlation between land condition and poverty.

There have been several past initiatives that the government has implemented, attempting to resolve the problem of land degradation and land scarcity. For the past 3000 years, the Chinese government has employed different ideas, such as terracing and water management plans, to control resources. In the late 1990's, with strong encouragement from outside governments and private awareness organizations, the total budget allocated programs to increase awareness and execute programs to help rejuvenate the earth. The government passes a budget that would allot 1 billion dollars to the western provinces of China, the area considered most impoverished, to reform land degradation and improve water quality.

Aside from land degradation and water scarcity in China, the other major problem in the country is adapting to and preventing climate change. Since China is considered an industrializing nation, the country has a duty to modernize. However, this industrialization often comes with a price: the emission of carbon gases, including carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, hydrofluorocarbons and perfluorocarbons. These contribute to global warming and other changes in climate. Furthermore, as the climate warms within China and around the world, sea levels change, which attributes to salinization. Salinization is the process of accumulating excess salt in the soil. As soil salinity increases, the salt, in excess, leads to land and vegetation degradation. Obviously, as the climate changes within the country, the necessary circumstances for farming change, ultimately altering the farmers' output.

The trends for land degradation are worsening; thus, the land in general is becoming less arable, the crop yields are falling, and the income of the average farmer is decreasing. The average expansion of degraded lands in arid or semiarid regions in the 1980's was 1800 square kilometers. In the mid 1990's, that figure grew to 2460 square kilometers, and once again rose in the late 1990's to an astounding 3436 square kilometers. The average expansion of degraded lands due to wind erosion and salinization in the 1970's was 1500 square kilometers, and that number more than double in twenty years, where it became 3500 square kilometers. With more land deteriorating and less crops produced each year, the situation will only get worse if nothing gets done.

Not only are rural farmers losing money at the expense of land degradation; the government is increasing the amount of money allocated to slowing, and ultimately ending, this grim situation. An estimated 7.7 billion dollars are directly funded by the government and private organizations, and the indirect costs of land degradation are estimated to be about 30 billion dollars. From 1976 to 1989 the total grain output decrease by 6 million tons, which is approximately 700 million dollars of loss. The total nutrient loss was about a five percent reduction per year, directly attributed to the loss of land due to resource and land degradation. Also, national soil erosion was valued at a loss of four to six percent of the value of the annual agricultural products.

Resolving the issue of land degradation would increase the already bustling overall economy of the nation of China. It would increase the number of crops produced, which could help feed millions more people in China and around the world. Furthermore, it would increase the preservation of the environment as well by restoring the lands.

If the farmers of the rural area continue using the agricultural methods that the majority of the population employs, increasing agricultural productivity would actually have inverse effects on the land. This over-farming and these dangerous farming techniques would only catalyze the situation. However, if new techniques are utilized, and the farmers become thoroughly educated in efficient farming practices, conditions for farming in rural China will gradually improve. However, if the farming methods are not changed, the overall yields will worsen, more crops will be lost, and less area will be available for agriculture. If the next techniques are employed, crop yields will rise, and food security will undoubtedly increase.

The basic and most promising idea to increase the overall yield, the incomes, and the food security of the nation is to increase farmers' awareness and give them material, as well as instructional, means to improve their land and change their everyday farming routines. Several methods already exist, and if these were introduced or required by farmers, productivity could increase. For example, planting shrubs and cistanche temporary fencing would decrease the amount of wind erosion that occurs in rural areas. Using wind and solar energy would decrease the need for deforestation and other means of energy. Although a large amount of money is needed for building, it would increase profits in the long run because it would cause them to not rely on crop fields or product for energy. Canal lining would allow a better water source to get to the area and would allow the majority of farmers to not have to concentrate on water and irrigation so closely. Furthermore, it would decrease run off fertilizer from running back into the water system. Sacsoul fencing would be a permanent way to minimize wind and/or water erosion across fields. The standard practice of fertilizer would replace the necessary nutrients into the soil to increase productivity and would renew the soil with each turning season. The practice of rotating crops and livestock would also increase overall yields. Stall feeding for all livestock would make overgrazing obsolete.

Governments and private organizations can implement policy or funds to increase productivity. Better integration of administrative mechanisms through this state of administrative mechanisms would essentially create legislature or something to that degree that will force farmers and local and provincial

leaders to implement the changes. Voluntary means have not worked thus far, and the leaders must intervene and ensure that the farmers are implementing the means to increase incomes and yields, which will only increase productivity. Also governments must delegate the responsibility and place it primarily on provincial and local levels. Though the national government still needs to have a careful eye on the operation, it needs to place most of the pressure upon the local and provincial governments which will indirectly force research to take place and new means will then surface. These means will also be more specialized based on the regional problems and conditions. Also, on-site education gives the farmers more trust in their government by seeing someone there to help them, along with face to face contact to give them the guidance in learning the new methods. The main problem with implementing this legislature is that the farmer will feel oppressed if forced to abide and will not want to take part. However, direct contact could definitely improve trust between the government and the farmers. It will also ensure that the practices are understood by the farmer, and the farmers will implement them into their routines. In the past, farmers have often been mistreated by the Chinese government. The contact and agreements can instill a sense of security that wasn't usually present, making farmers more likely to follow the Chinese government's guidelines. Also, the government needs to be more attentive to pricing in markets and economic infrastructure issues. Farmers need security of pricing to ensure they will be paid the correct amount for their product. They also will need infrastructure such as roads and highways to increase mobility and ease of access to produce markets.

The rural mainland of China is among the most severely and adversely affected areas in the world by natural resource degradation, especially land degradation. China accounts for approximately twenty-two percent of the world's total population; however it only contains seven percent of the total available of the farmland in the world, and only around six percent of the world's water resources. It is not hard to see how China has become as arid, and the land has become so degraded as a whole. The oversight of this problem has caused the problem to come to this level, but it is now up to the Chinese government and the government of the provincial states and local areas to take responsibility in the roles of farmers. The Chinese national government needs to pressure the local and provincial governments to take a strong role, set up an on-site education system to help the farmers create better farming habits and practices, and the national government and provincial government need to work together in regulating the agricultural marketing system. Combining all of these methods and solutions will create the necessary political and economic environment for the farmers to succeed. However, it does not end there. The majority of the problem still lies with the farmers. As mentioned above farmers have several options to invest in, in order to reduce degradation of their lands and to increase their overall yields over time. They can invest in fences to stop overgrazing and wind and water erosion. They can plant different types of plants and shrubs and such to reinstall the necessary nutrients into the soil, and they can invest into a better irrigation and canal system to decrease run off into the water supply and efficiency in watering crops. All of these solutions will create a better run system of agricultural productivity in China. With increased yields and overall productivity China will increase food security in the country and around the world.

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