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### **Sustainable Farming and Land Degradation in China**

China is a land of a bursting population and a booming economy, but a belligerent agricultural system. The agricultural system plays host to a plethora of problems caused by erosion, pollution, and human mismanagement. A few consistent changes would have an incredible impact on solving these problems and improving conditions in China. Agriculture in China has changed greatly over the last century. In 1958, Mao Zedong initiated The Great Sparrow campaign, which organized collectives into communes, banned private food production, required collective eating, and emphasized industrialization over agriculture. This pressure and insufficient management of agriculture ultimately led to The Great Chinese Famine, killing an estimated fourteen to forty-three million people. In 1978, the Four Modernizations campaign began the Family Production Responsibility System, which returned to the family farm system. This commenced the transformation to a market-oriented, family centered economy. Each family was given a crop quota to provide for their family in return for essentials such as tools, draft animals, and seeds. Other than these quotas, the land may be used to meet each family's individual needs. Even though the renovations in agricultural systems have undeniably surpassed the commune system in terms of efficiency, efficacy, and production, China still does not have the means to feed all of its overwhelming population, even though China is a leader in worldwide food output.

"Rural Life in China," an article by Jeffrey Hays, published on the *Facts and Details* website, states that "There are 800 million rural peasants--roughly 600 million farmers and 200 million excess unskilled rural laborers. There are around 1 million villages in China, about one third of the world's total. Each village has an average of 916 people." Rice and cotton are the major crops of rural farmers, with China ranking first in their production. They also grow corn (maize), wheat, vegetables, white potatoes, oats, sweet potatoes, cabbage, tea, bananas, oranges, and pineapples. More often than not, farmers will own chickens or other fowl and pigs. Most farms exist on less than an acre to five acres of land and produce only enough to eat, with little surplus from which to earn a profit. Farmers work their fields by hand with a hoe or with wooden plows pulled by oxen, horses or water buffalo. Mikel Flamm and Windy Xie, authors of "The Strength of Rural Women in China," an article published in the *UN Chronicle*, wrote, ". . . The main economic crop is konjak (mushroom used for medicinal and edible purposes), while the main livestock are pigs, chickens, goats and cows" (22).

"Poverty is common in China's countryside and is a way of life for a large section of the population. But within this poverty is a strength and determination to make ends meet with what is available. Facing numerous challenges, boys and girls as young as six years old work in the fields with their parents, often foregoing education" (Mikel and Xie 21). Few families own a vehicle or any mode of transportation, so many must walk to their crops along steep hillsides. Grandparents will look after their grandchildren while the parents are off at work. Once children are old enough, they assist in the cultivation of crops like potatoes, corn and cabbage. If the family has enough money, and if a school is available, the children are sent to a school in the village. (Mikel and Xie 22). The average annual income in poor families ranges from 1, 800 to 2,500 RMB (the official currency of China), which is about \$225 to \$312 USD. China's one-child policy encourages families to limit the number of children they have. Rural areas are limited to two, and families with more than two are required to pay a fee, though most families have three to four children on average. This policy is harmful to the families' incomes, as the children help tend the fields and gather the harvest (Mikel and Xie 22).

These rural residents typically live in wooden houses with a thatched or tin roof, use outhouses, and cook over open hearths. Public services, such as education, health, and new technologies are usually inadequate. Over 180 million rural peasants are illiterate, and four out of five can not afford to see a doctor (Hays 8). “Traditional houses are made of stones, mud, wood and thatch roofs, and are dark, damp and in poor condition” (Mikel and Xie 22). Often families will live together. Such is the case of Xue Yuanabi, a fifty-year-old female resident of the village Youzhafang. She describes her experience living in poverty: “ ‘We used to live in an old house with a large family that included my mother, three brothers and their wives and several children. There was little privacy and it was very crowded’ ” (Mikel and Xie 22).

A *New York Times* article by Patrick Tyler entitled “Oh He’s a Wily One, that Tibetan Medicine Man” stated, “Market day is magic for millions of Chinese peasants who see civilization only three or four times a month when they pack their bundles and their hopes and head for town. They stream out of the mountains on bike or on foot or in a packed horse carts, cheerfully suffering the burdens of their rice bags, pork shanks or spinach heaps. They travel for hours along bumpy roads, some just hoping to make a successful purchase of a needed farm tool, a well-woven basket or a hand-fitted wooden water pail to balance on a shoulder pole.” The markets are vital to rural farmers as a way to sell their product and purchase necessary tools and other goods.

Women comprise 48.5 percent of China’s population. Traditionally, especially before 1949, when the Chinese Communist Party took power, women would be found working at home, raising children and managing the household. Confucian teachings instructed women to have few abilities and to be obedient and subservient to men. This was enforced with practices like foot binding, polygamy, and patrilineal wealth distribution, and didn’t change until the turn of the century, when women began to demand their own role in society. “Women’s Employment Rights in China: Creating Harmony for Women in the Workforce,” an article by Jamie Burnett, published in *Indiana Journal of Global Legal Studies*, expressed, “For over sixty years, Chinese women have enjoyed legal equality. Article 91 of the 1954 Constitution of the People’s Republic of China (China or PRC) specifically gave women ‘equal rights with men in all areas of political, economical, cultural, social, and domestic life’ ” (289). Since then, some women have become successful entrepreneurs and businesswomen. However, labor inequality is still a serious issue. “. . . Women make up approximately forty-five percent of the country’s workforce, but on average the salary of a working Chinese woman is seventy-four percent less than that of a man’s wage” (Burnett 291).

Before the 1950’s, women in agriculture were always behind the scenes while men made business decisions and worked the fields. The land reform in the 1950’s changed women’s roles in agriculture. Women were expected to care for the family and become wage earners by getting involved in agricultural production. Rural women took part in collective labor and various other jobs that were reserved solely for men, thus broadening their potential. By becoming wage earners, women increased the families’ income, providing more money for modern-day needs. Household chores are also distributed more equally in the family. Another remarkable change was occurring in many rural farm families: the feminization of agriculture. The feminization of agriculture means that men from rural families were flocking to the cities to make money, leaving the women at home to tend the fields and the household. This practice allowed families to live more comfortably by raising their income (Zuo 510-511).

Money is a factor in every decision families make, simply as a necessity of survival. Undernourishment affects 1.02 billion people, one out of six doesn’t get enough food to be healthy, and a child dies every six seconds from hunger-related causes. Hunger is viewed by many people as the main threat, but the real damage comes from many other hunger-related issues, such as malnutrition. Malnutrition and micronutrient deficiencies make people susceptible to many diseases, increase the possibility of a premature death, reduce labor productivity, and impair development, both mentally and physically. These

threats cause more death each year than AIDS, malaria and tuberculosis combined. Hunger can only be controlled and reduced by implementing sustainable farming practices to increase both production and conservation.

One problem affecting arable land is overpopulation. The population of the world is about 6.7 billion. China is a land of about 1.3 billion people, or 22 percent of the world's population (Berry 3). However, China has only 6.4 percent of the world's land mass, 9,569,901 square kilometers of land and 27,060 cubic kilometers of water (Berry 3). Only 2,829.6 cubic kilometers of that is renewable water, and only 14.86 percent is arable land that can be used for agriculture (Berry 2). China's land mass is 28 percent grassland, 24 percent woodland and forest, and 48 percent unproductive, urban, or industrial areas (Berry 3). China's land is being degraded by desertification, overgrazing, wind and water erosion, industrial pollution, salinization and deforestation. These problems make it nearly impossible to have an independent means of sustenance for their people.

Conserving the topsoil by implementing sustainable farming practices will benefit agriculture. A massive 100 billion tons of topsoil around the world is lost each year, at a rate five times the speed nature can replenish it. China alone has lost about 6.6% of its arable land in the last decade! In a vicious cycle, China's rapid growth stimulates the need for a higher production of food, which requires more arable land. Farmers will cut down trees and plant on steep hills to construct this land, causing soil erosion during heavy winds or rain. The industrious big cities are ever growing because of the booming economy, and are causing intense air pollution and are building on precious farmland. Challenging expansion of urban sprawl and erosion depleting the soil are two ways China loses its soil. Farmers need to be educated in good agricultural practices in order to preserve what cultivatable land China has left.

China is affected by intensive, extensive, and economically impacting land degradation. Annual soil loss in China is about five billion tons. Ninety percent of grassland suffers overgrazing as the demand for meat and other livestock increases. Deforestation of steep slopes, intensive use of grasslands, neglect of community conservation practices, and use of biomass for energy in rural areas are all direct causes of land degradation (Berry 4). Assessments made of the cost and other impacts of land degradation dictate that the total direct costs were estimated at \$7.7 billion in 1999, and indirect costs were \$31 billion (Berry 7). Direct costs included water erosion at \$4.8 billion, wind erosion and sand storms at \$.59 billion, and salinization at \$2.24 billion (Berry 7). Reduced grain yield due to nutrient loss was estimated at 5% per annum through the years 1976 to 1989 (Berry 7). This is equivalent to 6 million tons of grain valued at \$700 million, and that represents 30% of the grain imports for those years (Berry 7).

Land degradation results from a mixture of several environmental factors and inappropriate management by humans. In the southern part of China, intense rain and typhoons impact steep slopes. During springtime in the northern part of China, strong winds erode dry loose loess soils and degraded grasslands. Relief from the mountains adjoins alluvial plains and floods the overflowing rivers full of sediment (Berry 8). Direct human activities, such as deforestation of hill slopes, inappropriate cultivation of steep slopes, overly intensive use of grasslands for livestock production, grain production in land areas without soil conservation, poor management of ground water resources, improper management of soil and water on irrigated lands, loss of agricultural land through urban and industrial expansion, and use of biomass for rural energy needs are all major factors impacting the effect on the soil (Berry 2, 8-9).

China has such distinctly diverse landscapes that the government has divided the country into seven regions. The areas impacted the greatest by land degradation are the Loess Plateau and the extensive Western Region, the more arid part of the nation. Moderate to severe land degradation affects almost half the area, a region of 350 to 400 million people with 27 percent of the area experiencing wind erosion, 16 percent water erosion, and 10 percent advanced desertification (Berry 14-20).

The Loess Plateau, in the Northern Central Region, has deep gullies and up to 200 meters of fine sediment. 80 percent of the total area in the Loess Plateau is affected by soil erosion. The Loess Plateau is a rural region with low population densities and mostly small farms. The rivers yield a high amount of sediment, as the soil loss rate can be 50 to 100 tons per ha per year. The surface soil has been completely eroded in certain parts of the Loess Plateau, resulting in areas of skeletal and immature soils. Two natural occurrences, flooding and drought, are increased by the lack of proper farming techniques (Berry 4). Landslides and mud flows cause a great deal of soil loss through mass wasting. These factors combine to make the Loess Plateau one of the poorest regions of the country, populated areas are far apart, the local markets are poorly organized, and the economic, institutional, and social structures are especially weak. (Berry 3-4).

In the Northeast China Region, the safety of the soil productivity is very important, as it is the largest corn base in China. The top layer of the major soil type, black soil, or phaeozem, is fertile but easily eroded. This region is victim to excessive erosion in areas with high potential for grain production loss if not well managed. The Red Soil Region, located in the southern area of China, is vulnerable to water erosion and is mostly infertile. This region has the best vegetative cover; however, the intense precipitation causes severe water erosion. This area also has a better potential for restoring and conserving the soil (Berry 15-16).

The mountain regions, taking up 66 percent of China, are only agriculturally productive in the valleys and grassland areas in the northwestern part of China. In the Northern Mountain Range, crops are planted and harvested two or three times a year. This is a region in which crop rotation would be particularly beneficial. In the South West Mountain Region the soil is thin, and little soil resides on the steep slopes. Contour plowing and terracing would help in this region. Soil erodes quickly, and even the smallest amount of erosion is a major problem. Rockification has been a major problem in this area, with 50,000 square kilometers in the last 20 years, expanding 1800 square kilometers each year (Berry 18). For example, about 91,300 hectares (ha) changes to bare mountains and hills each year in the Guizhou province (Berry 18). The North West Region has a fragile environment, being dry, windy, and remote. The extensive plans laid out by the Chinese Government are being carefully set forth, to prevent any developments that are unsustainable by the environment. The Tibetan Plateau is a high, cold region with low crop production potential. The alluvial plains and river valleys are agriculturally productive, but are affected by overgrazing, destruction of grasslands, and improper use of hills and marginal land (Berry 16-20).

According to Shi Peijun, et al., authors of "Wind Erosion Research in China: Past, Present and Future" as published in *Progress in Physical Geography*, "Wind erosion is one of the most important processes associated with land degradation and desertification in the arid, semi-arid and portions of the subhumid regions of China. The total land area experiencing wind erosion is approximately 160.74 104 square kilometers, which is 16.7% of the national territory" (366). Wind erosion is a serious problem, especially in arid, semi-arid, and dry areas. Wind erosion causes accelerated soil damage and is harmful to crops, especially young seedlings. Increased farming and maintenance to battle wind erosion can be very expensive and destructive to the already sensitive soil (Shi Peijun, et al. 367).

Extreme dust storms illustrate the damaging effects of wind erosion. Storms in Beijing increased 0.5 a year in the 1950's to 2.3 per year in the 1990's. Sand and dust was deposited in the capital in March 2002, at times measuring up to 56,000 tons. Chemical fertilizers have doubled in use, but the application of organic matter has decreased by 70 percent. Crops residues are also more likely to be used for fuel, so an increase in fertilizer is necessary. These factors increase the salinity of the soil, with an amount of 7-8 million ha, or 8 percent, of China moderately to severely affected by salinity (Berry 5).

Water quantity and availability is also a huge issue when it comes to sustainable land practices.

According to Chen Liding, et al., authors of "Soil and Water Conservation on the Loess Plateau in China: Review and Perspective" as published in *Progress in Physical Geography*:

. . . The Xingzihe watershed in the Loess Plateau in the early 1980s told us that soil and water loss from sloping croplands contributed approximately 60% of the watershed total. About 8000–10 000 t km<sup>-2</sup> of soil was lost from the cultivated areas. Meanwhile, overgrazing and other human activities, such as mining, urban expansion and infrastructure construction, also caused considerable soil erosion and land degradation” (396).

High evaporation and limited rainfall can lead to low soil moisture. Soil moisture affects soil workability, and vegetation growth and development. Summer storms have a vast effect on the soils, exerting high pressure that increases soil and water loss. In order to restrict evaporation, methods like surface mulching with straw or polythene are effective. However, the soil pollution from these methods could impede other conservation efforts (*Liding et al. 397*). “Mass movement on steep slopes was proved to be the major source of soil erosion and land degradation. It may account for up to 50% of total soil loss in the Loess Plateau” (*Liding et al. 397*).

The greatest impact of land degradation is felt in the poorest areas. There is a strong positive correlation between poverty and ecologically sensitive environments. Degraded areas produce less income which results in poverty. Poor and degraded areas are usually effected by extreme health deficiencies. Malnutrition, disease resulting from poor water quality and respiratory diseases from dust and other contaminants are all effects of living in these areas. Over 13 billion dollars have been invested the last ten years in the Western Provinces. Over 30 million people in this region are affected by absolute poverty. China’s definition of absolute poverty is \$0.75 million a day in 2001 values. The world bank’s definition of absolute poverty is \$1 a day, which would increase the total to 100 million (Berry 8).

In the Yangtse Valley, the conservation measures were very effective. Efforts to increase conservation methods were put into action, making markets available and expecting increased benefits. The government should invest in conservation and development projects like the Heilongjiang Land Reclamation Project, Jiangxi Agricultural Development Project, Sustainable Forestry Development Project, and the Yellow River Flood Management Sector funded by the World Bank and the Asian Development bank, to increase conservation and crop yields (Berry 9).

In order to preserve China’s rapidly reducing cultivatable land, farmers and governments must join together to take action and reduce the destruction of the land and even reverse their effects. Years and years of poor farming conditions and practices have stripped the soil of its nutrients and left it barren and infertile. In order to reverse this effect and replenish the soil, new types of farming must be implemented. The farmers don’t have the time or money to change the effect they have on the soil, so the government must step in. National governments and private organizations would reduce land degradation by funding projects to teach rural farmers more efficient, less destructive agricultural practices.

Resolutions for land degradation must see and focus on root and proximate causes. Some root causes are decreasing land resources per capita, resulting in growing intensity of use and degradation, poverty in the most vulnerable ecological zones (90% of poor live in areas of moderate - severe land degradation), and increasing urban demand, as living standards, especially in urban areas, rise rapidly, demanding meat and livestock products and encouraging overuse of grasslands. Other root causes are changes in farming and land use systems from traditional to intensive modern with the growing use of chemical fertilization inadequate regulatory environment for dealing with land degradation, poor financial incentives for conservation, and under pricing or regressive pricing for natural products especially for irrigation water and land rents (Berry 8-9, 12). Some economic benefits of alternative land use are reduced sediment yield, community participation in land degradation responses, reduction in dust storms and improvement

in the patterns of water flow (Berry 12). With increased yields and overall productivity, China will increase food security in the country and around the world.

In order to restore the degraded land and prevent more damage, proper farming methods must be implemented and managed. Afforestation, especially planting dense rows of trees, will help reduce wind and water erosion, as well as fight desertification. Two methods to fight sediment loss in fields are contour plowing and terracing. Contour plowing can increase crop yields by up to 50 percent, and both contour plowing and terracing slow down rapid run-off and allow water and sediment to seep into the soil. Stall feeding and fences would control ground lost due to overgrazing, a major issue in several regions. Planting certain shrubs and grasslands will reduce sediment loss and fight desertification by replenishing nutrients. Crop rotation would also decrease the nutrient loss in the soil by planting separate crops that keep the proper balance of nutrients in the soil. For example, rice followed by cotton rather than rice followed by rice would help keep nutrients rich and in continuous production. Farmers could also plant legumes, such as beans or peas, to increase nitrogen levels in the soil and reduce the need for fertilizer.

With these simple steps, overall yields, incomes, and food security will all increase. The first step, however, is to get these options to the farmers. They need affordable materials and instructional advice on how these methods will affect their land. On site education will help the farmers learn better, and may increase their trust and belief in their government. A great deal of money would be required from the government and world organizations, but the long term effects would be worth it. Building canal linings would allow easier irrigation for farmers and better water. Utilizing wind and solar energy would decrease the need for deforestation and using crops and other products for energy. Building infrastructure such as roads and highways would increase mobility and allow better access to markets. The loss of land and increase in degradation in China has reached enormous levels. Farmers and government must band together to rejuvenate the soil and reduce any further damage. Farmers need to implement long lasting and positive farming practices, and their government needs to teach them how and provide security and materials. If the farming habits mentioned above are successfully applied, food security will be better not only in China, but around the world.

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