

Sustainable Development in China: How to Realize a Breakthrough

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Abstract: Although China enjoys a good tradition of sustainability, and has made great strides at addressing pressing environmental problems, it still lacks a substantial environmental base for sustainable development. The national ecological condition seriously deteriorated in the 1990s. This paper examines major ecological challenges and explores a new path towards sustainable development. The paper points out that the weakness of sustainability in China is primarily determined by the fragility of the national ecological geography and the huge population. However, the present underdeveloped market is a key driving force for ecological problems, because it maintains a powerful mechanism that delivers a higher pressure on the land. The prospect of China's sustainable development depends on the transformation of the market mechanism. However, realizing sustainable development necessitates taking a Chinese approach, which is aimed at a modest development oriented towards a comfortable lifestyle and based on a harmony of the society with nature. Sustainable development is in the mainstream of today's ideology. As one of the largest developing countries in the world, China has paid a great attention to it. It is still one of the top pressing issues, and it is an arduous task for China to approach sustainable development in the new century. As a contribution to the UN Summit of Rio+10, this paper examines the progress and problems on the subject of sustainable development in China. The original concept and primary principles of sustainable development is introduced in Section 2. However, China should have its own deeper understanding of sustainable development because of its long history and cultural tradition in sustainability. This history is narrated in Section 1. Major actions taken in the past decade and their achievements are summarized in Section 3. Today's national pressing ecological problems are introduced in Section 4, and explained in Section 5. A Chinese path towards sustainable development is explored in Section 6. The last section gives a general conclusion for the paper.

A TRADITION OF SUSTAINABILITY

The ecological environment. These challenges resulted directly from two sources. The first was population growth. The total population in 1987 was double that of 1949. Raising newborn children was an extra heavy economic burden, which finally affected the lands, since China was a closed economy based on agriculture. The second was massive industrialization. Since the 1950s, the country has pursued an economic prosperity with a preference for heavy industry, which operated at the expense of mineral resources. As a result, the national environment suffered from ecological

destruction. After the reform and opening to the world, this situation became China is a long-developed country and enjoys a prosperous ancient culture. Ecological problems similar to today's often occurred at critical periods in history. This occurred because of the relatively greater environmental pressure on lands, which were the result of population density and economic activities. Therefore, attention was paid to the environment, and sustainability was an important composition of ancient Chinese culture.

Sustainability has an important position in ancient Chinese philosophy. Numerous philosophies deal with the relationship between humans and nature. The principle philosophy expounds the "integration of nature and humans into one" (天人合一). Here, "one" means the whole, the entirety, and the top

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dominion over the world. It can be seen that humans are neither conquerors of nature, nor masters of the world, and should obey the common “one”. Nature is neither an object to be conquered, nor an object to be awed. It is a partner with humanity. Consequently, “humans should co-exist harmoniously with nature” (人·自然和·相). This was a prevailing idea in Chinese history, and could be found in other philosophies, especially in Taoism and Buddhism. It is evident that most religious buildings or temples are usually located in ecologically pleasant surroundings.

Ancient Chinese theories of sustainability focus on the use of natural resources. Indeed, China should take a great pride in its long history of natural conservation (Xu Hui, Zhou Dexiu, 2000). In the days of *Spring and Autumn* (春秋), 2200 years ago, ancient sages had learned how to close off hills regularly to facilitate forestation, and how to protect pregnant animals and spawning fish. The book *Xunzi* (《荀子》) says that “if planted and felled in season, trees will be flourishing on hills and people could be rich in wood.” Unsustainable ways of economic activities were often criticized and great emphasis was placed on conserving natural resources. The book *Lushichunqiu* (《氏春秋》) asks, Is there not rich fishing by draining a lake? However, nothing can be fished next year. “Is there not a big gain by firing a hill? However, nothing can be hunted next year.” Although these ideas of sustainability were simple, they played an important role in economizing resources and conserving nature.

However, the Chinese ancient theories on sustainability were difficult to be put into practice, although they were well formulated. They advanced from the relationship between humans and nature, and held a unified view of the world. Their plentiful and profound implications are, however, ambiguous, and not easy to translate into operational guidelines for actions. This can explain, to a major degree, why these advanced theories could

not bring about significant driving force for economic and social development.

As a result, the ecological environment was still in a fragile condition in many periods of the history because of the increased pressure the population placed on lands. The size of population before the Yuan Dynasty was generally stable between 20 and 60 million. However, there was a notable increase after the Ming Dynasty (Xiao Zili, et al., 1998). Population growth in the twentieth century was especially dramatic. It was inevitable that high population density resulted in ecological deterioration. In fact, from the Sui to Qing dynasties, there was a significant increase in the frequency of natural disasters, such as floods, droughts, and plagues of locusts, especially along the Yellow River. It was discovered that the covering rate of vegetation over the country fell from 21% in 1650 (the beginning of Qing Dynasty), to 10% in 1949 (the foundation of modern China). The sagacious ancient ideas on sustainability had not prevented the land from being ecologically burdened.

After the foundation of modern China, the national development has faced new challenges from much more serious. Ecological problems frequently emerged. Economic and social development began to be restricted by the limitations of the environment and natural resources. In these conditions, it is necessary to introduce the new idea of sustainable development into the country.

SUSTAINABLE DEVELOPMENT: THE PRINCIPLES AND CHINESE UNDERSTANDING

The Concept and Principles

- Social development, cultural promotion, and improvement of living standard. Economic development is important, but not the sole purpose of human life. It should not be allowed to damage the achievements made in other areas

It is possible for human beings to make development sustainable and to meet the needs of the present without compromising the ability of future generations to meet their own needs. This calls for technological innovation, clean production, environmentally friendly lifestyle, modest population growth, institutional change, social fairness, political and The World Commission on Environment and Development, chaired by Ms Gro Harlem Brundtland, published a notable report, *Our Common Future* (the Brundtland report), in 1987. This report coined a new concept, *sustainable development*, and prompted a worldwide surge of studies on it. Henceforward, sustainable development has been at the nucleus of the focus of international environment and development concerns.

Brundtland's definition provides a base for further discussion although sustainable development has become a loose term with a diverse understanding in a variety of contexts. As explained in the report, sustainable development is "development that meets needs of the present without compromising the ability of future generations to meet their own needs."¹⁾ This definition laid a special emphasis on fairness between present and the future generations in the use of environmental resources. According to this understanding, sustainable development should contain the following points.

- The environment and the natural resources stored in it are the basis of sustainable development and the major area of discussion
- The goals of sustainable development are both to meet the needs of present generation to acquire well-developed individual personalities and to protect the environment to prevent future generations from suffering threats to their survival and development
- The development of human beings is a comprehensive progress founded in economic growth,

democracy, and an equity-oriented policy

Sustainable development is a new model of human development. It is an ideal state in the future and the process of approaching of it from the present (Stockholm Group for Studies on Natural Resources Management, 1988). Despite there are no common standards in different countries, the principles to be practiced are the same:

Principle of development: A prerequisite for sustainable development is development. Sustainability without development makes no sense.

Principle of sustainability: The needs of human beings should be within the capacity of natural resources and the ecosystem. An overloaded environment undermines the quality of development. Development and sustainability cannot be separated from one another.

Principle of equity: Everyone has a right to survival and development. So, social fairness is a prerequisite for sustainable development. It is important to maintain equality in the distribution and use of resources among peoples in different circles, different areas, and different generations. Development is to meet the needs for the whole society, not just for a special party. Discrimination and inequality are key obstacles to sustainable development.

Principle of integrity: Human beings exist as a unity. The environment is also a unity, and no part of it can be separated. It is necessary for all the parties to take joint actions against global environmental problems. At the same time, sustainable development rests on comprehensive improvements in every area, not just in the environment.

It can be seen that sustainable development is a philosophy of development based on a strong economy, social fairness and ecological stability. Sustainable development is one of the greatest human achievements in practice today. Although the ancient Chinese theories of sustainability are

1) World Commission on Environment and Development: *Our Common Future*. Oxford: Oxford University Press, 1987.

important and contain the essence of sustainable development, they will inevitably be replaced and real sustainable development will be well accepted by China.

Chinese Understanding

Sustainable development is a general idea, which should be translated by countries into their own languages. This inevitably leads to diversity in understanding of the term because of different cultural backgrounds and development stages. As the largest developing country and having a traditional preference for sustainability, it is reasonable for China to understand the concept of sustainable development in its own specific manner.

As President Jiang Zemin said at the National Working Conference on Family Planning and Environment in March 1996, "The so-called 'sustainable development' is to consider not only present development but also future development, and to benefit the present without compromising the profits of next generations." According to this understanding, China places an emphasis on development.

- Development is at the core of sustainable development
- The economy plays a key role in maintaining sustainable development. Economic development implies not only the increase in quantity but also, and more importantly, the improvement in quality. The latter is the base for sustainable development
- It is necessary to change the patterns of economic development. China is undergoing "Two Fundamental Transformations" - the one is to transform the economic management system from central planning to a socialist market economy, and the other is to transform the economic growth patterns from extensive to intensive

- Sustainable development is ultimately determined by social patterns. A green civilization and an environmentally friendly lifestyle are essentials for realizing sustainable development
- Sustainable use of natural resources and a pleasant ecological environment are important signs of sustainable development. Effective measures should be taken to protect the environment and conserve natural resources while developing the country
- Every one has a right to exist and to develop. Sustainable development of human beings rests on the positive development of individuals. Population control and the elimination of poverty are two basic prerequisites for sustainable development

It can be seen from above that the Chinese understanding of sustainable development is development-biased (Chen Yaobang, 1996). It is reasonable and suitable to the present status of the national development. Therefore, it is easy to be put into practice.

ACTIONS AND ACHIEVEMENTS IN SUSTAINABLE DEVELOPMENT

Actions

There is great significance in China to carrying out sustainable development. However, China did not create the theory of sustainable development although it has a tradition in sustainability. The modern theory of sustainable development was introduced to China from abroad. The UN played a key role in this process. In fact, the modern theories of environment and sustainable development in China greatly benefited from two UN conferences (Zhang Kunmin, 2000). The first was the UN Conference on Human Environment in Stockholm in 1972, which was the first opportunity for China to be involved in international environmental

issues, and thus prompted the spread of new environmental ideas nationwide. It was after this conference that China began its modern environmental protection activities. The second was the UN Summit on Environment and Development in Rio de Janeiro in 1992, which delivered the impetus for China to accept officially the theory of sustainable development and to translate it into the national actions. Since this conference, the Chinese government has paid great attention to sustainable development. Specific steps have been taken to implement it.

First, sustainable development became one of the key national strategies. Immediately after the Rio Summit, the Chinese government published the state bulletin, *Chinese Environment and Ten Countermeasures*, in August 1992. The bulletin stated that sustainable development was an inevitable national choice for the present and the future, and China would put it into action soon.

Second, an institutional system related to sustainable development has been established. In August 1992, a national leading group was set up in charge of working out *China Agenda 21*. Following that, local groups at the provincial and municipal levels were organized.

Third, a series of strategies towards sustainable development were worked out and put into action at different levels. In March 1994, the state white paper, *China Agenda 21*, was published.²⁾ It is a program to guide Chinese policy on population, environment and development for the next century. Afterwards, local agendas at provincial and municipal levels were drawn up. At the same time, action programs were put forward and brought into practice. In March 1996, the Ninth National People's Congress approved "The Ninth Five-year

Plan on National Economy and Social Development and Perspective for 2010," which was designed in accord with the principles of sustainable development and the purport of *China Agenda 21*. It is indicated that the strategy of sustainable development would be officially put into effect. Then relevant departments of the central government also put forward their own action plans, such as National Program for Control of Overall Amounts of Major Pollutant Emissions and National Plan for Green Projects, which were drawn up by the State Environment Protection Agency and ratified by the State Council in September 1996.

Fourth, strong measures have been taken against environmental problems. After the middle of the 1990s, China quickened the pace of reforming the economic structure and eliminating obsolete technologies and equipment in factories. In June 1997, the National Economic and Trade Commission published the first list of technologies and equipment to be phased out. Afterwards, about 65 000 small firms with obsolete technology and heavy pollution were closed nationally. At the same time, the State Council and relevant departments also announced a series of decrees and regulations on curbing air pollution in cities, cleaning important rivers, and controlling acid rain. In 1997, Beijing stopped the use of lead fuel. Then most large cities followed suit. The central government also supplied financial support for environmental infrastructure projects, such as building disposal facilities for urban wastewater. In the beginning of 1999, a radical "zero point action plan" was undertaken by the State Environment Protection Agency against water pollution in Huai River. This plan was later applied to Tai Lake in the beginning of 2000.

Fifth, governments are increasing their environmental awareness by mobilizing the public to participate in discussion forums and put their newfound awareness into practice. In 1993, the China Environment Protection Campaign, in which

2) State Commission of Development and Planning and the Department of Sciences and Technologies: *China Agenda 21: The State White Paper on Population, Environment and Development in the 21st Century*. Beijing: China Environment Press, 1994.

the media played a key role, was launched and it began with a project for protection of the Huai River. In 1998, Beijing began making public announcements on television about urban air quality (first weekly and then daily). This practice is also followed in most major cities.

Sixth, legislation on environmental protection and sustainable development was gradually strengthened. In recent years, there has been significant progress in legislation for environmental protection and conservation of natural resources. By the end of 2000, 18 national laws, 29 State Council decrees, numerous central governmental department regulations (more than 70 established by the State Environment Protection Agency), 375 items pertaining to national standards, and more than 900 local regulations were enacted. These have played an important role in environmental protection.

Finally, China has actively cooperated with international partners in addressing global environmental issues. In April 1992, the Chinese Committee of International Cooperation on Environment and Development was set up. It is a top-level consultative group to the Chinese government and an important forum for information exchange on sustainable development. In 1994 and 1996, two high-level international roundtable conferences on *China Agenda 21* were held in Beijing. At the same time, a series of international conventions related to global environmental issues were signed and ratified by the Chinese government. Moreover, China has also strengthened collaboration in environment and relevant areas and reached 29 agreements or memoranda of understanding with 24 countries.

It can be seen that China has made a great effort at addressing environmental problems. That the national strategy for sustainable development has been worked out and specific actions have been taken nationwide indicates the resolution of the Chinese government to solve environmental problems. It can be expected that these actions will

produce a positive effect.

Achievements

China's achievements toward sustainable development are remarkable (State Commission of Development and Planning, 2002). They may be categorized into six areas, namely: economy, population, poverty, pollution, awareness and education.

First, national economic growth has been maintained at a higher pace, and national comprehensive power has been greatly strengthened. In the 1990s, the average annual GDP growth rate was near 10%. In 2000, the total GDP exceeded \$1000 billion.³⁾ China is the sixth largest economy in the world. This lays a substantial foundation for sustainable development in other dimensions.

Second, great progress has been made in population control. The one family, one child policy, which was put into effect at the end of 1970s, has resulted in birthrate decline of around 300 million. The total population was controlled to less than 1.3 billion in 2001. This has great significance in relieving environmental pressure on the land. It is also a contribution to global population control.

Third, a remarkable success has been achieved in combating poverty. National poor population was reduced to 28 million at the end of 2001, down from 80 million in 1994. The central government has launched a new campaign to develop the western part of the country, for the western areas to eliminate poverty. At the same time, the social welfare system in cities and towns is in a process of which will provide momentum development, and a minimum standard of living has been established in a majority of cities.

Fourth, the previous surges of environmental deterioration have been curbed while the country

3) The State Bureau of Statistics: *The State Bulletin of Statistics on the National Economy and Social Development of China in 2000*. People's Daily, 1 Mach 2001.

has been rapidly developing. In general, the rate of environmental pollution is lower than the growth of GDP because the majority of actions have been implemented (World Bank, 1997). Some progress has also been made in the effort to clean the country's major rivers and lakes.

Fifth, the public's environmental awareness of is beginning to awaken. Most people pay increased attention to their quality of life.

Finally, academic activities in sustainable development are becoming more active. Since the middle 1980s, Chinese scholars kept a close eye on international sustainable development discussions (Niu Wen Yuan, 1990, 1993, 1994, 1996, and 1997), and a significant contribution has been made, especially in quantitative studies that focus on measuring indicators of sustainability (Ye Wenhui, et al., 1996; Hao Xiaohui, 1996; Chen Ying, 1997; Cao Fengzhong, et al., 1998). Since 1999, an annual report on the national progress of sustainable development has been published by the Research Group on Sustainable Development, Chinese Academy of Sciences.

In general, China has made a great progress towards sustainable development. Notable evidence is that the environmental pollution has been less than the rate of economic development (Zhang Xiao, 1999). This is cause for rejoicing, and it has laid a foundation for the new century. However, it is necessary to point out that there are also many shortcomings in the practice of sustainable development. They should be resolved as soon as possible.

Failures in Sustainable Development

Although many successes are boasted in sustainable development, there are also lots of failures. The principle failures are the following:

- The restraint to environmental pollution and destruction is still weak
- National ecology is beginning to deteriorate

seriously

- The shift of economic growth pattern has not completed
- An integrated mechanism for decision-making on environment and development has not been developed. Sustainable development still lacks the substantial support of institutions.
- The national reform has brought strong challenges to the environment, and a social context favorable to sustainable development does not exist.

In a general word, China's practices are still backward. This is in sharp contrast to relatively advanced theories. A notable indicator is that the national ecological condition is seriously deteriorating, although the environmental pollution seems to be ameliorated.

FOCUS ON THE NATIONAL ECOLOGY

In China, a pressing issue is the poor condition in the national ecological environment. It is predicted to be a key obstacle to China's sustainable development in the future. This section will provide a general look at the major ecological problems that exist at present.

Major Ecological Problems

Ecological problems usually occur in four media: the atmosphere, water, land and vegetation.

Atmosphere

As the atmosphere absorbs a great quantity of pollutant emissions from industrial factories and traffic systems, the air becomes heavily contaminated, and this is especially serious in urban and industrialized areas. Furthermore, atmospheric properties also begin to change due to human intensive

activities, such as civil aviation. Because of long-term, strong disturbances and pollution, it was inevitable that the climate would change. Certainly, climatic changes can happen at local, regional, national, or global level, and these changes can interact. However, local climatic change has a fundamental significance, and major contributions to it come from native factors.

In China, climactic changes appear mainly as instability in the climate. In the 1990s, there was a trend for the weather to become warmer and dryer, such as a warm winter with little snow combined with a hot summer with insufficient rainfall. Especially in 2000 and 2001, the country has experienced extremely hot summers with serious drought. High temperatures lasted for a long period with arid weather in North and Northeast China Plains. In these summers, the rainfall decreased by around 50% of the normal average in north parts of China (including the Han River basin), and by 80% in some areas. Unstable climate with a tendency toward drought are ideal conditions to bring about the following natural disasters.

1) Drought

Drought is the most frequently occurring natural disaster in China, and has gone to extremes in the summers of 2000 and 2001. High temperature and shortage of rainfall has dried up the majority of lands. The long-lasting drought struck more than 20 million hectares of farmlands in north parts of China, and caused extensive crop failures. In many counties of this area, village residents and livestock ran short of drinking water.

2) Plague of Locusts

China is also prone to plagues of pests because of frequently-occurring drought. "Short drought usually leads to suffering from insects, and prolonged drought must bring about a plague of locusts." In summer of the year 2000, locusts extensively

invaded north parts of China, in which the core was along the lower reaches of Yellow River. These plagues have laid a heavy burden not only on farms but also on pastures.

3) Acid Rain

This is an increasingly serious problem in China. In the 1980s, acid rain was limited to a few areas in the southern part of the country. In the 1990s, however, it has expanded to eastern (the cores were at Xiamen and Shanghai), central (the cores were at Changsha and Nanchang) and northern (the core was at Qingdao) regions – an area comprising more than 20 provinces – and has affected a quarter of the country. China is one of the three areas with the world's heaviest acid rainfall. At the same time, the acid rain problem is becoming more serious. There was a record acid rainfall with a pH value of less than 4, which was the most serious acid rainfall ever recorded. It fell as acid rain, acid fog and acid snows. In January and February of 1994, there were five recorded black rainfalls in Chongqing. Acid rain is a key culprit for soil acidification and the deterioration of agricultural ecology.

Water

China is a country with a long history of water resource development. Water has a special significance to it. However, China is also short of water though there are seven large rivers and numerous lakes. The share of water resources per capita is just a quarter of that of the world average. In addition to unbalanced spatial distribution, water resources are extremely scarce in the north and northwest parts of the country. Wasteful water usage, such as by squandering and polluting, not only results in an unsustainable water supply, but also exacerbates the water ecology. The major problems related to water ecology are the following.

1) Drying Up of Rivers and Lakes

With the trend toward dry weather and the increased water use by human activities, water storage cannot maintain a balance between use and regeneration. As a result, a majority of rivers and lakes are drying up. This is happening not only in the habitually dry northern parts, but also in the southern regions.

The Yellow River has the most serious run-off of all the rivers in China. From 1972 to 2001, there were 23 years of run-off. At the lowest hydrological station along the Yellow River, Lijing Station near the mouth of the river, there was 86 days of run-off in the 1970s, 105 days in the 1980s, and 717 days from 1990 to 1997.⁴⁾ The average length of run-off along the river was 135 km in the 1970s, 179 km in the 1980s, and 672 km in the year 1995. In 1997, it recorded 226 days and 700 km with run-off. Then the dry course backed from the river mouth up to Kaifeng. Moreover, run-off also happened at the source of the river in 1996 and 1998. It is evident that aridification is prevailing throughout the entire Yellow River basin.

The run-off can also happen in other rivers, such as the Hai, Liao, Songhuajiang, and Tarim. Even the Yangtze and Zhujiang, very abundant in water, are also run dry in some tributaries, especially near the sources. In the North China Plain and the Loess Plateau, most rivers are becoming seasonal. Most river courses have been retrograded to canals to discharge floods.

Corresponding to rivers, lakes are also tending to dry due to similar reasons. China is a country abundant in lakes; however, the number of lakes is decreasing. The campaign to reclaim lands from lakes and rivers after the foundation of the new China exacerbated this process. As a result, 800 lakes disappeared, and the areas occupied by lakes

reduced by 11.05%. In the north and northwest parts of China, few of the past famous lakes remain: some of them, such as Rop, the largest lake in the Xinjiang Autonomous Region, have dried up (Rop early in 1964); some, such as Baiyangdian, the largest natural lake in the Northern China Plain, have retrograded and exists now only as a seasonal lake.

The drying up of rivers and lakes leads to a serious shortage of water for cities and towns. In the summer of 2000, there were more than 400 cities in Northern and Northeastern China where water shortages happened, and of these cities, 108 including Beijing, Tianjin, Shenyang, Changchun, Harbin, Taiyuan, Jinan, and Qingdao faced extreme conditions.

2) Lowering of the Water Table

Ground water is the major source of water for national economic activities, most notably agriculture. However, water tables are quickly falling due to over-depletion. In the Northern China Plain, about 87% of total water use comes from groundwater, and it is estimated that an excess of 30 billion m³ were drawn from groundwater. That happens to one of the world's largest subsidence water table funnels with an area of more than 50 000 km² centered at Cangzhou.

In turn, the lowering of the water table is also a key factor in hydro-geological disasters, such as earth subsidence and seawater erosion. As a result, the water ecology is exacerbated and complex.

3) Water Pollution

Water pollution is an increasingly serious problem, and major rivers and lakes are heavily polluted. It is estimated that nationally more than three quarters of the total lake areas are polluted. This is most notable in the Northern China Plain, where the rivers are dry or filled with wastewater. Recently, groundwater has become polluted, especially the

4) Chen Qiwei, Mu Xingmin, 2000: Tendency, causes and control measures on Yellow River dry-up. *Journal of Natural Resources*, 15 (1): 31-35.

groundwater running under cities. Although much effort has been expended to combat water pollution, it is still in a serious problem and exacerbates the shortage of fresh water.

Coastal waters are also beginning to be polluted. Seas are the final containers of land contaminants and easily polluted. Increasingly, intensive offshore economic activities have had an impact on the sea ecology. Many signs indicate that sea ecology is deteriorating and the last line of ecological defense is broken.⁵⁾ The following problems are greatly in evidence.

- Red tides happened more frequently and pervasively in the last decade. The years 1998 and 2000 saw the largest red tides
- Offshore bio-diversity is reduced as are fishing resources
- Onshore scenery is destroyed

4) Floods

The run-off of rivers cannot prevent floods. In fact, that would result in changes to hydrological features. The suddenness and rushing of the currents could bring about violent floods. Soil erosion and the consequent silting of river courses are also flood culprits. The 1998 large floods occurred along the Yangtze, Nenjiang and Songhuajiang Rivers, which involved 29 provinces and caused an economic loss of more than ¥200 billion.⁶⁾

Land

China is a nation that lives on the land and enjoys a long history of land use. However, it extracts a high burden from the land and degrades the land

ecology. Most particularly since the reforms in rural areas, agricultural production has increased rapidly, but farmland ecology has degraded dramatically due to excessive use of chemical fertilizers, pesticides and plastic film, and the over-depletion of groundwater. Agricultural activities are an extensive source of pollution and affect the national ecology.

Another important pressure is exerted on the land by natural resource development. Because of careless management and lower - technological methods, these activities usually cause a waste of resources or destruction of the natural structure. The productive potentialities, released by market-oriented reform in 1990s, to develop natural resources have been especially devastating to the environment. Long-lasting, continual demands on the land have resulted in degradation of land ecological functions. Major ecological problems are the following.

1) Soil Erosion

This is a worldwide problem and more prevalent in China. In the 1990s, 1.8 million km² of farmlands nationally succumbed to soil erosion. This represents 18.6% of the country and about 5 billion tons of soil elements that were washed away every year. Although widely spread, soil erosion is concentrated in the zone between damp and arid areas. The most seriously affected region is the Loess Plateau. It is estimated that about 450 000 km² of land a year is eroded, and 1.6 billion tons of soil elements is washed into the Yellow River.

Soil erosion may induce other ecological problems, such as:

- Soil impoverishment
- Silting in rivers, lakes, reservoirs and harbors
- Plant deterioration

5) Shen Yunfen: the water pollution is broken the last barrier. Report in the *Guangming Daily*, 11 September 2000.

6) State Environment Protection Agency: China State Bulletin on Environment (1998). Environmental Protection, 1999, (7): 3-9.

2) Desertification

China is not only a country with vast deserts, but also one that is subject to the threat of desertification because of windy and dry weather as well as widespread sandy soil. Although governments have tried to prevent farmlands from turning into deserts, the situation is still urgent. According to a report, there is nationally 1.74 million km² of desertified lands, which accounts for 18.2% of the country, and is expanding annually by an average of 3436 km².

3) Sandstorm

Sandstorms are a widespread phenomenon in the northern parts of China. The phenomenon appears to occur more frequently. In 1998, there were three strong sandstorms in Northern and Northwestern China. These storms adversely affected the eastern areas, and violently struck Beijing, Jinan, Nanjing, Hangzhou and other major cities. There was even a mud rainfall in Beijing. After weakening the next year, they strengthened again in the following years. In 2000, there were 13 sandstorms and they occurred earlier than before. In the middle of March 2002, the strongest sandstorm occurred in Guansu, Ningxia and Neimenggu, which widely swept Shaanxi, Shanxi, Hebei, Beijing, Tianjin and Liaoning, and last more than a week. On March 20, it violently struck Beijing. Afterwards it moved to Korea and Japan.

4) Disappearing of Wetlands

China is a country rich in wetlands, which play an important ecological role in ameliorating the impact of human activities. However, a majority of wetlands is at risk of disappearance due to dry weather and farmland reclamation projects. If this situation continues for another decade, the lost bio-diversity dependant on wetlands will be beyond retrieval.

Vegetation

Plants and grasses are an important adjuster for land ecology and play a key role in covering land from disturbances. However, they are also sensitive to ecological disturbance because they themselves are the outcome of environmental evolution. Plants and grasses are important ecological indicators.

After a long history of cultivation, there are fewer natural plants remained, and many grassland areas have been reclaimed as farmlands. Meanwhile, changes in vegetation patterns have had a strong impact on the land ecology, and non-native plants are more prone to disturbances. However, cultivation continues even more strongly today, especially in poverty-stricken areas where excessive cultivation is a key factor in the degradation of vegetation in ecologically fragile lands. Extensive degradation of plants and grasses is a sign of ecological deterioration, which in turn exacerbate other problems, such as soil erosion and desertification (Liu Guohua, et al., 2000).

It can be seen from the above that ecological problems can happen in any component of the environment and are becoming more serious. The problems are interacting. Even though there is a long-term plan to combat the effects, they are still prevalent in the country. Some new trends are emerging.

New trends

After the middle of the 1990s, the ecological issues in China became more serious and more complex. This can be seen from the following features. First, ecological problems are becoming more obvious. As substantial actions have been taken against them, a strong wave of environmental pollution was curbed and environmental problems seemed to be ameliorated. However, ecological problems are increasingly exacerbated.

In order to have a close look into environmental problems, it is necessary to distinguish ecology

from environment. The latter is a substantial base for survival and activities of human beings, such as lands, plants, water and air, and the former refers to relationships with a focus on the natural balance between different components of the latter. In general, problems that happen in the environment are the direct result of pollution or destruction exerted by human activities. However, problems related to the ecology are induced by a complex interaction of various factors. Relatively, environmental problems are usually the first stage of environmental issues, such as air pollution, and more easily cured. However, ecological problems are a further evolution of the issues, such as climate change, and difficult to tackle. Despite so, the ecology and environment cannot be separated from one another although there is a distinction between them. In fact, they are two sides of the biosphere.

According to the above, it should be understood that the environmental situation is still severe. There should not be too much joy in a small amelioration in environmental problems. In fact, most environmental problems are transformed into ecological problems, which have greater potential to damage the ecological system. This will be the greatest challenge for sustainable development.

Secondly, water shortage is an increasingly provocative factor in the environmental issues (Qu Geping, 2001). Water is a special substance. It is not only a component of nature, but also a key medium in maintaining the ecological balance. This is also true in human societies. Water is the most important natural resource used in human activities, and a crucial medium in maintaining the primary human functions. However, water shortage is a serious national problem. In north and northwest parts of the country especially, water shortages have been a key obstacle to economic activities and social affairs (Water Department, 2000). In most parts of these areas, particularly around big cities, such as Beijing, Tianjin and Tangshan, the need for water cannot be met by native sources, and there is

a need for outside sources. Nevertheless, water want will be prevalent in north parts of China in the near future, even if the great plan proposed by central government to canalize the water of Yangtze to north is quickly realized.

Thirdly, agricultural ecology is facing great challenges. Generally, agriculture is an environmental-friendly sector, and therefore should be encouraged. Open, vast farmlands surrounding a city are very necessary to maintain a pleasant urban ecology. However, agricultural pollution is in evidence today. It not only pollutes the environment itself, but also is beginning to pollute the surroundings of city, such as ground water. This is a great risk to the national ecology because widespread agricultural pollution can contribute greatly to the country's ecological deterioration. Actually, desertification, the most outstanding ecological problem, is an important sign that the national agricultural environment is beginning to seriously degrade.

Fourthly, the system of ecological environment is holistically deteriorating. In the vertical dimension from the atmosphere to vegetation, water and land, problems can happen at every layer of the environmental system, as they interact and enmesh themselves. In the horizontal dimension, ecological problems may happen anywhere: from city to village, from factory to farmland, from the eastern economic developed zone to western underdeveloped countryside, from lower plain to higher mountain, and from mainland to surrounding seas. There is nowhere the environment is purely clean, and nowhere the ecology is free from problems. In general, the Chinese ecological environment is worsening although there is some amelioration of environmental pollution. If these trends continue, the ecological situation will be even more severe in the first half of the 21st century.

Prospect

The new century begins a new era for China.

China will stride towards socialist modernization and catch up with medium level developed countries at by the middle of the 21st century. In the process of attaining this ambitious goal, China must face many ecological environmental challenges.

There are two primary factors to determine the general condition of the national ecological environment. One is population, and the other is the economic growth pattern. A huge population that steadily increases will always exert great pressure on the environment because of numerous needs for material wealth. A pattern of extensive and expansive economic growth is at the expense of the depletion of natural resources and environmental pollution. However, these two factors are quite stable and independent of human will. The national ecology will primarily follow the courses of the two factors.

Population is the more fundamental factor to the ecological environment, and any change will be a substantial contribution to the national ecology. Meanwhile, the pressure that the population exerts is passed onto the environment by way of economic activities. Therefore, the link between population and environment is bridged by economy.

According to a report, the national population will continue to grow for a few decades. If the present economic growth pattern continues and political stability is maintained, China will experience successively "three peaks" or "three zero increases" in the first half of the 21st century (Chinese Academy of Sciences Sustainable Development Research Group, 2000):

- Population peak in 2030: the total rises to 1.6 billion, and then the rate of population growth drops to zero
- The peak of materials and energy consumption in 2040 when the rate of consumption growth falls to zero
- The peak of ecological exacerbation in 2050: the national ecological pressure index reaches its

summit of 160% and then the rate of ecological exacerbation is zero⁷⁾

According to the above forecast, it is inevitable that the country's ecology will continue to worsen for at least half a century. It is after the middle of the 21st century that the ecology may begin to be restored. It is then that China can really begin to approach sustainable development. This is a long way to struggle against the ecological deterioration.

COMPREHENSIVE ANALYSIVE OF ECOLOGICAL DETERIORATION

A thorough analysis is a prerequisite for effective actions. However, there are quite different answers to the question of why the national ecological condition is so poor. Despite this divergence of opinions, a majority of the scholars share the view that ecological problems result from excessive human activities, especially destructive ones, and people should bear the responsibility for repairing the damage (Yang Chaofei, 1998; Yang Shuhua, 1998; Wang Run, et al., 1999). Some may argue that ecological deterioration is a part of the evolutionary process and beyond human control; therefore, humans bear no specific responsibility for repairing the damage. In fact, the natural evolution is not free from the interference of human activities. Human beings should try to reduce the interference.

This paper is intended to view ecological problems in a holistic manner and thus gain insight into the mechanism. In fact, physical geography provides human activities an arena that is influenced by two actors: one is the earth and the other is humans. In general, the former's influence is primary and the

7) This is calculated according to the base of 100% in 1995. See Niu Wenyuan et al., 1996: China: the forecast of its environmental situation in the 21st century. *Environment Management*, 17: 179-186.

latter's influence is secondary, but the two are interwoven. Moreover, the influence exerted by humans is increasing and playing a more significant role in the process of environmental changes. A difficulty, however, to explain how human influence works. This paper exams some possibilities.

Basic Factors

1) Fragile Ecological Geography

The geographical environment is an important and diverse arena for human activities. Differences occur in different geographical locations, and this has profound significance to a country's ecological environment.

In the view of ecology, a general feature of China's geographical environment is fragility. This is rooted in the country's geographical location. China is located in the central-eastern part of the Asian Continent, and most of the country is far from the oceans. Consequently, the general geographical profile of the environment is primarily determined by the natures of the continent, and weakly influenced by the seas.

The fragility contains the following three points:

- Aridity. The climate is a primary factor to the ecological environment (Ouyang Zhiyun, et al., 2000). However, the climate of China is arid. Nearly half of the country has an average annual rainfall less than 400 mm, where the aridity index is greater than 2.0% due to relatively higher temperature and strong wind. About 13% of the country is desert. If recently desertified lands are included, deserts comprise a quarter of China's total territory
- Variability. A classical Eastern Asian Monsoon prevails over most of the country, and it has a strong impact on the ecological environment. The climate controlled by monsoons is unstable. The summer monsoon is particularly unpredictable. However, any variation, such as rainfall,

will exert a notable impact on the ecology. Therefore, the ecological environment dominated by monsoon is also similar in nature-variable

- Yellow structure. This is one of the most notably visible profiles of China's ecological geography. With an arid ecological environment, China has vast areas of deserts and loess, and less than a third of the territory is covered by permanent green plants. In winter, a yellow color and desolation are prevalent in most areas, although greenery and vitality dominate in summer. The seasonal greenery structure, however, is unstable

The fragility of China's geographical environment implies that it is easily disturbed and difficult to restore because the arid environment has a weak resistance to interference. The variability of it, however, implies frequent interference. Therefore, the environmental ecology is unstable, and destructive phenomena, such as natural disasters, frequently occur. If a disturbance happens, it is difficult to recover the ecology. There is much evidence of it from history, such as environmental changes in Loess Plateau.

It is obvious that water is a key factor to ecological environment. Water not only plays a determining role in maintaining regular ecological functions, but it is also an important essence for revitalizing deserts. With sufficient water, the yellow structure can turn green, although it should be noted that it is neither possible nor desirable for humans to change the primary structure of nature. The aridity is a reality and beyond human capacity to change since the yellow structure is natural.

The geographical environment provides a weak background for human activities because of its fragility and yellow structure. That is to say, human activities should be exercised with caution and limited to within the ecological capacity. However, the reality is far different.

2) High Intensity of Human Activities

In spite of a weak ecological background, China's environment should not degrade, although that can easily happen. Whether it will degrade or not, also depends on another key factor – human activities.

Indeed, the huge population of nearly 1.3 billion holds a high potential for exerting pressure on the land. In eastern parts of the country, the average population density is about 500 per km². Even if in the western mountain provinces, such as Sichuan, Yunnan and Guizhou, the density is also very high. In desert areas of the Ningxia Hui Autonomous Region, the density is usually more than 50 persons per km², two and a half times greater than the popularly acknowledged desert population density of 20 persons per km². China is an over-burdened land: regardless of city or village, plain or mountain, south or north, it is crowded everywhere.

As mentioned above, the economy is a bridge between population and environment. The densely populated land is a fundamental factor in environmental degradation. This degradation is also exacerbated by non-environmentally friendly economic activities.

Indeed, China has a great need for material welfare. However, the efficiency of material utilization is quite lower. According to an analysis, in 1994, the ratio of GDP to the total material requirement in China was only 2-6% of that of developed countries (Chen Xiaoqiu, Qiao Lijia, 2000). This indicates that the environmental costs of economic activities in China are enormous. In China, the total material requirement in 1994 was 1.6 times that of the USA's. Moreover, the Chinese economy depends mainly on domestic natural resources. In 1994, the domestic material requirement per capita in China was 1.5 times that of Japan's. Therefore, the land of China usually undertakes greater ecological burden than other lands. At the same time, China pays little attention to the restoration of mined areas after development. At present, the rate of mine restoration is less than 5% in China, yet it is usually

greater than 65% in developed countries.⁸⁾

It is regrettable that China also has a backward tradition that also has a significant impact on the ecological environment. This tradition holds that "those living on a mountain live off the mountain, those living near water live off the water." This is a lifestyle of "living off the land," and implies a strong dependence on primary and local resources. It does not matter whether the land is over-burdened or not, or whether it is degraded or not, people always live there. This can explain why the land where the poor live is usually degraded, and why the poorer of the people the more destructive they become, and the more destructive they become the poorer they are. For this reason, the most serious ecological deterioration occurs in the poor, northwestern parts of China, where the ecology is naturally fragile.

Since the foundation of modern China, a comprehensive industrial system has been established. However, the social differentiation between cities and villages are also accompanied the process. A prevailing pattern of social structure is "city - industry, village - agriculture," or "urban dwellers - workers, villagers - farmers." As energy and materials used for industrial activities mainly depend on domestic natural resources, urban dwellers are actually leading the same life of "living off the land" villagers. The difference is that the former mainly use of underground resources, and the latter depend on surface resources – both depend on the land.

This pattern of land use puts an extra ecological burden on the country. Especially when productivity is lower, serious environmental destruction can be provoked. This is the reason that a strong link exists between the circles of economic growth and the waves of ecological disasters (State Commission of Sciences and Technologies Comprehen-

8) Yang Chaofei: The challenges from the Chinese ecological crisis. *China Environmental Management*, 1998, (1): 7-10.

sive Research Group on the National Physical Disasters, 1992). Although after reform and an opening to the world there were some changes in many areas, the backward lifestyle remains prevalent throughout the country.

It can be seen from the above that the high intensity of human activities and the fragile ecological geography have determined the general situation – a deterioration-prone ecosystem. This is call for a heightened environmental awareness by the public. However, it is also a sorry state of affairs.

3) Weak Environmental Awareness

China began to be involved in environmental issues in the early 1970s. The Chinese traditional culture lacked a primary modern environmental ideology, although it had a foundation of environmental ethics. However, the public concerns on environment have been notably elevated during the last quarter of the 20th century. At the same time, great progress in academic activities in the environmental area has also been made, and a system of environmental theories has been established. This has had great significance to China.

Despite this, the public awareness on environment is still weak. Environmental concerns are usually shared among scholars, officials, students, or urban dwellers. However, farmers, a principal part of the national population, are seldom aware of environmental issues. Although they have relatively stronger environmental concern than farmers do, urban dwellers are also ambiguous about most environmental ideas. Moreover, there is also a large gap between ideas and actions. Many investigations indicated that most citizens are advanced in word, but backward in action (Tang Jun, 2000).

Weak environmental awareness provides an unfavorable social context for environmental actions. In fact, it is a sign that the national culture and social improvement are at a lower level, and that it has been, and will continue to be detrimental to

environmental protection and sustainable development. This can largely explain why the national policies and actions against environmental problems cannot bring about the expected results. If this situation is to change, increasing the national environmental awareness is a pressing issue. This is, however, very difficult.

Shock of Market-oriented Reform

Market-oriented reform is the theme of China's reform. Since the end of the 1970s, China has been on a path toward fundamental market reform. One of the primary purposes of reform is to lead market functions into the national economic system. After the early 1990s when the central government named its target of establishing a socialist market system, the pace of marketization is quickened. The system of market economy is now primarily established.

This reform has a great significance to China's sustainable development. It has delivered strong shocks to all society in all dimensions, and these shocks are finally being transferred to the environment by means of economic activities.

1) Political Dimension

China is a politicized country. Political reform has fundamental relevance, however, it is difficult to realize. Up to now, only a little progress has been made in this area.

Before the reform, the general state of the country was as the following:

- The national powers in all areas were centralized to the government
- Economic activities operated at low efficiency, and the national economy and finance were in a severe condition
- Living standards of the public were at a low level.

The key problem was that the over-centralization of the power had stifled the public enthusiasm. The primary purpose of the reform was to mobilize the initiatives and bring them into practice.

The reform was focused on how to balance the power between the central and local governments. A key measure was to transfer a major part of executive authority to the lower levels. It was well accepted by local governments, and it motivated their initiatives toward local economic activities.

However, this process was also accompanied by another kind of transfer – the transferring of financial pressure to lower levels by means of “having their own meals in individual kitchens.” This was helpful to alleviate the financial burden on the central government, and to concentrate the attention of local governments on promoting economic growth. However, it also brought about some negative effects. A key problem was that the authority of the central government was weakened, and the influence of local sectionalism increased because the different levels of governments were only about maximizing their own economic interests. Although the central government still has a powerful ability to implement its strategies and policies, the local governments can also play a positive role in these activities. As a result, the relation between the central and local governments became tenser.

However, this situation is unfavorable to environmental protection actions. The Environment is of long-term interest to the whole, and the central government is paying increasing attention to it because it has a responsibility to fulfill its international commitments for cooperation in environmental issues. In recent years, many environmental programs have been put into action, and many national policies related to the environment have been published. However, these actions and policies have not achieved their expected results (Fu Bojie, Ma Keming, 1998). The reason is that the local governments paid more attention to their own

temporary economic interest and did not provide full cooperation with the central government. At the present stage, most of the national environmental actions and policies are incompatible with sectionalist interests. Nevertheless, the sectionalist interests are key obstacles to environmental actions

2) Economic Dimension

The most important and direct consequences of market-oriented reform are the rapid expansion of the national economy and the prosperity of the national market. However, the growth and prosperity also imply a greater impact on the national ecological environment.

The relationship between economy and politics is now much closer than before. Nowadays, the economy is a key determinant in the national political arena. At the same time, politics is more likely to interfere in economic activities. To some extent, a political-economic union emerged.

In fact, governments according to their political competence have encircled the national economic activities. Enterprises and markets are graded by size according to the government level to which they belong: the first rank to the central government, the second to the provincial governments, the third to the municipal level, the fourth to the county level, the fifth to the township level, and the last to the village level. It can be imagined that the governments primarily care about the enterprises and markets under their charge, which could make a direct contribution to their financial condition.

However, there is a great difference in productivity among enterprises at different ranks. Enterprises at the lower ranks are usually operated at a lower productivity due to their out-of-date technologies. Moreover, inefficient economic activity is a key technical factor to determine the extent to which pressure on the environment is applied. Naturally, these enterprises seriously pollute the environment, or waste natural resources (Li Zhou, et al., 1999). Therefore, they should be closed or

technologically upgraded. However, they are usually shielded by local governments. This is why some local governments are reluctant to ensure environmental protection.

Social Dimension

The market-oriented reform has also brought many challenges to social issues. Mr. Deng Xiaoping, the key leader of the reform, had a famous remark that "development is a supreme right." However, it is popularly translated as "money is a supreme right" in the process of marketization. As a result, the supremacy of economic interest has infiltrated every section in social dimension, and brought reverberations.

First, it has motivated the desire for money. Nowadays, everyone wants money, and the desire for money has brought about a huge force to economic growth. This is the reason why a slowdown of economic growth would provoke social disturbances. It can also explain why little attention is paid to the environment at present. The people do need a high quality environment, but they more urgently need the money. Economic interest is popularly acknowledged as the first priority. This is the source of pressure on the environment.

Second, a non-environmentally friendly consumption style emerged in the late 1990s, when a great change happened in the Chinese economy, namely, a glut of goods. Lower price stimulated the public to consume more goods. A new fashion became "contenting themselves with consuming and wasting goods in bulk." This consumption style has put an extra pressure on the environment, especially in the areas surrounding cities.

Third, the legislative system faces big challenges. The Market should be operated within the context of a well-developed legal system. Unfortunately, legal institutions cannot keep pace with marketization. Market rules or business regulations are often broken in order to gain additional profit.

Some adventurers run illegal businesses, such as smuggling or tax frauds, even at the risk of their lives. They can ignore the national laws, so why should they pay attention to the environment. It is evident that in recent years offenders of environmental laws have been on the increase. The legal context is unfavorable for the environment, and it is an important obstacle to sustainable development (Wang Jun, 1997).

Fourth, China has become a greatly differentiated society because of the gap in economic incomes. Before the reform, the highest salary was usually several times greater than the lowest. Today, however, it is more than 100 times greater. Besides this, personal incomes are pluralized, and salary is but a small part of the total incomes. As a result, a new bourgeoisie is emerging. This is a marked achievement of the reform, and should receive approval. However, it also causes many social problems, which are indirectly related to the environment.

- Inequity. Great inequalities in wealth have increased unfairness. In turn, the unfairness leads to greater inequalities in division of economic profits. This exacerbates the social condition
- Disorder in social consciousness. The ideas and behaviors are quite different among people. One of the consequences is that the public environmental awareness is difficult to be raised
- Slow rise in living standards. Although the national economic growth has kept up at a high rate, the living standards of the public have difficulty keeping pace because of the inequalities in division of economic profits. This has contributed to maintain pressure on the environment because at the grassroots, people live in a non-environmentally friendly way.

A popularly held image is that the rich are pro-environmental and the poor are the culprits of

environmental degradation. However, it is not true. Indeed, the rich are more concerned about the environment and willing to pay for improving of it. However, that is not to say that they are actually environmentally friendly. In fact, they care mainly about their immediate surroundings. For example, the rich usually have a comfortable house with a garden, and they like to choose an environmentally pleasant community to live. However, they are reluctant to pay attention to waste sorting, and unwilling to take a bus to their offices instead of driving their own cars. Therefore, that the rich care about their immediate surroundings cannot be expanded to a global concern. It is just evidence that they have a higher lifestyle and have the economic ability to afford it.

By the same principle, that is not to say that the poor are anti-environment. In fact, they are also concerned about their surroundings because these surroundings have a direct economic relation to them. The reason they conduct themselves in a non-environmental-friendly way can be explained economically. Their economic conditions determine that the poor have to lead a substandard life and have no ability to content themselves with their desired surroundings. In most cases, they are driven by poverty to do some destructive things to the environment. If economic conditions permit, they are also willing to improve their quality of life and would be more active to do some things to improve the environment.

In fact, the rich are the real culprits of environmental degradation, and the poor suffer for the faults of the former. It can be confirmed that pressure on the environment, such as disturbance, pollution, or destruction, is generally proportional to economic activities. It is known that any activity must affect the environment, regardless of its size or extent. However, the various activities are interrelated. For example, banking in and of itself is an activity without pollution and destruction, but the economic activities financially supported by it,

such as construction projects, traffic lines, or exploitation of natural resources, are highly destructive. There is no activity without an environmental impact. At the same time, economic profit is proportional to economic activities. This is to say that personal income is proportional to economic activities, regardless of who performs these activities. Accordingly, economic income should be proportional to pressure on the environment. That is, those who have a higher income will exert inevitably greater pressure on the environment than those who have a lower income. Therefore, the rich are real culprits of environmental degradation, although they are not always directly involved in environmental problems, and the poor are actually their scapegoats.

It should be known that there is a mechanism to transfer the pressure, which is exerted mainly by the rich, through hands of the poor onto the environment. In fact, the rich are the primary source of the environmental pressure, and the poor mainly act as deliverers. Based on this mechanism, the pressure is transferred from the rich to the poor, and then onto the environment. Meanwhile, this mechanism can function between the upper circle and the grassroots, between cities and villages, and between developed areas and underdeveloped areas (Jin Leshan, 1997). Accordingly, there are two basic models of environmental pressure transfer: stratum transfer and spatial transfer. Because of this mechanism, ecological problems happen primarily in poor areas and the grassroots live in an unhealthy condition. The power to maintain this mechanism to function well is the market, which drives the profit of economic activities from the environment to the rich via the poor and the pressure from the rich to the environment via the poor. This will be discussed later.

It can be seen from the above that there are a series of factors involved in ecological deterioration. In fact, factors are not limited to those mentioned above. Anything that is significant to

economy must have an influence on the environment. However, it is more important to find out the root cause of these factors because that plays a key role in dynamic relations among them. The future condition of the national ecological environment depends mainly on the root causes.

The Crux of Ecological Problems

Although many factors have been examined above, the crux of ecological deterioration is still unclear. In fact, the market is the real crux. As mentioned above, the market-oriented reform has brought great challenges to the environment. This is because the market exerts tremendous forces that drive the society to behave in a non-environmentally friendly way:

- Unsustainable production: material production is performed for the only purpose – economic profit without regard for the environment
- Unsustainable consumption: personal consumption is merely to meet one's uncontrolled desire for material wealth without regard for the waste
- Unsustainable lifestyle: the only sense of life is to content oneself without regard for the rest of the society

Obviously, this behavior deviates from the fundamental principles of sustainable development, and should be changed. However, this behavior has gained powerful momentum, and it will continue to affect the environment.

In general, the market has two fundamental functions. The first is to promote the exchange of goods and services, and the second is to motivate the mechanism of economic interest. Indeed, the two functions have played an important role in Chinese economic activities. However, they have also brought unbearable side effects, which have led to increased pressure onto the environment.

First, the market has mobilized all the resources

that could be used to exchange for money. Natural resources, particularly minerals, usually have priority of exchange because they are accessed relatively easily. As a result, they are developed at large-scale, and led to serious environmental destruction.

Second, the market has distorted the value system. Everything has its own intrinsic value, and this value cannot be expressed by prices. In particular, the environment in which people live is the surface of the earth, which has an evolutionary history of more than 4.5 billion years. It is invaluable. However, everything on the market is priced according to demand and supply. It is absurd, but that is the practice. This inevitably brings great destruction to the environment because the environment is not worth much on the market. With the process of globalization, the environment has to endure greater shocks because the exchange of goods is expanded. As the domestic market is short of money, a lower price for goods is maintained, and money is the real master of the market. In this distorted market, human beings naturally lose their inherent values. This is especially true of the poor. The environment is also a victim of marketization.

Thirdly, the market has disturbed the national ideologies. In fact, this is the ultimate root of ecological problems. As a long-developed country with a prosperous ancient culture, China had its own conventional ideological system. In history, the ideologies had created several harmonious, peaceful societies. After the entrance of western culture in the middle of the 19th century, these societies were broken up. Since the reform and open to the world, the national ideologies have especially lost ground because of great shocks from marketization and globalization. Nowadays, western ideologies prevail in every area. Although it deserves to be happy as the national economy becomes stronger, the country has lost their own traditional merits, such as frugality, sustainability, tolerance, harmony and co-existence, which are in conformity

with the principles of today's sustainable development. In fact, China is becoming the new and biggest follower of the western lifestyle with a craving for cars, high-tech equipped houses, and other technological wonders. Of course, it satisfies western countries because they can open a new market. However, this lifestyle cannot be sustained because it lacks a substantial support from natural resources and the environment, and the desire motivated by it has brought great challenges to the environment. Although it is unclear if globalization and American-led western ideologies are beneficial to developing countries, the weakness of the national ideologies is the worst misfortune for China.

It can be concluded from above that ecological problems happened in China have a complex social history. The contrast between the huge population and fragile ecological geography implies limited room for China to realize sustainable development, and the underdeveloped market necessitates that the county curbs its surging economic activities. This is a fundamental contradiction between the economy and environment, which is a great challenge for China's sustainable development. In fact, environmental degradation is a natural process for the environment to adjust itself to the high pressure placed on it. The problem is that this adjustment is not favorable to human beings. If the environment is expected to re-adjust, a new economic pattern oriented to lighten pressure on the environment is necessary. This necessitates a strategic perspective for the national reform and economic development.

A CHINESE WAY TOWARDS SUSTAINABLE DEVELOPMENT

It would have great significance to the world if China could maintain sustainable development. China is also desirous to realize it. As mentioned above, China has made a great effort toward

sustainable development but with little progress. It cannot meet the needs of sustainable development. Up to now, no fundamental changes have happened in the mechanism of economic development or in the national environmental conditions. The country is still prone to the threat of instability. The pressing issue is how to make a substantial breakthrough in sustainable development. This section is intended to explore the way and strategy for it.

Finding a Short Cut

As demonstrated above that China cannot but choose the path of sustainable development. This is determined by the national conditions (Niu Wen-yuan, 2000). However, the path towards sustainable development is still not clear although it has been one of the national strategies. A popularly accepted idea is that China could reach sustainable development only if it follows western countries, especially America. This obviously confuses sustainable development with a high level of economic development. In fact, it is the thinking of western countries that the world is threatened with non-sustainability. This is because western countries have highly developed economies and updated technologies, which have a strong reliance on natural resources. However, China has none of these advantages, but it does have three disadvantages as mentioned above: huge population, underdeveloped economy and fragile ecological geography. It is obvious that these constraints will continue to prevent China from taking the western path because China cannot afford it economically or environmentally (Chinese Academy of Sciences the National Conditions Analysis Group, 1996). Consequently, China must find its own path towards sustainable development.

In fact, China should be creative on the path to sustainable development. As a long-developed country and the center of ancient eastern culture, China has a great capacity to maintain sustainable development. A history of more than five thousand

years is a sign that Chinese culture has the potential for sustainability, although at a lower level. It is evident that the theory of sustainable development could be revitalized if it is merged with Chinese culture. Therefore, a reasonable to sustainable development is to guide the national strategies by Chinese theory of sustainable development. This necessitates the combination of Chinese culture with sustainable development.

The Chinese path to sustainable development should have the following points:

- A balanced national development in all dimensions: politics, economy, sciences, technologies, education, culture, welfare, national security, and the environment, and at all levels: national, provincial, municipal, county, town, village, family and individual
- A stronger and stable economy with equitable division of economic profits among different circles
- Advancement in the overall quality of life
- Stable progress in political democracy and social fairness
- A full revival of the national environmental ecology

In general, the Chinese path of sustainable development is a modest development based on the harmony of human society with nature and oriented towards a comfortable lifestyle. This is a unification of the traditional Chinese philosophies with modern theory of sustainable development. Meanwhile, it also necessitates a Chinese strategy to carry it into practice.

Framing a New Strategy

Sustainable development implies a radical transformation of society. This transformation should be driven by the national reforms. Therefore, reforms have great significance for sustainable develop-

ment. In the near future, national reforms should be continued and be sustainable development oriented. The key purpose is to provide a favorable context for China's struggle for sustainable development. This necessitates a strategic arrangement for reforms undertaken in the political, economic and social areas. Only concerted actions taken in different areas and at different levels can reach their expected effects.

1) Political Dimension

Political reform is a prerequisite for sustainable development. China is a pan-politicized country. Politics has a strong and extensive influence on the national issues. Although the political system has undergone reforms for more than 20 years, it is still stiff and lacks sufficient democracy. Today, political issues are also sensitive to public opinion and seem to be in the hands of competent political leaders.

This is a sign that political reforms are necessary and urgent. In fact, problems in every other area have their roots in politics. The key problem is that the national power is intensively centralized and focused on a few political leaders. Although some change in the process of balancing the power among the governments at different levels has occurred, the key governmental officials still have a supremacy over political, economic and social issues within their own sections. The difference is that previous system of direct control of business in every area has been replaced by today's system of indirect interference. However, the latter has propagated secret operations and led to create malfeasances, such as corruption. As a result, during the process of political reforms, powerful interest groups have emerged to accompany economic marketization. These groups have divided the national economic resources, and they will continue to control the direction of future reforms. This is the reason that some new reforms are unfavorable to the public. It is obviously a departure from the

originally expected goal of reforms, and this has become a new obstacle to China's reform and sustainable development.

The national political reforms should be reoriented. Their general purpose is to create pleasant surroundings for economical reform and sustainable development. China should be creative with its political structure. The centralized structure should be changed, however, a decentralized structure is also not suitable for China because of the culture and specific conditions, particularly in the present stage. An ideal is a centralized structure with a mechanism for collective decision-making. This structure should ensure that the leader group is composed only of sagacious persons and every member in it can play an equitable and positive role. For this purpose, the People's Congress is a legislative institution. The Communist Party should be a policy-making and supervisory group. The government is an executive organization.

It is regrettable that there is a large gap between the ideal and practice. There are more obstacles to political reforms. It is important to encourage the public to participate in the political process of decision-making. However, the resistance to reform is not from the public, but from groups with a stake in the outcome. In this condition, the struggle for the public to participate political decision-making will take a long time. If a breakthrough is expected in this area, the first step is to encourage the public in struggling for their freedoms of speech and news.

2) Economic Dimension

Economic reform has direct significance on sustainable development. Its purpose is to create a favorable economic order and to establish a well-developed market. As mentioned above, the underdeveloped market has brought great challenges to the environment. The problem is rooted in its lower quality. Economic reform is to promote the market to have sufficient development and to ensure it

functions in a favorable context.

Economic reform should be guided by Chinese theory of sustainable development. The market is a means to promote economic activities, but not the end of economic reform. Therefore, economic reform should provide a guideline for the market, instead of leading the former by the latter. The problems that happened in economic area indicate that economic reform has deviated from its due direction. The pressing issue is to re-orientate the reform toward sustainable development.

Sustainable development-oriented reform should contain the following points:

- Restructure the economic system and establish a dematerialized economy
- Promotion of clean production through technological innovations
- Development of the sciences and technologies base on the national traditions
- Pay more attention to develop labor resources
- Insistence on the principle of equitable division of economic profits among different circles
- Promotion of green consumption

3) Social Dimension

Social transformation is an important prerequisite for sustainable development. In fact, the determinants of unsustainable development are mainly rooted in the social area. In order to realize sustainable development, it is necessary to make radical social changes. However, this has a profound complication and needs comprehensive reforms to be undertaken in all areas.

The purpose of social reform is to create a favorable context for sustainable economic development. The major point is to establish a comfortable and harmonious society. Sufficient development of individual personalities is an important object.

The social reform strategy implies the following points:

- Development of a knowledge-based society
- Establishment of a well-developed welfare system
- Promotion of a well-enhanced legislative system
- Encouragement of a green culture

Taking Radical Measures

The ecological problems are a reality. They have exerted a strong impact on the national economy. In many places, they are beginning to be a key obstacle to local economic development. If this condition continues in the future, the ecological environment will be an insurmountable barrier to the national economy. Urgent actions should be soon undertaken.

As National President Jiang Zemin said, environmental protection is to protect productivity. In fact, ecological degradation has caused a great economic loss. According to a report (State Environment Protection Agency Nature Conservation Department, 1999), annual direct economic loss resulting from ecological deterioration and environmental pollution and destruction was estimated to be 14 % of the total GDP in the 1990s. However, the total loss will be much greater than this figure. Therefore, environmental protection has great economic significance.

Based on the strategy outlined above, major measures should be taken are as the following:

- Investigate the status of the national ecological environment and establish a data base for it (State Environment Protection Agency, 2001)
- Plan for the national ecological recovery
- Enhance the management of natural resources
- Develop low economic cost and effective environmental technologies
- Develop economic incentives for environmental protection, such as ecological taxation (Li Keguo, 2000)
- Revitalize environmental media, especially the

NGOs, to participate in environmental activities (Lu Yang, Zhu Deming, 2000)

- Start environmental actions with Beijing (Song Xiujie, Zheng Xiwei, 2001)
- Complete the market system
- Promote academic exchanges and research activities
- Strengthen international environmental cooperation

Reforming the Environmental Management System

Environmental issues should be open to the public. Everyone has a duty to participate in environmental actions. However, China seems to be an exception. The Chinese government takes on almost the entire role in environmental protection. This is an outstanding feature of China.

In fact, this is in accord with the national political structure. The government operates all the businesses in environmental area, and it conducts environmental activities by means of executive mandates (Zhang Kun, Xia Guang, 2000). This kind of environmental management system is effective for actions against pressing environmental problems, such as industrial enterprise pollution. However, it cannot bring the same effect for ecological problems, such as farmland degradation, and this system has led to many problems:

- The executive power of environmental management is centralized at governments at different levels, and this has led to an over-burden on governmental finance
- It has led to a reduction of the public's enthusiasm for environmental issues
- Environmental activities lack the mechanism of public supervision
- There is a huge shortage of environmental investments, which depend mainly on governmental finance

In general, the environmental issues are also heavily politicized. This has greatly reduced the efficiency of environmental management. It is obvious that the system cannot be sustained and is in need of reform.

The national environmental management system should be reformed according to the principle of efficiency. The present environment protection agency should be transformed into a department of the central government that mainly functions as a decision-making, supervising and administrative organization. However, specific plans and actions should be undertaken by other professional agencies or NGOs. More importantly, the public should be motivated and involved in these activities. Only when the public actively participates will the government's environmental actions bring about their expected results.

CONCLUSIONS

- find a short cut to it, as it enjoys a cultural tradition in sustainability and a history of more than 5000 years. Many ancient Chinese philosophies are in accord with the modern theory of sustainable development. The combination of the Chinese culture and sustainable development could provide a guideline for the national development in the new century

The fundamental purpose of China's sustainable development is a modest d According to the discusses above, the following can be concluded:

- China is an ecologically deterioration prone country. This is determined primarily by its fragile ecological geography and huge population
- The national ecological condition is seriously deteriorating, although a new surge of environmental pollution seems to be ameliorated
- The key motivation factor for ecological pro-

blems is the underdeveloped market which maintains a strong pressure on the environment

- The Chinese government has made great strides, especially in the 1990s, to combat pressing environmental and ecological problems, and a substantial progress has been made in approaching sustainable development. However, the country still faces great challenges of non-sustainability
- The determinants of unsustainable development are rooted in the society. The source of environmental and ecological problems is the path of unsuitable development
- China's sustainable development depends on a new Chinese path. It is possible for China to development oriented towards a comfortable lifestyle and based on a society in harmony with nature
- A set of radical measures against ecological problems should be undertaken at once. It is the time to act and not just to talk

In general, sustainable development is more than merely environmental friendliness. Sustainable development has ecological, social, and economic components. A breakthrough in realizing sustainable development requires the establishment of a good symbiosis between these three components (Hugo Priemus, 1999).

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