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Perspective

Recalibrating China's environmental policy: The next 10 years

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ABSTRACT

Just after its once-a-decade leadership transition, China faces the cumulative consequences of the 30-year drive to grow its economy with scant attention paid to mounting ecological and social costs. A survey of six main stressors in China – ecosystem degradation, food security, energy, water, urbanization and climate change – reveals that domestic environmental policies are inadequate and need to be reformed. China's ecosystems remain subject to widespread degradation and food insecurity is increasing. There are growing conflicts over water quality and quantity, and energy demand is rising rapidly. Urbanization is set to power future growth in China, yet sustainable urban planning cannot proceed without fundamental environmental and social policy reforms. Climate change is already negatively impacting China and is projected to grow in strength. China's new leaders must act soon to recalibrate environmental policies across all these sectors. In addition, they must address the lack of interdisciplinary problem-framing and gaps between central government policy and local level implementation. While many sectoral solutions are already in progress, over the next decade and beyond, institutional reform across the country's social–ecological systems will be key to solving China's environmental problems.

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1. Introduction

In 2013, as China ushered in its once-a-decade leadership transition to new President Xi Jinping and Prime Minister Li Keqiang, the country stands at a critical crossroads. The economy has slowed and both domestic and international experts are calling for a broad transition away from the export-led growth that has made China the world's second-largest power (The World Bank and Development Research Center of the State Council, 2012). Concurrently, China faces the cumulative consequences of its 30-year focus on economic growth with scant attention paid to mounting ecological and social costs. In January 2013, citizen outrage over Beijing's hazardous air quality served as a tipping point for the central government to act and, since then, environmental problems have been featured prominently in the media and been discussed widely (Wu et al., 2013). The government has already made legally binding commitments to reduce national carbon intensity, increase

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the use of non-fossil fuels and expand forests. Yet there is little interdisciplinary problem-framing to address the lack of policy connections within and across China's social–ecological systems (United Nations and Asian Development Bank, 2012). (A social–ecological framework accounts for the links between resources, people and governance systems (see Ostrom (2009)). At the national level, ministerial actions often lack coordination and officials often do not have the capacity to enforce regulations. There are disconnects between central and local decision making; at local levels, Beijing's edicts are subject to "bureaupreneur" behavior where officials often act contrary to central government mandates resulting in poor policy implementation (Hillman, 2010). With environmental problems now openly acknowledged but solutions still far off, and already-unprecedented urbanization rates gaining speed, the next decade will likely determine the future trajectory of China's rise. A brief overview of six main stressors – ecosystem degradation, food security, energy, water, urbanization and climate change – shows that Xi and Li must act soon to recalibrate the nation's environmental policies to meet growing resource demands and uncertainties.

2. Ecosystem degradation

Despite extensive restoration efforts and huge amounts of funding, China's ecosystems remain subject to ongoing degradation (Lu et al., 2011). For example, though there have been large increases in forest cover, only about 11% of China's forests have good ecological functioning (Department of Forest Resources Management, 2010). There has been a logging ban in place in 12 western provinces since 1998, yet due to illegal cutting, primary forests in some places have decreased by 6% over this period (Brandt et al., 2012). Ecosystem fragmentation is increasing as a result of rapid infrastructure growth with little coordinated planning (Li et al., 2010). This has been particularly extensive in Xishuangbanna, southern Yunnan, the most species-rich region of the country (Xu et al., 2013). Grasslands, comprising c. 40% of the countries' land area, remain severely degraded, though the pace of degradation has been slowed (Huang et al., 2013). Aquatic systems, including rivers, lakes and wetlands, have been modified extensively and/or polluted by industry and agriculture. Marine pollution has doubled since 2009; Chinas' coastal waters are now polluted over an area of c. 145,000 km^2, stretching from Vietnam to Korea (Zhang and Crooks, 2012). Loss of intertidal habitat is also severe and set to increase; recent studies show that fisheries and ecological services are collapsing with implications for human livelihoods (MacKinnon et al., 2012). Overall, government efforts to protect species and ecosystems have increased, but effectiveness has not kept pace with degradation. For example, the terrestrial nature reserve system has expanded but little progress has been made on major problems (i.e. unmarked boundaries, poor enforcement, low levels of staff training, inadequate funding, rampant commercial development) that were identified 10 years ago (Jim and Xu, 2003; Xu et al., 2012). The central government's large-scale payment for ecosystem services campaigns are remarkable in terms of funding and longevity (Liu et al., 2013a). But program effectiveness remains unclear due to a general lack of science-based assessment (see Ran et al., 2013) and conflicting outcomes with positive results that meet program goals in some locations (Lü et al., 2012; F. Zhang et al., 2013) and mixed (Yang et al., 2013) to poor results (Zhai et al., in press) in others.

3. Food security

China's grain harvests continue to set yearly production records, but food demand is outpacing supply (Fan et al., 2012). To meet demand, the country is importing record amounts of grains; in 2012, China's grain self-sufficiency fell to 87–88% of total production putting pressure on leaders due to the government's traditional commitment to food independence (Li and Sun, 2013; Zhong, 2013). But there are benefits to importing foodstuffs. First, the country can use the 27–33 million h that represents the land needed to grow the soybeans that China imports to produce other high- value crops. Second, China, a water-poor country, gains a measure of "virtual water" by not having to use its own sources to produce imported foods. Nevertheless, as grain imports are projected to increase further in 2013 and beyond according to the China National Grain and Oils Information Center (Zhou, 2013), pressures on the food system are growing. Other factors contributing to China's increasing food insecurity include the world's highest use of fertilizers leading to unmitigated levels of nitrogen deposition (X. Liu et al., 2013), groundwater depletion in key agricultural areas (Cao et al., 2013), extensive soil pollution (Q. Wang, 2013), and a farm work force with an average age of 60 years. Loss of arable land continues due to rapid urbanization; the amount is already likely below the government's "red line" of 121 million h (Li, 2011). These losses are compounded by the fact that many municipal governments rely on income from urbanization-led land sales for much of their revenue.

4. Energy

Energy demand in China continues to grow dramatically and, according to the Ministry of Land and Resources, may not peak until 2030–2035 (Xinhua, 2013a). In response, the central government is ramping up energy production across all sectors. Coal will continue to provide the bulk of thermal power with use projected to increase by 70% from current use over the next two decades (Best and Levina, 2012). In 2012, oil imports rose to 58% of supply; the State Council plans to cap this amount at 61% by 2015 (Du, 2013a), though how to accomplish this is unknown given sales of 14–17 million new passenger vehicles/year. Plans call for a tripling of nuclear power production by 2015, causing China's uranium import dependency to rise dramatically (Froggett, 2012). Hydropower delivered 22% of the countries' energy in 2011; the goal is to increase this amount by c. 66% by 2015 (Information Office of the State Council, 2012). But with no cumulative impacts review of cascades of dams on multiple rivers, it is unclear whether implementation of environmental standards can match the rate and scale of proposed growth (Grumbine et al., 2012; Tullos et al., in press). Non-fossil fuel energy is targeted to contribute 15% of all of China's energy by 2020. However, in 2011, due to institutional implementation and pricing barriers, the State Regulatory Electricity Commission estimates that 23% of wind turbines and 28% of solar panels were not connected to the grid and therefore not contributing to power production (Ma and Zhou, 2013).

5. Water

China faces both water quantity and quality problems. By 2030, demand is projected to exceed supply by 25% (Addams et al., 2009) and conflicts over water are already evident and increasing between agriculture, energy and urban demands. Water usage is highly inefficient in each of these sectors. In agriculture, for example, only c. 45% of irrigation water reaches target crops (S. Peng, 2011), and, in cities, data from the China Urban Construction Statistical Yearbook and a Beijing NGO suggest that pipe leakage rates range from 12% to 23% (Ji, 2011). Water quality concerns are also mounting. Across the country, the Chinese Academy of Sciences reports that 43% of surface water is too polluted to use (Liu and Yang, 2012). A 2013 Ministry of Environmental Protection report