COMMENTARY

# Breathing Better: Linking Energy and GHG Reduction to Health Benefits in China

By Kong Chiu, Yu Lei, Yanshen Zhang, and Dan Chen

What health benefits can be associated with actions that reduce greenhouse gas (GHG) emissions? How do GHG reduction measures affect ambient air quality? Do the costs of implementing these measures exceed any short-term economic benefits? What are the best multi-pollutant strategies for reducing greenhouse gas emissions while improving air quality? How can greenhouse gas reduction considerations be integrated into existing or planned air pollution programs? These are just some of the questions the U.S. Environmental Protection Agency's (EPA) Integrated Environmental Strategies (IES) program helps developing country policymakers consider.[1]

Through the IES program, EPA builds capacity around the world to cost-effectively manage greenhouse gas and air pollutant emissions concurrently. This is often referred to as "co-control." IES focuses on demonstrating and quantifying the mutual benefits associated with energy and transport policies and measures. This knowledge can then be used by policymakers to understand co-control opportunities in and synergies between climate change, energy and air quality management policies.

While GHG emissions are generally thought to have no direct, short-term impacts on public health, they are often emitted concurrently with other air pollutants that have direct health impacts. The fact that fossil fuel combustion leads to emissions of both carbon dioxide and criteria air pollutants creates a logical connection between policies that manage GHG emissions and policies that manage air quality. Since air quality directly affects public health, it is not difficult to demonstrate the public health benefits of certain GHG reduction measures and policies. In fact, a large body of analytical work has been conducted worldwide on the many co-benefits associated with GHG reduction measures (OECD, 2000; Burtraw et al., 2003).

## CHINA'S AIR CHALLENGES

China's rapid economic growth has created a dramatic expansion of energy production and consumption, mostly from fossil fuels. As a result, China's rapid urbanization and growth is behind the nation's increasing emissions of greenhouse gases and other air pollutants. Ambient levels of criteria air pollutants, including particulates, sulfur dioxide and nitrogen oxides significantly exceed World Health Organization (WHO) standards in many Chinese cities. In some instances, particulate and sulfur dioxide concentrations in China's urban centers are among the highest in the world. Similarly, China's GHG emissions are among the highest in the world. In fact, recent estimates suggest China has already overtaken or may very soon overtake the United States as the largest GHG emitter.

A newly released OECD study (2007) on environmental indicators in China estimated that health damage from air pollution in China cost the country anywhere between 1.8 to 4.7 percent of GDP. Drawing from studies by Ho and Nielsen (2006) and the World Bank (1997), the OECD report cited that without major improvements in air quality, by 2020 China could lose up to 13 percent of its GDP to health effects, which include:

- 600,000 premature deaths in urban areas;
- 9 million person-years of work lost due to air pollution-related illness,

# BOX 1. Energy Options and Health Benefits Analyses in Shanghai and Beijing

**Integrated Assessment of Energy Options and Health Benefits for Shanghai, China:** a co-benefits analysis of energy and air quality policies and measures in Shanghai. Local technical team members included the Shanghai Academy of Environmental Science and Fudan University. The Shanghai Assessment was completed in 2001 and demonstrated that certain industry and power sector measures could simultaneously reduce greenhouse gas emissions, and emissions of $SO_2$, $NO_2$ and $PM_{10}$, while yielding substantial, quantified, public health and economic benefits. Results from this analysis influenced the development of Shanghai's Tenth Five-Year Year Plan.

**Energy Options and Health Benefits for Beijing Case Study:** a co-benefits analysis of energy and air quality measures to support the 2008 Beijing Olympics, was launched in Beijing in 2002. Local technical team members included Tsinghua University and the Peking University Health Science Center. Results from this analysis indicated that $SO_2$ and $NO_X$ concentrations would reach the city's goals by 2008 if all of the measures included in the scenarios (derived from the Beijing Olympic Action Plan) were implemented. However, additional policies and measures would be needed for the city to reach its targets for fine particles.

- 20 million cases of respiratory illness per year; and,
- 5.5 million cases of chronic bronchitis and health damage.

In many countries, including China, policies that address energy and climate change are often managed separately from air pollution control policies. This makes it difficult for policymakers to adopt an integrated or multi-pollutant approach to managing emissions. For example, China's most recent Five-Year Plan includes a goal to reduce energy intensity by 20 percent by 2010 and a goal to reduce sulfur dioxide ($SO_2$) emissions by 10 percent. The lead agency for implementing the energy intensity goal is China's National Development and Reform Commission (NDRC) and the lead agency for implementing the Total Emission Control policy to reduce $SO_2$ emissions is the State Environmental Protection Administration (SEPA). While the government appears to treat these as two unrelated policies, China's heavy reliance on fossil energy creates powerful linkages and potential synergies between energy intensity and $SO_2$ emissions. Both policies clearly have implications for GHG emissions.

EPA's ongoing IES work in China seeks to shed light on linkages between the energy intensity and $SO_2$ policies by quantifying the related energy, GHG, air pollution and health benefits of measures that meet their targets. Other co-benefits may also be examined. The IES-China program was launched in 1999 under a statement of intent between EPA's administrator and SEPA's minister in conjunction with the U.S.-China Forum on Environment and Development. Since that time EPA has teamed with local partners to quantify the benefits, including greenhouse gas reductions, of energy and transport programs in China—initially with studies in Shanghai and Beijing that were well received by municipal governments. (See Box 1). The most recently completed phase of U.S.-China collaboration on IES is a national-level assessment of air quality, public health and economic impacts of clean energy and transportation strategies in China. It is part of a broader effort by EPA to support integrated planning and multi-pollutant approaches to environmental management in China.

## OVERVIEW OF ENERGY SCENARIOS AND ASSUMPTIONS

The IES China National Assessment examines the air quality and public health impacts of clean energy and transport sector strategies in China

## TABLE 1. Summary of Business as Usual and Climate Change Policies Scenarios

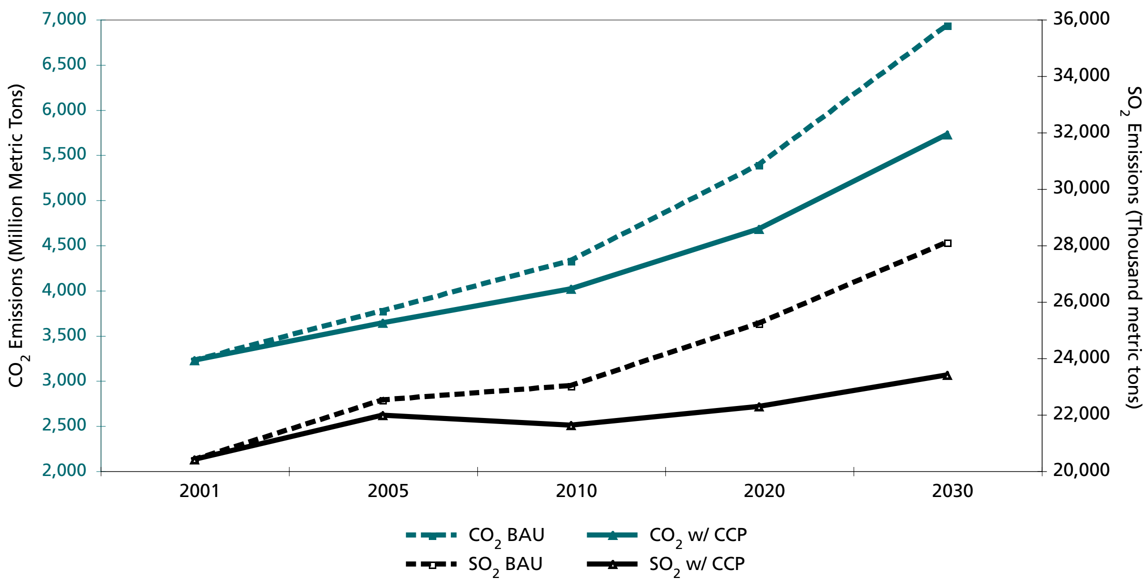
| | BAU Assumptions | CCP Assumptions |
|---|---|---|
| **Household Energy Efficiency** | | |
| Urban household energy saving lamp usage by 2010 and 2030 | 34% by 2010<br>45% by 2030 | 45% by 2010<br>70% by 2030 |
| Rural household energy saving lamp usage by 2010 and 2030 | 20% by 2010<br>40% by 2030 | 24% by 2010<br>53% by 2030 |
| **Industrial Energy Efficiency** | | |
| Iron & steel annual energy intensity reduction | 1.62% / year | 1.72% / year |
| Nonmetal minerals annual energy intensity reduction | 2.9% / year | 3.2% / year |
| Chemical production annual energy intensity reduction | 3.25% / year | 3.5% / year |
| Manufacturing annual energy intensity reduction | 2.5% / year | 3.5% / year |
| **Building Energy Efficiency** | | |
| Terminal heat load (Watts/cubic meter, $W/m^2$) of public buildings as percentage of 2001 value | 68.4% in 2010<br>51.8% in 2030 | 54.4% in 2010<br>32.8% in 2030 |
| Terminal heat load ($W/m^2$) of residential buildings as percentage of 2001 value | 70.6% in 2010<br>54.0% in 2030 | 55.5% in 2010<br>36.1% in 2030 |
| **Vehicle Energy Efficiency** | | |
| Increase in energy efficiency of light buses and cars by 2030 | 46% | 87% |

from 2001 through 2030. The IES team compared analytical scenarios incorporating polices and measures against a "business as usual" (BAU) baseline scenario. The BAU scenario adopts long-term economic and energy projections developed by NDRC's Energy Research Institute in 2003. These projections assume:

- Continued GDP growth between 5.5 and 7.2 percent annually through 2030;
- Population will grow from just under 1.3 billion in 2001 to over 1.5 billion by 2030;
- Urbanization will shift from its current levels below 50 percent to approximately 65 percent by 2030;
- Industrial energy intensity will gradually improve through structural adjustments, technological improvements and cost-reduction measures;
- Existing energy conservation laws and policies will be well-implemented; and,
- In the transportation sector, the vehicle population will continue to grow, EURO III standards will be established in 2008, EURO IV in 2012 and EURO V in 2018.

Two policy scenarios were designed for analytical comparison against the BAU scenario.[2] One is a climate change policy (CCP) scenario that assumes the adoption of policies and programs that reduce the emissions of GHGs. The scenario's assumptions include: (1) the dissemination of efficient technologies throughout all industry sectors, (2) improvement in building energy conservation standards, and (3)

FIGURE 1. Projected $CO_2$ and $SO_2$ Emissions Reductions with Climate Change Policies




improvement in the efficiency of electric power plants and industrial boilers and vehicles. Overall, the CCP scenario projects a more rapid improvement in energy intensity over BAU assumptions, but was developed before China's recent national goal to reduce energy intensity by 20 percent. A summary of the BAU and CCP scenarios is provided in Table 1.

The second policy scenario adds pollution control policies to the CCP scenario. The pollution control policies scenario assumes: (1) a more aggressive timeline for adoption of EURO IV and V vehicular standards, (2) phase-out of power plants over 30 years of age, (3) faster than BAU installation of Selective Catalytic Reduction technology in power plants; and (4) more aggressive particulate matter (PM) controls for industry.

## TOOLS AND METHODOLOGY FOR THE NATIONAL ASSESSMENT

The energy and emissions outcome of each scenario was modeled using two tools, the Long Range Energy Alternatives Planning System (LEAP), a multi-sector bottoms-up energy-environment model developed by the Stockholm Environment Institute and an emissions inventory developed under the Transport and Chemical Evolution over the Pacific (TRACE-P) program. A modeling timeframe of 2001 through 2030 was used to calculate the energy demand, supply and investment under each scenario as well as the emissions of $SO_2$, nitrogen oxide ($NO_x$), PM, volatile organic compounds (VOC), carbon monoxide (CO), and carbon dioxide ($CO_2$).

Total criteria air pollutant emissions were translated into atmospheric air pollutant concentrations using EPA's Community Multi-scale Air Quality (CMAQ) system, a third generation air quality model that uses a "one atmosphere" approach to estimate primary and secondary pollutant concentrations based on emissions and meteorological data. CMAQ can predict concentrations of pollutants that are created in the atmosphere through photochemical reactions, like ground-level ozone and fine particulates ($PM_{2.5}$). Many of these pollutants have strong health impacts, making CMAQ an important tool for air quality and health analysis. While CMAQ has been used often in the United States for air quality modeling, the IES China National Assessment was one of the earliest applications of CMAQ to China.

Information on air pollutant concentrations generated by CMAQ was then used to estimate health impacts with EPA's Benefits Mapping Assistance Program (BenMAP) health benefits model. Historically, avoided health impacts have been one of the key co-benefits examined under IES. Building the capacity to conduct health benefits analysis has been an unintended, but not unwelcome consequence of this

## TABLE 2. Baseline Incidence of Health Endpoints

| Health Endpoint | Incidence Rate, per 100 persons, per year |
|---|---|
| **Mortality** | |
| Death by All Causes | 0.575 |
| Death by Cardio-pulmonary Disease | 0.320 |
| Death by Lung Cancer | 0.028 |
| **Morbidity** | |
| Hospital Admissions, Respiratory | 0.597 |
| Hospital Admissions, Cardiovascular | 0.881 |
| Outpatient Visits, All Causes | 26.18 |

work. Health effects partners in China included Fudan University (formerly Shanghai Medical University) and the Peking University Health Science Center. Through the course of conducting an IES project, these partners have received practical hands-on experience and training on topics including estimating avoided health impacts, examining local epidemiological studies, developing and/or adapting appropriate concentration-response functions and calculating changes in health impacts for different scenarios. Part of this capacity building has been the introduction of tools and resources including BenMAP.

BenMAP uses changes in pollutant concentrations, exposed population data and baseline incidence rates of health endpoints in conjunction with concentration-response functions to estimate health impacts associated with changes in ambient air pollution. With the inclusion of estimated unit economic values for each health endpoint, BenMAP also calculates the economic impact associated with their incidence. This project was the first application of BenMAP to calculate health effects in China.

The researchers used the 2001 *China Statistical Yearbook* for baseline mortality incidence rates. Baseline morbidity incidence rates were taken from the 2003 Chinese National Health Services Survey. Air pollution has both chronic, long-term impacts on human health and acute, short-term impacts. Numerous studies have been done to determine the concentrations response relationship between air pollution and human health. Looking specifically at particulate matter as a pollutant, the IES team examined both long-term cohort studies and short-term time series for the China National Assessment. These studies include the impacts of exposure to total suspended particulates, $PM_{10}$ and $PM_{2.5}$ on human health. Table 2 lists the health endpoints examined and the baseline incidence rates.

In calculating economic impacts and benefits from air pollution, the team used contingent valuation (a.k.a. willingness to pay values) for the mortality estimates and cost of illness for morbidity estimates. The contingent valuation figures were derived from values published by Wang and Mullahy in 2006. The cost of illness figures (e.g., medical expenditures and lost earnings) were derived from the 1998 National Health Services Survey conducted by China's Ministry of Health.

### Sample Results

The results of the IES analysis show that the climate change policies examined can reduce annual $CO_2$ emissions by approximately 13 percent by 2020 and roughly 17 percent by 2030. Concurrently, annual $SO_2$ emissions could be reduced by approximately 12 percent by 2020 and 17 percent by 2030. Projected annual emissions of $NO_X$, black carbon, organic carbon and non-methane volatile organic compounds also experience reductions with implementation of the climate change policies. Figure 1 illustrates the concurrent air pollution and GHG reductions achieved through the climate change policies.

With the reductions in pollutant emissions, modeled pollutant concentrations also fall when compared to the business-as-usual (BAU) base case scenario. For example, the study's preliminary results indicate that the climate change policies decrease national average particulate matter ($PM_{2.5}$) concentrations by 2 percent or 0.2 micrograms per cubic meter by 2020 and 3.5 percent or 0.4 micrograms per cubic meter by 2030. Although the study calculated annual emissions and average $PM_{2.5}$ concentrations of several air pollutants, only estimates of concentrations were used in the health effects analysis.

Preliminary results of the health impact analysis indicate that implementing the climate change policies (CPP) could prevent 20,311 cardiopulmonary related premature deaths nationwide annually due to by 2020 and 29,239 by 2030. The results from examining morbidity under the CCP scenario suggest that more than 6,000 respiratory hospital admissions could be avoided by 2020 and approximately 9,000 respiratory hospital admissions could be avoided in 2030. Applying the economic valuation figures derived by the team, these results translate (in 2005 U.S. dollars) into economic savings of more than $22 million for avoided respiratory hospital admissions in 2030 and approximately $4 billion for avoided cardiopulmonary deaths. Thus the adoption of certain climate change policies could help address the growing health problems stemming from China's severe air pollution and the co-benefits of these policies could help offset the cost of implementing them.

## POLICY IMPLICATIONS

China's rapid expansion is expected to continue in the immediate future, with the National Congress establishing a goal of fourfold economic growth between 2000 and 2020. While the economy remains heavily industrialized and dependent on fossil fuels, China's GHG emissions also will continue to grow. China is clearly paying attention to these trends, as indicated by the release of their National Climate Action Plan in June of 2007. With economic growth as a priority in the nation's development, China must weigh the costs and benefits of implementing measures to support the plan. Analyses like this one, and the capacity to conduct similar studies, will help the Chinese government understand and quantify additional benefits, including air pollution reductions and avoidance of health impacts that climate change mitigation measures may yield. Integrated analytical approaches like IES may also help China identify potential overlaps between climate, energy and air quality goals and synergies between actions to reach those goals.

The opinions and recommendations included in this article are those of the authors and do not represent official policies or positions of the United States Government, the U.S. Environmental Protection Agency or the Government of the Peoples Republic of China.

*Kong Chiu manages U.S. EPA climate and energy projects in China including IES and eeBuildings (www.epa.gov/ies and www.epa.gov/eebuildings). Prior to this, Mr. Chiu oversaw evaluation of the environmental and financial performance of U.S. EPA's Clean Water State Revolving Fund. He can be reached at: chiu.kong@epa.gov.*

*Yu Lei is pursuing a Ph.D. at Tsinghua University in the Department of Environmental Science & Engineering. His work focuses on emission inventories of air pollutants. He can be reached at: leiyu98@mails.tsinghua.edu.cn.*

*Dan Chen, is now a Ph.D. candidate in the Department of Environmental Science & Engineering at Tsinghua University. Dan's Ph.D. study is focused on air quality modeling. He can be reached at: chd00@mails.tsinghua.edu.cn.*

*Yanshen Zhang graduated from Weifang Medical College and is a Ph.D. candidate in the Department of Occupational and Environmental Health at Peking Medical University. His research interests are focused on the short-term effect of particulate air pollution on human health and health impact assessment of air pollution. He can be reached at: zhangyanshen@126.com.*

## REFERENCES

Burtraw D. & A Krupnick et al. (2003). "Ancillary benefits of reduced air pollution in the US from moderate greenhouse gas mitigation policies in the electricity sector." *Journal of Environmental Economics and Management* 45 p. 650-673.

Energy Research Institute. (2003). *China Sustainable Energy Scenarios in 2020.* Beijing: ERI. (In Chinese).

Ho, S. Mun and P. Chris Nielsen. (2006). *Clearing the Air: Assessing the Health and Economic Damages of Air Pollution in China*. MIT Press, Cambridge.

OECD. (2000). "Ancillary benefits and costs of greenhouse gas mitigation: Proceedings of an IPCC co-sponsored workshop held on 27-29 March 2000 in Washington, D.C." Paris, France.

Wang, H. & J. Mullahy. (2006). "Willingness to pay for reducing fatal risk by improving air quality: A contingent valuation study in Chongqing, China", Wang, H. and J. Mullahy, *The Science of Total Environment*, 367(1): 50-7.

World Bank. (1997). *Clear Water, Blue Skies: China's Environment in the New Century,* World Bank, Washington, DC.

## NOTES

1. For more information on U.S. EPA's Integrated Environmental Strategies program, including full copies of studies from the China program, please see: www.epa.gov/ies.

2. Specific details of the BAU and other scenarios are available in the IES China National Assessment final report, "Energy Options and Health Benefits: China Case Study" available at www.epa.gov/ies.

# COMMENTARY

## Back to the Future: Bicycles, Human Health, and Greenhouse Gas Emissions in China

By Peter Koehn

China's greenhouse gas (GHG) emissions either have surpassed or shortly will surpass those of the United States (Bradsher, 2006; Graham-Harrison & Wynn, 2007). However, few individuals in China or elsewhere are motivated to change their emission-producing behavior exclusively out of concern for global warming. In every country, mitigating GHG emissions requires issue-bundling, or establishing links with other compelling human motivations. In urban China, reducing air pollution and protecting personal and family health constitute powerful current public concerns (Koehn, 2006). GHG emissions will be simultaneously mitigated as policymakers are successful in changing behaviors that currently produce air pollution and undermine health.

A majority of the world's most air-polluted cities are in China, and over the past decade vehicle emissions have replaced coal soot as the principal source of urban air pollution. In 1996, 8 out of every 1,000 inhabitants owned a car in China (Sperling & Salon, 2002). By 2006, some 24 million private vehicles (roughly 18 per 1,000 persons) navigated, or idled, on China's roads ("Low-emission cars," 2006; Kim & Turner, 2006). In Beijing and other major cities, the public refer to the prevailing rush-hour transportation gridlock as "one giant parking lot" (Murray and Cook 2004, 8-9; Phoenix Satellite Television, 2006).

China's vehicle emissions are associated with "brain damage, respiratory problems and infections, lung cancer, [and] emphysema" among other health concerns (Paterson 2000). A joint UNDP-WHO study found air pollution responsible for an estimated 500,000 unnecessary deaths per year in 28 Chinese urban centers (Porter, Shi, & Zhao, 2003). Asthma attacks in urban areas of China have reached 75 million a year, with the young and elderly the most susceptible (OECD, 2007).

At the turn of the century, pedal-power friendly China boasted one of the world's lowest rates of obesity among men and women aged 35 to 64 (McQueen, McKenna, & Sleet, 2001, 320). Since then, however, China's population has experienced a dramatic rise in obesity, diabetes, and abnormal blood lipid levels ("Health and Weight," 2004; "Obesity Increasing," 2006; Brownell & Yach, 2006).[1] Studies indicate that Chinese households with access to private motorized vehicles possess obesity rates that are 80 percent higher than peer households' records (Saletan, 2006).

City planners are responsible for the transportation decisions that have triggered much of the pollution and health issues. These recent developments not only coincide with rapidly increasing ownership and operation of personal motor vehicles, but also with the elimination of bicycle lanes and pedestrian sidewalks (Liu, 2006; Notar, 2006). Many Chinese cities continue to encourage private car ownership and create obstacles to bicycle use. For example, Guangdong has banned bicycles from the city center and many other cities are building new roads without separate bike lanes.[2]

For China's cultural leaders and local government authorities, reaching back to the bicycle as the "vehicle of the future" would enable them to connect public-health promotion with motor-vehicle-emission mitigation (see Lowe, 1989). Less than a decade ago, Shanghai inhabitants made 60 per cent of their trips by biking or walking (Schipper, 2006). Nationwide rates for non-motorized travel have declined to about 40 per cent at present (Oliver, 2006). Addressing the manifold problems associated with operating even more private motor vehicles

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constitutes an urgent sustainable-transportation priority throughout China (Schipper, 2006, 22).[3]

Since curtailing automobile emissions primarily requires addressing "the amount and length of journeys" (Potter, 2001, 141-142) and, on average, people in China only move a total of 12-14 kilometers per day (Schipper, 2006), expansion of cyclist- and pedestrian-friendly routes and encouraging pedaling in place of short car trips—particularly during peak traffic hours—could bring about a substantial reduction in local air pollution, GHG emissions, and help keep respiratory problems, obesity, and type-2 diabetes in check (Helgerson, 2006). More than any other form of urban mobility, with the exception of walking, biking is consonant with the principal economic, social, and environmental "drivers" of sustainable transportation (Schipper, 2006): it is affordable to users, bears full social costs, promotes access for all, builds healthy communities, minimizes accidents and damage to human health, leaves no burdens for future generations, and produces no GHG emissions. In certain situations, biking even reduces overall travel time.[4] Current pedal-power options include the traditional "affordable" bicycle model, upscale versions designed for managers, various load-carrying models with trailers (Benjamin, 2004), and zero-pollution zinc-air-battery-powered bicycles (Tao, 2003).

Of course, not all of China's city and town dwellers can be expected to rely on bicycles as their exclusive form of vehicular transportation. Parallel pollution-reduction efforts, including links with improved bus and subway systems and support for concentrated residential patterns that are integrated with services, schools, and employment opportunities (Zhou et al., 2001), also constitute important components in an overall sustainable urban transportation-sector package. A feasible bicycle-centered goal would concentrate on reversing current personal-car usage and urban air-pollution trends. To encourage increased use, local policymakers in China need to ensure that bicycles are a safe, convenient, and cost-effective option. With the requisite infrastructure in place, a large-scale incentive scheme would further enhance the attractiveness of the bicycle among mobile individuals.

Encouraging sustainable pedal power in China (and elsewhere) calls for a new accounting system that rewards zero-emission, health-promoting mobility. In comparison with calculating clean-development credits by measuring reductions in GHG emissions, a more direct, personally recognizable, and potentially decisive approach would amply reward zero-emission (bicycle and foot power) travel. In the section that follows, I present some initial thoughts on what an emission-avoidance transportation incentive scheme might look like.[5]

Under my proposed emission-avoidance approach, each mobile individual would receive a monthly "GHG-transportation score." For illustrative purposes, a simple "zero-emission reward" system would calculate GHG-transportation scores as follows:

- Each zero-emission trip by bicycle, roller blades, or walking of one kilometer or longer: 1 point
- Each trip by public transportation of any distance: -1 point
- Each motorcycle trip of any distance: -2 points
- Each trip (multiple occupancy) of any distance in a passenger motor vehicle (or taxi): -2 points
- Each trip (single occupancy) of any distance in a passenger motor vehicle: -3 points

A GHG mobility-accounting system could involve a combination of honor-system reporting, observation, and trip-monitoring technology. Scores would be linked to powerful symbolic and monetary incentives for individuals, households, organizations, and communities. Individuals, families, business, government, and not-for-profit organizations, cities, and townships[6] would be recognized and rewarded/docked (in terms of health co-benefits, by financial remuneration, prizes, awards, tax relief, or clean-development credits, and by local, national, and international recognition) based on their net annual scores, applying the principle of *net emitters pay, net non-emitters reap*.

Monitoring and recording trips and managing the allocation of rewards would be challenging. While the prospect of such a system seems unwieldy, this proposal is meant to stimulate interest among and elaboration by policymakers, community members, local planners, and far-sighted thinkers in China and other countries (such schemes should not simply be attempted in China). Detailed consideration of these issues goes beyond the scope of this commentary. Possibilities include submission by employers of independently verified reports on employee commuting, biking bonuses and commuting tax exemptions (see Daly, 2003), tax breaks for businesses when their employees record a net positive annual GHG-commuting emission score, support for a zero-emission tracking network of NGOs, monitoring and reward allocation by local environmental protection bureaus, and strengthened case for model-green-cities recognition.

Rediscovering and revitalizing China's vehicle of the past as the premier vehicle of its future represents a promising climatic-stabilization and health-promoting alternative, which could offer a model for other countries. At this juncture, the outcome of the emission-mitigation/health-promotion race remains undecided. Reaching back for lessons on how to protect and promote pedal power can thrust China forward into the "yellow-shirt" position of global mobility-leadership.

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*Peter Koehn is a professor of political science at University of Montana, Missoula. His research focuses on U.S.-China relations, transnational competence, and sustainable development. He can be reached at: peter.koehn@umontana.edu.*

## REFERENCES

Agarwal, Anil. (2002). "A Southern perspective on curbing global climate change." In Stephen H. Schneider, Armin Rosencranz, and John O. Niles (Eds.), *Climate change policy: A survey* (pp. 375-391). Washington: Island Press.

Benjamin, Ed. (2004). "Light electric vehicle propulsion." *Cycle Electric*.

Bradsher, Keith. (2006, 7 November). "China to pass U.S. in 2009 in emissions." *The New York Times*, pp. C1, C4.

Brownell,, Kelly D.; and Yach, Derek. (2006). "Lessons from a small country about the global obesity crisis." *Globalization and Health* 2:11.

Daly, Matthew. (2003, 23 March). "Oregon congressman wants tax break extended to cyclists." *Missoulian*, p. A3.

Graham-Harrison, Emma; and Wynn, Gerard. (2007, 23 March). "China seen topping U.S. carbon emissions in 2007." *Reuters*.

"Health and weight." (2004, 13 October). *The New York Times*, p. A6.

Helgerson, Steven D. (2006, 2 April). "A tale of two pandemics: One is coming, one is here." *Missoulian*, p. A7.

Koehn, Peter H. (2006). "Fitting a vital linkage piece into the multidimensional emissions-reduction puzzle: Nongovernmental pathways to consumption changes in the PRC and the USA." *Climatic Change* 77, 377-413.

Landler, Mark. (2007, 8 March). "Rethinking the European car." *The New York Times*, p. C1.

Liu, Zhi. (2006). "Urban transportation challenge and its implications to the automobile manufacturing industry." Presentation at the Automotive News China Conference, Beijing, 15-18 November. Accessed at www.wilsoncenter.org/cef (Events Summary 30 November 2006).

"Low Emission Cars Popular in China." (July 10, 2006). *SEPA News Link*. [Online]. Available: www.zhb.gov.cn/english/news_detail.php3?id=13015.

Lowe, Marcia D. (1989). *The Bicycle: Vehicle for a Small Planet*. Worldwatch Paper 90. Washington, D.C.: Worldwatch Institute.

McQueen, David V.; McKenna, Matthew T.; and Sleet, David A. (2001). "Chronic diseases and injury." In Michael H. Merson, Robert E. Black, and Anne J. Mills (Eds.), *International Public Health: Diseases, Programs, Systems, and Policies* (pp. 293-330). Gaithersburg, MD: Aspen Publishers.

Murray, Geoffrey; and Cook, Ian G. (2004). *The Greening of China*. Beijing: China Intercontinental Press.

Notar, Isabella. (2006). "China's cities seize the initiative: Strengthening auto emissions control on the streets." *China Environment Series* 8, 92-97.

"Obesity Increasing." (2006, 10 July). *China Daily*.

Oliver, Hongyan He. (2006). "Reducing China's thirst for foreign oil: Moving towards a less oil-dependent road transportation system." *China Environment Series* 8, 41-58.

OECD. (2007). *OECD Environmental Performance Indicator Report for China*. Paris: OECD.

Paterson, Matthew. (2000). "Car culture and global environmental politics." *Review of International Studies* 26, 253-270.

Phoenix Satellite Television. (2006). *The Lost City: Beijing*. New York: Filmakers Library.

Porter, Gareth; Shi Han; and Zhao Shidong. (2003). *Energy and Environment Outcome Evaluation*, 21 May. Beijing: UNDP China.

Potter, Stephen. (2001). "Summing up the technology fac-

tor." *Town & Country Planning* (May), 139-142.
Saletan, William. (2006, 15 September). "Global gluttony." *The New York Times*, p. B4.
Schipper, Lee. (2006). "Urban transportation in China: Car crazy?" Presentation at the China Environment Forum, Woodrow Wilson Center, Washington, D.C., 30 November. [Online]. Available: www.wilsoncenter.org/cef (Events Summary 30 November 2006).
Smith, Graham. (2006). "China urban transport: Keeping it clean.'" Presentation at the China Environment Forum, Woodrow Wilson Center, Washington, D.C., 30 November. [Online]. Available: www.wilsoncenter.org/cef (Events Summary 30 November 2006).
Sperling, Daniel; and Salon, Deborah. (2002). *Transportation in Developing Countries: An Overview of Greenhouse Gas Reduction Strategies*. Arlington: Pew Center on Global Climate Change.
Tao, Nuyi (compiler). (2003). "Environmental briefing." *Sinosphere Journal* 6, No. 1 (March), 50-52.
Weiss, Eric M. (2007, 22 April). Commute wears more on the driver than the car." *Missoulian*, p. H4.
Zhou, Hongchang; Sperling, Daniel; Delucchi, Mark; and Salon, Deborah. 2001. *Transportation in Developing Countries: Greenhouse Gas Scenarios for Shanghai, China*. Arlington: Pew Center on Global Climate Change.

## NOTES

1. U.S. studies indicate that the health hazards of commuting by automobile include elevated blood pressure, increased neck and spine problems, and "lower thresholds for frustration at work" (Weiss, 2007).

2. In Beijing, however, "attempts to build new roads in the city without the obligatory bike paths were defeated by popular protests …" (Notar, 2006, 96).

3. Even in Europe, passenger-vehicle emissions "are rising rather than falling, unlike overall greenhouse gases …" (Landler, 2007, C1).

4. Zhi Liu (2006) reports that peak-hour speeds on Beijing's arterial roads averaged about 10 km/hour in 2005. Bicyclists can match or better this speed and save additional travel time in the vehicle-parking process. While living in Shanghai in the mid-1990s, the author usually was able to outpace buses on his affordable-model bicycle.

5. One advantage of an emission-avoidance-reward approach is that it incorporates populations that currently produce little in the way of *reducible* greenhouse gases (see Agarwal, 2002, 386).

6. This scheme also should be feasible in villages and small towns. Special consideration might be necessary for remote rural residents who depend upon motorcycles for contact with settlements and services. Aggregate country-wide scores need not be computed so that credit and attention remains focused on grassroots efforts.

# Shanghai Green Oasis

By Kang Hongli and Mayu Suzuki

Recipes for *Heibanwa* (black-spotted frog) abound in China—gently-spiced stir fry, stewed, deep fried, or made into a congee. Frog legs are especially popular in these dishes, which are consumed most heavily in Shanghai, Guangdong, and Hubei. Despite prohibitions on eating frogs, they remain on the menu. In 2006, the NGO Shanghai Green Oasis conducted a survey on frog consumption in Shanghai and discovered that among 267 stores, 38 percent stocked frogs (102 stores); and slightly over half of the 259 street markets they investigated sold frogs. Shanghai Green Oasis estimates that annual frog consumption in Shanghai is approximately 3,000 tons. Frogs are imported from provinces near Shanghai (Zhejiang, Anhui, and Jiangsu) and further away (Sichuan and Shandong). This massive capture of frogs is leaving a decisive footprint on local rural ecology in these provinces in that they have lost a major natural insect predator, which translates into a greater need for chemical pesticides. In an effort to raise awareness of the danger of wild frog consumption, Shanghai Green Oasis has distributed this survey to government organizations, food safety management units, private companies, schools and neighborhood associations.

This activity is but one of many environmental education projects undertaken by Shanghai Green Oasis, one of the few green groups in Shanghai. This NGO was established in 2004 by a handful of volunteers who were working at various environmental organizations, such as the Shanghai Wild Animal Protection Association. The group's education activities focus on protecting wild animals, reducing water pollution emissions, and raising awareness of global warming—the last being an issue that could severely impact this coastal metropolis.

## ENVIRONMENTAL EDUCATION PROJECT

Shanghai Green Oasis shapes its environmental education projects in ways that not only aim to raise awareness, but also help people feel connected to the issues, which ultimately could lead them to change their behavior. In 2005, Shanghai Green Oasis received 50,000 Yuan from the China Youth Toyota Environmental Protection Award to launch an educational project in ten elementary and middle schools in collaboration with the Shanghai Youth Technology Center. These ten pilot projects aim to develop and test an "ecological moral education" curriculum, which they hope could eventually be carried out nationwide.

## FINDING SUSTAINABILITY FOR A SHANGHAI-BASED NGO

Unlike Beijing, Shanghai is not a hotbed of environmental NGO activism in China in terms of domestic or international groups. Thus, Shanghai Green Oasis decided to act as a communication network for the few environmental groups in the region, creating the Shanghai Green Association Forum. This forum has helped give Shanghai area NGOs an opportunity to interact and share ideas and to create joint activities.

Like other NGOs in China, Shanghai Green Oasis finds it difficult to maintain a consistent group of volunteers to carry out their work, for many of their volunteers are students who eventually move on. While funding has been challenging for Shanghai Green Oasis, they have benefited from support from Pacific Environment, Global Greengrants Fund, Bird Life International, and the Shanghai bureau for wild animal protection.

For further information about Shanghai Green Oasis see www.greensocc.org or contact info@greensocc.org.

*Kang Hongli, is the director of Shanghai Green Oasis and she can be reached at: kanghli@126.com. Mayu Suzuki is a fall 2007 intern with the China Environment Forum and she is working on her Master's in International Development at the University of Denver. She can be reached at: yumakisuzu@gmail.com.*

金 木 水 火 土

# FEATURE BOX

## China Holds the Key to Saving Wild Tigers

By Grace Ge Gabriel

It was not long ago when wild tigers roamed the dense forests of Lei Gong Mountain in Xi Jiang, Guizhou Province. That's when the forest in Xi Jiang teemed with wild bears, deer and boars, essential prey species for tigers, the ultimate predator. That was also the time when Tang Zhengbao, an ethnic Miao hunter, became known as the Tiger-Killing Hero. Responding to the government call for the elimination of tigers, then considered "pests," Tang bought a rifle and some traps. He proceeded to hunt anything that moved in the mountains and subsequently brought down over 30 tigers during the 1960s alone. For the pelt and bones from a 300-pound tiger, he was paid 500 Yuan ($70), a good price at the time! Today, Lei Gong Mountain stands empty and silent, barren of wildlife. Old man Tang, the hunter-turned-forest guard still goes into the mountain everyday hoping to find signs of tigers. Yet he has not seen anything bigger than a snake for a long time.[1]

This story captures the tragic end of the South China tiger (Panthera tigris amoyensis), the tiger subspecies that existed only in China. Merely 40 years ago, there were reportedly over 4,000 tigers. Yet, no South China tiger has been seen in the wild in nearly 20 years. Scientists believe this subspecies has become extinct in the wild. In fact, in the last fifty years, habitat loss and intensive poaching of tiger prey and tigers for the commercial trade in their parts and derivatives have caused the extinction of three additional subspecies of tigers in Asia. The fate of those remaining in the wild is uncertain.

While fewer than 30 individual South China tigers may still exist in the wild in the border region between China and its neighbors, over 5,000 tigers live on various captive breeding facilities across China. Under pressure from businessmen with commercial interests in these "tiger farms," the wildlife authority in China announced that it is "conducting policy research on the possibility and feasibility of permitting the medical use of tiger bone derived from captive bred tigers."[2]

This announcement brought significant alarm to the international community, particularly in many of the tiger range countries, which are experiencing increased poaching and a resulting dramatic decline of wild tiger populations. The status of tigers in the wild is now so precarious that any additional poaching pressure could quickly push the species to extinction.

Tigers have been listed on Appendix I of the Convention on International Trade in Endangered Species (CITES) since its first Conference of Parties (CoP) in 1975, and the desire to conserve the world's remaining wild tigers has galvanized the political will of the global community ever since. In order to halt the dramatic decline of wild tigers, CITES countries have adopted by consensus numerous resolutions and decisions to control the illegal trade of tiger parts and derivatives. To demonstrate compliance to CITES and effective implementation of its resolutions, China in 1993 banned the domestic trade in tiger bone, an ingredient historically used in Traditional Chinese Medicine (TCM). Since then, the government had removed tiger bone from the official pharmacopeias, conducted public awareness campaigns, and actively sought alternatives to replace tiger bone in medicine. These actions effectively closed down a significant legal tiger parts industry in China, which exported 27 million units of tiger products to 26 countries between 1990 and 1992.[3]

The ramifications for the surviving wild tiger populations of opening a floodgate to tiger parts consumption, even from captive bred tigers, in the world's

Factory farming of tigers in row after row of enclosures at the Guilin Xiongsen Bear & Tiger Farm, Southwest China. Photo Credit: IFAW/Sinopix

fastest growing economy is simply too dangerous an idea to contemplate. To counter this huge threat to the survival of wild tigers, an unprecedented coalition of NGOs from conservation, animal welfare, zoological and TCM communities came together to form the International Tiger Coalition (ITC) in 2006. Coming from around the world and each with its own mandate, ITC members share the common concern for the survival of wild tigers and work to end tiger trade (www.endtigertrade.org).

By the end of 2006, tiger farms across China have about 5,000 tigers in captivity with an annual reproductive potential of 800. Seeking a way out of the financial predicament that has resulted from the bad business decision of investing in the production of a banned commodity, tiger farm owners have been openly and actively lobbying the Chinese government to lift the trade ban.

ITC member investigation found that under the while tiger farms bill their work as "conservation" and "benefiting human health," they are in fact pure commercial operations that speed-breed tigers, stockpile tiger carcasses, and some even sell tiger bone products illegarlly. Farm-bred tigers are genetically compromised and therefore have no conservation value, nor can they be released into the wild, as they lack the skills to survive.

Farming tigers for legal trade in their parts would revive what is now a waning market interest in tiger products. Lifting the ban would stimulate more poaching of wild tigers, for it costs as little as $15 to kill a tiger in the wild, yet as much as $7,000 to farm a tiger to maturity for trade.[4] Since it is impossible to distinguish between farmed and wild tigers from their bones and products, farming tigers for trade provides opportunities to "launder" products made from wild tigers, creating enormous difficulties for law enforcement.

Moreover, farming tigers for trade in their parts tarnishes the reputation of TCM. With increasing recognition that prescribing endangered species hurts the image of TCM and reduces its ability to expand into global markets, the TCM communities within China and abroad have stopped using tiger bone. A recent survey by one ITC member revealed that of 518 TCM shops in China, a mere 2.5 percent of them claimed to stock tiger bone.[5]

"TCM as a cultural heritage of China does not wish to take the responsibility of causing the extinction of tigers," said Lixin Huang, the president of the American College of Traditional Chinese Medicine (ACTCM) who works to promote TCM in the United States. ACTCM, representing the TCM community in the ITC made the clarification at the CITES CoP that "the request to legalize trade in tiger parts does not come from the TCM community. It represents only the desires of tiger farm-related business interests."

Concerned that farming tigers for trade could be detrimental to the survival of wild tigers, the 171 State members that are Parties to CITES, adopted by consensus the decision Conservation of and Trade in Tigers and Other Asian Big Cat at CoP14. The decision specifically urges all Parties to strengthen implementation of the previous tiger protection resolution (Res. Conf. 12.5), to improve international cooperation to control trade, and to not breed tigers for trade in their parts and derivatives. The decision became effective on September 13, 2007.

In this tiger emergency, the world awaits China's commitment to make the tiger trade ban permanent, close down tiger farms to keep the captive population only at conservation levels, and invest in the protection of tigers in their natural habitat. If the stabilization of the Amur tiger population of the Russian Far East is any indication, there may still be hope for wild tigers to roam the mountain forests of south China.

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*Grace Ge Gabriel is the Asia Regional Director of the International Fund for Animal Welfare (IFAW). She can be reached at ggabriel@ifaw.org. IFAW (www.ifaw.org) works around the world to improve the welfare of wild and domestic animals by protecting wildlife habitats, reducing commercial exploitation and helping animals in crisis and distress.*

## NOTES

1. Yu Weiren. (2007). "People and animals, love and hate." In *Miao Jiang Sheng Di*. (苗疆圣地). Beijing: Shandong Hua Bao Publishing.

2. China Delegation document to CITES CoP14, June 2007.

3. Mills, J & Jackson, P. (1994). "Killed for a cure: A review of the worldwide trade in tiger bone." *TRAFFIC species in danger report*. [On-line]. Available: http://www.traffic.org/publications/summary-tigerbone.htm.

4. Damania, R and Bulte E. (2007). "The economics of wildlife farming and endangered species conservation." *Ecological Economics* 62, 461-472.

5. Nowell, K & Xu, L. (2007). "Taming the tiger trade: China's markets for wild and captive tiger products since the 1993 domestic trade ban." *TRAFFIC East Asia Report*. [On-line]. Available: http://www.traffic.org/RenderPage.action?CategoryId=1776.

COMMENTARY

# Where the Wild Things Are…Sold

By Linden J. Ellis and Jennifer L. Turner

As China becomes more affluent, demand for previously unaffordable goods has increased, most strikingly rekindling the age-old tradition of wild animal consumption on a massive scale. Despite wildlife protection laws and fears of wildlife spreading diseases, such as SARS, wild animals continue to be consumed as fur, food, and medicine all over China, particularly in the southern regions. Because of the great consumer demand, China has become the world's fastest growing market for illegal wildlife smuggling, despite the government's efforts to crackdown on such trade ("Endangered wildlife," 2004).

## SURVEY OF CONSUMPTION

In 2006, WildAid and the China Wildlife Conservation Association released findings from a one-year study of wildlife consumption in China between December 2005 and January 2006. The survey showed that the percentage of people who did not eat wildlife had increased by 11 percent since 1999. SARS contributed to the drop in consumption over this time period. The top reasons for consuming wildlife were health and nutrition, curiosity and taste. Other interesting findings included: restaurants serving wildlife had decreased by 6.6 percent, but the number of grocery stores selling wild animals had increased by 22.8 percent; around 63 percent of those people surveyed believed that eating wild animals from illegal sources was unsafe; and 74 percent of all the respondents knew that consuming certain wild animals was against Chinese law (Parham, 2007).

## A SLITHERING LUNCH

One recent *China Dialogue* article (Parham, 2007) notes that "twenty tons of snakes and as many as 20,000 birds were eaten every day in Guangdong restaurants in 2001." The popularity of snakes on the menu in southern China has led to significant drops in cobra and rat snake populations ("Snake species," 2004). While officially banned, hunting and raising snake and other wild animals is a lucrative endeavor, with a pound of civet cat costing more than 8 times a pound of pork. Many farmers depend heavily on wildlife consumption for their income.

### Something Fishy

South China is a major gateway for live fish and shark fin imports into China. While such marine animals are not illegal, the rate and means of catching them pose a growing threat to marine ecosystems globally. For example, many Chinese fishers use cyanide or dynamite to stun fish so they can be sold in the lucrative live-fish markets, inflicting great collateral damage upon habitat and non-target species. Until the late 1980s, shark-fin soup was only a regional delicacy in southern China. Notably, the Chinese government had for decades condemned the soup as a symbol of elitism, but according to a WildAid researcher, the official stance against the soup ended in 1987 (Pellissier, 2003). Shark-fin soup is an increasingly popular dish throughout China at weddings and banquets, eaten more for social status than for nutritional value. Conservation International researchers report that fishing fleets globally are capturing millions of sharks each year to sell fins to what appears to be an insatiable and primarily Asian market (Barret, 2007). Nearly half of the global trade in shark fins goes to China through Hong Kong (Pellisier, 2003).

### Fur for Fashion

In 2007, 104 furs, including 27 highly endangered snow leopard pelts, were confiscated from a man's flat in Gansu Province ("Snow Leopards," 2007).

The fur trade in China is geared towards export, where it is consumed primarily in Europe. In many cases, the fur trade is impossible to separate from the food and medicine trade, for while tiger pelts are very lucrative for clothing, their paws and meat also fetch a high price. While the lucrative sale of endangered animals threatens wildlife, it does not match the volume generated by lower tier fur animals, such as raccoon dogs (*Nyctereutes procyonoides*), which is a farmed wild animal, not a domesticated dog. Due to a U.S. law stating that any item sold in the United States priced below $150 does not need to label the type of fur, many garments have fur trims that can only be identified through DNA. In February 2007, the Humane Society released a report showing that 24 out of 25 Chinese-made coats labeled "faux fur" were raccoon dog fur, most of which are raised in concentrated animal feeding operations (CAFOs) (Holland, 2007).

> **Many Chinese fishers use cyanide or dynamite to stun fish so they can be sold in the lucrative live-fish markets, inflicting great collateral damage upon habitat and non-target species.**

### Bony and Bilious Medicine

Traditional Chinese Medicine is responsible for endangering 27 species in China, according to the *OECD Environmental Performance Report for China* (2007). Based on a 1998 survey, 74 percent of Hong Kong medicinal animal consumers would give them up if they knew it would save wildlife, and 65 percent who consume rhino and tiger parts for medicinal purposes would give them up if they knew they were illegal to consume (OECD, 2007). The survey underscores a major problem of under-informed consumers.

Additionally, bear bile farms in China market their products aggressively, driving consumers away from better, more environmentally friendly, synthetic products (Lavorie, 2007). Many Chinese believe that wild animal parts are more potent and beneficial than farmed animals. One wild-caught bear gall bladder—used for preventing and repairing liver damage—can sell for $45,000, as compared with around $230 for a farmed gall bladder (Lavorie, 2007; Highley & Highley, 1993).

### Wildlife Farming—Good Protection Strategy?

The central controversy around wildlife farming is whether it actually helps protect wild animals or exacerbates their consumption. Some believe that legalizing farm-raised animals represents a promising strategy for protecting wildlife for two reasons: (1) wildlife is a high-value product that could help lift some poor farmers out of poverty, and (2) farming increases the numbers of the animals for sale thereby lessening pressure to poach them. Moreover, because animals can be farmed for much less money and risk than they can be poached, farmed animals in theory out-compete wild animals in the market.

Notably, there are two obstacles that prevent legalized farming from being a sustainable option. Firstly, since the SARS epidemic, many consumers now believe that, at whatever price, wild-caught animals are safer to eat than farmed animals. Secondly, there is no discernable difference between the products of farmed and poached animals, so illegally caught wildlife can easily slip into the market without punishment. The alternative plan for wildlife conservation is to make all forms of wildlife consumption illegal, thus anyone selling the animals or their derivatives can be identified easily and punished.

Legalized sale of farmed wildlife thus can increase demand for consumption and poaching, which depletes ecosystems of important animals. For example, snakes, one of the most widely consumed predators, have experienced high population losses in China over the last decade—as high as 90 percent of cobras and 75 percent of common rat snakes. This has left the mouse population unchecked, adding to crop decimation in southern China ("New lunar year," 2001). Another ecological side effect from increased wildlife farming is pollution, since few wildlife farms in China process animal wastes before dumping them into local waterways (Ellis, 2007).

Besides ecological damage, cruelty is another argument against wild animal farms. Many animal activist organizations, such as Animals Asia and International Fund for Animal Welfare, argue that wildlife farming has led to cruel treatment of many animals For example, bear bile farms keep bears in small cages so as to continually drain their bile through a permanently inserted tube ("China bear rescue," 2007). Rough transportation to markets and rapid slaughter resulting from an intense preference for fresh products, is another source of cruelty. So as not to damage pelts, animals for fur production are beaten on the head to stun them, but many remain conscious for 5 to 10 minutes after they are skinned (Hieh-Yi et al., 2005).

### Illegal Animal Smuggling Into China

A 2006 study found 80 types of wildlife species available for consumption in Chinese markets, up from 53 found in a 1999 survey (Wong, 2007). With such a high domestic demand, China has become the world's fastest growing market for illegal wildlife smuggling. Despite the Chinese government's efforts to crack down on such trade, China's wildlife market is estimated at $10 billion annually (Wong, 2007). Four examples to give a sample of this smuggling include:

- In 2005, a police raid in Hong Kong found 2,000 pangolins destined for restaurants in Guangdong ("Odd chicken wings," 2005).
- Malaysia's marine police thwarted an attempt to smuggle 5,000 endangered monitor lizards to Hong Kong and Thailand in 2006 ("Malaysian police, 2006).
- In 2007, 2,400 live banded rat snakes were intercepted in Penang airport, Malaysia, on their way to Hong Kong ("Outrage as snakes," 2007).
- In Guilin in 2007, police arrested one man smuggling 64 bear paws from a protected species. The net worth of the catch was $42,666 (Chinese police nab," 2007).

### Government Action

The Chinese government has been attempting to prevent unsustainable consumption of wildlife, beginning with the 1982 Constitution that directs the state to ensure rational use of endangered animals (OECD, 2007). The foundational 1988 Wildlife Protection Law dictates a list of protected species and allows the death penalty for significant damage to wildlife resources (OECD, 2007). In 2001, the Chinese government began issuing hefty fines for consuming protected wildlife (Parham, 2007). Perhaps one of the most successful efforts has been the Traditional Chinese Medicine labeling system introduced in 2003 by the State Forestry Administration (OECD, 2007). Under this program, only medicines containing legal ingredients can be labeled.

China also has been increasing both land and marine protected areas to cover about 16 percent of the country's area, with 31 percent dedicated to protecting wild fauna (OECD, 2007). According the 1994 Regulations on Nature Reserves, the protected areas are intended to be strict nature reserves, but management of these areas is often insufficient.

To combat trade in endangered species, China became a member of the Convention on International Trade of Endangered Species (CITES) in 1981. In 2006, the Chinese government issued new CITES regulations directly impacting Traditional Chinese Medicine (OECD, 2007). According to the OECD, China has a good reputation for submitting CITES reports, and has a national office dedicated to enforcing the regulations. Nevertheless, on-the-ground enforcement remains weak.

### Conclusion

Wildlife consumption in China continues despite government intervention and education campaigns, such as those by WildAid, which is using Chinese Olympiads to help in their aggressive public service advertising campaign against wildlife consumption. Shark-fin soup remains standard fare at Chinese weddings, which indicates environmental education has not yet stymied the age-old appeal of consuming wildlife. Ultimately the best solution to wildlife consumption in China lies primarily with consumer education and in streamlining identification and prosecution of anyone dealing in threatened species.

## REFERENCES


AnimalsAsia Foundation. (2007). "China bear rescue campaign." [Online]. Available: http://www.animalsasia.org/index.php?module=2&menupos=2&lg=en.

Barrett, Kate. (2007). "Preying on predators: Shark tagging data will guide conservation policy efforts." *Conservation International.* [Online]. Available: http://web.conservation.org/xp/frontlines/2007/03260701.xml.

"Chinese police nab bear paw smuggler." (2007, October 25). *Xinhua*. [Online]. Available: http://www.chinadaily.com.cn/china/2007-10/25/content_6207674.htm

Ellis, Linden. (2007). "Environmental health and China's concentrated animal feeding operations (CAFOs)." *China Environment Forum.*

[Online]. Available: http://www.wilsoncenter.org/index.cfm?topic_id=1421&fuseaction=topics.item&news_id=225795.

"Endangered wildlife trade rife in China." (September 30 2004). *Independent Online.* [Online]. Available: http://www.iol.co.za/index.php?set_id=1&click_id=31&art_id=qw1096517703456B254.

Highley, Keith. Highley, Suzie Chang. "Bear Farming and Trade in China and Taiwan." A report by Earthtrust Taiwan. [Online]. Available: http://www.earthtrust.org/bear.html.

Holland, Sally. (2007, February 8). "Humane Society: 'Faux fur' often animal hair." *CNN*. [Online]. Available: http://edition.cnn.com/2007/POLITICS/02/07/dog.fur/.

Hsieh-Yi et al. (2005). "Fun Fur? A report on the Chinese fur industry." *Care for the Wild.* [Online]. Available: http://www.careforthewild.com/files/Furreport05.pdf.

Lavoie, Judith. (2007, July 22). "B.C. incident underlines illegal trade in bear organs." *Canada.com*. [On-line]. Available: http://www.canada.com/topics/news/national/story.html?id=2e5602ab-60c6-4753-87ae-77b74ab58efb&k=68722.

"Malaysian police detain 5 China men, thwart bid to smuggle 5,000 monitor lizards." (2006, October 20). *Associated Press Worldstream, International News*.

"New lunar year spells trouble for mainland's slippery citizens." (2001, January 30). *South China Morning Post.*

"Odd 'chicken wings' latest sign Hong Kong a centre of smuggling to China." (2005, August 29). *Terra Daily*. [Online]. Available: http://www.terradaily.com/reports/Odd_Chicken_Wings_Latest_Sign_Hong_Kong_A_Centre_Of_Smuggling_To_China.html.

OECD. (2007). *OECD Environmental Performance Review of China*. Paris: OECD.

"Outrage as snakes saved en route to HK end up in Malaysian restaurants." (2007, March 23). *South China Morning Post*.

Parham, Walter. (2007, July 30). "South China's taste for wildlife." *China Dialogue.* [Online]. Available: http://www.chinadialogue.net/article/show/single/en/1191.

Pellissier, Hank. (2003, January 20). "Shark fin soup: An eco-catastrophe?" *Urban Animal.*
[Online]. Available: http://sfgate.com/cgi-bin/article.cgi?file=/g/archive/2003/01/20/urbananimal.DTL.

"Snake species under threat, survey shows." (2004, June 12). *South China Morning Post*.

"Snow leopard furs seized in China." (2007, August 6). *BBC News*. [Online]. Available: http://news.bbc.co.uk/2/hi/asia-pacific/6932613.stm.

Wong, Stephanie. (2007, February 12). "Illegal Wildlife Trade In China Undiminished By Bans And Health Threats." *Terra Daily.* [Online]. Available: http://www.terradaily.com/reports/Illegal_Wildlife_Trade_In_China_Undiminished_By_Bans_And_Health_Threats_999.html.