China has been undergoing a period of economic reform and expansion since the late 1970s, accompanied by rapid and widespread urbanization. During the early 1980s, 18% of China's population lived in cities, but this rose to 39% by 2003, while the number of cities increased from 190 to 660 (including about 170 cities with a population greater than 1 million) over the same time period. From 1980 to 2003, the contribution of Chinese cities to gross national product (GNP) increased from 69.9% to 85.9% (Chinese Statistical Bureau 2004). However, urbanization has also led to serious environmental and ecological problems, both in urban and surrounding areas, including increased air and water pollution (Briant and Guo 2000; Liu and Diamond 2005; Shao et al. 2006), local climate alteration (Zhou et al. 2004), and a major reduction in natural vegetation cover and production (Fang et al. 2003). Urban residents have experienced an increase in levels of cholesterol-related diseases (Lee 2004) and an overall decline in quality of life.

As the largest and most modern city, Shanghai has experienced extensive urban expansion over the past three decades (Figure 1a). Between 1975 and 2003, the city's population increased from 10.8 million to 13.4 million (Shanghai Statistic Bureau 2004). The ecological consequences of urban sprawl have caused considerable concern among scientists and policy makers.

Since China's economic reform in the late 1970s, Shanghai, the country's largest and most modern city, has experienced rapid expansion and urbanization. Here, we explore its land-use and land-cover changes, focusing on the impacts of the urbanization process on air and water quality, local climate, and biodiversity. Over the past 30 years, Shanghai's urban area and green land (e.g., urban parks, street trees, lawns) have increased dramatically, at the expense of cropland. Concentrations of major air pollutants (e.g., SO\(_2\), NO\(_x\), and total suspended particles) were higher in urban areas than in suburban and rural areas. Overall, however, concentrations have decreased (with the exception of NO\(_x\)), due primarily to a decline in coal consumption by industry and in private households. Increased NO\(_x\) pollution was mainly attributed to the huge increase in the number of vehicles on the roads. Water quality changes showed a pattern similar to that of air quality, with the most severe pollution occurring in urban areas. Differences in mean air temperatures between urban and rural areas also increased, in line with the rapid pace of urban expansion, indicating an accelerating "urban heat island" effect. Urban expansion also led to a decrease in native plant species. Despite its severe environmental problems, Shanghai has also seen major economic development. Managing the tradeoffs between urbanization and environmental protection will be a major challenge for Chinese policy makers.

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