The Evolution of Environmental Management Philosophy Under Rapid Economic Development in China

Ping Li, Zhongliang Huang, Hai Ren,
Hongxiao Liu, Quan Wang

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The International Energy Agency (IEA 2010) recently reported that China consumed 2.25×10^9 tons of oil equivalents in 2009, i.e., China had become the world's largest energy consumer. Subsequently, the National Energy Bureau of China stated that the IEA report was inaccurate (Gai 2010). This debate reminds us the two important conferences held in the end of 2009. At the first conference (the Climate Change Conference of United Nations), the Intergovernmental Panel on Climate Change (IPCC 2009) stated that global climate changes might be more severe than predicted. Although there is disagreement about the IPCC report (Fölster and Nyström 2010), most scientists believe that climate change is a real and severe challenge and that controlling greenhouse gas emission is the most effective way to reduce global warming (Tollefson 2010).

The goal of the second conference (The 2009 United Nations Climate Change Conference) was to develop a new emissions-reduction timetable. The representative of each country balanced the national interest in maintaining economic development against the international need to reduce global warming. The major countries finally made commitments to reduce emissions (Ding et al. 2009).

The Sustainable Development Strategy Research Group of Chinese Academy of Sciences found that, during technological advancement, the developed countries greatly increased their C emissions, and in the absence of restrictive policy and resource constraints, per capita C emissions increased with increases in per capita GDP. In part because of the oil crisis in 1970s and the constraints of *Kyoto Protocol*, per capita and total C emissions have peaked and

begun to decline in most developed countries (Wu and Wang 2009; Ding et al. 2009). C emissions per unit of GDP in China are also decreasing, but greater reductions are possible. From 1990 to 2005, China reduced energy consumption per unit of GDP by 47% and C emissions per unit of GDP by 45% (Wu and Wang 2009). Considering stage of development, population growth, increase of per capita consumption, and cost effectiveness, China can better reduce C emissions by reducing energy consumption. Reducing poverty and solving other social problems, however, make it difficult to reduce C emissions.

While trying to reduce energy consumption and C emissions per unit of GDP, China has also recognized the value of terrestrial ecosystem management and vegetation restoration for C fixation. The estimated net C fixation of terrestrial ecosystems in China was $3.8\text{--}5.2 \times 10^9$ tons from 1980 to 2000, equivalent to 30% of the emissions from fossil fuel combustion over the same period (Piao et al. 2009). In 2008 in China, forests covered about 195 million ha (5% of the world total) and plantations covered 62 million ha (29% of the world total) (Ren et al. 2010). About $5.9\text{--}6.2 \times 10^9$ tons of C is stored in Chinese vegetation (Yu and Li 2009). The total C storage of all forests in China was about 1.5×10^9 tons during 1980–2000, with the afforestation projects between 1970 and 1990 contributing 450 million tons. In 2004 alone, the net absorption of Chinese forests was roughly 500 million tons of CO₂ equivalents, accounting for more than 8% of the national greenhouse gas emissions over the same period (Yu and Li 2009). Over the past 10 years, the Chinese government has invested 70×10^9 US dollars in plantation and forest restoration projects (Ren et al. 2010). The potential C fixation of current restoration projects in China is approximately 20×10^9 tons with a duration of about 100 years. In the

next 50 years, implementation of forestry projects is expected to increase forest C storage per year by 182–194 million tons (Yu and Li 2009).

CHINA'S ECONOMIC AND SOCIAL DEVELOPMENT AND ENVIRONMENTAL PROBLEMS

Chinese pollution problems are inseparable from economic and social development. Before the People's Republic of China was established in 1949, pollution problems were small and localized, and economic development did not appear to conflict with environmental protection.

During the “Great Leap Forward” in late 1950s to early 1960s, however, serious environmental pollution and ecological damage resulted from increased industrialization and especially from increased iron and steel production. During the “Cultural Revolution”, from 1966 to 1976, environmental pollution and ecological damage increased. At that time, economic development favored output quantity rather than production efficiency, resulting in a waste of resources and pollution (Xue 2008). To feed the growing population, grasslands and forests were destroyed,

and lakes and coastal areas were reclaimed (Ren et al. 2007).

Since the reform and opening-up policy in 1978, China's economy has grown rapidly. The country is now a world leader in agricultural and industrial production, its infrastructure has greatly improved, the level of export is very high, and the amount of foreign investment is the highest among developing countries. As a consequence, the income of Chinese citizens has grown (Table 1) (National Bureau of Statistics 2008; Lu and Chen 2009). With this rapid economic development, China now faces enormous social and environmental problems (Zhang and Zhang 2005).

To balance economic growth and environmental protection, the Chinese government has developed projects that promote ecological protection and environmental management (Ren et al. 2008). Many ecosystems in China, however, still face serious problems (Yang 2001; Ren et al. 2007). The Communist Party of China implemented the “ecological civilization construction strategy” in 2007. Whereas an “agricultural civilization” considers land assets as the basis of wealth, and an “industrial civilization” focuses on capital, materialism, and high consumption, an ecological civilization emphasizes “green wealth”, i.e.,

Table 1 Statistical data describing China's economic and social development from 1978 to 2007

Parameter	1978	1980	1985	1990	1995	2000	2005	2007
Total population by the end of year (by million)	963	987	1,059	1,143	1,211	1,267	1,308	1,321
Natural growth rate of the population (%)	12.0	11.8	14.3	14.4	10.6	7.6	5.9	5.2
GDP ($\times 10^9$ Yuan)	3,645	4,546	9,016	18,668	60,794	99,215	183,218	249,530
The primary industry	1,028	1,372	2,564	5,062	12,136	14,945	22,420	28,095
The secondary industry	1,745	2,192	3,867	7,717	28,680	45,556	87,365	12,1381
The tertiary industry	872	982	2,585	5,888	19,978	38,714	73,433	100,054
Per capita GDP (Yuan)	381	463	858	1,644	5,046	7,858	14,053	18,934
GDP growth rate over the previous year (%)	11.7	7.8	13.5	3.8	10.9	8.4	10.4	11.9
Export amount ($\times 10^9$ Dollars)	98	181	274	621	1,488	2,492	7,620	12,180
Import amount ($\times 10^9$ Dollars)	109	200	423	534	1,321	2,251	6,600	9,558
Actual utilization of foreign capital ($\times 10^9$ US Dollars)			229	696	2,307	5,204	8,092	9,698
Urban residents' income per capita (Yuan)	343	478	739	1,510	4,283	6,280	10,493	13,786
Rural residents' net income per capita (Yuan)	134	191	398	686	1,578	2,253	3,255	4,140
Grain output (million tons)	304.77	320.56	379.11	446.24	466.62	462.18	484.02	501.48
Crude oil output (million tons)	104.05	105.95	124.90	138.31	150.05	163.00	181.35	186.66
Power output ($\times 10^9$ KWH)	25.66	30.06	41.07	62.12	100.70	135.56	250.03	327.77
Crude steel output (million tons)	31.78	37.12	46.79	66.35	95.36	128.50	353.24	489.66
Automobile output (by thousand)	149	222	437	514	1,453	2,070	5,705	8,887
Highway mileage (thousand kms)	890.2	883.3	942.4	1,028.3	1,157	1,402.7	3,345.2	3,583.7
Waste water discharge amount ($\times 10^9$ tons)				3.54	3.562	4.152	5.245	5.567
COD discharge amount (million tons)				7.08	7.70	14.45	14.142	13.818
Exhaust emission discharge amount (trillion m^3)					108,000	138,145	146,431	132,213
Industrial solid wastes (hundred million tons)				5.8	6.5	8.2	13.4	17.5

resource security, environmental security, and social safety. An ecological civilization produces high-quality products with minimal pollution and encourages people to conserve resources and protect the environment. Establishing an ecological civilization requires coordinated regional development that considers social, economic, and environmental needs (Hu 2007).

VIEWS ON ENVIRONMENTAL MANAGEMENT PHILOSOPHY HAVE CHANGED IN CHINA

With the convening of the United Nations Conference on the Human Environment in 1972, the Chinese government realized the China, like other countries, had serious environmental problems (Kang 2008). In 1973, the State Council of China held the first National Environment Protection Conference and issued regulations concerning environmental protection—the first document on environmental protection in China. The document established policy that emphasized overall planning, rational distribution, comprehensive utilization, and environmental protection for the benefit of the people. Afterward, environmental protection institutions were set up to reduce and recover waste water, waste gas, and waste residue. In spite of the establishment of an environmental science and technology system and some achievements in pollution control, environmental protection continued to focus on easy, short-term, and end-treatment solutions.

From the 1980s to 1990s, China began to recognize the value of the environmental and natural resources and attempted to internalize the external costs of industrialization and other aspects of development. In other words, the negative effects of pollution and environmental damage were to be reflected in the price of products and services (Ye and Wan 2008).

In 1990s, the focus of environmental protection in China changed from end-treatment to control over pollution sources. Clean production was emphasized, and both the concentration and quantity of discharged pollutants were monitored. Nevertheless, priority was given to economic development, and environmental pollution and degradation continued (Yang, 2001).

Since 2000, China has realized that environmental problems relate to development and that environmental strategies should guide rather than follow economic development. The outline of the national program for eco-environmental conservation issued in 2000 indicates that environmental deterioration must be completely stopped by 2030; that areas with rich biological resources, including first-level branches of major river system and wetlands, must be protected; and that damaged ecosystems must be reconstructed and restored (Xu et al. 2009). At the same

time, the Chinese government has shifted its emphasis from environmental security to ecological security and enhanced ecosystem services (Information Office of State Council 2006).

While China has attached great importance to the study of natural systems, its research on the social system has been limited. Past research on the social system has emphasized that economics and profit maximization are the basis for “development” and “modernization.” It is this kind of “development” and “modernization”, however, that has degraded China’s ecological systems and polluted its environment. Because of limitations in fossil fuel supplies and the recognition of environmental deterioration, and because of governmental incentives and technological innovations, traditional industries are being replaced by more efficient and less harmful industries (Shang 2009). At the Sixth National Environmental Conference, Premier Wen Jia-bao emphasized the importance of three transitions: (1) we must replace the focus on economic growth with a focus on environmental and economic development; (2) we must no longer view environmental quality as secondary to economic development; and (3) we must use administrative methods to rationally and comprehensively combine environmental and economic management.

HOW ENVIRONMENTAL STRATEGY CAN GUIDE THE ECONOMY

China is facing unprecedented challenges in its efforts to protect the environment and natural resources. The rapid deterioration of the nation’s environmental quality and depletion of its natural resources are threatening the lives and health of its citizens and the potential for sustained economic growth. In response, the Chinese government has recently elevated the importance of environmental protection in its national development strategy (Li 2004; Task Force on Environmental Governance 2006). In the current environmental strategy, policy and initiatives guide the economy (Xu et al. 2009). Policy is being connected to human activity and the environment in four coordinated ways described in the following paragraphs.

- (1) The creation of sustainable styles of life and production. Economic development in China should increasingly depend on the inventiveness and hard work of its citizens rather than on the exploitation of its natural resources and ecosystems (Qi et al. 2007). China should encourage the development and use of low-carbon technologies so that green industries will develop. China should also increase the conservation of natural resources and the protection of its ecosystems. Education programs should enhance public

awareness of the benefits of low-carbon consumption, reduced pollution, and conservation of resources and ecosystems.

- (2) The continued reform and opening-up of the economy and optimization of industry. The industrial development strategy should be strengthened, and population distribution should be adjusted accordingly. The ability of cities to absorb rural labor should be increased. While urbanization continues, terrestrial ecosystems must be managed and restored so that they serve as valuable pools for C storage.
- (3) The improvement of policy that will guide the development of the low-carbon economy. This will involve the establishment of a nationwide social security system, a decision consultation system, an ecological resource and environmental compensation mechanism, a mechanism for planning and coordinating regional development, and a policy system that will encourage the development of an ecological civilization.
- (4) The strengthening of international cooperation for the peaceful use of global environmental resources. China has only 7% of the world land area, its per capita consumption of freshwater is only 25% of the world average, and its farmland per capita is only 14% of the world average. Yet, China feeds more than 20% of the world population and serves as the “factory to the world”. This imbalance contributes to environmental problems in China and should be corrected by the rational use of global environmental resources. Apart from fairly purchasing global energy sources and primary products, China should invest in other countries, should export labor and technology, should produce and sell products in other countries and finally should share experiences with other countries.

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Ping Li

Address: Key Laboratory of Vegetation Restoration and Management of Degraded Ecosystems, South China Botanical Garden, Chinese Academy of Sciences, Guangzhou 510650, China.
Address: Graduate University of the Chinese Academy of Sciences, Beijing 100049, China.

Zhongliang Huang (✉)

Address: Key Laboratory of Vegetation Restoration and Management of Degraded Ecosystems, South China Botanical Garden, Chinese Academy of Sciences, Guangzhou 510650, China.
e-mail: huangzl@scib.ac.cn

Hai Ren (✉)

Address: Key Laboratory of Vegetation Restoration and Management of Degraded Ecosystems, South China Botanical Garden, Chinese Academy of Sciences, Guangzhou 510650, China.
e-mail: renhai@scib.ac.cn

Hongxiao Liu

Address: Key Laboratory of Vegetation Restoration and Management of Degraded Ecosystems, South China Botanical Garden, Chinese Academy of Sciences, Guangzhou 510650, China.

Quan Wang

Address: Institute of Silviculture, Shizuoka University, Shizuoka 422-8529, Japan.