Synopse

East and West at a Crossroad: A Commentary on China's Environmental Regulation and Resource Use

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Abstract: This commentary arises from a seminar course on China's environment taught at Yale University. Emerged out of the seminar discussion are five themes, including: a) the balancing act of local interest and regional coordination in the fight against pollution dispersion, b) the creation of special environmental zones for experimenting bold, forward-looking ideas, c) new approaches to environmental education and capacity building, d) the need for international collaboration, and f) the unique situation of checks and balances in China's environmental decision-making. This paper is not intended to provide an in-depth analysis of these topics; rather its goal is to emphasize the need for infusion of western environmental thinking with China's reality.

Key word: environmental regulation; resources use; western thinking; China

1 Introduction

This commentary arose largely from a lecture series course taught in the School of Forestry and Environmental Studies, Yale University in the fall semester of 2008. The course explored the environmental ramifications of economic growth in China and the challenges to protect natural resources and preserve biodiversity. It discussed the science foundation for environmental decision-making and strategies for engaging the government, private, and non-government sectors in sustainable development. Eleven prominent environmental scholars were invited to Yale to join the discussion with Yale faculty and students (Figs. 1–3). The lecture series was motivated by three broad questions: 1) What are the most pressing environmental problems China faces now and in the future? 2) Which problems are confined to the national boundary and which have a global footprint? 3) How can the international communities contribute to China's environmental reform? The lecture series represents the first step of a larger Yale research and education initiative on China's environment.

The rationale for the lecture series was simple. China is the fastest growing economy in the world. Associated with the rapid growth are environmental pollution, loss of biodiversity and depletion of natural resources. The central government of China, in recognition of these environmental challenges, is seeking policies and regulations that can promote sustainable development "in harmony with nature". Some of the environmental damages are not confined within China's national boundary. It is imperative that developed countries play a constructive role in helping China meet these challenges. The fusion of western thinking with China's reality will promote stewardship of natural resources in China and worldwide.

In the course, we discussed a set of diverse and seemingly unconnected topics. Our speakers were asked to deliver their perspective on the topic of their choice, and not to emphasize too much on cross-cutting issues. Their presentations and the subsequent discussions have been published elsewhere (Lee 2009). The purpose of this commentary is to distill the themes that have emerged out of these discussions into constructive recommendations, in the hope that they may help policymakers to move forward with China's environmental reform.

2 Pollution dispersion: local interest versus regional coordination

Protection of local interest occurs in response to various political and regulatory pressures. During the 2008 Olympics, "yellow cars" – cars that were built before 1999 and did not meet the EU1 emissions standards – were kept outside Ring Road 6, in an effort to improve air quality in

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Fig. 1 Class photo with Professor Alice Newton (5th from left, back row), University of Algarve, Portugal.

Beijing. In Guangdong Province, policies that promote the change of its industry towards the service and high tech sectors have caused polluting textile factories to relocate to the less developed, neighboring provinces. For some factories, relocation to regions of cheaper labor is also a matter of survival as the new labor contract law increases their operation cost. In the wake of the 2007 Lake Taihu algal boom, the central government shut down thousands of chemical factories in the lake catchment, only to find that many of them reopen elsewhere. Because of weak national and regional coordination, such instances of pollution dispersion appear widespread.

Fig. 2 Professor LIU Jianguo (middle), Michigan State University, speaking to students at the reception after hislecture.

Pollution dispersion matters because the transport of pollutants through either the atmosphere or the hydrosphere is not confined by any political boundary. In principle, the performance of government officials is evaluated against not only GDP growth but also emission reduction and energy savings targets. But attention to these environmental goals varies across the country. In the less developed, interior regions, GDP growth still dominates the social and economic agenda, so much so that some county and provincial officials would disregard environmental regulations in order to recruit polluting enterprises. Yet locations that see polluters moving away may not actually enjoy improved environmental quality. For example, relocating textile factories from Guangdong to Guangxi could even deteriorate the water quality of Pearl River in Guangdong. This is because with less stringent regulations, these factories can discharge more waste water into West River, a large tributary of Pearl River. In the case of air quality management, consideration of pollution footprint is equally important: only by shutting down factory operation and tightening road traffic in its neighboring provinces did Beijing see improved air quality during the Olympics.

Clearly, regional coordination is necessary in order to improve environmental quality. One idea advocates utilizing industrial parks as an effective solution to the dispersion problem. In these parks, pollution regulation is more stringent, environmental monitoring more comprehensive, and enforcement capacity much stronger than if pollution sources are dispersed to remote locations. By

confining industries in a small area, recycling of solid waste, heat and waste water becomes cost-effective, on the principle of industrial ecology (Graedel and Allenby 2002). One downside is that most of the industrial parks in China are located in population centers so special attention must be given to human exposure to air pollution.

A second idea that deserves serious consideration is the ranking of ecological service zones according to their carrying capacity. Some zones must be protected for water quality and others for wildlife conservation. These ecological attributes determine where pollution sources should be placed. Practicing the ecological principle, however, requires holistic thinking beyond one single performance measure. The "Grain-to-Green" program is a successful example of national coordination to protect marginal land in China's west. The burden of food production is now shifted to more fertile land in the east, sometimes with unintended consequences. In the Lake Taihu catchment, fertilizer use, an important contributor to water quality degradation, is at 580 kg ha^{-1}, which is 40% higher than the national average and 6 times the global average (An and Wang 2009; Sun and Luo 2009; Table 1). Arguably, the pressure to sustain high crop yield makes it difficult to curb fertilizer pollution.

3 Special experimental environmental zone

Progress towards environmental objectives is hampered by the mismatch between the simplicity of environmental policies and the complex reality on the ground (e. g., Percival 2008). Environmental laws in China often lack enforceable details. Policy directives, such as the 11th Five-Year Plan, contain goals that are more aspirational than binding. In the case of wildlife conservation, the blank ban against hunting may actually hurt conservation objectives because it removes incentives for local people to participate. Indeed, prohibition is easy to legislate, though not necessarily easy to enforce.

In our opinion, one way to move forward is to create special environmental experimental zones (SEEZs). Like the special economic zones that spurred the economic reform in the 1980s, the SEEZs are intended for experimenting with bold, forward-thinking environmental measures. They are test ground for trying out concrete methods being used in the developed countries for regulation, monitoring and capacity building. The mindset of learning from experimentation also provides real hope to break the ideological gridlock that otherwise would be insurmountable at the national scale. The lessons learned would then propagate from these zones to the rest of the country, much like the way the economic reform policy did in the 1990s. To paraphrase Deng Xiaoping, China would be practicing environmental regulation with Chinese characteristics.

Some environmental experiments are already happening. In ecocities, new technology and concepts are being tested that will minimize resource consumption and waste output. The trial SO_2 emissions trading program is an attempt to learn from the success of acid rain abatement in the U. S. In Shanghai, a new land credit system allows real estate developers to gain development right if they restore enough degraded wetland elsewhere (An Shuqing, personal communication). One feature that distinguishes the SEEZ from these ongoing environmental experiments (and the special economic zones) is the necessity to encompass large geographic areas. Without coordination over a large enough area, ecocities cannot improve the quality of life as they are merely green dots in a landscape inundated by brown smog and fouled by polluted water.

In the spirit of experimentation, we should challenge the widely-held view that it is the publicizing of the

Table 1 Comparison of yields & inputs in the agricultural sector, 1997 (Gale 2002).

	Unit	China	World	US
Production per hectare				
Rice, paddy	Tons	6.2	3.9	7.0
Wheat	Tons	3.7	2.7	2.8
Corn	Tons	4.6	4.3	8.6
Soybeans	Tons	1.7	2.2	2.6
Fertilizer use per hectare	Kilograms	271	94	111
Farm worker per 100 hectare	Number	310	82	2
Land irrigated	Percent	40	18	13
Tractor per 1000 hectare	Number	7	18	27

Fig. 3 Professor HAO Jiming (center, front row), Tsinghua University, attending dinner hosted by students.

damage of pollution, not the pollution problem itself that may trigger social unrest. In the SEEZ, efforts should ensure that not only data on environmental quality but also those on human health are easily accessible by the general public. Even simple maps of morbidity and mortality, when analyzed together with air and water pollution maps (http://en.ipe.org.cn/), can send powerful message to policymakers and entrepreneurs about the real cost of economic development.

Another experiment for consideration in the SEEZ is to privatize the work related to environmental monitoring. An obstacle in China's environmental reform is the lack of manpower in the State of Environmental Protection Agency (SEPA; now Ministry of Environmental Protection, or MEP). As noted by Liu and Diamond (2008), SEPA employs only one-eighth of the number of workers of the US Environmental Protection Agency even though China's population is three times that of the U.S. The elevation of SEPA to a full ministry has changed the power dynamics as MEP leaders can now participate in cabinet-level meetings. However, the size of the MEP workforce remains essentially unchanged. Because the government uses a rigid quota system for hiring public servants, a drastic increase in the MEP size is not going to happen anytime soon. In recognition of this reality, private firms should be allowed to shoulder some of the workload. Environmental monitoring is a technical field, with well-defined parameters and technology. It is a good candidate for the privatization experiment. In the Changzhou Municipality, Jiangsu Province, the city environmental bureau has already contracted private firms to monitor waste water discharge at various factories. More such practices should be encouraged.

Forward-thinking is an important hallmark of the SEEZ. So far, the emphasis of air quality management has been on sulfur compounds and particulate matters. Ozone and mercury, two other pollutants at the center of regulatory activity in the developed countries (e. g., Amar 2003; European Environment Agency 2005), have received little attention. Rather than handling one set of pollutants at a time, policymakers are encouraged to think beyond the present timeframe and anticipate the harm ozone and mercury will continue to cause in the future. Similarly, the SEEZ should lead the way in experimenting effective strategies for reducing the carbon footprint of economic development. Experiments of this type are impetus for transforming China into a society in true harmony with nature. This forward-looking vision is increasingly recognized by high-level government officials: In a recent public lecture at Yale University, Dr. Xu Kuangdi, president of the Chinese Academy of Engineering and former mayor of Shanghai, argued that the only way to achieve modernization is through the development of renewable energy and building a low-carbon economy.

4 Environmental education and human resource development

The need to build environmental capacity, especially human resource development, is a top priority for environmental reform. Harris (2008) offers a sobering example: only one wildlife biologist is engaged in the management of a wildlife reserve that is twice the size of Montana. The reasons for the low capacity are manifold. Wildlife education and research in China are very theoretical and are not well connected to managing wild species in open habitats. More generally, environmental monitoring is a blue-collar, technician job with a low social status and little prospect for career advancement. In universities and government laboratories, SCI publication counts are an

overriding factor in job performance evaluation. People are not rewarded for painstaking work on data collection and on the solution of practical problems.

New incentives generated by the privatization experiment discussed above can operate in parallel to the academic performance matrix. They allow market mechanisms to value the service the technical people provide to the society.

University education plays a vital role in capacity building. Environmental degree programs in Chinese universities have a relatively short history of ten years or less. They place a strong emphasis on technical training related to some focused aspects of the environment. In comparison, the US environmental programs emphasize rounded education, with a mode of training akin to that of the MBA degree. Students study not only technical skills, but also environmental law and policy, environmental economics, and statistical analysis of environmental data. At graduation, they are knowledgeable of the critical issues concerning pollution, natural resources, biological conservation and environmental regulation, the four pillars of effective environmental management. Such a model of environmental training could be of value for China.

A related, but broader question is whether people with more advanced education will have a smaller environmental footprint. Liu *et al.* (2003) made the case that investment in education is a viable solution to making the Wolong Panda Reserve a better system. This is because with good education, young people in the reserve can find employment elsewhere, thus reducing the pressure on local ecosystems. On larger scales, how education shapes personal consumption habit is poorly known. Quantitative studies are needed to establish evidence that links better education to greener consumption choice.

Executive training is increasingly used for capacity building. For example, Tsinghua University has been collaborating with the Yale School of Forestry and Environmental Studies on an environmental education program targeted at city mayors. Sun Yat-Sen University has launched a training program for the municipal government of Shenzhen, in which mandatory attendance is required of its top officials. In the author's opinion, executive training is much more effective if social, economic and technical lessons are brought to bear on the analysis of specific cases than theoretical lectures on Environment 101.

Lake Taihu, the third largest freshwater lake in China, is an excellent candidate for such case analysis. According to An Shuqing, an expert on wetland ecology in Nanjing University, there are 103 lakes with size greater than 1 km^2 in the Yangtze River Basin. All but three are now isolated from Yangtze for flood control, land reclamation and fish horticulture. Whether or not to dam Lake Poyang, China's biggest freshwater lake, is now in heated discussion between the Jiangxi Province government and wetland ecologists (Li 2009). (Lake Dongting, the second largest lake, seems safe at the moment because the nature of the geography requires that the river water runs though it.) There is an urgent need for local officials and business leaders to learn lessons from the restoration of Lake Taihu so that the ecological problems that have occurred in its catchment are not repeated elsewhere.

5 International collaboration

China's environmental woes are also those of the world. The developed countries are partially responsible for environmental degradation in China: They deplete natural resources in and import factory products from China but leave behind hazardous wastes (Liu and Diamond 2005). It is also important to note that some of the pollutants are dispersed globally through the atmosphere so that their damages are not confined to China's national boundary. It is imperative that the international community play an active role in helping China meet its environmental challenges.

Ma and Zhao (2009) emphasize the unique role of business leaders of multinational companies in international collaboration. By forming partnership with domestic NGOs, these companies can influence business practice in China. Some of them mandate that their suppliers adhere to stringent international pollution standards. Domestic companies on their own pay less attention to being black-listed on Ma's pollution map, but are more likely to clean up if their polluting behavior is hurting the brand name of the multinational that purchases their products (Esty and Winston 2006). Over time, this bottom-up pressure should lead to positive changes in the Chinese corporate culture.

Several barriers to international collaboration deserve further attention. The first one concerns intellectual property right. Technology transfer, especially the transfer of green technology, has the potential to produce low-hanging fruits. Although Chinese laws on intellectual property have been streamlined since China joined the WTO, enforcement of these laws is still weak. A strengthened protection will remove the fear of some entrepreneurs that their intellectual property rights may be infringed upon should they use their

latest invention in China. It will also stimulate the emergence of new technology that can cope with China's unique situations. For example, there is an urgent need to find ways to dispose the massive amount of manure waste being produced by livestock farming (Sun and Luo 2009). Scientists are challenged to convert the manure to either chemically balanced fertilizer or a new generation of biofuel. Foreign talents are likely to take on these challenges if they are assured that their research results will be strictly protected.

A second barrier is the lack of transparency in bilateral collaborations. Many government agencies and universities have environmental programs that engage partners in China, but they are not fully informed of what others are doing. The lack of multi-lateral dialogues may stem from the desire to protect trade secrets, or more likely from different incentive structures for their work with China. We believe that programs that target at a specific problem can bring nations to work together. For example, South Korea, Japan and the U.S. all feel the impact of mercury emissions in China. Having this problem orientation should help streamline the incentive structure towards a common goal for these countries.

Shortage of bilingual professionals is identified as the third barrier that hinders international collaboration. In the Office of International Affairs at the US EPA, fewer than a handful of people are proficient in Chinese. According to Alice Newton, a professor at the University of Algarve, Portugal, language difficulty is a big obstacle that plagues the direct dialog between small businesses in the EU countries and their Chinese counterparts. She also notes that EU's capacity building efforts bear the legacy of its colonial past: Spanish researchers prefer to work in Mexico and Portuguese scientists in Brazil, in large part because of convenience of communication. Language immersion programs, such as the two-way Erasmus-Mundus where western students receive intensive language training in China (Newton and Hsu 2009), could facilitate better collaboration in the future.

6 Checks and balances

The power balance in China's environmental regulation is played out vertically between the central government and those at the provincial and county levels. In western democracies, environmental regulations are negotiated among elected government officials (who represent citizens 'concerns), industrial groups, and environmental NGOs (Revesz 1997). In China, the interests of various actors are intertwined. For example, enterprises in the energy, auto and construction sectors are the backbone of the booming economy and also the main culprit of the smog problem. A majority of these enterprises are state-owned. Some government entities serve the dual role of polluters and pollution regulators. There is little oversight from NGOs and private citizens on how these regulators regulate themselves. Only their superiors in the vertical chain of command have the real power to hold them accountable.

The central government, with good intentions and policies, often relies on environmental incidents as leverage for action. Immediately after the chemical spill in Songhua River in 2005, the minister of environment protection was removed from power. The Lake Taihu algal boom cut off water supply to millions of residents in the Wuxi Municipality, and more than 3000 chemical plants were shut down. In response to the severe water shortage in the lower reach of Yellow River, a strict water quota system was enforced for provinces in the upper reach of the river basin. The governmental response is decisive when people's lives are threatened or conditions are causing social unrest.

Environmental degradation differs by degree. If the situation does not reach the point of crisis, it usually does not get the attention at the top. Even if it does, the shortage of enforcement manpower does not guarantee prompt action. This is a gap that non-governmental actors can fill. Through streamlining the accessibility of environmental pollution data, NGOs can generate pressure on polluting enterprises and even on local governments. With the backing of the central government, professional societies, such as the Ecological Society of China, are now taking on the added responsibility of environmental monitoring, auditing and eco-labeling. Scientists, especially prominent ones such as members of the People's Congress and the Science Academy, are playing an important role in the power balance.

The relationship between NGOs and the government is unique in China. For these actors to be effective, it is essential that they do not have a hidden agenda, that their motives are in line with the social and economic goals of the central government, and that their actions support rather than undermining the socialist state of governance.

A bright side of the top-down command structure is that if implemented on sound sciences, it can avoid the situation of various parties being bogged down in endless negotiations. This often translates into speed and efficiency, especially if aided by

the ubiquitous role of public land ownership. The web of high-speed rails connecting major Chinese cities, when completed, is expected to greatly reduce greenhouse gas emissions. The vast expanse of the rail system in China and its speed of construction are possible largely because of public land ownership under centralized planning. A project of this scale would be unimaginable in the US where land is privately owned and seizure of private property must clear numerous legal hurdles such as the claim of eminent domain. It is no surprise that after decades of deliberation, only recently did Californians see the real hope of a high speed rail line connecting San Francisco and Los Angeles. The efficiency is also felt at the local scale: authorities in Beijing have implemented measures to fight air pollution at a speed that environmental professionals in the west can only envy (Wines 2009).

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References

Amar P. 2003. Mercury Emissions from Coal-Fired Power Plants: The Case for Regulatory Action. Northeast States for Coordinated Air Use Management, Boston, Massachusetts. (Available at www.nescaum.org)

An S Q, Wang R S. 2009. Human-induced drivers of the development of Lake Taihu. In: Lee X (ed) Lectures on China's Environment. Yale School of Forestry & Environmental Studies Publication Series Report Number 20. (available at http://pantheon.yale.edu/~xhlee/pubs.htm)

Esty D, A S Winston. 2006. Green to Gold. New Haven, CT, USA: Yale University Press.

European Environment Agency. 2005. Air pollution by ozone in Europe in summer 2004. EEA Technical Report No. 3/2005, Copenhagen. (Available at www.eea.eu.int)

Graedel T E, B R Allenby. 2002. Industrial Ecology (2nd edition). Upper Saddle River, New Jersey: Prentice Hall.

Gale F. 2002. China at a glance: A statistical overview of China's food and agriculture, In: USDA (2002), China's Food and Agriculture: Issues for the 21st Century.

Harris R B. 2008. Wildlife Conservation in China: Preserving the Habitat of China's Wild West. East Gate Books.

Lee X. 2009. Lectures on China's Environment. Yale School of Forestry & Environmental Studies Publication Series Report Number 20. (Available at http://pantheon.yale.edu/~xhlee/pubs.htm)

Li J. 2009. Scientists line up against dam that would alter protected wetlands. *Science*, 326: 508–509.

Liu J, J Diamond. 2008. Revolutionizing China's environmental protection. *Science*, 319: 37–38.

Liu J, J Diamond. 2005. China's environment in a globalizing world. *Nature*, 435: 1179–1186.

Liu J, Ouyang Z, S L Pimm, P H Raven, Wang X, Miao H, Han N. 2003. Protecting China's biodiversity. *Science*, 300: 1240–1241.

Newton A, A Hsu. 2009. EU collaboration with China in environmental capacity building. In: Lee X (ed) Lectures on China's Environment. Yale School of Forestry & Environmental Studies Publication Series Report Number 20. (Available at http://pantheon.yale.edu/~xhlee/pubs.htm)

Ma J, Zhao Y. 2009. The role of environmental NGOs in shaping a green China. In: Lee X (ed) Lectures on China's Environment. Yale School of Forestry & Environmental Studies Publication Series Report Number 20. (Available at http://pantheon.yale.edu/~xhlee/pubs.htm)

Percival R V. 2008. The challenge of Chinese environmental law. *International Environmental Law Committee Newsletter, American Bar Association*, Vol 10, No 4.

Revesz R L. 1997. Foundations of Environmental Law and Policy. New York: Foundation Press.

Sun L, Luo Y. 2009. Impact of increasing feed and meat demand on China's agriculture and environment. In: Lee X (ed) Lectures on Chinas Environment. Yale School of Forestry & Environmental Studies Publication Series Report Number 20. (Available at http://pantheon.yale.edu/~xhlee/pubs.htm)

Wines M. 2009. Beijing's air is cleaner, but far from clean. *New York Times*, October 17.

关于中国环境管理和资源利用的几点思考

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摘要：这一评述总结2008年耶鲁大学中国的环境和资源利用问题研讨会的讨论重点，包括：1) 保护地方利益和防止污染扩散的区域协调；2) 建立环境特殊区，实行前瞻性的环境政策试验；3) 加强环境和资源利用教育和能力建设；4) 协调国内和国际环境合作关系；5) 中国的环境决策中权力的制约与平衡。本文不打算对这些专题进行深入分析，而是强调西方环境管理经验和教训与中国的现实相结合的重要性。

关键词：环境管理；资源利用；西方思路；中国