

# What Makes A Difference in Ecological Restoration in China and A Related Case Study of Sloping Land Conversion Program

FRST 497 – Graduation Essay

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## Abstract

For many years, China has devoted to restoring ecosystem to meet human demands. According to the Society for Ecological Restoration (SER), ecological restoration (ER) is defined as “the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed” (SER, 2004). It is a young field integrating theory and knowledge from various disciplines, including the biological, physical, and social sciences as well as the humanities (Howell *et al.*, 2012). Triggered by increasingly severe problems of soil erosion, land degradation, flooding, dust storms, habitat loss, and etc., the Chinese government has been undertaking several unprecedented ecological restoration programs (ERPs). This essay is to analyze what makes a difference to ER in China. I will discuss in three aspects: Chinese concepts of man and nature, population, and economic development. In the end, I will also take a look at the resulting ER situations in China. This section includes a brief discussion of current China ERPs and an assessment of Sloping Land Conversion Program (SLCP), which is one of the most famous ERPs in China.

**Key words:** ecological restoration, China, concepts of man and nature, population, economic development, ecological restoration program, Sloping Land Conversion Program

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## List of Abbreviation

DCBT	Desertification Combating Program around Beijing and Tianjing
EF	Ecological Footprint
ER	Ecological Restoration
ERPs	Ecological Restoration Programs
LULCC	Land Use and Land Cover Change
MEA	Millennium Ecosystem Assessment
NFPP	Natural Forest Protection Program
NPP	Net Primary Productivity
PES	Payments-for-environmental-services
SER	Society for Ecological Restoration
SFA	State Forestry Administration
SLCP	Sloping Land Conversion Program
WWF	World Wide Fund for Nature

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## 1. Introduction

### 1.1 Ecological Restoration

Many of the world's ecosystems have experienced significant degradation of biological diversity and human being living conditions (Gann & Lamb, n.d.). They have been put under intense pressure by land degradation and loss of biodiversity. Furthermore, their capacity to provide vital services is declining while at the same time the demand for these services is growing (Butchart *et al.*, 2010; Millennium Ecosystem Assessment [MEA], 2005). Because of this, ER is identified as one of the key activities that can reverse this trend (MEA).

ER is the process of repairing damage caused by humans to the diversity and dynamics of indigenous ecosystems (Jackson *et al.*, 1995). As environmental problems are threatening the nature as well as human beings, such as desertification and global warming, there is a growing realization of restoring the ecology (Gann & Lamb).

### 1.2 Environment in China

China has undergone rapid economic development since the 1978 reforms, which resulted in most Chinese having raised their living standards. With a growing population of 1.3 billion, over 20 years' income growth averaging nine per cent per annum, and historic exploitation, a large portion of China's primary forests and wetland was exhausted, and a high percentage of its farmland and grassland was degraded (World Wide Fund for Nature [WWF], 2003; Yin *et al.*, 2005). Moreover, many cities and rivers of China are among the most polluted in the world (MacBean, 2007). Zerkel (2013) concluded that the Jian River in China is the second polluted river in the world. And the Yangtze Rive is listed as No. 7. Figure 1 and 2 shows the extensive pollution in these two rivers. And not only that, according to the

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Environmental Performance Index released by Yale University and Columbia University at the World Economic Forum in 2010, China ranked 121 out of 163 countries on the list (Zhou, 2013).



**Figure 1 Red polluted water flowing from a sewer into the Jian River in Luoyang, north China's Henan province.**

*Source* STR. (2013). *Red polluted water flowing from a sewer into the Jian River in Luoyang, north China's Henan province.* [Figure], Retrieved April 12, 2014 from

<http://www.weather.com/news/science/environment/worlds-most-polluted-rivers-20130627?pageno=3>





**Figure 2 Polluted water on the Yangtze River is shown in Chongqing Municipality, China.**

Source China Photos. (2013). *Polluted water on the Yangtze River is shown in Chongqing Municipality, China*. [Figure], Retrieved April 12, 2014 from

<http://www.weather.com/news/science/environment/worlds-most-polluted-rivers-20130627?pageno=3>

The environmental problems in China are generally thought to rise from economic development and the population condition. It is well known that there are close relationships between economic growth and environment quality (Grossman & Krueger, 1991). Together with economic growth often comes urbanization. This particular process will put pressure on environment. For example, there is a case study of urbanization and environment in Shanghai shows that most pollutants had an increasing tendency from rural to urban. Another study in Switzerland also showed the air quality were worst in urban areas, while suburban areas had intermediate levels of air pollution and rural areas had the lowest levels (Monn *et al.*, 1999); huge and growing population is considered as another pressure on environment because population growth is likely to result in agricultural expansion to unexplored area. Generally, these two challenges predominantly lead to current environmental condition in China. Since that, these challenges should be considered when restoring the ecology.

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### 1.3 Ecological Restoration in China

China has been undergoing a degradation of ecosystems with its huge population and developing economy. The economic reform in 1978 spurred land use and land cover change (LULCC) in China and resulted in many ecological problems. These ecosystem degradations involve extensive desertification, flooding, soil erosion, dust storms, elevated levels of greenhouse gas emissions, and severe damage to wildlife habitat (Liu & Diamond, 2005; Xu *et al.*, 2006). To deal with this series of environmental problems, China has been undertaking several major ERPs, such as the SLCP, the Natural Forest Protection Program (NFPP), and the Desertification Combating Program around Beijing and Tianjing (DCBT) (Yin, 2010). Nevertheless, since 1978, for instance, Chinese government has launched a number of afforestation projects (Xu *et al.*). However, Some of these ecological restoration programs have delivered desired results while the others have not.

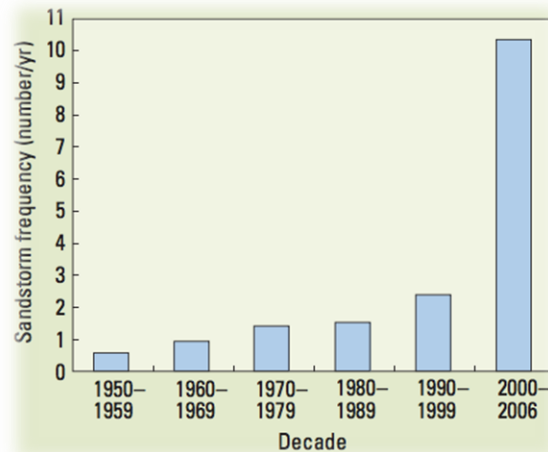
There is a successful ecological restoration example in Xinjiang, China. A study estimated the impacts of the LULCC driven by ecological restoration programs in Xinjiang from 2001 to 2009. It used net primary productivity (NPP) as an important indicator of the arid and semi-arid ecosystem's productivity. According to the records, total NPP of whole area increased by 252.51 Gg C during the study period. The results demonstrated that the forest area of Xinjiang had the most net increase of 9093 km<sup>2</sup> in the study period, compared to other land cover types. In addition, there is a dominant land cover changes from grassland to forest and mutual transformation between grassland and desert. It can be concluded that ecological restoration programs produced positive impacts on forest expansion and carbon sequestration in Xinjiang (Yang *et al.*, 2014).

But yet, not all restoration programs in China are successful. To take forestry projects as an example, the failure often entangles with poorly prepared sites, improperly planted seeds and/or seedlings, and badly tended saplings. Therefore,

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these forestry projects have failed to deliver the prospective environmental benefits. Similar problems have impeded the efforts to curb farming on slopes (Xu & Cao, 2001). The Great Green Wall in China is an example that failed to restore the ecosystem. In order to release the impact of sandstorm, the Government planted millions of trees across Inner Mongolia and Hebei province, to the north of Beijing. Officials hailed this "green wall" with much fanfare as a "storm prevention forest". Nevertheless, the wind proved so strong that the trees have been unable to grow tall enough to absorb the sand (The Times, 2005).

One of the most serious problems caused by improper ecological restoration is land degradation. Specially, afforestation projects in China are often promoted improperly, which leads to the degradation. Cao (2008) indicated that afforestation projects in China actually increased "environmental degradation in arid and semiarid regions, with ecosystems deteriorating and wind erosion increasing." He thinks that the plantation in these regions lead to negative impacts o soil moisture, hydrology, and vegetation coverage. He mentioned the Three Norths Shelter Forest System Project, an ambitious conservation program in China that aims to prevent desertification by carrying out large-scale afforestation in arid and semiarid areas (Li, 2004), in his paper as an example to show that large-scale afforestation in China has led to land degradation. According to him, the Three Norths failed to solve the desertification. Instead, Yang *et al.* (2005) suggested that the area of degraded land has continued to expand and the desertification problem has become severer throughout the country because of this project. From 1950 to 1975, deserts in China have expanded to cover an additional 1560 km<sup>2</sup> of land every year. The number increases to 2100 between 1976 and 1988, and even become higher at 3600 after 1988 (Zha & Gao, 1997; Shi *et al.*, 2007; Kooten *et al.*, 2004). With the severity of desertification intensifying, the frequency of sandstorm increased as well. Figure 3 below shows an extremely fast increase in sandstorm frequency from 1990 to 2006. And Cao concluded this phenomenon as a result of ignoring natural ecosystem characteristics.



**Figure 3 Sandstorm frequency in China since 1950**

Source

Cao. (2008). *Sandstorm frequency in China since 1950*. [Figure], Retrieved April 13, 2014 from <http://pubs.acs.org.ezproxy.library.ubc.ca/doi/pdf/10.1021/es0870597>

## 2. Three Factors Influencing Ecological Restoration in China

In this section, I will introduce three factors that may make a difference to ecological restoration in China. They are also the considerations when restoring the ecology. According to the existing environmental and ecological restoration conditions in China mentioned above, these three factors are: views towards nature, population, and economic development. The relationship between these elements and ecological restoration, as well as how they influence restoration ecology in China, will be discussed in the following part.

Chinese view towards nature is based on the traditional philosophy built in ancient times. Two fundamental philosophies, Taoism and Confucianism, have similar concepts of relationship between man and nature. Having been suffering from Mao's belief of "man must conquer the nature" (Shapiro, 2001), Chinese people are aware of the core Confucians value that the world is a precious heritage passed on to us from our ancestors. In modern China, the government is seeking to reverse current

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environmental crises with the idea of “tianren heyi”, which is put forward by Confucians and Taoists.

Population has been worsening the environment for decades. The environmental crises that China is facing partly owe to its population issues. It can be concluded from either carbon emissions or the Ecological Footprint. For both aspects, even though China maintains at relatively low level for per capita, the country is always at the top level for total when multiplying with population.

China, as a developing country, puts economic development as a top priority. This makes difficulty when China’s government restoring the ecology, as it is hard to achieve balance between economic and environmental values. To improve its economic strength, China has to accelerate industrialization and urbanization, while these two processes usually impede ERPs.

## **2.1 Chinese concepts of “man and nature” and Ecological Restoration**

### **2.1.1 Formation of views towards nature**

Xia (1985) claims that Chinese culture originates from Yellow River basin and Yangtze River basin. The footprint of ancient Chinese people was first found in the Yangtze river plain and Yellow River plain since long time ago, where is suitable for farming as the land is fertile and the climate is clement. This comfortable life made Chinese people form a national personality of farming, which means following the law of nature and obeying it. It is important to note this personality because it is where the idea of worshipping nature developed. Since ancient times, Chinese people have been used to praying for peace and happiness. Even when they encounter natural disasters, praying is the first thing they would do instead of struggling for survival. Once the disaster passes, people thought it is merely because of the prayers. It is still common to see this Han-nationality’s folk faith in our

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modern life. There are many travels to Chinese cities, for instance, include temple-visit. It is a habit for Chinese to visit local temple during the first traveling to a place. Another habit embodies the faith as well. People will worship the gods and their ancestors in the Spring Festival, which is the most important festival in China (Luo, 2005). The respect to gods to Chinese people is the respect to nature. According to Lin (2007), people made up many legends about sun, moon, wind, rain, thunder, lightening, and etc. and named them with gods' names. These legends were worshipped and handed down to generations.

### **2.1.2 Chinese philosophy of relationship between man and nature**

Not only Chinese civilization creates an affiliation between man and nature, Chinese philosophy also have similar and more detailed description of the relationship. Both Confucianism and Taoism, two essential thoughts in China, share the thought of “Tianren heyi”, which means that man is an integral part of nature. The book of *Yijing* (the book of changes), regarded as the prime scripture by Confucians, has a similar state of this idea. It judges that the world is consisted of the law of heaven, the law of earth and the law of man. The man can and must “integrate the nature of both heaven and earth” (Ju, 2008). This idea influence China in many aspects, including environment, economic development, policy, and etc.. Dr. Ji Xian Lin, one of the most famous linguists and philosophers in China, used to talk about “tianren heyi”. According to Ji (1996), “tianren heyi” is a common and basic expression of classical Chinese philosophy. It needs to be paid much attention to and carried forward because “tianren heyi” will have an impact on human development. Taoism stated in a representative literature *Chuang Tzu·Qiwulun* that “the heaven and the earth have intercrescence with human and the entire nature integrates with me”, which indicates the same idea with “tianren heyi” (Deng, 2010).

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### **2.1.3 A rise of Confucianism in Ecological Restoration**

Regarding ecological crises, Confucianism plays an important role. Thomas Berry, recognized as a pre-eminent pioneer in a cosmological approach to spirituality and morality, is described by Heffern (2009) as “one the 20th-century’s most probing thinkers on the human relationship with the natural world and its implication for religion.” His continuous effort to overcome ecological degradation while trying to establish a foundation for a viable future through the development of a functional cosmology has been given considerable attention. As noted by Tucker (2006), Confucianism played a central role in the formation of Berry’s thought and had the greatest influence on his work of all the Asian religious traditions.

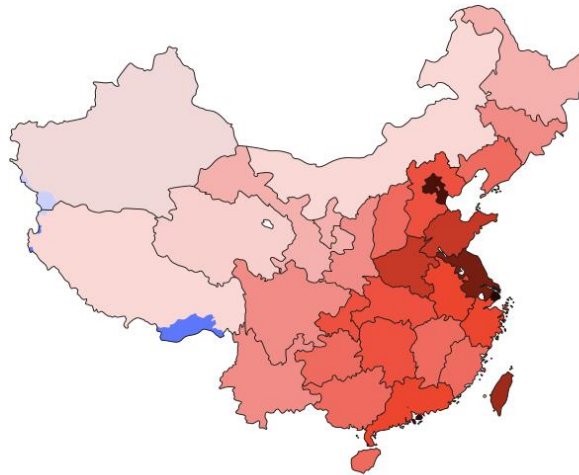
Nevertheless, Dr. Daniel Bell, a professor of philosophy at Tsinghua University, has written that Confucianism is on the rise in China (Bell & Ham, 2003). According to Bell in the conversation with Oliva Boyd (2012), many intellectuals and NGOs are promoting Confucianism in different forms. One of the key Confucian values is social harmony, which means three things, peace, diversity and promoting harmonious relations. The harmonious relations include relations between the family members, relations in society within a country, relations between countries, as well as relations between humans and the environment.

Therefore, ecological restoration in China is closely connected with Confucianism. One of the core values of Confucianism is people-orientation, which means that people should be considered first. This idea not only embodies Chinese ancient civilization, but also appeals to current China’s conditions. The development concept advocated by the Communist Party, the governing party of the People’s Republic of China, is a people-oriented development. The Party holds that serving people’s fundamental interests is a top priority (Chen, 2007).

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## 2.2 Population and Ecological Restoration

Induced by fast increasing population, China faces great stresses on its resources and environment. According to China Daily (2013), strong winds dispersed Beijing's lingering haze, but ushered in dust storms and a sharp temperature drop on March 9, 2013, which is the second bout of dusty weather to hit Beijing that year. The wind and dusty weather changed the capital's major air pollutant component from PM2.5, airborne particles measuring less than 2.5 micrometers in diameter, to PM10. In addition, the haze mostly concentrated in the east of China, where the population density is the highest (see Figure 4). Even though the Ministry of Environmental Protection blamed unfavorable weather patterns, vehicle exhaust and coal burning for winter heating for the problems, it is difficult to say that population has nothing to do with the problem.



**Figure 4 China's population distribution map.**

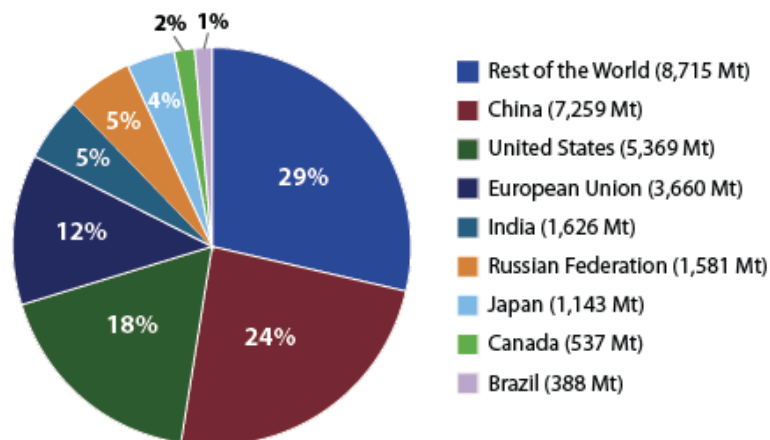
Source National Bureau of Statistics. (2010) *China's population distribution map*. [Figure], Retrieved March 20, 2014 from [http://en.wikipedia.org/wiki/Demographics\\_of\\_China](http://en.wikipedia.org/wiki/Demographics_of_China)

As a country where 1.3 billion people are squeezed into an area of about 9.6 million km<sup>2</sup>, China presents a paradigmatic test case for environmental sustainability in the



21st Century. Although China's "one-child" policy has largely succeeded, the large population base determines that China still has a long way to environmental sustainability. By 1993, China ranked third in carbon dioxide emission, just behind the US and the former Soviet Union (Boffey, 1993). Until 2010, China has been the country that contributes the most fossil fuel carbon in the world (Environmental Indicators, 2013). However, regarding CO<sub>2</sub> emissions per capita, China is not the number one. It can be illustrated from the comparison between Figure 5 and 6 below that China's large carbon emission owes partly to its huge population base.

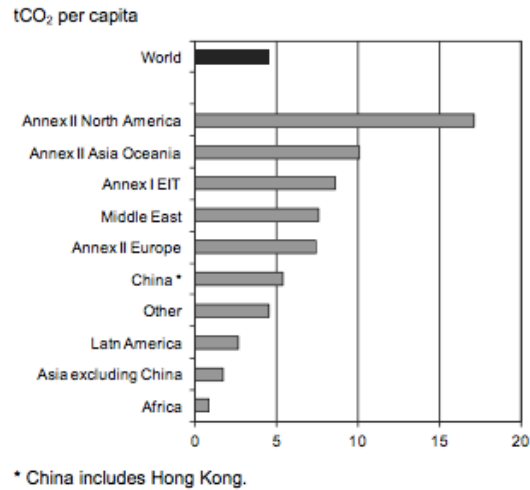
Another measurement of environmental impact is the Ecological Footprint (EF), which estimates the amount of biologically productive land used per capita. It tracks humanity's demand on the biosphere by comparing human consumption with the Earth's regenerative capacity, or bio-capacity. All human activities use biologically productive land, the sum of which is the EF (China Ecological Footprint Report 2012, 2012). Figure 7 explicitly illustrates EF components.



**Figure 5 Distribution of world carbon dioxide emissions from fuel combustion, 2010**

Source Environment Canada (2013) *Distribution of world carbon dioxide emissions from fuel combustion, 2010*. [Figure], Retrieved March 20, 2014 from

<https://www.ec.gc.ca/indicateurs-indicators/default.asp?lang=en&n=54C061B5-1>

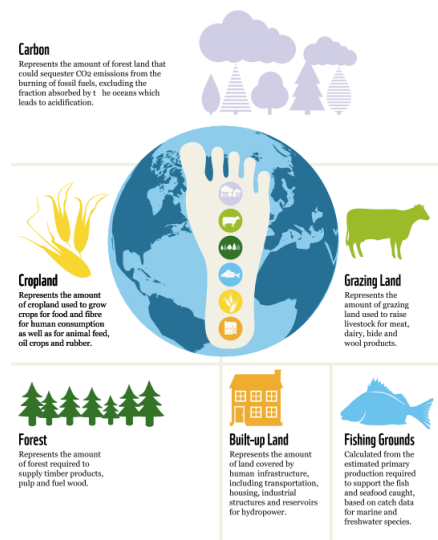


**Figure 6 CO<sub>2</sub> emissions per capita by major world regions in 2010**

Source International Energy Agency (IEA). (2010). *CO<sub>2</sub> emissions per capita by major world regions in 2010*.

[Figure], Retrieved March 20, 2014 from

[http://www.oecd-ilibrary.org.ezproxy.library.ubc.ca/energy/co2-emissions-from-fuel-combustion-2010\\_9789264096134-en](http://www.oecd-ilibrary.org.ezproxy.library.ubc.ca/energy/co2-emissions-from-fuel-combustion-2010_9789264096134-en)



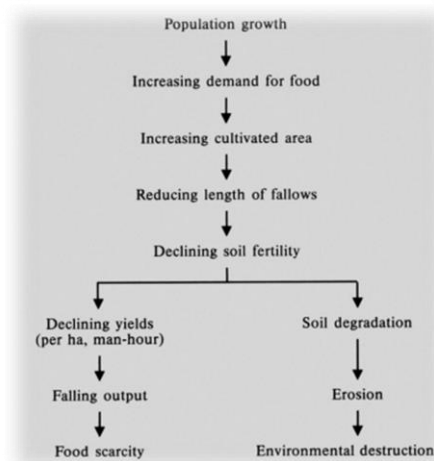
**Figure 7 Components of the Ecological Footprint**

Source China Ecological Footprint Report 2012. (2012). *Components of the Ecological Footprint*. [Figure],

Retrieved March 20, 2014 from [http://www.footprintnetwork.org/images/article\\_uploads](http://www.footprintnetwork.org/images/article_uploads)

China's EF suffers from huge population as well. According to the China Ecological Footprint Report 2012, in 2008, China's EF per person was 2.1 gha, which is lower than the global average of 2.7 gha. Although China's per capita EF of 2.1 gha is just 80% of the global average, China's total EF is the largest (2.9 billion gha) in the world. And the total EF is a factor of China's total population and per capita footprint.

Additionally, according to Camp (1992), "as population pressures mount, the degradation of arable lands in wide areas of Africa, Asia and Latin America increases." Regarding the linkages between population growth and environmental degradation, Mortimore (1993) summarized a cause and effect diagram according to Malthusian view. From Figure 8, it can be clearly stated that population growth will eventually lead to soil degradation by increasing cultivated area.



**Figure 8 Linkages between population growth and environmental degradation according to a Malthusian view.**

Source Mortimore. (1993). *Linkages between population growth and environmental degradation according to a Malthusian view*. [Figure], Retrieved April 15, 2014 from <http://www.jstor.org.ezproxy.library.ubc.ca/stable/41145902>

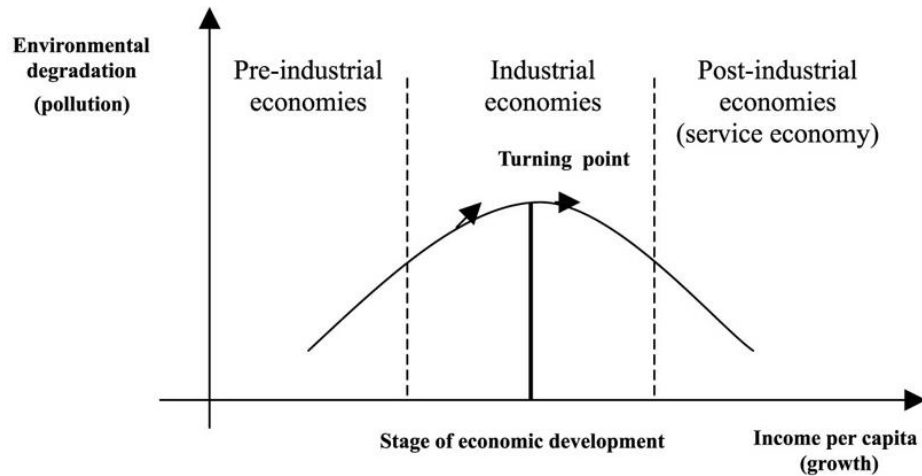
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Overall, China's huge population makes ecological situation more complex. Therefore, the need for ecological restoration will be more urgent than other countries with less population. In addition, population issues make ERPs in China not able to treat nature separately. So the "people-oriented" ecological restoration is not only because of Chinese philosophy, but also population status.

### **2.3 Economic Status and Ecological Restoration**

Another factor that affects ecological restoration in China is its economic development. In fact, the natural environment plays an important role in supporting economic activity. "It contributes directly by providing resources and raw materials such as water, timber and minerals that are required as inputs for the production of goods and services; and indirectly, through services provided by ecosystems including carbon sequestration, water purification, managing flood risks, and nutrient cycling (UK Department for Environment, Food & Rural Affairs, 2011)."

Therefore, natural resources are vital for securing economic growth and development, not just today but also for future generations. However, the relationship between economic growth and the environment is complex and mutual. Figure 9 shows a general relationship between environmental degradation and economic development. As shown in the figure, the industrial economies cause the most environmental degradation. And China is now experiencing an industrial economy.



**Figure 9 The environmental Kuznets curve: a development-environment relationship**

Source Mazur, L.. (2013). *The environmental Kuznets curve: a development-environment relationship*.

[Figure], Retrieved March 20, 2014 from

<http://www.newsecuritybeat.org/2013/01/building-sustainable-cities-warmer-crowded-world/#.UzMpEq1dVnc>

Jiang (1992), the previous president of China, claimed that China's economic development under the "reform and opening-up" strategy since 1978 brought the country into a rapid industrialization and urbanization process. Arora and Vamvakidis (2011) wrote about economic development in China, describing that "the size of the economy has increased nearly 20-fold in US dollar terms over the past 30 years. Real GDP growth has averaged 10 percent annually, with the implication that GDP has doubled every 7–8 years."

With a highlight in economic booming in development plan, China has lots of constrains regarding ER. Although Chinese government has announced several policies to deal with environmental degradations, they are not paid sufficient attention to. Therefore, a number of ERPs serve the economy in fact. For instance, the Three North Sheltbelt, also known as the "Great Green Wall", failed because the program ignored "real natural". During this program, afforestation was misled to

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plant a single-species stand of aspen on grassland because aspen is of great economic value. The government cannot get rid of its aspiration of economic growth even in a restoration program. The result of the afforestation is that numerous aspens died for insect pest (China.com.cn, 2006).

### **3. Primary Ecological Restoration Programs in China**

#### **3.1 Initiation**

In China, primary natural forests are mainly located in the northeast and southwest of the mainland. Most of them are nationalized. According to the China forestry development report 2001 published by the State Forestry Administration (SFA), 136 state-owned forest bureaus were set up to produce timber to stimulate the country's economy. Logging was the main revenue source for many of these regions. And the state enterprises lacked motivation and autonomy to manage resources efficiently (Yin, 1998). In this way, over-cutting became popular, and the regeneration and other types of forest management were ignored (R. Yin & G. Yin, 2010). Moreover, the ecological environment in rural areas was even worse, which partly owes to historical issues. Shapiro suggested that the Great Leap Forward campaign in Mao's era deteriorated the environment heavily. The campaign advocated industrialization untimely, which consumed large amount of wood for steel production and discouraged people from tree-planting and forest management (Yin, 1994). It resulted in a large-scale famine as well. To address the grain shortage, agricultural expansion was then induced throughout the 1960s and 1970s. These malpractices led to a vegetal degradation, including deforestation (R. Yin & G. Yin). In addition, disasters such as the dry-up of the Yellow River in 1997, the widespread flooding in the Yangtze basin in 1998, and the desertification in the Northwest, are another driving force of ERPs' promotion in China.

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### 3.2 What Has Been Done

In response, the Chinese government has made attempt to struggle with the environmental crises (R. Yin & G. Yin). It has been presumed (Yin *et al.*, 2010) that the performance of Ecological Restoration Programs is determined by their effectiveness of implementation and significance of impact. Implementation effectiveness can be measured by the indicators including land area that converted or conserved, survival and stocking rates of restored vegetation, etc. However, impact significance can be measured by the induced changes in ecosystem functionality and stability, and socioeconomic conditions, etc.

Based on an exhaustive search of the publications, three findings can be concluded: "the implementation effectiveness has not been examined as extensively as the impact significance; efforts to assess the impact significance have concentrated on the SLCP, particularly its socioeconomic effects; most of the socioeconomic studies are based on rural household surveys and discrete choice and difference in differences models (Yin *et al.*)."

### 3.3 Challenges and What Remains To Be Done

Apparently based on above said, future work should pay more attention to the implementation effectiveness, the NFPP and other programs, and the environmental impacts. That means more field data regarding evolving ecosystem conditions and socioeconomic information of higher aggregation must be gathered, and more research across scales and disciplines must be conducted. In addition, enhancing the local acceptance and participation of Ecological Restoration Programs in China is also stressed and suggested. Therefore, more attention should be paid to the quality of the forestation rather than its quantity, and officials should consider offering better information and training services to increase public engagement in decision making.

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However, a lot of ERPs actually ended with disappointing effectiveness. For example, a number of afforestation projects launched since 1978 (Xu *et al.*, 2006) were failed despite their broad geographic reach and remarkable planting efforts (Smil, 1993). To sum up the lessons from these failures, Smil pointed, “sites were poorly prepared; seeds and/or seedlings were not properly planted; and saplings were not well tended.” Additionally, ERPs in China actually have faced great challenges, which increase the difficulty in implementation. R. Yin and G. Yin have summarized the following main challenges: “inadequacies in monitoring and assessment; heavy reliance on state financing; rigidity and inconsistency regarding certain policy measures; lack of inter-agency cooperation and policy measures; lack of inter-agency cooperation and careful planning; insufficient consideration of local interests; and neglect of appropriate technical practices.”

### **3.4 Case Study: Sloping Land Conversion Program (SLCP)**

China launched some major ERPs and resource expansion projects in the late 1990s and the early 2000s in order to alleviate severe environmental challenges; to reduce the poverty and improve the livelihoods of rural population; and to adjust its structure of land-based economy, (Liu *et al.*, 2008; Wang *et al.*, 2007; Yin *et al.*, 2005). These ERPs include the SLCP, the NFPP and the DCBT. This section is going to discuss and assess the SLCP as an example of China’s ERPs.

In many countries of the world, the poor live in mountainous and other ecologically fragile regions (Kelly & Huo, 2013), and China is no exception. In the middle and upper reaches of the Yellow River and the upper reach of the Yangtze River, many farmers have aggressively sought new croplands, and herders have increased their livestock after gained economic independence from the rural reforms (Du, 2001). This led to a great demand of the more sensitive patches on steeper slopes and a large amount of overgrazed grassland in the arid and semi-arid regions (R. Yin & G. Yin). As a result, these environmental unfriendly actions will cause severe soil



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erosion. According to Xu *et al.* (2002), 2 billion tons of silt is released into the Yangtze and the Yellow Rivers annually, among which 65% comes from sloping cropland. And west China, with 70% of the agricultural land with slopes greater than 25 degrees, contributes the majority of this.

In order to achieve a dual-goal of poverty reduction and ecological restoration, the developing countries have implemented payments-for-environmental-services (PES) programs. China's SLCP, also known as the "Grain for Green" program, is the largest PES program in the developing world. This land conversion pilot program was announced by the former premier Zhu Rongji in 1999 (Kelly & Huo), having the goal of converting 14.67 million hectares of cropland to forests by 2010 (4.4 million of which is on land with slopes greater than 25 degrees) (SFA, 2003). It mandates that participating farmers be compensated. And the retired farmland can be eventually converted into ecological forests, commercial forests, or grasslands (R. Yin & G. Yin). According to the *Economic Daily* (2007), SLCP has already retired and afforested more than 9 million ha of cropland. In the following part of this section, I am going to analyze this program in terms of three factors I mentioned above: Chinese concepts of "man and nature", population, and economic status.

SLCP embodies Chinese idea towards nature. The implementation has considered both ecosystem and human beings. Its success partly owes to the "people-oriented" consideration, which reflects the philosophy of "tianren heyi". SLCP led to a conversion of millions of hectares of marginal croplands to forests across 25 provinces involving 124 million people and costing the government 233 billion Chinese dollars (Yuan). Overall, it seems that the areas will remain as forests in the near and medium future. However, the forests are possibly to be reconverted back to croplands later. It is considered to be a successful restoration program because the participating farmers are positive towards the program ("Sustainability of," 2014). These farmers offered their supports to this program because of two incentive: the converted croplands were exempted from property taxes, which was not a small

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amount at the time; and the long-term contract signed between participating farmers and the government ensured their ownership and management of the forests for 50 years.

In addition, demographic issue is one of the driving forces of SLCP. According to previous part, population growth means an invasion of sloped lands because people want to seek new croplands. As the demand for farmland in projected areas increases, the implementation of SLCP becomes more difficult as well (Liang & Tan, 2002), because this is inconsistent with the goal of SLCP, which aims to reduce the farmland and increase forests or grasslands in sloping land.

Economic status in projected regions is another consideration in SLCP. The projected areas of SLCP usually have relative poor economic conditions (Liang & Tan). People's desire of improving livelihoods is more intense. In other words, they have less awareness of environment protection. Therefore, SLCP needs to provide market incentives for land conservation. As a result, SLCP is targeted towards cost-effective conservation measures in environmentally sensitive areas (Kelly & Huo). In order to achieve the target, sufficient financial support matters a lot, which is one of the main challenges of ERPs in China. Plus a relative large population, the requirement of financial support is even higher.

#### 4. Conclusion

Ecological restoration programs in China are different with those in other countries, especially western countries. The differences are mainly caused by three factors: the natural concept, population, and the economic status. Among these three, the natural concept weighs more than others since it is the motivation behind these programs. China's government seeks a harmony between man and nature, known as the "tianren heyi", when restoring the ecology. This idea leads ERPs in China to people-oriented programs, which also appeals to the governing Party in China. In

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this way, ERPs in China often care more about the human beings than the environment. Another factor is population. With a large population base, China faces severe environmental degradations. In addition, large population makes difficulty in the implementations of ERPs because there always exists a contradiction between human livelihoods and environment. And that more people means a more intense contradiction. Moreover, economic status influences ERPs in China as well. Considering the economic conditions of most ERP projected areas are poor, ERPs are actually carried out with many constrains, either higher requirement for financial support or necessity of considering economic values of vegetation.

To have a better understand of ERPs in China, I also provide an overview of ERPs in China and a related analysis of SLCP, a famous ERP in China. To summarize, SLCP is affected by the three factors I mentioned in this paper. The program is partly driven by the population issues in the projected areas. And local economic conditions increased the difficulty of implementation. Finally, it achieved general success partly due to comprehensive consideration of local people's demand.

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