

## **Environmental Challenges Facing China Rehabilitation of The Loess Plateau**

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In 1995, the World Bank asked me to film the early stages of the “Loess Plateau Watershed Rehabilitation Project” for a film called “Investing in People”. This film was about initiatives that were changing the focus of the bank from large infrastructural projects, to projects intended to provide direct benefits to poor people living in remote areas of the world.

This first trip piqued my curiosity to understand more and has led me to follow the research of many others and to pursue my own research to better understand what I was documenting.

During the last decade, I have led the Environmental Education Media Project on 8 filming trips to the region with support from various development agencies including the EU, UNDP, GEF, UNICEF and the World Bank. During each visit I gained greater understanding and collected more material. To date, we have collected more than 100 hours of broadcast videotape of the region, its people and the rehabilitation efforts.

Our journey has led us to examine tiny microscopic bacteria and to observe the earth from space and many levels in between to better understand the complexity of the Earth’s ecosystems and the economy in China’s Loess Plateau. This work has revealed profound lessons that may help future generations to live in harmony and prosperity in a sustainable world.

### **The geography**

The Loess Plateau is approximately the size of France, encompassing 640,000 square kilometers in the upper and middle reaches of the Yellow River. It gets its name from the powdery loess soil that is its primary feature. The mineral-rich windborne sedimentary loess deposits are hundreds of meters thick in many places.

The Loess Plateau stretches over parts of 7 Chinese provinces; Qinghai, Gansu, Ningxia, Inner Mongolia, Shaanxi, Shanxi and Henan.

Fossil remains prove that humans and their ancestors have lived here for more than 1.5 million years. This is where the Han, Qin, Tang and many other magnificent Chinese dynasties flourished.

This is the cradle of Chinese civilization where settled agriculture spontaneously emerged between 9,500 and 10,000 years ago. Dating the distant past is very difficult, but according to most western experts agriculture was only introduced earlier in Mesopotamia. With agriculture, as happened elsewhere, came the specialization of Chinese civilization.

The stuff of life in the Loess Plateau; love, ambition, trade, science, art, war; as well as flood, drought and famine, shaped the lives and character of Chinese people. The Chinese in turn, in an ever more interconnected world, touch the lives of everyone on the earth.

The story of the Loess Plateau is very complex; more than the historian's eye is needed to fully understand it. Human activity not only gave birth to a magnificent civilization but also severely damaged the plateau.

The Yellow River gets its name from the yellow loess soil that has eroded continuously and in ever increasing amounts, since the advent of settled agriculture, until the plateau became one of the most eroded places on earth. This constant degradation changed the river. The silt raised the riverbed, which made it easier for the river to flood. Seasonal flooding was more and more often followed by drought and famine. Chinese history is well documented. We know that the Yellow River has flooded more than 1,500 times in recorded history. The Yellow River became known as "China's Sorrow" because of all the suffering caused by the floods. Yet the river also helped shape the resilient and hard working nature of the Chinese people.

### **The cycle of poverty and ecological destruction:**

The history of the Loess plateau is an epic tale. Research shows that in the Loess plateau, what was once a pristine nurturing ecosystem, was fundamentally altered by human impact, leading to almost total ecologic devastation over a vast area. The land must have been especially fertile as it gave rise to the most populous ethnic group in the world, now comprising one fifth of the people on earth.

Each passing generation did not worry too much that the environment was in decline. They must have seen that when they cut the trees that the river was muddied. They might have noted when it rained that gullies were forming where they had been dragging the logs. They had to notice that after clearing the forest the soil was very fertile and their crops flourished but then a few years later they were unable to grow much.

People living on the plateau experienced a gradual social and economic decline. What happened took place over such a long time and on such a scale that few people were aware that these changes were taking place. Cutting the forests and preparing the earth to plant crops did several things. First it exposed the fragile loess soil to the wind and rain, causing the erosion that led to the many gullies that are now so evident in the plateau. This exacerbated the tendency of flooding during the rainy season, and drought and famine the rest of the year.

Removing the vegetation cover also devastated a microbiologic layer near the soil surface made up of decaying plant litter called the necromass. This destroyed the cycle of natural fertility of the region by breaking the cycle of regeneration in which each generation of plants and animals gives their bodies to fertilize the next. This also disrupted the ability of water to be absorbed into the soil during rainfall disrupting the hydrological cycle in which water is circulated between the soil, biologic life and the atmosphere.

## **Ecological destruction**

Gradually wild plants and animals disappeared. People planted crops on steeper and steeper sides of the gullies and took their sheep and goats further to eat grasses and bushes hoping to eke out a living. However, with their own activities further degrading the natural systems, the people became mired in poverty.

The decline was slow and continuous; people were preoccupied with wars, with commerce and with their accomplishments. The fact that all of the accomplishments derived from the resources they were extracting out of the earth and that these might some day be completely exhausted was not foremost in their minds.

Gradually the wealthy and powerful moved away to conquer other lands. The mighty early Chinese dynasties centered on the Loess plateau were themselves replaced by others who moved the capital away from what was fast becoming a desert. The magnificent past was just that, history was grand and the reality for people in the Loess plateau became a spiral of poverty and ecologic destruction that deteriorated into misery and ruin.

## **Rehabilitation:**

It takes an overarching and ambitious vision to believe that what was destroyed over 10,000 years could be restored; yet a little over a decade ago the Chinese government decided to do just that.

The rehabilitation of the Loess plateau arguably ranks as the largest development project on earth. The level of complexity and the size of the endeavor made this a wildly ambitious undertaking. When we first began to film it seemed necessary but quixotic. Few people believed that it could be done. The project team was undeterred and had great faith in an integrated approach to watershed management. A complex long-term process was set in motion that I will briefly summarize.

### *1. Planning:*

The first steps required careful analysis and planning. Chinese planners from the Ministry of Water Resources and international planners from the World Bank worked together to design a workable project plan. Experts in hydrology, soil dynamics, forestry, agriculture and economics, as well as local officials and farmers were consulted to determine what was possible. This research and planning phase took over 3 years.

The team divided their work into 2 areas: the economic and social well-being of the people; and the ecologic health of the environment. They chose to identify land that could be made into economically viable croplands and land that was more valuable when left to regenerate naturally. This process was long and difficult. The people who looked beyond the devastated plateau and believed that the damage could be repaired are true visionaries.

## 2. Policy:

There were four main policy decisions that emerged from the planning process to direct the rehabilitation.

- Ban tree cutting
  - A law was instituted banning indiscriminate tree cutting throughout China, following the devastating floods of 1998.
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- Ban planting on steep slopes.
  - This reversed centuries of unsustainable agricultural practice among poor farmers trying to plant crops on the sides of hills and gullies.
- Ban free range grazing of sheep and goats.
  - This policy ended the practice of allowing great numbers of goats and sheep to range freely to denude the natural vegetation.
- Land tenure
  - Clear policies on land tenure were established to delineate the rights and responsibilities of farmers for each terraced field and each tree planting area in the project.

## 3. Participation

Early in the rehabilitation process it was critical to engage the local people to understand and participate in the rehabilitation efforts. Great efforts were expended to ensure that the people would cooperate now and in the future. Ultimately generations of farmers must be engaged to finish the job.

### **Showing the local people**

In the beginning it was necessary to convince the people of the value of the rehabilitation. As the project has progressed, the advantages have become evident and the people are more motivated to participate because they can see the benefits in their own lives.

## 4. Engineering

The Loess Plateau had been so fundamentally altered that restoring economic productivity and ecologic health required basic engineering. Including:

- Sustainable water management - Sustained access to water is critical to development. If development depends on water diverted from other watersheds or from finite underground supplies, then as development peaks, the needs will overwhelm the supply. Another way to state this is that the “moment of greatest dependence is also the moment of greatest scarcity”.

- Terracing - Terracing creates flat fields in steps on the sides of the gullies and hills. As long as these terraces are maintained they will reduce erosion while providing economically viable fields for the farmers.
- At Scale - China has 22 percent of the world's population and only 7 percent of the world's arable land. Terracing an area the size of France is a vast undertaking, but one that becomes well worth it when you consider the alternative.
- Warping dams - Warping dams are an innovative way to use the power of erosion to fix the bottoms of the gullies. A shallow dam is built at the bottom of the gully that is expected to fill with eroded loess soil during the rainy season. When the lowest dam is filled another is made a bit higher in the gully, and this is continued until the entire gully bottom consists of flat fields. This can create rich productive croplands and entice the farmers away from planting on steep slopes, giving the slopes back to nature while ensuring the farmers can improve their income and quality of life.

##### 5. *Vegetation*

- Dune stabilization - Dune stabilization is an extreme measure to halt the movement of sand dunes afflicting the most fundamentally damaged areas. This pioneering Chinese method of stabilizing shifting sand dunes is the front line of environmental protection at the edges of growing deserts. Straw is laid in grids together with plants and grasses that can survive in high sandy soils. They hold the sands from shifting in the wind and covering more vegetation and when sufficient organic matter is available, begin to reverse the process and establish plant life to defeat the sands.
- Grasses and Bushes - Grasses and bushes which are indigenous or especially well suited are being planted and are taking hold. Without the constant pressure of goats and sheep that eat the plants, this strategy is having a profound effect on the rehabilitation.
- Trees - This most publicized aspect is certainly very important. Returning trees to the region is a chance to fundamentally correct the damage that was done over thousands of years. However, trees alone are not the answer. It is critically important to understand the policy changes such as the banning of tree cutting, planting on steep slopes, and unrestricted grazing that accompanied active tree planting to realize the significance of what is being done in the Loess Plateau. It is this integrated approach that has provided the most success.
- Perennial crops — for instance orchards - perennial crops are an excellent way to stabilize the soil cover. These crops raise incomes and diversify the economies of small farming communities.

6. Understanding active and passive Measures - Active measures generate income from economically viable cropland. But ecologic restoration is often harder to

support when it does not produce a direct financial return.

- An important finding is that when sustainable water and land use policies are in place, passive rehabilitation methods that let nature restore itself may be more effective than active ones. This is especially welcomed since passive measures require little or no investment, but result in tremendous ecological payoffs.
- Ecologically important land which is protected, from human impact, allows for vegetation cover to return naturally, and soils to regenerate. Protecting ecologically sensitive land results in massive long-term benefits to soil, biodiversity and climate; whereas trying to exploit these areas for economic benefit only causes more degradation and does not lead to significant financial returns.

## 7. *Outcomes*

Over the past decade as we have documented rehabilitation of the Loess Plateau, an astounding transformation has taken place. **We have collected strong visible evidence that it may be possible to rehabilitate large-scale damaged ecosystems. While we have been filming we have watched as once denuded hillsides came alive with grasses, bushes and trees. Birds and insects are returning to the area. The humidity is changing as the soil absorbs moisture and the plants exchange gases in respiration. The entire dynamic of the plateau has changed.**

This has profound implications. We are trying to also understand these for the local people, the Yellow River basin and global ecology.

### **Implications:**

The success of the Loess Plateau Rehabilitation Project has resulted in profound changes for the local people; their economy, incomes and quality of life have improved tremendously. The seemingly hopeless cycle of poverty and ecologic destruction has been broken... millions of people have been lifted out of poverty.

The ecologic improvements show great promise and will eventually reveal whether it is possible to restore fundamental systems that were disrupted by humans such as the natural fertility of the soil and the hydrological cycle.

In the Yellow River Basin, the rehabilitation is reducing the levels of eroded loess that has traditionally clogged the river and led to the dangerous cycle of flooding, drought and famine. This, coupled with the potential to absorb water into the soil and vegetation and release it slowly throughout the seasons, could fundamentally alter the downstream dynamic that has caused so much suffering through the ages.

The rehabilitation of the Loess Plateau also has global implications. Restoring the soil

crust and vegetation cover will reduce the risk of dust storms originating in the Plateau. These storms have traveled in the atmosphere around the globe with a multitude of negative ecologic and health effects.

The rehabilitation is also helping address one of our most egregious problems. The vegetation over this huge area is absorbing carbon, offsetting CO2 emissions worldwide that are exacerbating climate change.

The restoration of the Loess Plateau can serve as a model for other regions, showing that it is possible and beneficial to restore large-scale damaged ecosystems that have been degraded by human impact.

**Paradigm shift in human consciousness:**

The lessons of the Loess Plateau rehabilitation are fundamental to human survival. For more than 10,000 years China's Loess Plateau was consistently degraded by human impact resulting in serious ecological damage and human suffering.

While much remains to be done, in only a little over a decade vast improvements have been made in the area's ecology, and in the health and prosperity of her people.

**Lessons from the Loess Plateau can help shape a sustainable future for humanity. In the Loess Plateau we are witnessing a paradigm shift in human consciousness that is addressing mistakes of the past. These lessons could be applied to other damaged ecosystems and could help guide humanity towards a sustainable future.**

This is a great tale of epic proportions that shows the power of human ignorance to destroy and the hope of human consciousness to understand and protect natural systems. The story of the Loess Plateau offers hope that we can balance use and protection of the land, and allow nature to restore herself for the health of the planet's ecosystem and ultimately for our own survival.

**“Earth's Hope”**

The rehabilitation of the Loess Plateau is an ambitious undertaking with important lessons for everyone. The Environmental Education Media Project for China (EEMPC), a U.S. 501 c 3 non-profit, non-government organization, has begun an ambitious campaign to publicize the accomplishments from the rehabilitation throughout the world. The EEMPC is preparing a feature length film “Earth's Hope”, about the Loess Plateau and the people who live there, drawn from over 100 hours of video material documenting the plateau and rehabilitation over the past decade.

“Earth's Hope” is a timeless epic showing how destructive humanity can be and how enlightened conservation can allow nature to heal herself. The film is scheduled to be shown next year and for years to come all over the world.

The EEMPC is seeking private sponsors who share our commitment to communicating the astonishing and inspiring messages contained in the material and who could benefit from being associated with this environmental education effort in China and worldwide.