Part 1. From Developmental to Environmental Policies

Trajectories for Greening in China: Theory and Practice

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ABSTRACT

This edited volume argues that China's development poses the greatest ever challenge for the modern world in terms of speed, size and scarcity. The volume is organized around the greening of the Chinese state and society: can the inclusion of sustainable development principles into governance, management and daily practices by social actors lead to sustainable development *per se*? This introduction sketches the different scholarly camps around greening and sustainable development, ranging from sceptical to radical environmentalism. The contributions demonstrate that China is showing clear signs of greening as new institutions and regulations are created, environmental awareness increases and green technologies are implemented. However, the question remains whether this is sufficient to effectuate long-term sustainable development. The key factors here are the sheer speed of China's economic growth, the size of its population, and the relative scarcity of its natural and mineral resources. Chinese development presents compelling reasons for rethinking the viability of greening. It is necessary to move beyond both alarmist visions of an environmental doomsday, and optimistic notions that incremental changes in technology, institutions and lifestyles are sufficient for sustainability. It might be more fruitful — and not only for China — to consider 'precautionary' rather than 'absolute' limits to growth.

THE CHIMERA OF SUSTAINABLE DEVELOPMENT

The concept of sustainable development was first launched onto the international political agenda at the United Nations Conference on the Human Environment in Stockholm in 1972. Yet in scholarly and political circles more than three decades later, it is still highly contested whether mankind is capable of reconciling economic growth with environmental pressure. The sociologist Redclift noted: 'like motherhood and God, it is difficult *not* to approve of it. At the same time, the idea of sustainable development is fraught with contradictions' (Redclift cited in Elliott, 1999: 15). Although one may criticize the notion, to date sustainable development has evolved

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into the single most dominant idea that combines our conceptualization of development processes with environmental change. In fact, much of the confusion surrounding the term bears testimony to its success in capturing the development and environmentalist discourse.[1]

The relevance of the question, 'can human development be "development that meets the needs of the present without compromising the ability of future generations to meet their own needs"?'[2] became critically clear with the publication of Bjørn Lomborg's *The Skeptical Environmentalist* (Lomborg, 2001). Lomborg makes the controversial argument that the world's environmental crisis is not so much a disquieting reality as a social construction by activists and officials who make themselves heard through increasingly alarmist reports. Today's world is witness to the decline of 'green' ideas in favour of rising neo-conservatism; this is amply shown by new administrations that have attempted to push the environment from the political agenda in the United States, Germany, Italy, Belgium, The Netherlands and other countries. Yet, the fierce reactions that Lomborg's book triggered worldwide can and should not be attributed solely to this political struggle. Neither should these reactions be regarded as scholarly outrage over works that 'objectively speaking, deem to fall within the concept of scientific dishonesty' as the Danish Committees on Scientific Dishonesty (DCSD) (DCSD, 2004) labelled the monograph.[3] What the heated debates over 'sceptical environmentalism' do teach us is that we simply do not know whether sustainable development is possible or not. Discussing the de-linking of economic growth from environmental pressure — the potential for a so-called 'win–win scenario' — in the end boils down to taking positions with regard to the earth's future, the role of technology, state capacity and the transformative forces inherent in markets and communities.

Regardless of one's position on sustainable development, however, the nexus between development and environment is indisputable. Development implies industrialization, urbanization and the intensification of resource use, the costs of which have often been externalized at the expense of the environment. In First World countries, industry's promise of unlimited consumerism has led to disproportionate levels of energy and water use, emission of greenhouse gasses and the conversion of natural habitats. The transitional economies and few remaining socialist states of the former Second World also reveal an array of environmental problems — the sorrowful result of the modernization effort to outperform the capitalist world. These range from oil spills in the Russian oil fields of Usinsk to radioactive contamination on dismantled nuclear test-sites in Kazakhstan (Rijs, 2000). Countries of the Third World are plagued by a vicious circle of

1. A substantive introduction to the history of sustainable development as a political and academic concept is provided in Adams (2001: 54–79).
2. This is the most widely accepted definition of sustainable development; see Brundtland (1987: 43).
3. See also some of the letters sent to the journal *Nature*, for example, Abbott (2003: 195).

population pressure, rural poverty and the destruction of natural resources such as forests, wetlands and grasslands. Moving beyond simplifying categories of First, Second and Third Worlds, it is evident that mankind today is confronted with a new generation of environmental problems of unprecedented scope, intensity and dynamics.

According to the German sociologist Beck, earlier risks of nineteenth century industrial society, such as industrial accidents and natural hazards, were discrete, statistically describable and thus 'predictable' and subject to 'supra-individual and political rules of recognition, compensation and avoidance' (Beck, 1992: 99). In contrast, development processes since the early twentieth century have unleashed environmental risks that are increasingly undetectable by direct human sensory perception, capable of transcending generations, and exceeding the capacity of current mechanisms for compensating victims (Cohen: 1997: 107). Climate change, nuclear waste, gene flow and biodiversity loss belong to those invisible yet incalculable hazards which Kai Erikson dubbed a 'new species of trouble' (Erikson, 1994). Moreover, the up-scaling of risks from the local to the global level implies that processes of modernization and greening in the North are inseparably linked to those in the South: both developing and developed nations find themselves in the same developmental boat.

The question is whether the 'new species of trouble' also herald the end to sustainable development. In other words, is the greening of state and society fact or fiction? Whereas sustainability implies that production and consumption processes are geared towards an ecologically sustainable, economically viable and socially acceptable way of resource use, the term 'greening' is here understood as the incorporation and awareness of principles of sustainable development into governance, management and daily practices by social and political actors (Hin et al., 1997; Ho, 2005; Utting, 2002).[4] This is the critical issue that this volume addresses; it does so by highlighting the case of one of the world's largest and most populous developing countries — the People's Republic of China. Before turning to the relevance of the Chinese developmental experience in furthering our understanding of environmental reform processes, it is necessary to describe in a nutshell the leading scholarly themes of, and perspectives on, sustainable development.

CONTESTED SUSTAINABILITY: DE- OR RE-LINKING ECONOMY AND ENVIRONMENT?

There is a wealth of writings on sustainable development; yet, as the academic literature on the topic proliferates, one might easily lose track of the debates. It is not my intention here to provide a comprehensive and

4. For an overview of the greening of industries in Asia, see also Mol and van Buuren (2003).

complete overview of what has been said on sustainable development, when, and why. Rather, I hope to make the contemporary scholarly debates more insightful by identifying the main camps and reviewing their standpoints. This can be done by asking two simple questions: is it possible to reconcile economic development and environmental protection? And if so, what does that require?

According to the Eurobarometer survey held in 2002, 45 per cent of the citizens in the European Union felt more attracted to the optimistic belief that 'the deterioration of the environment can be halted by changing our way of life', while 44 per cent adhered to the pessimist view that 'irretrievable damage had been done to the environment'.[5] A similar optimist–pessimist dichotomy has split scholars over the question of whether development can go hand-in-hand with environmental care — those who advocate the possibility of a 'win-win scenario' versus those who believe in 'zero-sum'. The environmentalist movement of the 1960s and early 1970s started out from neo-Malthusian pessimism, an utterly successful strategy of ecological politics which gained global momentum for environmental concerns, for the first time in world history.[6] What so strongly appealed to public imagination was the looming threat of failing global life support systems on 'Spaceship Earth'[7] — a lonely blue ball spinning in the infinite darkness of the galaxy. Human development and its demographic explosion had exceeded the natural limits of our planet, which is itself unique in the universe. The only way out of the impasse was to freeze economic development in time: the notion of a steady-state or zero-growth economy. For this to happen in a meaningful manner it was necessary to assess the limits to development. This line of thought resulted in attempts to design computer models of the world system, notably Forrester's *World Dynamics* (1971). The approach was further elaborated by a research team at the Massachusetts Institute of Technology working for an international group of environmental advocates set up with the support of European multinationals — the Club of Rome. In 1972 this group published *Limits to Growth*, which rapidly became one the most cited environmentalist works of the era (Meadows et al., 1972; see also Golub and Townsend, 1977).

5. The Eurobarometer was held in all fifteen states which were members of the EU at that time, covering a total of 16067 respondents. Respondents were asked to choose one statement from three, the third option being 'human activity is in harmony with nature' which was selected by only 4 per cent of respondents. The non-response rate to the question was 2 per cent while 4 per cent fell in the 'do not know' category; see European Opinion Research Group (2002: 2).
6. Although the realization of the limits to human development predates environmentalism of the 1960s, with neo-maltusian views emerging in the 1920s and 1930s. In fact, the origins of environmental concern can be traced back to the nature conservation movement of the nineteenth century (Adams, 2001: 25, 45).
7. The term 'Spaceship Earth' was used for the first time by Boulding (1966).

The Limits-to-Growth rationale was pushed even further by radical environmentalism which criticized the Club of Rome's anthropocentric views. Instead of assessing criteria for some sort of steady-state development that does not squander natural resources at man's disposition, radical environmentalism rejected the separation between 'man' and 'nature'. In this view, man and nature enjoyed equal rights to develop and blossom. Inspired by nineteenth century romantic writers such as Henri Thoreau, John Muir and Aldo Leopold, radical environmentalists offered a retrogressive perspective on human development — the credo of 'back to nature' rather than zero-growth. Radical environmentalism has found various expressions ranging from those who seek to solve the environmental crisis by regional self-sufficiency or bio-regionalism, through eco-centric Deep Ecology thought, to militant *Earth First!* activists calling for 'ecotage' and 'ecological guerilla warfare'.[8] What binds these different streams together is a deep-seated belief that incremental social and institutional change from within the current industrial-developmental complex is insufficient to halt the world's environmental crisis; only a fundamental reformation of the foundations of production and consumption can tilt the balance.

Although initially successful, the increasingly catastrophist predictions and environmental doomsaying of the green movement during the 1960s and 1970s proved self-defeating in the end. For one thing, neo-Malthusianism was surprisingly resilient as an explanatory philosophy in the face of an ever-expanding — and yet still surviving — Spaceship Earth. In 1970, when world population reached 3.5 billion, Ehrlich and Ehrlich (1970: 3) noted that the world was 'filled to capacity and beyond and is running out of food'. Twelve years later and with an additional 1.5 billion people on the globe, scholars still warned that 'whichever way one looks at the population problem . . . it is obvious that it presents the greatest menace to the future of the biosphere' (Worthington, 1982: 98]. Even today, with the world population surpassing 6 billion and rising, pessimistic voices still prevail in academic writings. The juggling of statistics by green activists to support their cause incited fierce criticism of the Limits-to-Growth approach. According to Maddox (1972: 2) 'the doomsday cause would be more telling if it were more securely grounded in facts',[9] while Simon deemed the work of the Club of Rome to be a 'fascinating example of how scientific work can be outrageously bad and yet be very influential' (Simon, 1981: 286). The result of garbled data on sustainability has been the emergence of a countercurrent in environmental thinking.

8. For more information on the various schools such as Deep Ecology, bioregionalism, and the Earth First! movement, see also Adams (2001); Devall and Sessions (1985); Taylor (1995).
9. Similarly, Beckerman (1974: 242) thought the *Limits to Growth* report to be 'guilty of various kinds of flagrant errors of fact, logic and scientific method'.

The first major international work to refute the ideas of the Club of Rome was the *World Conservation Strategy* jointly published in 1980 by the International Union for the Conservation of Nature (IUCN), the United Nations Environment Program (UNEP), and the World Wide Fund for Nature (WWF) (IUCN, 1980). This publication broke new ground with the idea that development should be regarded as 'a major means of achieving conservation, rather than an obstruction to it' (Allen, 1980: 7). Building on this notion, and subsequently gaining worldwide influence, was *Our Common Future* (Brundtland, 1987) written by the World Commission on Environment and Development and presented to the UN General Assembly in 1987. Popularly referred to as the Brundtland Report, this work made two critical contributions to the debate on sustainable development. First, it put forward the view that 'the environment does not exist as a sphere separate from human actions, ambitions, and needs' because 'attempts to defend it in isolation from human concerns have given the very word "environment" a connotation of naiveté in some political circles' (Brundtland, 1987: xi). Second, rather than assuming that human development is constrained by absolute physical limits as the Club of Rome suggested, the Brundtland Report posited that these limits can shift over time and place as they are set by technology and the specific constellation of social, economic and political institutions. A favourable alignment of these elements would include:

- a political system that secures effective citizen participation in decision-making
- an economic system that is able to generate surpluses and technical knowledge on a self-reliant and self-sustained basis
- a social system that provides for solutions for the tensions arising from disharmonious development
- a production system that respects the obligation to preserve the ecological basis for development
- a technological system that can search continuously for new solutions
- an international system that fosters sustainable patterns of trade and finance
- an administrative system that is flexible and has the capacity for self-correction. (Brundtland, 1987: 6)

The sociological pendant of the Report's ideas is the notion of 'ecological modernization' of society and polity, as conceived by the German thinker Joseph Huber (1982, 1985). Ecological modernization starts from the premise that de-linking economic growth from environmental pressure can be a reality. Such societal evolution from environmentally destructive to ecologically sustainable societies can be witnessed in different spheres and at different levels: the creation of state agencies and changes in governance styles; the application of environmentally friendly technologies; the

emergence of markets for trade in emission permits and green products; the establishment of public–private partnerships in environmental co-regulation; and the increased role of international environmental agreements and global non-governmental actors. The driving force behind this process of greening is what Brundtland would term the 'capacity for self-correction' and Huber 'reflexive modernization', because it is only when social and political actors are reflexive on the externalities of development that institutional and social change is brought about.

The academic discussions on ecological modernization, and greening for that matter, have been sharply divided between realist *vis-à-vis* social constructivist approaches.[10] On the realist side of the equation — and intrinsic to the works of, for instance, Jänicke (1985), Simonis (1988), Mol and Sonnenfeld (2000) and Utting (2002) — greening and ecological modernization are seen as an interlocking of social, political and environmental change with perceivable effects on environmental quality. On the other hand, the social constructivist view regards ecological modernization as a discourse created to serve the interests of various stakeholders in society's political ecology. Rather than 'greening', ecological modernization is seen as the 'greenwash' of production and consumption to satisfy certain environmental norms and values in society (see for example, Greer and Bruno, 1996; Hajer, 1995; Welford, 1997).[11] Similar to the fate of the sustainable development concept, ecological modernization has been 'fed into the green machine' (Chatterjee and Finger, 1994: 79). As such it has become 'a strategy of political accommodation of the radical environmentalist critique of the 1970s' (Christoff, 1996: 477), and a thin layer of 'green veneer' to cover up mankind's environmentally *unfriendly* course of development. As a social theory, ecological modernization is claimed to have explanatory and

10. A second divisive issue is the position of theory development in relation to political action. Contrarily, ecological modernization as a political action programme carries with it certain normative assumptions on the measures that politics, business and the civil sector *should* take to avoid environmental degradation. However, as Kotilainen wrote: 'Because of the often prevailing normative dimension of ecological modernisation theory, it is not always easy to see the difference between the theory and the ecological modernisation process in practice. It seems to be a somehow inherent quality of the concept of ecological modernisation that society and technology should proceed towards better relations with nature and the environment. What kind of changes this process should involve is then another, and obviously controversial, subject for debate' (Kotilainen, 2002: 17). Gibbs (2000: 12–13) pointed to a possible third issue with his remark that there are two versions of ecological modernization: a weak and a strong version depending on the relevance accorded to technological change in processes of environmental reform. However, in the writings on ecological modernization this issue never gained as much prominence as the other two mentioned here.
11. The divide between realist and constructivist approaches is actually not as strict as proponents or critics of either approach might want us to believe. In fact, the two approaches often contain a mix of realist and constructivist notions. See also the discussions in Lundqvist (2000) and Murphy (2000).

analytical value for understanding environmental reform in contemporary society. In this sense, some argue that the theory is more concerned with the analysis of social and institutional change than with actual physical, environmental changes (see, for instance, Kotilainen, 2002). Yet, this might also be its weakest link.

In the recent discussions on 'industrial metabolism' and 'ecological footprints', the debate on the potential de- and re-linking of economic growth with environmental protection has flared up again. In an article in the authoritative *Proceedings of the National Academy of Sciences* (PNAS), Wackernagel et al. (2002) presented empirical evidence showing that human demand has exceeded nature's supply since the early 1980s, with a total 'overshoot' by 20 per cent in 1999. According to Opschoor (2000: 280–81), gradual environmental reforms are insufficient: 'For several countries environmental pressure appears to have been re-linked with the environment since the mid-1980s. . . . The message of recent empirical analysis may be that endogenous de-linking does not appear as a process which is stable or persistent under conditions of sustained economic growth. Sustained growth is not necessarily sustainable'. Similar conclusions were reached by the European Environmental Agency (2003: 7, 28), which found that the environmental measures and technological innovations of the past decades had been offset by the sheer increase in the scale of production and consumption.[12]

In this volume we will see that China's developmental experience teaches us exactly that lesson: greening does not necessarily imply sustainability. In other words, even if China is able to embark on the greening of its political, social and market institutions, this might not be sufficient to bring sustainable development within reach. There are other factors, such as the country's huge population, its economic growth, its relative scarcity in resources, and as a result, its potential global impact, which make the critical difference. In this sense, science and society might be forced to move beyond discussions of apocalyptic environmentalism or incremental reforms in order to open up the way for renewed discussions on environmental norms, values, and limits. If we want to understand the importance of the Chinese case in a world perspective, we first need to determine the driving political, socio-economic and cultural parameters in its development.

GREEN DEVELOPMENT, 'YELLOW DANGER'?

The People's Republic of China — founded on 1 October 1949 after the Nationalist forces under Chiang Kai-shek had been driven to Taiwan by the

12. A new and interesting trend in environmental pressure has been observed by Liu et al., who noted a rise in one-person households in industrialized countries, which pose a higher pressure on natural resources (Liu et al., 2003: 530–3).

People's Liberation Army under Mao Zedong — is among the largest nations of the world. As we can see from Figure 1, the total area of 9.6 million km^2 spans twenty-two provinces,[13] five autonomous regions (Inner Mongolia, Guangxi, Tibet, Ningxia and Xinjiang), four municipalities directly under the State Council (Beijing, Shanghai, Tianjin and Chongqing) and two special administrative regions (Hong Kong and Macau). Over one-third of the total land mass is covered by high (over 3,000 m) and medium (2,000–3,000 m) altitude mountain ranges, while forests occupy 17 per cent, grassland 41 per cent, and cultivated land around 14 per cent. China's main rivers are the Yangtze River with a length of 6,300 km and the Yellow River of 5,464 km (National Bureau of Statistics, 2001: 6–7).

There are three main reasons why the Chinese case is crucial for understanding the political, socio-economic and physical factors that determine sustainable development: size, speed and scarcity. In other words — China's large population; its explosive economic growth and the increasing socio-economic cleavages which result; and its relative shortage of natural and energy resources. These three factors together imply that China will have a profound environmental impact at the global level.

First, when multiplied by the sheer numbers of China's population — approximately 1.3 billion at the beginning of the twenty-first century — any environmental process or phenomenon acquires a magnitude unparalleled in the rest of the world. According to the demographic transition model developed by Schultz (1981), population dynamics pass through three consecutive stages as economic development progresses. Applying this model to China, the country sped through the three stages within half a century. Until the late 1940s, it was in the first stage of demographic transition, featuring slow population growth owing to high death and birth rates; during the 1950s and 1960s it moved through the second stage, of rapid population growth associated with a decline in mortality rates combined with high fertility rates (leaving aside the tragic population losses during the aftermath of the Great Leap Forward); it arrived in the third stage in the early 1970s, as fertility rates dropped and population growth gradually stabilized but at substantially higher levels than before.[14] The significant decline of fertility rates was a direct result of increased tightening of population controls starting from the 'Late, Sparse, Few' (*Wan, Xi, Shao*) birth control campaign in 1971 and culminating in the proclamation of the one-child policy in January 1979.[15] By encouraging

13. Namely: Hebei, Shanxi, Liaoning, Jilin, Heilongjiang, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, Shandong, Henan, Hubei, Hunan, Guangdong, Hainan, Sichuan, Guizhou, Yunnan, Shaanxi, Gansu and Qinghai.
14. For more information, see also Smil (1993: 3–35).
15. Note that in the late 1950s Ma Yinchu, a Colombia University trained economist and President of Peking University, had already pleaded for strict birth control measures. He proposed a bill on this topic to the First National People's Congress in 1957.

Figure 1. Administrative Map of the People's Republic of China

Source: Provided courtesy of The General Libraries, The University of Texas at Austin.

the postponement of marriages, the extensive free distribution of contraceptives and the provision of state-subsidized vasectomies, abortions and tubal ligations, the various campaigns succeeded in bringing down fertility rates from over 33 per cent in 1970 to 16 per cent in 1998. Furthermore, the average annual population growth rate over 1991–99 was 0.3 per cent below the world average of 1.4, just 0.1 higher than that of the United States over the same period (National Bureau of Statistics, 1999: 1; 2001: 879).

Although the Chinese demographic transition can, without overstatement, be labelled an extraordinary feat in birth control, the population has not yet reached its peak. This is expected to occur in 2038 with an estimated population level of 1.6 billion people (Lo and Xing, 1999: 10). One can therefore imagine that — even though science and technology have significantly increased efficiency in the use of natural resources — in the Chinese context 'the power of population is indefinitely greater

than the power in the earth to produce subsistence for man' (Malthus, 1933: 13).[16]

A second reason why studying China's experience might be vital in our understanding of sustainable development, is its formidable economic growth. Over the past two decades, the Chinese economy has grown at a record-breaking rate. Of over 200 countries monitored by the World Bank through the World Development Index, none has exceeded the average growth rate over such an extended period as exhibited by China. Although India has also experienced a considerable acceleration in economic growth over the past two decades, its average rate of GDP growth during 1980–2000, at nearly 6 per cent per year, lagged behind the Chinese figure of over 10 per cent. Moreover, at around 9 per cent, China's annual growth rate of per capita income by far surpassed India's 4 per cent, so that China's per capita income was nearly 70 per cent higher than India's by 2000 (World Bank, 2002). But the speed of China's economic development has led to ruptures in society which might not have emerged at all, or at least to a lesser extent, had socio-economic development been more gradual.

In *The Political Economy of Uneven Development*, Wang Shaoguang and Hu Angang (1999: 12) argue that 'the First World and Third World coexist within China'. I would suggest that it is not so much a case of coexistence; rather, one world is rapidly emerging within the other, which is the cause for much social and political friction. China's Third World is represented by traditional rural society featuring subsistence farmers, undeveloped state institutions and small-scale village and township enterprises with outmoded technology. At the same time, the First World is emerging where processes of rising urbanization, industrialization, commercialization and consumerism are occurring. Currently, China has a distressing environmental record of sharply increasing air, water and soil pollution, blamed by many foreign and domestic observers on the haste to develop the economy at all costs. In particular, local authorities seem happy to sacrifice environmental protection in favour of economic growth, a tendency aggravated by the pressure of rural poverty. As a local Communist Party Committee of one of China's poorest counties noted in an internal document:

> We need to ease environmental protection policy: relax air pollution policies, leniently issue or do not issue [*huanban huo buban*] emission permits . . . Small-scale projects with few investments and underdeveloped environmental technology should be developed first and controlled later [*xian fazhan hou zhili*]. And environmental protection departments should simplify procedures for the approval of environmental impact assessments for the convenience of users. (Guyuan Party Committee, 1994: 18)[17]

16. The demographic challenge facing China is not unique: India, the world's other population giant, is in a similar predicament. With a natural growth rate of 16.7 per cent in 1999 (twice that of China), the Indian population is expected to overtake the Chinese population within the next fifty years

17. Unless otherwise stated, translations from Chinese are by the author.

The attitude of 'pollute first, clean up later' is illustrative of the clash between central versus local authorities, environmental interests versus economic interests and China's First versus Third World. There, where the two clash, the limits of existing institutions are being challenged through environmental pressure, social conflict and political calls for reform. This should be a focus of scholarly attention, as it is the locus where shifts in environmental governance are likely to occur and novel rules of engagement between state, civil and market actors will be renegotiated.

Amongst the most disturbing elements in China's explosive development, are the constraints imposed by the country's main natural resources — land, water and energy. This provides the third reason for closely monitoring the Chinese experience. Vaclav Smil wrote that 'an inquiry into the biospheric foundations of any modern society must still start with close looks at water and land resources. In China's case, this primacy is especially pointed, as these resources are in such relatively low supply'. This is why he believed that 'there are no solutions within China's economic, technical, and manpower reach that could halt and reverse environmental degradation — not only during the 1990s but also during the first decade of the new century' (Smil, 1993: 38, 193).

In 1995, Lester Brown shocked the Chinese government with his prediction that China's land resources would be unable to feed the ever-expanding population and that, as a result, critical food shortages were sure to arise in the future (Brown, 1995). Despite substantial agricultural growth generated predominantly by higher use of chemical fertilizers, land is still one of the basic inputs to farm production, while the average area of farmland per capita is less than half of the world average.[18] Brown's thesis was highly contested by scholars because he had not addressed the possibility of increased agricultural productivity, while the greater part of China's land was producing well below its potential. Although the criticism is partly justified, China's land scarcity is aggravated by substantial losses in arable land due to agricultural restructuring, rapid urbanization, and environmental problems (flooding, soil erosion and desertification).[19] The official figures mention a decrease of 4 per cent in the total arable area over 1978–96 — an annual loss of 218,000 ha (Ash and Edmonds, 1998: 838; see also Smil, 1999). In addition, recent research has shown that much of the lost land belongs to the most productive fields[20] located in the coastal, southeastern provinces (Lin

18. In 1996 the figure for China was 0.106 ha per capita, versus the world average of 0.236 ha. Before the 1996 national agricultural census, the data on the total area of arable land were unreliable. The census, however, showed that arable land had been under-reported with 37 per cent or 35 million ha. For more information, see National Agricultural Census Office (1999).
19. According to Lin and Ho (2003: 102), agricultural restructuring, construction and natural hazards accounted, on average, for 62 per cent, 21 per cent and 17 per cent respectively of the total land losses over 1986–95.
20. Multiple Cropping Index over 200.

and Ho, 2003).[21] It is estimated that by 2050 the total demand for arable land will have outstripped supply by more than 12 per cent (Lo and Xing, 1999: 63).

In terms of water, perhaps the most forceful and grim symbol of China's shortage is the drying up of the Yellow River. The *Huanghe* or Yellow River is a potent emblem in Chinese mythology and stands for the cradle of Chinese civilization, a fierce dragon in Chinese legends, and the 'River of Sorrow' which wreaks havoc as its untamable waters flood farmers' fields. But from 1970, owing to large-scale irrigation upstream, the river began to periodically stop running in its lower reaches in Henan and Shandong provinces. Between 1970 and 1998, this has happened eighteen times.[22] It is estimated that the period of drying up will extend to 200 days per year by 2010, and will be year-round by 2020. China's water resources are characterized by small per capita shares, and an uneven spatial distribution. In particular, the arid and semi-arid areas of China's north and northwest face a severe lack of water resources. As early as 1993 it was estimated that China's total water shortage was 30 to 40 billion m^3 (Lo and Xing, 1999: 70, 136). According to the World Resources Institute, China has freshwater resources of 2,304 m^3 per capita, which is less than one-third of the world average and around 25 per cent of that of the United States.[23] Water shortages are expected to worsen as current water demand is still low (461 m^3 per capita compared to the world average of 645 m^3 per capita and 1,839 m^3 in the United States) and is expected to double by 2050.[24]

China's aggregate exploitable energy reserves (coal, petroleum, natural gas and hydropower) amount to 206 billion tons standard coal equivalent. This represents 14 per cent of the world's total energy resources and about 60 per cent of the world's average per capita endowment. Calculated at the current low levels of energy consumption these resources should last China for the next 194 years. However, China's energy use is expected to rise by a factor of ten during the next half century, reaching the levels of intermediate developed nations (Ni and Sze, 1998: 76). In fact, in 2000

21. According to Lin and Ho, this is also the reason why these losses cannot compensate for the farmland gained through newly reclaimed land. The farmland gains mainly occur in the western interior or northern frontier of the country and concern low-productivity, marginal fields with multiple cropping indices below 100. This complements the research by Ash and Edmonds (1998: 847), who drew attention to the need for a qualitative assessment of land losses in relation to the remaining area of arable land.
22. In 1995 the Yellow River stopped running for 122 days over a distance of 683 km measured from its mouth at the Bohai Sea.
23. The world average freshwater resources per capita is 6,918 m^3 and for the United States 9,270 m^3; see World Resources Institute (1998).
24. The doubling of water demand is calculated according to a balance of different demand scenarios (Lo and Xing, 1999: 70).

total energy consumption already exceeded total energy production by 17 per cent.[25]

China's present structure of energy consumption can be broken down as 67 per cent coal, 24 per cent crude oil, 2 per cent natural gas and 7 per cent hydropower. For the first two of these, the People's Republic is facing serious challenges ahead. The national coal reserve is estimated at 604 gigatons, but it has proved to be insufficient to power the country: over the period 1990–99 the deficit in coal availability increased from 33 to 228 million tons (Lo and Xing, 1999: 80–1; National Bureau of Statistics, 2001: 229–32). With the Daqing and Tarim Basin oil fields in Heilongjiang and Xinjiang, China has emerged as the largest oil producer in Asia with an annual output of 160 million tons of crude oil. However, domestic supply can no longer satisfy the rising demand. According to Ni and Sze (1998: 85):

> The annual growth rates have been gradually decreasing from 20 to 50% in the 1960s and '70s to 1 to 2% in recent years. Exploration of new oil reserves are not keeping pace with the expanding demand for oil production. . . . Assuming an average recovery rate of about 30%, China now has only 4.0 billion tons of oil which can be recovered. This amount of oil will last less than thirty years if annual production is 150 million tons.

Adding together the three factors that constitute an 'explosive mix' of Chinese development — speed, size and scarcity — it is evident that China's rise will have a substantive international influence as well. A painful illustration of this potential negative impact on the global environment are the Chinese constraints in coal and oil. The predominant use of coal to fuel China's economic development not only causes serious domestic atmospheric pollution, mainly through total suspended particulates (TSP) and sulphur dioxide (SO_2), but has also turned China into the world's second largest national emitter of carbon dioxide (CO_2).[26] As CO_2 is the main greenhouse gas responsible for global warming, China's developments have attracted close scrutiny from many multilateral institutions, such as the World Bank, the World Resources Institute and the Intergovernmental Panel on Climate Change (IPCC). Although China began the transition from coal to oil in the late 1950s, it will remain heavily dependent on coal for the foreseeable future.[27]

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25. With a total energy production of 1.09 billion tons coal equivalent versus a total energy consumption of 1.28 billion tons coal equivalent in 2000 (National Bureau of Statistics, 2001: 229). However, the coal production figure might be higher with approximately 10 per cent because of illegal, collective coal mines which production does not appear in the statistics.
26. In 1999 China accounted for a total of 3,051.1 million metric tons (2.5 m^3 per capita) or 13 per cent of total world emissions, while the United States accounted for 5.584.8 million m^3 (19.9 m^3 per capita). See World Resources Institute (2003: 258).
27. In the period 1978–2000 the dependence on coal as a percentage of total energy consumption in standard coal equivalents, has hovered at around 70 per cent, with a maximum of 76.2 in 1990 and a minimum of 67.0 per cent in 2000 (National Bureau of Statistics, 2001: 229).

Consequently, greenhouse gas emissions will continue to rise with potentially grave consequences for climate change. A number of studies with varying assumptions of economic growth levels have predicted that China is likely to surpass the United States as the leading national emitter within the next couple of decades (for example, Fang et al., 1998; Ho et al., 1998; National Environmental Protection Agency, 1996). Furthermore, as China's demand for oil rises, so will its impact on the world's oil reserves. From being a net oil exporter before 1993, it has been a net oil importer ever since, and will have to rely on oil imports during its future development. In 1995–99, net oil imports quadrupled from 12.2 to 48.4 million tons (Lo and Xing, 1999: 80–1; National Bureau of Statistics, 2001: 229–32; Ni and Sze, 1998: 84–5). The World Bank (2001) estimated that if China's per capita oil consumption were to match the current level of the United States, Chinese oil demand would exceed today's total global oil production by 18 per cent.

China's global impact will not be limited to coal and oil alone. Observers have noted a worrying increase in illegal logging practices in Russia and Latin America by Chinese companies that have been pushed abroad since the 1998 national logging ban (van der Valk and Ho, 2004),[28] while others have warned of a 'biodiversity debacle' as the country has embarked on a new 'biotechnological Great Leap Forward'. China has become the world's fourth largest grower of genetically modified (GM) crops after the United States, Argentina and Canada. In 2002 China accounted for the world's largest acreage in pest-resistant Bt cotton (Zhao, 2002; Zhao and Ho, 2005). The potential environmental impact of GM crops in terms of gene flow, immunity of pests, and adverse impacts on natural predators are largely unknown and under-researched.

MOVING BEYOND FATALISM AND GRADUALISM

As millions of Chinese farmers seek employment in the ever-expanding cities, urbanites jump into polluting cars and planes, and industries increase the scale and intensity of their production to keep pace with insatiable consumerism, China's environmental future looks bleak. The country's developmental constellation of speed, size and scarcity may well prove to be a dangerous mix, certainly in terms of China's potentially large-scale negative impact on the global environment.

That said, the alarmist predictions of an impending Chinese environmental crisis are also reminiscent of green activists' apocalyptic and self-defeating visions of global development during the 1970s. Moreover, one might discern certain 'orientalistic overtones', (Said, 1979) in these views, as the 'Yellow

28. For more on the problems of illegal logging by Chinese companies, see Kortelainen and Kotilainen (2002); Toyne et al. (2002).

danger' seems to have been replaced with a 'Chinese environmental danger' that according to some 'will be yet another intractable destabilizing factor for the world' (Smil, 1993: 193). But on what other basis could industrialized nations deny China a 'right to pollute', while their own development was initially based on just that? It seems unlikely that China will sacrifice growth for environmental protection if other nations do not, and any scholarly exercises in sustainability should start from that premise. If China's development and its impact on world sustainability is to be fully understood, it is crucial to avoid both fatalism, and unfounded optimism. Fatalism implies an absence of choice, while optimism based on educated guesses disregards an elementary truth: the unsustainability of China's development. To be more precise, if per capita consumption in China reaches the current levels of developed nations, it would require a virtual doubling of global resource utilization. If we also add the rapid development of the other BRIC countries (Brazil, Russia and India, as well as China) into the environmental equation, it is not difficult to see that modern industrialized society with its dependence on oil has reached its limits.

Current environmental debates on greening, ecological modernization and sustainable development tend to skirt the nagging, and increasingly urgent, question: what if it's already too late? If environmental collapse can be averted, one should of course be working toward that end. But suppose for a moment that China and the rest of the world have already passed the point of no return, and that some form of environmental collapse is inevitable. What should we be doing in that case? Is it possible to reconcile economic development and environmental protection through greening the state and society? And if so, what does this require?

The various contributions in this volume highlight the contradictory trends within China's environmental governance and environmental record. The stance of the Chinese state reflects the persistent tension between the environmental aspirations of reformers on the one hand, and protectionist, developmental tendencies on the other. At the international level, China has cleverly balanced global environmental concerns and claims for developing country status to secure continued domestic growth. Moreover, environmental protection measures frequently run counter to legal, institutional and market constraints. What we learn from the contributions that follow is that greening has unmistakably taken place, but it is insufficient to safeguard sustainable development. Although this paves the way to exploring where we should go from here, that question is not directly answered by the authors. The conclusion of this collection will suggest some future directions for examining this issue.

THE CONTRIBUTIONS

This edited volume is divided into three separate sections. The first part, *From Developmental to Environmental Policies*, deals with the various shifts

in environmental governance that have occurred or need to occur in the greening of China's state and society. Apart from this introduction, this section includes a theoretically-informed piece by Arthur Mol, which anaylses the extent to which environmental reforms in contemporary China can be interpreted according to the concepts and ideas of ecological modernization. In so doing, Mol focuses on the similarities and differences between Chinese and European modes or styles of ecological modernization with respect to the role of state institutions, market dynamics, civil society pressure and international integration. The following contribution by Benjamin van Rooij analyses the changes in China's environmental polity with an eye to policy effectiveness and law enforcement styles. Van Rooij demonstrates that politico-legal campaigns in China are a way to gain a short-term victory over structural problems that hamper regular (not campaign-induced) environmental law enforcement. On the other hand, he also argues that the long-term success of such campaigns is limited because the resulting strict enforcement is sometimes incompatible with local development. This study finds that in certain cases, command-and-control style regulatory systems may function when backed up by campaign-type pressure of political power holders. Furthermore, campaigns are a method of making strategic choices among scarce enforcement resources. However, for a regulatory system to be successful over a longer period of time, even when backed up by political pressure, the regulatory design must suit local conditions and regional variations.

Instead of sole reliance on command-and-control and regulatory measures, environmental policies ultimately need to be more integrated and consensual, allowing for feedback from the grassroots, as van Rooij also maintains. Non-governmental and voluntary civic groups might have a critical role to play in this context. In recent years the number of green non-governmental organizations (NGOs) in China has sharply increased (Ho, 2001; Ho and Edmonds, forthcoming; Yang, 2005). These organizations make use of the newly opened, yet limited public spaces in Chinese society to strive for environmental reforms. This volume does not deal directly with environmental activism, although two chapters in the final section will address related issues of consumer rights with particular reference to food safety and environmental risks, as well as the recent developments around the building of the Three Gorges Dam.

The second part of this volume, *The 'Technological Fix': Greening Industry and Business*, focuses on the potential of environmentally friendly technologies to effect more sustainable use of resources and a decrease in environmental degradation. The contributors to the section address this theme from the perspective of clean vehicle technology, the transfer of clean coal technology, cleaner production, and innovation and technology policy. The thread that runs through these contributions is the interaction between the state, business and industry. In what way can the state facilitate the adoption of green technologies by enterprises? What are the institutional

and market constraints that hamper the successful transfer of such technologies? These are some of the questions that will be reviewed in this section.

The first two contributions offer a vivid account of the difficulties and pitfalls in technology transfer processes in a developmental context. With two policy implementation case studies — on clean coal technology and on cleaner production — the authors demonstrate the need for effective interagency co-ordination, as well as market reforms in tune with environmental policies. Stephanie Oshita and Leonard Ortolano examine the diffusion of cleaner coal technologies (CCT), with particular reference to flue gas desulphurization (FGD) and coal washing technology. They argue that the Chinese experience illustrates how differences among central government agencies have resulted in limited promotion of FGD. In addition, tax reform and hard budget constraints reduced the motivation for local governments to rigorously enforce national air pollution control policies. Experience with coal washing demonstrates that even when central government agencies have common interests, there are limits to their ability to encourage CCT adoption. When coal pricing reform and coal industry restructuring were not co-ordinated with environmental policies, production of washed coal slowed down. Further promotion of CCT in China thus hinges on changes in incentive structures for local governments and enterprises, as well as enhanced policy coordination among central government agencies.

The following contribution by Hongyan He Oliver and Leonard Ortolano examines the implementation of city-level Cleaner Production (CP) programmes in two cities in Jiangsu Province: Changzhou and Nantong. They find that both cities failed to implement CP in all their large- and medium-scale enterprises. They argue that the reasons for this should be sought in the lack of effective vertical control and interagency co-ordination, as well as the incongruity between CP requirements and the core missions and operational procedures of implementation agencies. The limited successes in implementation could largely be attributed to the professionalism and skills of individual implementation agents. However, outcomes that rely heavily on individual agents may not last in the long term, which requires institutional changes if broader CP adoption is to result from the government's initiatives.

The chapter by Jimin Zhao reviews the dynamic responses of the Chinese government and automotive industry to the challenges of economic development, environmental protection and energy security. China has moved its policy focus from development of the automobile industry *per se*, to development with emission controls and cleaner vehicle technology. Responding to concerns over serious urban air pollution, national policies and programmes have played a major role in implementing this shift. However, in the transition from a centrally-planned to a market-oriented economy, government command has become less effective than before. Environmental management in the automobile industry increasingly features integration of command-style

regulations, economic instruments, and voluntary co-operation (co-regulation) between government and industry. The desire to 'leapfrog'[29] technologically in the auto industry has motivated the government's willingness to invest in 'green vehicle' research and development (R&D). However, the remaining barriers to green vehicle development include the lack of systematic and long-term plans, the absence of incentive policies to encourage the use of clean vehicles, poor R&D capability in conventional vehicle technology, high costs of manufacturing electric, hybrid and fuel cell vehicles, and insufficient supporting infrastructure.

The last contribution in this section, by Richard Welford, Peter Hills and Jacqueline Lam, is a spirited defence of improved innovation and technology policy that can effect sustainable development while simultaneously maintaining the competitiveness of Hong Kong companies. It demonstrates that environmental policy reform in Hong Kong has actually followed tendencies that might fit in with a greening approach. In certain areas (particularly the control of air pollution, greenhouse emissions and ozone depleting substances) some successes in reducing environmental damage have already been achieved. Nevertheless, much more needs to be done and Welford, Hills and Lam argue that a priority for the future should be to initiate environmental technology policy that is capable of stimulating innovation, benefiting the environment and maintaining the competitive position of Hong Kong companies, at the same time. The authors also show that the restructuring of Hong Kong's economy has entailed the relocation of polluting industries to neighbouring Guangdong Province. As a result, Hong Kong's environment has also suffered from trans-boundary pollution which requires the co-ordination of environmental policies at a higher administrative level.

The final section of this volume — *Environmental Frictions? Dams, Agriculture and Biotechnology* — reviews some of the new and fascinating developments in China's environmental politics: the government's increased sensitivity to the environmental impact of large-scale dam construction, the opportunities and constraints of ecological agriculture, and the emergence of consumer consciousness and rights in relation to genetically modified food. In recent years, there has been a growing consensus within the Chinese government that the construction of large-scale dams should be critically reassessed against their environmental impact. To a great extent, this is the result of increasing popular opposition to dam building. Amongst the most eventful and interesting protest movements are those against the Nujiang river dam construction in Yunnan province, as well as conflicts over the dam that threatens to inundate the famous Dujiangyan project — a 2,200 year old engineering marvel in Sichuan province. In response to these

29. In other words, to skip the 'dirty' stages of development by installing advanced environmental technologies, see also Ho (2005).

protests, the Chinese government took the surprising step of calling a temporary halt to no less than thirty construction projects in 2004. Although at the time of writing, work has resumed on the majority of these projects, a few are still suspended as a result of serious environmental impact problems (Shi, 2005; Yardley, 2004a and 2004b).

The project that became China's first national figurehead for environmental protest, the Three Gorges Dam, is the focus of the contribution by Gørild Heggelund. Domestic and international opposition to this mega-dam grew stronger during the 1990s, and the political role of premier Zhu Rongji in pushing the re-evaluation of the dam's environmental impact might explain the greater political space of the anti-dam movement in China today. Heggelund discusses how the constrained environmental capacity in the Three Gorges reservoir area has influenced resettlement policy. She shows how issues of environmental protection and natural resource management have led to changes in the resettlement programme, such as the shift in resettlement policy to transmigrate the rural population outside of the reservoir area, and the promulgation of new regulations. Over the years, China's resettlement performance has improved. This is due to the recognition of the integrated relations of resettlement with other issues, such as socio-economic development, and ecological and environmental protection in the target area — in particular soil conservation and water pollution control. An in-depth analysis from the resettlement implementation process is presented to illustrate the resource and other problems. These are assessed in accordance with selected points in the Impoverishment Risks and Reconstruction (IRR) model applied by the World Bank in international resettlement projects.

A very different but equally important issue is addressed in the chapter by Richard Sanders. Economic reforms in China have led to a rapid expansion in the use of chemical inputs and agricultural plastic by farmers, which has caused increasing environmental pressure in the countryside. On the other hand, the reforms have also provided opportunities for farmers to become involved with new products that cater for an emerging domestic green consumerism, as well as with transnational markets. On the basis of several village studies, Sanders describes and distinguishes between organic and ecological farming, and assesses their institutional bases. He argues that while the early reform process in the late 1970s and early 1980s made the adoption and extension of ecological agriculture difficult, the opening up of markets both domestically and internationally as the reforms progressed has provided the rural populace with opportunities to gain revenues by producing green and organic foods. But he argues that, in the institutional setting of contemporary China and given the exigencies of green and organic food, the state continues to play a vital role. For one thing, the state needs to establish clear rules and certifying institutions for the labelling and quality control of green and organic products. Moreover, the fragmented structure of family farming in rural China today represents a major inhibition to the

development of organic and ecological agriculture both in terms of adequate supply, and marketing systems. The market for green and organic products requires ongoing state support to encourage the appropriate producer associations and distribution and marketing systems, if necessary by direct participation, on top of the technical assistance it currently provides. In addition, Sanders argues, favourable tax treatment for organic products, which does not exist at present, would clearly give further encouragement to this sector.

Whereas Sanders looks at the possibilities of greening from the producers' side, the closing chapter by Peter Ho, Eduard Vermeer and Jennifer Zhao takes the consumers' perspective into consideration. In this respect, increased environmental awareness and knowledge among Chinese citizens is crucial. Various studies have shown that environmental awareness in China has risen over the past few years, mostly due to vigorous environmental campaigns pursued by the state in the media. A survey in 1999 showed that environmental protection ranked fifth among issues of greatest concern by urban residents (Li, 2001: 122). A more recent survey carried out by the Social Survey Institute of the Systems Reform Commission found that 62.5 per cent of Chinese respondents deemed environmental protection 'extremely important'. Interestingly, environmental *knowledge* is still limited — in the same survey, urban residents scored an average of 4.5 (on a scale of 13 points) and rural residents 2.4, in an environmental knowledge test (Cui, 2002: 87). In other words, Chinese people's understanding of the causes and effects behind specific environmental issues is minimal.

A similar situation prevails in terms of consumers' understanding of the potential risks of genetically modified organisms to the environment and human health. The contribution by Ho, Vermeer and Zhao is based on a survey of consumer awareness and acceptance of genetically modified (GM) food products in China. The survey polled the opinion of approximately 1,000 urban respondents. In recent years, the Chinese government has grown more cautious about the risks of transgenic food crops but is trying to to keep all options open. The state plays a critical role in biotechnology politics and does not allow GM food to become a 'hot' public issue. This is also reflected by the data. The survey shows that although an overall majority of respondents (71 per cent) had heard of genetically modified food, only one-fifth possessed a limited understanding of genes and GM products. In the absence of adequate information on GM organisms, the majority of the respondents (60 per cent) are neutral or even unwilling to consume GM food. More importantly, when given both positive and negative information about potential GM food allergenicity, the willingness to buy dropped sharply. This might point to future scenarios of Chinese consumer resistance to GM food products.

There is ambiguity in China's environmental record and policies. On the one hand, since the start of the economic reforms, pressures on the environment — in terms of air, water and soil pollution — have undeniably and

substantially increased. So have abatement costs. On the other hand, the Chinese central leadership has also demonstrated a strong commitment to deal with the environmental challenges ahead. This is reflected in the comprehensive corpus of environmental policies and laws that have been developed over the past decades, the increase in environmental capacity through the steady build-up of environmental institutions and specialized staff, the rise in research and development of environmental technologies, and the state's relatively positive stance towards emerging green activism. Some see these shifts in political, social and market institutions as a greening of state and society, and a testimony to a certain self-reforming capacity within the state, industries and the citizenry. However, one might also argue that China is simply evolving into one of the many industrialized, resource-intensive nations in the world, not much different from the United States, Japan or certain member states of the European Union. As such, China's political ecology is likely to incline towards incremental change[30] and polluting 'business-as-usual'. This, coupled with China's 'explosive mix' of speed, scale and scarcity (rapid economic growth, a large population, and limited natural and mineral resources) might eventually trigger a gradual but inevitable mechanism of self-destruction, as economic growth fails to de-link from environmental pressure. In other words, China's future ecological footprint will eventually 'overshoot' the globe's natural resources. The concluding chapter of this volume attempts to probe into these critical issues, and posits that the consideration of 'precautionary' rather than 'absolute' limits to growth might be helpful in this regard.

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30. Or what Lindblom calls the 'Science of Muddling Through' (Lindblom, 1979, 1992).

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