THE BAD EARTH: ENVIRONMENTAL DEGRADATION IN CHINA, by Vaclav Smil. Armonk, N.Y.: M.E. Sharpe, Inc.; London: Zed Press, 1984. Pp. xvi, 247. Cloth $25.00, Paper $13.95.*

Many recently published books and articles describe the rapid and fundamental economic changes that have taken place in the People's Republic of China over the last decade.[1] However, few of these works, if any, examine China's prospects for continued economic expansion, modernization, and development in light of existing environmental problems and trends. With *The Bad Earth*, Vaclav Smil makes a timely start toward filling this analytical gap.[2]

The Bad Earth is intended to examine the environmental problems of contemporary China and indicate how such problems are likely to grow in complexity over the coming years. Chief among the environmental concerns Smil presents are the deterioration of natural resources and rise of severe pollution. The book adopts a broad analytical perspective, arguing that the greatest threat to China's continued economic development is not its social and political instability, but rather specific limitations and obstacles imposed by its history of environmental mistreatment.

A major strength of *The Bad Earth* is its uniqueness. It is the first major piece to categorize and discuss in an orderly manner the complex and varied environmental problems of modern China. The book addresses the following categories of problems: water shortages, drinking-water pollution, air pollution, soil erosion, siltation of rivers and lakes, deforestation, the disappearance of animal and plant species, desertification, losses

* The student-author of this review lived in China from 1981 to 1983. The following draws, in part, on personal knowledge, experiences, and observations gained in these years.

1. Readers interested in these matters may wish to consult from among the following: WORLD BANK, CHINA: SOCIALIST ECONOMIC DEVELOPMENT (1983); ALMANAC OF CHINA'S ECONOMY 1983, (Xue MuQiao ed. 1984); 1985 ASIA YEARBOOK, (Far Eastern Economic Review eds. 1985); A. BARNETT, CHINA'S ECONOMY IN GLOBAL PERSPECTIVE (1981); C. HOWE, CHINA'S ECONOMY: A BASIC GUIDE (1978); A. ECKSTEIN, CHINA'S ECONOMIC REVOLUTION (1977); O. SCHELL, TO GET RICH IS GLORIOUS: CHINA IN THE EIGHTIES (1984); S. MOSER, BROKEN EARTH (1984); M. GOTTSCHALK, *The Politics of Change in China*, THE NATION, Feb. 1, 1986, at 105; *The Second Revolution*, TIME, Sept. 23, 1985, at 42.

2. Further reference might also be made to earlier works by Professor Smil and others. V. SMIL, R. GOODLAND, G. TOH, THE PEOPLE'S REPUBLIC OF CHINA: ENVIRONMENTAL ASPECTS OF ECONOMIC DEVELOPMENT (1982); *China's Environment*, 79-458 CURRENT HISTORY 14 (1980); *Environmental Degradation in China*, 20-6 ASIAN SURVEY 777 (1980).

of arable land, industrial and urban pollution, mismanagement of agroecosystems, and rural energy shortages. Although the short length of the book renders comprehensive treatment of any one of these topics impossible, Smil succeeds in providing a comprehensive overview of the state of the environment of modern China.

The Bad Earth owes a great debt to post-1978 developments in the domestic Chinese press. To put it more clearly, changes in the leadership style and press controls of the government of the People's Republic of China have permitted, in recent years, increasingly extensive and candid domestic reporting of environmental failures, hazards, and problems. To a lesser but also important extent, publications printed in China for foreign distribution have also come to include frank discussions of environmental problems.[3] Both types of sources are illuminating, and fortunately, Smil displays a ready familiarity with such materials. He finds in them shocking evaluations of the state of the Chinese environment; descriptions so revealing that he states at the outset of the book: "Without this new Chinese information, so staggering in its cumulative impact, this book could not have been written."[4]

Despite what the foregoing might imply, the book is not simply a distillation of the post-Cultural Revolution Chinese view of domestic environmental problems. This is because the book has been enriched by consideration of western remote sensing techniques and other technical information as well as Smil's own analytical insights. For example, although the book contains frank descriptions—mainly drawn from domestic reports—of such environmental problems as urban overcrowding and freshwater siltation, probably the most convincing evidence of the severity of these problems is obtained by interpretation of LANDSAT satellite photographs in the text. In sum, Smil's work serves to make the domestic press reports particularly vivid and compelling.

The Bad Earth begins with an introduction to some of the unique features of China's varied physical environment. It is a land of incredibly diverse landforms and habitats, including not only the world's tallest mountains but also vast expanses of

3. The BEIJING REVIEW, a weekly published in the People's Republic of China, is one such publication. In the following notes, reference is frequently made to this and other english-language sources for the convenience of the reader.

4. V. SMIL, THE BAD EARTH: ENVIRONMENTAL DEGRADATION IN CHINA xii (1984).

deserts, grasslands, and coastal plain. Then, in separate chapters, the book explores five general themes: Land, Water, Air, Biota, and Living Environments. Discussion of each begins with some reference to historical conditions and patterns of resource use, but quickly proceeds to discuss post-1949 environmental policies, developments, and actions. This emphasis on events after the 1949 Chinese revolution is intentional, as one of Smil's goals in the book is to reach an assessment of the environmental record of the communist leadership after it assumed power. He finds that record quite deficient. Indeed, his survey of the present state of China's environment leads him to conclude that:

> [I]t is not the large population *per se*, not the relative poverty of the nation, not its notorious political instability, but rather its staggering mistreatment of the environment that may well be the most fundamental check on China's reach toward prosperity, a hindrance also the most intractable and difficult to deal with.[5]

The above represents a provocative and important statement. To address it, this review will need to set out some of the environmental problems of modern China and the responses, if any, that have been implemented. Accordingly, Section II—paralleling the structure of *The Bad Earth*—discusses some of the important environmental problems facing modern China. Section III then addresses the question posed by Smil's conclusion, namely, whether China can pursue economic development and modernization without hastening further environmental damage and degradation.

II.

This section does not comprise a complete list of existing environmental problems in China, but it discusses many of the major concerns.

a. *Deforestation*

The critical and complex problem of deforestation affects the entire country. Despite its huge physical size, China ranks 120th out of the 160 nations of the world in per capita forest acreage.[6] Even this figure may be optimistic since the nation's forest

5. *Id.* at 199-200.
6. *Id.* at 12.

reserves are unevenly distributed and those nearer heavily populated areas are not as "dense" as in the more remote areas.[7] Furthermore, China's growing population will continue to place severe upward pressure on the rate of forest exploitation.[8] In any event, there is little current dispute in China that in both the highly-populated lowland areas of the coastal plains and the less-populated grassland regions of Inner Mongolia, already sparse forest resources are declining at a rapid rate.[9]

The primary causes of the advance of deforestation have been the needs of the growing population and forestry mismanagement. As wood products are used widely for manufacturing, construction, and fuel, China's population growth has inevitably led to forest declines. Political and economic policy errors also have contributed to forest declines. For example, during the short "Great Leap Forward" period of the late 1950's alone, demand for wood as a fuel source increased dramatically with little productive result.[10] Another frequently promoted political emphasis has been to clear forests to create more land for grain production.[11] Finally, until quite recently, the Chinese gave so little attention to reforestation efforts and afforestation campaigns that forests have had difficulty recovering from timber harvests.[12]

Recent liberalizations of the rural economy have also maintained pressure on forests. First, peasants amassing disposable income have triggered a home construction "boom" increasing the demand for wood both in the form of raw lumber and manufactured wood products.[13] Second, peasants residing in areas short of cooking and heating fuels have not obtained substitute fuels. Consequently, they continue to use trees and parts of trees for these basic purposes.[14] Third, liberalization of peasant free-marketing policies has increased demand for raw lumber that can be manufactured into wood furniture and sold to neighbors and

7. *Id.* at 13.

8. *Id.* at 181.

9. *Id.* at 21.

10. *Id.* at 15.

11. During both the "Great Leap Forward" and the early stages of the "Cultural Revolution" grain production was thought to be the key link to economic progress. *See* M. MEISNER, MAO'S CHINA: A HISTORY OF THE PEOPLE'S REPUBLIC (1977).

12. SMIL, *supra* note 4, at 29.

13. *Id.* at 25.

14. *Id.* at 25.

urban residents.[15] In sum, as the population and its economic growth and wealth has increased, so has the demand for forest resources.

Even casual observation of the Chinese countryside evidences the scarcity of wood and the severity of recent pressure on forests. Near many populated areas, one commonly finds trees with only the topmost branches remaining, because the lower branches have been taken prematurely for use or sale. The result is stunted and incomplete tree growth. Near many urban areas, there are also reports of tree "poaching". This practice can take the slow form of repeated "notching" of a tree's trunk to hasten its suitability for harvesting, or the more risky practice of outright tree thievery.[16]

The government has responded, since 1978, by promulgating strict forestry conservation regulations and promoting afforestation. Denunciations of illegal deforestation have appeared in newspapers and journals throughout the country.[17] Yet the decline continues. Smil notes that, at the present time, most forests—not only softwoods but also tree crops such as mulberries, bamboo, and oranges—are in decline.[18] He estimates that one-quarter of the forest reserves in existence in 1949 have now disappeared.[19]

Forest losses of the magnitude Smil uncovers might not, by themselves, be reason for alarm. Deforestation, however, has significant ecological effects on other aspects of the environment. A brief consideration of these indicates that the situation clearly warrants continued afforestation and forestry preservation measures. To rephrase the problem, it is thought that losses of forest cover undermine the stability of plant and animal ecosystems, alter the climate, reduce the ability of the soil to withstand erosion, and exacerbate problems associated with flooding.[20] The frequency of floods on China's major rivers in recent years substantiates this theory. Specifically, over the last decade, the Chiang Jiang (Yangtze) and Huang He (Yellow) rivers have flooded al-

15. *Id.* at 26.
16. SMIL, *supra* note 4, at 16.
17. *Id.* at 31.
18. *Id.* at 21.
19. *Id.* at 10-11.
20. *Id.* at 25.

most annually in the winter months.[21] Observers generally acknowledge that deterioration of upstream forest-cover has been a major cause of the flooding.

Forest destruction, of course, endangers those plants and animals dependent on the forest habitat. In the southwestern provinces, the expanding human population and the sporadic use of destructive agricultural techniques by some minority tribes have endangered existing tropical forest ecosystems.[22] There is also evidence that the forest destruction has altered the climactic pattern of the northern region. For example, encroachment of desert sands into formerly arable regions of Inner Mongolia has been attributed to the higher winds and more frequent droughts partially caused by degradation of the sparse forest-cover of the area.[23]

Because deforestation has had dramatic and wide-ranging effects on the environment, it has been accorded nationwide attention. In 1978, the government's response was to issue a strict Forestry Law to deter indiscriminate timbering and punish tree thievery.[24] Later, afforestation campaigns were organized to repair already damaged forests. The Forestry Law bans arbitrary and indiscriminate logging of state-owned timber resources. It provides legal sanctions against responsible individuals and their units.[25] Its applicability, however, to new varieties of ownership and control of timber resources is problematic. Until recently, all significant timber resources in the country were "state-owned." But, liberalizations of food production by co-operativization or "privatization" under a contractual system may also give rise to "privately-owned" forests. Thus, the Forestry Law may need to be refined to apply to other varieties of forest ownership.[26] On the other hand, Smil argues that agroforestry and "privitization" of timber production could ensure better management of forestry resources and achieve what the law seeks.[27] To be specific, pri-

21. *Id.* at 54.

22. *Id.* at 19. *See* J. WHITE, CHINA'S FORTY MILLIONS (1978).

23. SMIL, *supra* note 4, at 58.

24. *Forestry Law of the People's Republic of China*, translation printed in COLLECTION OF LAWS AND REGULATIONS OF CHINA CONCERNING FOREIGN ECONOMIC AND TRADE RELATIONS XI-18-43 (China Market Publishing Corp., eds.1983). The Forestry Law, originally issued in trial form, was offically enacted in 1984.

25. *Id.*

26. SMIL, *supra* note 4, at 30-31.

27. *Id.* at 31.

vate ownership or control of trees could discourage poaching and restrict indiscriminate harvesting in some areas. In any event, agroforestry provides a slow return on investment and the present government is not likely to emphasize complete "privatization" of timber resources. Therefore, the proper course may still be to expand the applicability of the Forestry Law and related regulations.

The government has also responded with annual afforestation campaigns. In 1981, the campaigns began in earnest after the issuance of a Nationwide Voluntary Tree-Planting Resolution.[28] Section three of the Resolution reads as follows: "All citizens of the People's Republic of China, males ages eleven to sixty and females ages eleven to fifty-five, with the exception of the disabled, should undertake voluntary tree-planting tasks."[29] Although, the language suggests voluntary action, the government has actually treated the afforestation campaigns, at least in the urban areas, as a compulsory, patriotic duty. Students, factory-workers, academics, government employees, and members of the armed forces, all take part at least annually in tree-planting campaigns. Frequent and extensive press coverage of local tree-planting campaigns helps to ensure high compliance and public involvement near urban areas. In the more distant areas of the country, afforestation campaigns are reportedly being carried out by local peasants, travelling military units, and through aerial seeding.[30]

In one typical urban campaign, in the spring of 1981, the student body and faculty of a college in a provincial capital participated in a one day tree-planting holiday. Activists organized the university community into teams, and provided tools, trees, and transportation to selected suburban hillsides. The work consisted of a full day planting softwood seedlings in the foothills near the city. Unfortunately, "follow-up" teams were not organized to care for the young trees. The result was that local peasants had to provide any further attention the seedlings needed. As might be surmised, there was general concern that the seedlings would have difficulty reaching maturity.

28. *Resolution on a Nationwide Voluntary Tree-planting Campaign*, translation printed in SMIL, *supra* note 4, at 229.

29. *Id.* at 229.

30. *Id.* at 33; *Forest Campaign Gains Momentum*, 28-28 BEIJING REVIEW 8 (1985).

Given the long growth cycles of forests, it is premature to assess the success, if any, of afforestation campaigns in reversing forest declines. At the very minimum, however, the governmental and media attention lavished on these restorative activities should make clear the growing political importance of environmental and forest protection. Indeed, the afforestation campaigns have been one of the most publicized national efforts since the Cultural Revolution. These campaigns and the Forestry Law put potential mismanagers of forests on notice that negligence or wrongdoing may expose them to great political and legal liability.

b. *Erosion*

Water erosion and wind erosion endanger the habitability and productivitiy of many regions of China. Erosion of both types decreases the productivity of croplands and increases the formation of wind-borne or water-borne particulates. These particulates, in turn, exacerbate desertification of arable lands, degradation of land productivity, siltification of waterways and water projects, and the severity of flooding.

At present, the worst erosion problems are centered in the "loess" soil region of the upper Huang He (Yellow river) watershed.[31] "Loess" soil structures are deep accumulations of wind-blown particulate built up in surface deposits. As long as the topcover of these areas is not radically disturbed, erosion from such soil structures is not excessive. However, when the protective top surface is disturbed, the exposed underlying soils are particularly prone to erosion.

Attempts to increase the land area devoted to grain cultivation in the Huang He watershed has disturbed the topcover of grasslands and forests in the region.[32] Erosion problems have ensued and now much of the terrain exhibits the physical effects of advanced erosion. Travellers in the region can observe that the region is scarred by re-routed roads, steep and expansive gullies, and silt-clogged waterways.[33] Moreover, the rivers in the area transport excessive amounts of silt and particulate towards the ocean. On the Huang He and some other rivers, however, this silt does not reach salt-water. Instead, it contributes to problems

31. SMIL, *supra* note 4, at 47.
32. *Id.* at 42, 52.
33. *Id.* at 43.

for water conservancy and hydroelectric projects in downstream provinces and increases the rate at which the lower riverbed in the coastal plain rises above its surrounding countryside.[34]

Chinese publications now openly acknowledge the seriousness of the erosion problem in the Huang He watershed.[35] The government, for its part, has responded by 1) halting the conversion of grasslands to grain production 2) emphasizing afforestation efforts, 3) building dikes to withstand flooding, and 4) constructing water conservancy projects.[36] Unfortunately, the severity of the erosion problem on the Huang He dwarfs the responses thus far attempted. First, the erosion in loess deposits, by creating steep slope gradients has made it difficult for plants to become re-established.[37] Second, existing high levels of silt in the Huang He act to limit the effectiveness of water conservation and flood protection projects now in place. The most striking example of this is the limited effectiveness against floods of the huge "Sanmenxia" water conservancy and hydroelectric project. Sanmenxia was designed to reduce flooding on the Huang He but because the river carries high levels of silt during flood periods, the project must maintain high water flows to avoid silt precipitation in the project reservior.[38] In short, because the Huang He carries so much silt, the Sanmenxia cannot restrain the river's flow without endangering its own storage capacities. The experience of the Sanmenxia project with respect to erosion is relevant to other water projects as well. For example, there is concern that deforestation in Sichuan Province could lead to higher volumes of suspended particulate in the Yangtze River which, in turn, could impair the efficiency of the Gezhouba water project under construction on the middle stretches of the Yangtze.[39]

There is also growing domestic concern over wind erosion in the northern grasslands.[40] Erosion in this semi-arid environment can be particularly damaging because of the fragile ecology of the area and its close proximity to encroaching deserts. Further,

34. *Id.* at 44.
35. *Id.* at 50.
36. *Id.* at 37, 47-50, 60.
37. *Id.* at 40-41.
38. *Id.* at 45-47.
39. *Id.* at 55. *Gezhouba Hydroelectric Project Revisited*, 28-27 BEIJING REVIEW (1985); *Report from Gezhouba*, 24-35 BEIJING REVIEW 20 (1981).
40. SMIL, *supra* note 4, at 55; *Grassland Erosion Worries Experts*, 28-42 BEIJING REVIEW 10 (1985).

wind erosion in such areas erodes topsoils and nutrients that could otherwise contribute directly to food production and animal husbandry.[41]

In partial response to the wind erosion problem on the grasslands, the government, in 1985, issued a "Grasslands Law" to prohibit over-grazing of livestock and limit improper conversion of grasslands to other uses.[42] Little is yet known of the effect, if any, of this law. However, it is thought that recent liberalizations of governmental control over animal husbandry in the region will have the effect of creating strong incentives for over-grazing.[43]

c. *Desertification*

China's desertification problems are closely identified with wind erosion in the northern grasslands. Desertification describes the encroachment of desert sands onto or over useful lands. Smil notes that between the years 1949 to 1980 an area of 65,000 km^2 (or twice the area of Belgium and Luxembourg) became desert.[44] The direct effects of this are losses of arable land and reductions in the outputs of animal husbandry and grain cultivation. Indirectly, desertification is also thought to increase the frequency of droughts and sandstorms in neighboring regions related by climate to deserts.[45]

The government has responded to desertification, deforestation, and wind erosion problems in the northern grasslands in a creative manner. It has proposed to construct a lengthy forest shelterbelt system, a "great green wall", along the northern edges of the areas prone to desertification.[46] The shelterbelt system, roughly paralleling the "Great Wall" of China, would fit nicely within the goals of the national afforestation campaigns. The task, however, would be immense and costly. In the short run, perhaps the "Grasslands Law" and other rules will probably be of more use in limiting desertification of the northern grasslands.[47]

41. SMIL, *supra* note 4, at 60.

42. *Grasslands Law of the People's Republic of China*, translation available in the offices of Columbia Journal of Environmental Law.

43. SCHELL, *supra* note 1, at 47.

44. SMIL, *supra* note 4, at 59.

45. *Id.* at 59-60.

46. *Id.* at 61-62; *Great Green Wall Holds Back Desert*, 28-21 BEIJING REVIEW 9 (1985).

47. *See Grasslands Law*, *supra* note 42 and accompanying text.

d. *Deterioration of inland fishery and water resources*

China's growing population, its political infatuation with grain production increases, and increasing water pollution, have combined to put severe pressure on China's freshwater lakes and rivers. Population growth has raised demand for freshwater fish and other foods. Water pollution has left freshwater fisheries less productive. And, reclamation of portions of lakes and wetlands for grain cultivation has reduced the size of many freshwater bodies.[48] Ironically, such "reclaimed" areas often turn out to be less fertile than neighboring lands and are arguably, less productive than they had been as freshwater bodies. In any event, the reclamation, pollution, and population trends have led to reduced freshwater harvests, shrinking lakes and rivers, and in some areas, alterated climatic patterns.[49]

The issuance of the Law of Environmental Protection of the PRC, in 1978, signalled the formal governmental response to this problem.[50] The law forbids conversion of freshwater resources when such action would result in marked damage to a freshwater resource.[51] The legal restrictions arguably have had some benefit. Smil notes that, by 1980, declines in the harvests of freshwater fish had been halted.[52] This trend, of course, may not necessarily be linked to the laws. For example, the stabilization of the annual fish harvests may simply be a factor of changes in the character of fishery management on freshwater rivers and lakes.

In any event, many of China's rivers and lakes currently contain high concentrations of odorous and visually displeasing water pollution. The pollution is a combination of industrial, municipal, and rural wastes and sewage, often dumped carelessly into proximate freshwater bodies. Unfortunately, aside from the applicable provisions of the 1978 Law of Environmental Protection, the national government has declined to issue nationwide laws restricting freshwater pollution sources. Instead, the national government appears to be interested in premitting local officials to experiment with a variety of regulatory schemes.[53] For example,

48. *See* MEISNER, *supra* note 11 and accompanying text.

49. SMIL, *supra* note 4, at 64-65.

50. *Law on Environmental Protection for the People's Republic of China*, translation printed in SMIL, *supra* note 4, at 231.

51. *Id.* at 231.

52. *Id.* at 67.

53. SMIL, *supra* note 4, at 109-111.

one interesting regulatory structure, developed in Shanghai, would create a "fee" system for water polluters to "tax" large polluters according to the extent of their pollution of freshwater bodies.[54] Regardless of the level at which regulatory action is taken, however, it is readily apparent to tourists and residents alike that many lakes and rivers in China desperately need stronger protection against pollution and degradation.[55]

e. *Water storage, transfer, and use*

China's surface water resources are unevenly distributed largely because of geographic and seasonal patterns. Even in normal years, the prevailing national climatic pattern brings monsoons in summer and dry continental winds in winter. This has made seasonal water storage a long-standing national objective. In the late 1950's, this concern led the government to promote small-scale water conservancy projects, and thousands of small earthen dams were constructed.[56] Although many of these small dams now suffer from siltation, together they do provide significant local protection against climatic inconsistencies.

Despite the water storage capabilities described above, however, surface water transport remains a vital concern for many of the major cities in the northern part of the country. Since the southern areas of the country usually enjoy sufficient water resources, water transport plans under consideration generally hope to direct water from southern areas to points north. For example, in the 1970's it became apparent that the water resources of the northern coastal city of Tianjin were inadequate to support its growing industrial and residential requirements. In partial response, municipal leaders attempted to tap new underground sources, enforced water rationing, and resorted to importing water by truck in times of shortage. Further, in a major effort the national government has undertaken construction of a large water canal to carry water to the city from the Huang He river far to the south.[57] The enormous expense of this project

54. *Provisional Measures for the Levy of Pollutant Discard Fees*, translation printed in 14-15 COMMERCIAL, BUSINESS AND TRADE LAWS: PEOPLE'S REPUBLIC OF CHINA (Owen Nee, Jr. ed. 1985).

55. *Id.* at 106; *Water Pollution: A Growing Threat* 28-23 BEIJING REVIEW 7 (1985).

56. *See* MEISNER, *supra* note 11.

57. *Diverting Huang He River Water to Tianjin*, 25-34 BEIJING REVIEW 19 (1982).

makes clear the importance of water transport projects to the growth of the northern cities.

In the south, water transport has been of less concern than hydroelectric development. At present, a number of hydroelectric projects are being constructed throughout the region. The largest is the huge Gezhouba project on the Yangtze river.[58] Others, located in the more remote mountainous regions of Yunnan, Guizhou, and Guangxi provinces, involve sets of dams on smaller rivers.[59] Together, these projects, will improve China's electrical generation capacities. But since many are located some distance from the major urban centers, the electrical power and other benefits they hope to provide may be difficult to harness.

f. *Groundwater resources and drinking water pollution*

The larger cities of the northern part of the country—Beijing and Tianjin in particular—are critically dependent on groundwater for industrial uses and human consumption.[60] More critically growing populations and industrial sectors have led to degradation of local groundwaters and acquifers in these cities, including dropping water tables, salt-water ingress, pollutant percolations, and surface-level sinkages.[61] Indeed, in Beijing, Tianjin, and Shanghai, percolations of industrial wastes have led to the dangerous presence of such toxics and heavy metals as phenols, nitrates, arsenic, chromium, and mercury in the municipal drinking water system.[62]

Two types of solution to groundwater shortages and drinking water pollution may be implemented. First, inadequate water storage facilities and falling water tables might be remedied by injecting excess seasonal surface water into underground storage formations and acquifers.[63] This suggestion, of course, presupposes sufficient seasonal surface water to permit injections without damage to existing freshwater resources. It might also easily entail substantial financial expenditures. Acquifers capable of storing waters for later use do exist, however, throughout the

58. *See supra* note 39 and accompanying text.

59. *The Hongshui River: A Mighty Powerhouse*, 28-26 BEIJING REVIEW 14 (1985); *World Bank Opens Office in Beijing*, CHINA DAILY, Oct. 26, 1985 at 2.

60. SMIL, *supra* note 4, at 89, 157.

61. *Id.* at 93-96, 100.

62. *Id.* at 95.

63. *Id.* at 96.

northern part of the country. A second type of response would be to reduce industrial contamination of drinking water supplies by requiring pre-treatment of industrial wastes prior to release.[64] Here technological problems and high expenditures would not easily be avoided.

Polluted drinking water is also a problem in rural areas. This is because rural areas often lack effective means to eliminate pollutants which appear in their water supplies.[65] Pollutants appear for a number of reasons. First, over 90 percent of urban wastewater—much of it in the form of raw sewage—goes untreated into nearby rivers and lakes, usually passing downstream for dispersal.[66] Second, rural sewage itself, although often retained for use as fertilizer, can leach into freshwater sources. Third, the rural population uses inorganic fertilizers and pesticides and these also may also leach or spill into local water sources. Although it is true that urban and rural residents commonly bring drinking waters to a boil prior to consumption, reliance on this form of pretreatment, especially where fuel is scarce, is risky. Further, this method does not eliminate heavy metals or chemical toxics from water.[67]

Since effective pre-treatment can be both expensive and inefficient, more effective means to ensure safer drinking water would appear to be to limit pollution at its source. In this regard it should be noted that the 1978 Law on Environmental Protection does authorize the application of penalties and injunctions against excessive water polluters.[68] More refined water pollution laws, appear to be also within the capacities of the national government. Indeed, the recent development of a relatively sophisticated body of marine pollution laws and regulations suggests that more detailed drinking water restrictions can be expected.

The government's response to marine pollution began with the issuance, in 1982, of a Marine Environmental Protection Law of the PRC.[69] The Marine Law was patterned after the 1978 Law of

64. *Id.* at 112.
65. *Id.* at 112.
66. *Id.* at 100.
67. *Id.* at 112.
68. Article 20, *supra* note 50, at 235.
69. *Marine Environmental Protection Law of the PRC*, translation printed in COMMERCIAL, BUSINESS, AND TRADE LAWS, *supra* note 54, at 14-27. Subsequent marine pollution regulations, promulgated in 1982 and 1985, are available in translation in the offices of the Columbia Journal of Environmental Law.

Environmental Protection. It was necessitated by the rapid development of oil drilling joint ventures involving foreign companies in the South China Sea. To keep up with developments as drilling projects got underway, the government issued more detailed restrictions in 1982 and again in 1985 addressed to marine pollution issues. Regulations now specifically limit "oceanic pollution" by ships and other industrial facilities involved in the "exploration and exploitation of offshore petroleum."[70] In addition, the oil drilling companies operating in the South China Sea must obtain governmental approval prior to the discharge of waste materials offshore.[71]

While it is true that the involvement of foreign companies in the offshore oil drilling projects in the South China Sea was the primary catalyst for the refinement of the marine pollution laws, similar steps can be taken against freshwater pollution. The existing 1978 Law on Environmental Protection itself provides a good basis for regulation of narrow problems such as protection of groundwaters and drinking waters.

g. *Air Pollution*

Air pollution is most serious in the urban areas where population density is high and industry is clustered. The main sources of urban air pollution are the coal fires used for cooking and heating, windblown particulate and dust, industrial emissions, and motor vehicle exhausts.[72] In most cities, industrial emissions and household coal stoves are probably the most consistent contributors to air pollution. To conserve electricity, the government usually encourages city residents to burn "briquets"—formed out of a coal mixture—in small household stoves for cooking and heating. When burned, these briquets create very dense smoke carrying high levels of ash, slag, and sulfur dioxide.[73] Consequently, at mealtimes, when homes operate the stoves, the cumulative effect on air quality and visibility is pronounced. Additionally, the exhausts from power plants, other heavy industries, and a growing number of motor vehicles add to the aerial stew.[74] The results are apparent to the senses in almost every ma-

70. *Id.*
71. *Id.*
72. SMIL, *supra* note 4, at 114-121.
73. *Id.*
74. *Id.* at 117-118.

jor city. Smog envelopes the cities while the sun sets adopt red-orange tints. Soot, dust, and other particulates rapidly accumulate on flat surfaces. Finally, observation of urban residents reveals that a shockingly high number suffer from respiratory diseases.

Regulation of air pollution is still in its infancy. Although the 1978 Law of Environmental Protection explicitly prohibits "unreasonable" pollution of the air, the government has not yet promulgated consistent nationwide standards for air quality or industrial emissions.[75] Instead, regulatory activity, thus far, appears to have been pursued primarily at the local level. Regulations tend to be directed at discrete features of local air pollution problems.[76] For example, in Shanghai, natural gas is provided to households in the densely populated central area to replace coal stoves. In Beijing, a "ring" road has been constructed to divert motor vehicle traffic outside of the congested central area.[77] In other cities, local authorities are often engaged in monitoring large industrial facilities with the intention of regulating industrial air pollution at its source. As yet, however, the varied sources of urban poor air quality remain largely unregulated.

h. *Disappearance of species*

Increases in human population, the expanding size of urban areas and lands under cultivation, the construction of water projects, the clearing of forests, and ineffective regulation of hunting and harvesting, all contribute to the destruction of habitats needed by rare species of plants and animals. The number of plant species presently endangered is unknown, but in an appendix to the book, Smil lists 19 mammals and 10 birds, found only in China, that are threatened with imminent extinction.[78] The most famous animal on the list—the Giant Panda—has attracted sympathetic national and international attention, but others are relatively unkown.[79]

75. Article 3, *supra* note 50, at 232.

76. SMIL, *supra* note 4, at 122.

77. *Traffic Jammed on Beijing's Streets*, 27-39 BEIJING REVIEW 9 (1984).

78. SMIL, *supra* note 4, at 239.

79. The Giant Panda is the symbol of the World Wildlife Federation based in Washington, D.C.

The response of the government to declining populations of rare species has been to establish national preserves for the protection of their habitats. The Giant Panda population enjoys one such preserve in western Sichuan province. In 1980, 72 national preserves had already been established at locations throughout the country and 300 additional preserves had been proposed.[80] In addition, the government has created plant research institutes and wild areas to protect, categorize, and identify various species of rare plants. Somewhat surprisingly, one of the important functions of the plant research institutes located in the southern provinces has been to identify previously undiscovered species.

Reasonable preservation of rare indigenous species is an acknowledged goal of the government. With the 1978 Law on Environmental Protection, that goal was given legal form in provisions banning the hunting or poaching of rare animals and the taking of rare plants. Violators may be penalized with civil and criminal liablity.[81] Parallel efforts to reduce the pace of deforestation, and lake and river reclamation may also further habitat preservation goals. There may arise a conflict, however, with strict enforcement of hunting bans against tribal minorities living in the wilder areas of the country. Some of these peoples still rely in substantial part on hunting and gathering techniques.[82] Strict application of bans to these peoples could only hasten the destruction of their lifeways.

i. *Rural environments*

The majority of the Chinese population lives in the rural areas and is involved in farming and food production activities. As the national population increases, the rural standard of living may become more precarious than it has been in recent years. Indeed, although food production has been a top governmental priority since 1949—and crop harvests have increased dramatically under new economic liberalizations—rural food production still has been unable to completcly eliminate regional food shortages and famines.[83] One of the major reasons for this is that food storage and transfer facilities are not well developed. Indeed, even in fer-

80. *Id.* at 131. *See Call to Protect China's Wildlife* 27-16 BEIJING REVIEW 30 (1984).

81. Articles 15, 32, *supra* note 50, at 234.

82. *See* note 22 and accompanying text.

83. *See* MOSER, *supra* note 1; TIME, *supra* note 1.

tile areas, living standards depend on good annual harvests and favorable climatic conditions.

Rural life entails deprivations and hardships other than just food anxieties. Rural residents have far less access to consumer goods, luxury items, or advanced health care facilities than do city dwellers. Although prices are standardized nationwide, products from the large cities are not usually fully distributed to rural areas because poor transportation routes restrict commerce.[84] Thus, the increasingly common urban luxuries of televisions, telephones, bicycles, and sewing machines, are in frequently found in the countryside. Indeed, rural areas usually lack continuous electrification and running water. Of greater concern, rural residents are often unable to obtain modern health care because trained doctors and medical assistants generally resist serving in rural areas. Finally, for residents of the northern mountainous regions where winters are harsh, shortages of cooking and heating fuels can impose extreme hardships.[85] In such areas, alternative small-scale energy sources need to be developed. Indeed, throughout the rural areas of the country, biogas production, solar and wind energy mechanisms, and small-scale hydroelectricity plants should be established to lessen dependence on wood and coal, forestall fuel shortages, and improve rural living conditions.[86]

To be sure, in the last decade significant improvements have been made in the wealth and living conditions of many rural residents.[87] However, now most of the increases in wealth are occurring in those suburban areas located close enough to cities to permit profitable free marketing of private produce. The more distant rural communities do not benefit from the suburban produce trade. In any event, even in suburban areas, new hazards and problems are appearing. For example, although inorganic fertilizers and chemical pesticides help to boost crop production and wealth, their increasing use and frequent misuse has added to the health risks of village life.[88]

84. SMIL, *supra* note 4, at 136-142.

85. *Id.* at 151.

86. *Id.* at 152; D. LI, *China's Renewable Energies*, THE CHINA BUSINESS REVIEW, July-August 1985, at 32.

87. SMIL, *supra* note 4, at 141.

88. *Id.* at 143.

j. *Urban environments*

Beijing's most pressing urban problems result from its rapid population growth and its transformation since 1949 into a major industrial center. Not surprisingly, its most pressing urban problems, namely overcrowding, congested transportation routes, and industrial air and water pollution are, those of almost all large cities.[89] Despite the existence of a small subway, almost all travelling is carried out along surface routes in bicycles, buses, or motor vehicles. At peak hours, millions are commuting between homes and work locations along traffic routes designed for an earlier age. Too often, the rapid growth of both population and industry left too little time for urban planning. As in many cites, in Beijing, one frequently finds that residential facilities have been placed too close to industrial pollution sources. In winter, when winds blowing off the northern grasslands combine with industrial and other exhausts, the air quality is minimal. Moreover, throughout the year, Beijing's surface waters carry excessive loads of industrial and residential pollution.

Despite the foregoing litany of unhealthful living conditions, life in Beijing retains a continuing attractiveness to outsiders and former residents. The attraction is a result of the city's historical and modern prominence and the lifestyle it offers. On the other hand, perhaps it comes down to basic economics as Beijing tends to be well-supplied with consumer goods. In any event, residents do not seem to find the overcrowded, congested, and increasingly polluted conditions of the city to be reason enough to leave.

The same attraction principle applies to limit emigration of residents of the city of Shanghai, despite severe pollution and congestion problems.[90] As in Beijing population growth and industrial development have resulted in problems of pedestrian and traffic congestion, a housing shortage, and extemely polluted air and water resources.[91]

One of the reasons for the rapid industrial development is that Shanghai has been deemed important to the overall development of the nation's economy. This industrial prominence has had del-

89. *Id.* at 159; A. NESS, *Finding Space to Live and Work in Beijing*, THE CHINA BUSINESS REVIEW, July-August 1985 at 36; *Apartments Built in Beijing*, 27-22 BEIJING REVIEW 31 (1984); *Beijing Accelerates Construction of Parks*, 27-40 BEIJING REVIEW 6 (1984).

90. SMIL, *supra* note 4, at 161; *Shanghai's Revival is Sought*, N.Y. TIMES, Oct. 2, 1985 at D-1, D-26.

91. SMIL, *supra* note 4, at 161-166.

eterious effects on the local environment. One indication of this is that until groundwater depletions were slowed in the late 1970's, Shanghai had sunk roughly seven feet in 40 years.[92] Another is that as the Huangpu and Suzhou rivers pass through the modern city they carry extremely high accumulations of sewage and industrial wastes while no significant steps are being taken to remedy the situation. There is also a tendency to site industrial pollution sources at inappropriate locations. The worst example is the Baoshan steel complex located north of the city. This facility—now being constructed in a less grandiose form than originally planned—is located such that prevailing winds will carry smokestack emissions directly over the central city area.[93] In a city as densely populated as Shanghai, planning failures of this variety cannot long be tolerated.

Other Chinese cites share many of the urban problems described above. The major provincial capitals, in particular, have experienced the urban problems normally associated with rapid population growth and industrial development because the government has tried to foster regional industrial self-sufficiency. Further, if the current trend toward economic liberalization continues, the population problems of major cities may worsen. Existing employment and household registration requirements, should they be relaxed, would heighten rural migration to urban areas.[94] Health hazards, pollution, and congestion notwithstanding, urban life—for a variety of other reasons— remains desirable to many rural residents.

III.

As the foregoing should suggest, *The Bad Earth* successfully identifies and discusses a fascinating variety of environmental issues in modern China. In the process it also documents a tragic record of environmental degradation occurring since 1949. Drawing from these bases, Smil argues that there is little reason to be optimistic about future improvement of the Chinese environment. He asserts that given the environmental record of the past decades and the poor condition of the environment at present, any realistic appraisal of future economic development must

92. *Id.* at 163.

93. *Id.* at 166; M. WEIL, *Rationalizing Steel Output*, THE CHINA BUSINESS REVIEW, May-June 1985, at 25, 29.

94. SCHELL, *supra* note 1, at 48.

recognize the limits to growth imposed by China's natural resources, and environmental conditions, and political structure.

Smil's approach is useful, but his conclusion is too categorical. In fact, there are indications that economic development can be achieved while maintaining reasonable preservation of the environment. First, it should be noted that economic development, a notoriously complex process, can sometimes proceed with reliance upon foreign resources.[95] Smil's analysis does not encompass the possibility that significant Chinese economic development may be based on imported raw materials. Second, at the present time it is inappropriate to presume that the past record of political mismanagement of the environment will continue. Indeed, it is important to evaluate the unprecedented legal and political responses in China developed, since 1978, to protect natural resources, combat environmental degradation, and repair environmental deterioration. Information relevant to the effect, if any, that such legal and political development have had on the direction of China's environmental problems is still sufficiently unclear that conclusions as to their worth are premature but their existence alone marks improvement.

Consideration of the new legal approach properly begins in 1978 when the "Law on Environmental Protection of the PRC" was issued for nationwide implementation.[96] As China's first comprehensive environmental protection law, it marked the start of a reliance on legal form for regulation of the environment. Although the law was issued pursuant to general authority found in successive, 1954, 1975, and 1976 Constitutions of the People's Republic of China, no precedent existed at the time of its issuance. [97] Constitutional authority for the law was made much clearer, however, with the adoption of a new Constitution in 1982. That constitution contains language creating a state obligation to protect the environment and natural resources, prevent or lessen pollution, and promote afforestation. [98]

95. The most notable example of this variety of economic development is post-WWII Japan. Other Asian countries presently pursuing a similar export-driven model of economic development include South Korea, Singapore, and Hong Hong.

96. *See supra* note 50, at 231.

97. Translations available in the offices of the Columbia Journal of Environmental Law.

98. Article 26 reads in translation as follows: "The state protects and improves the living environment and the ecological environment, and prevents and controls pollution and other public hazards. The state organizes and encourages afforestation and the protection of forests." Translation printed in 25-52 BEIJING REVIEW 10 (1982).

The Law on Environmental Protection of the PRC is a extraordinary document for its breadth and organization. It is divided into the following chapters: 1) General Principles, 2) Protection of the Natural Environment, 3) Prevention and Control of Pollution and Other Hazards to the Public, 4) Environmental Protection Organizations and Their Responsibilities, 5) Scientific Research, Propoganda, and Education, 6) Reward and Punishment, and 7) a Supplementary Article. It was designed to encompass a wide variety of activities, by adopting a purposely broad definition of the term "environment". Accordingly, the restrictive aspects of the law can be applied to environmental problems not necessarily envisioned or discussed in the law itself as such problems arise.[99] In addition, the law envisions flexible and widespread enforcement because it formally delegates enforcement authority to provincial and local authorities and also to individuals.[100] Indeed, in a provision apparently patterned after the "citizen suit" provisions of many environmental laws of the United States, Article 8 of the law provides that: "All citizens have the right to supervise, inform against, and accuse any departments or individuals of causing environmental pollution and damage; the said departments and individuals shall not resort to any retaliation."[101] On its face, this provision seems to grant to individuals the right to participate in activities normally thought to be reserved to official bodies in China. This feature alone is an exciting development.

Regardless of the question as to where enforcement proceedings can be commenced and whether they eventually meet success, it is also significant—for substantive and symbolic reasons—that the law incorporates specific prohibitions of certain enumerated activities. Under the law, it is unlawful throughout the country to: 1) fish to the extent of endangering the fishery resource; 2) excavate and mine at random; 3) destroy forests to reclaim land or by means of arbitrary timbering; 4) dump wastes from ships into protected waters; 5) discharge toxics by means of ground-injection techniques; 6) over-graze or indiscriminately reclaim grasslands or 7) hunt rare animals or take rare plants.[102] Individual violators of the law can be held liable for civil or crimi-

99. Article 3, *supra* note 50, at 231.
100. Articles 5, 8, 26, *supra* note 50, at 231.
101. Article 8, *supra* note 50, at 232.
102. Articles 11, 12, 13, 14, 15, 20, *supra* note 50, at 233-236.

nal wrongdoing.[103] Economic units acting as principals or by means of agents to violate the law can be fined, criticized, or forced to stop production.[104] Thus, although it is true that the law's prohibitions are rather broad and subject to differing interpretations, at the very least, they symbolize the risk attending environmental mistreatment.

Other provisions of the Law on Environmental Protection are also of interest as indications of issues that the government now recognizes to have environmental implications. For example, under the law, the site selection, design, and development of all national construction projects must be carried out with minimal environmental damage.[105] Further, with respect to existing pollution sources, the law suggests that: "Effective measures must be taken to control and prevent pollution and damage . . . caused by waste gas, waste water, slag, dust, sewage, radioactive material, and other harmful matter, as well as pollution from noise, vibration, and toxic odors. . . ."[106]

Perhaps most importantly, the law also provides formal legal authority to establish a national structure of environmental protection bureaus at various levels of government.[107] The structure is pyramidal, headed by a State Environmental Protection Bureau at the national level and extending throughout the country to provincial and municipal environmental protection bureaus established in the major cities. This framework of environmental organizations has already helped to develop the increasingly complex body of laws, rules, and regulations that now impact at varying levels of the economy.[108]

In any event, one need not focus solely on legal developments to discern increased concern for the needs of the environment. At the level of the national bureaucracy, in 1982, a separate national Ministry for Urban and Rural Construction and Environmental Protection was created to facilitate better planning of large projects.[109] In academic circles, new national and international conferences, research societies, symposiums, publications,

103. Article 32, *supra* note 50, at 238.
104. *Id.*
105. Article 6, *supra* note 50, at 232.
106. Article 16, *supra* note 50, at 234.
107. Article 26, *supra* note 50, at 236.
108. Article 26, *supra* note 50, at 236; *State Plans to Boost Environmental Protection*, CHINA DAILY, Jan. 7, 1986 at 1.
109. SMIL, *supra* note 4, at 170-172.

and university specializations have appeared to deal with topics related to environmental protection and engineering. [110] And, in the domestic media, the dramatic coverage that has been focussed on such matters as afforestation campaigns, flooding problems, and new environmental laws and regulations, makes it clear that environmental protection has become an important national goal.[111] In modern China, where political signals are crucially important, these legal and other developments must have gained the careful attention of politically sophisticated cadres and managers, if not also the citizenry in general.

As should be apparent from the foregoing, *The Bad Earth* addresses many important questions in the process of describing the degraded state of China's environment. Although the book firmly establishes that aspects of China's environment are in great distress, at the same time it also evidences a nation's increasing awareness of the importance of environmental matters and illuminates some of the extraordinary reponses now underway. Whether the responses eventually implemented will be effective or timely, of course, remains for the future Smil's work, however, considerably enlivens the debate over the degree of economic development China can reasonably be expected to achieve in the coming years. Economists and other scholars working in this area will now need to reconsider their more optimistic assumptions about the size and health of China's natural resources and environment conditions. In short, *The Bad Earth* succeeds admirably in bringing environmental issues to their deserved place at the very forefront of western perspectives on the People's Republic of China.

Eugene C. Gregor

110. *Id.*
111. *Id.*