

## ECOLOGY

# China, India, and the Environment

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Cooperation between China and India can curtail biodiversity loss, mitigate climate change, and reduce deforestation.

China and India, the emerging economic giants of the world, will play a significant, perhaps a dominant, role in shaping the environmental outcomes for our planet in the 21st century. Both countries are expected to maintain an 8 to 9% rate of economic growth over the next several years (1). Even when much of the world is experiencing a recession, China and India in 2009 are projected to achieve high Gross Domestic Product growth (China, 8.4%; India, 6.2%; world, -2.2%) (1). Development in China and India is fueled not only by the natural capital within the countries, but also increasingly by imports of raw materials, particularly from southeast Asia. Both nations import ~9 million tons of crude palm oil annually—almost one-quarter of global production—mostly from Malaysia and Indonesia (2). The degree to which China and India consume natural resources within their boundaries, and beyond, will largely determine future environmental, social, and economic outcomes. The two countries have been engaged in a border dispute that included a bitter, but brief, war in 1962. We propose that much more earnest cooperation between the world's two most populous countries will be vital for mitigating biodiversity loss, global warming, and deforestation.

## Biodiversity, Water, Climate, and Forests

Nowhere are these issues better exemplified than in the Himalayas, the 2400-km-long chain of mountain ranges stretching between the Indus and the Brahmaputra River valleys (see the picture, above). The unique biodiversity of this region faces multiple pressures, including those associated with the military presence of both countries along the international border (3). This situation is particularly damaging to fragile subalpine and alpine ecosystems, which recover slowly from disturbance. Furthermore, resources are so scarce in these cold, high-altitude areas that the armies often use rare species for fuel.

Both countries are already facing severe surface and groundwater shortages (4, 5).



**A Himalayan landscape**—linking environmental integrity with peace and security.

Given the increased snow and glacier melt in the Himalaya–Hindu Kush region (6), the hydrology of major Asian rivers will be severely affected in the near future. The rush to harness hydroelectric power by building hundreds of dams on both sides of the earthquake-prone Himalayas will further accelerate changes in hydrology and the effects of climate change. For instance, India plans to increase hydropower projects in the Himalayas from 74 to 355 over the next 15 years, increasing the capacity from 15,208 to 126,588 MW (7); China is planning 750 projects in Tibet alone (8). Further, China may also divert water from the Tsangpo-Brahmaputra, one of the largest rivers in Asia, before it enters India (9). If true, dispute over political boundaries could extend to water resources.

Exploitation of Himalayan resources is likely to be accelerated as energy consumption rises more rapidly in Asia than anywhere else. China and India, respectively, are already the world's top and the fifth-largest emitters of greenhouse gases. Snow melt from Himalayan glaciers constitutes a principal water resource

during the summer months for at least half of the world's population (10). The synergistic effects of decreasing water resources, loss of biodiversity, increased pollution, and climate change may have negative social and economic consequences and, even worse, escalate conflicts within and between the two countries.

Beyond the Himalayas, both countries are enlarging their ecological footprint in Asia. If current trends continue to 2020 (2), China and India may be importing 45.8 and 18.8%, respectively, of their roundwood demand, or 64% of all currently produced roundwood in Asia. These imports will contribute to deforestation-driven greenhouse gas emissions and biodiversity loss in Asia.

## Benefits and Barriers to Cooperation

China and India have much to learn from each other. For instance, India's energy efficiency is higher than China's (11). However, China has much to offer to India in poverty reduction, health care, and large conservation programs, including the Natural Forest Conservation Program and the Grain-to-Green Program (12).

Cooperation between the two countries could help mitigate climate change, environmental damage, and biodiversity loss both regionally and globally. Both countries, but especially China, have experience with microhydropower projects. Local communities, especially in the Himalayas, have a tremendous

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knowledge of biodiversity, hydrology, and climate change (13). Sharing this knowledge could enhance the development of appropriate approaches and technologies. Both countries have recently increased forest cover (China, 157.1 million ha in 1990 to 197.3 million ha in 2005; India, 63.9 million ha to 67.7 million ha) (2). Sharing expertise in afforestation and in the development of policy frameworks for sustainable use of forest resources with the rest of Asia could contribute to reduction in deforestation and to an Asia-wide effort to mitigate climate change through both the preservation and enhancement of forest carbon stocks. Cooperation between the two countries can also have a huge impact on trade in tiger body parts and on conservation of the last remaining and the largest population of an icon species.

So far, collaboration and coordination between the two countries in dealing with environmental challenges has been limited, although there have been several signed agreements since 1988 (14). In 1993, a Sino-India collaboration agreement on the environment was signed (15). In the past few years, there have been research collaborations on terrestrial ecosystems, atmosphere-ocean-biosphere interactions, and related modeling (14) but the level of overall scientific collaboration has been lower than expected (16). In 2009, an international symposium on biodiversity and environmental changes in the Himalayan region was held in China and was attended by Chinese and Indian scientists (17). More recently, India and China have signed an agreement to comonitor glaciers (18) and to collaborate in the areas of energy, agriculture, and afforestation (19).

Despite the presence of these frameworks for cooperation, major barriers to collaboration between China and India persist. Linguistic and cultural differences perhaps tend to keep Indian and Chinese academics apart even in international meetings. Unresolved border disputes also deter cooperation. Furthermore, the severity of environmental challenges, and the opportunities for and benefits of coordinated and collaborative actions remain underappreciated.

#### Steps Toward Deepening Cooperation

First, both countries need to overcome cultural and linguistic barriers. Although China has been actively promoting Chinese language and culture internationally in recent years, only 2 out of 523 Confucius Institutes that have been established worldwide to support local teaching of Chinese are in India (20). Similarly, India needs to promote Chinese studies in India and Indian studies in China.

Second, with sparse or no human populations, some of the disputed areas or the areas

where armies have been amassed, which are alpine zones, are ideal for conversion to transboundary protected areas or peace parks, similar to the proposed K-2–Siachen Peace Park between India and Pakistan (21). The creation of peace parks—for which the United Nations Educational, Scientific, and Cultural Organization (UNESCO) could develop guidelines—and jointly run research stations could not only protect biodiversity, provide key ecosystem services, help mitigate climate change, and foster scientific collaboration, but also promote cooperative conservation actions and peaceful resolution to the border dispute (21).

Third, 2009 marked the 15th anniversary of agreements signed between the Chinese and Indian Academies of Sciences. The academies could exercise strong leadership in highlighting environmental issues, initiating joint actions, and fostering scientific exchanges. The Indian academies are gearing up to be more active in policy-making and could accord high priority to policy-oriented initiatives. Exchange and joint supervision of graduate and postdoctoral students could build on existing programs, such as those run by the Academy of Sciences for the Developing World (22). The governments could also establish a joint grants program for Himalayan research, as China and India have taken preliminary steps to establish a framework for scientific cooperation (23). The ecological societies of China, Japan, and South Korea have established formal agreements for cooperation and have held regular joint meetings. Such meetings could include India and place more emphasis on the environment.

Fourth, the United Nations and other organizations could create mechanisms for regional cooperation and governance of natural resources. Considering the number of heritage sites in the Himalayas, UNESCO and the U.N. Environment Programme, in particular, could be key in bringing the two countries together and facilitating such cooperation. Moreover, international foundations and nongovernmental organizations that are engaged in environmental issues on both sides of the Himalayas could develop transnational programs.

Fifth, the existing political and economic forums, such as the East Asia Summit and the Association of Southeast Asian Nations with China, Japan, and South Korea, which primarily foster trade, could pay more attention to the environment, which sustains most economic endeavors.

Finally, the United States, the European Union, and other developed countries could play pivotal roles in facilitating and encour-

aging multinational talks on climate change and related environmental problems that transcend political boundaries. The United States has good relations with China and India, but is engaged in separate discussions with each country over economic, energy, and environmental issues. Ultimately, as China and India begin to build more confidence and consensus from within, they will settle their differences bilaterally, particularly when environmental security starts to override concern for political boundaries.

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