COMMENTARY

Building Rural Models to Last: The Global Environmental Institute's Biogas Work in Western China

By Emmy Komada

During a recent trip to Wujinmai village in Sichuan for a routine visit to a biogas project household, Global Environment Institute (GEI) project managers inadvertently experienced the effects of indoor fuel burning firsthand. Upon entering the modest home, it was immediately apparent that the family had returned to using wood for fuel. "The kitchen was filled with black smoke so thick that I could barely see, let alone breathe normally," said project coordinator Mingjie Chen, "I couldn't believe [this woman] had lived like this for so many years." When asked why she was burning wood to cook, the woman replied that a small screw on the biogas stove had broken, making it impossible to use. She had been relying on her husband to repair their system, and his temporary absence left her no option but to use wood as she had not attended maintenance sessions to train her how to fix the system. Local project partners helped her replace the screw that very day and have since begun planning a training session aimed at the community's women, who are among those most negatively affected by wood burning.

This woman's family in Sichuan is but one of over one hundred Chinese households that have benefited from similar GEI biogas projects focused on sustainable solutions to rural health and development issues. Since 2004, the Beijing-based GEI has been helping communities and policymakers in China undertake research and project-based models that integrate economic viability into environmental problem solving. With offices in Beijing, Sichuan, Tibet, and Sri Lanka, GEI's development initiatives are uniquely placed to work with a diverse set of partners to develop multifaceted solutions that consider the demands of the market alongside those of environmental protection.

It is through the organization's sustainable rural development program that GEI has most directly impacted both rural poverty and health, and has helped alleviate the need for rural people to exploit their environment to support their livelihoods. At the center of GEI's rural development model is biogas technology, which not only provides a source of clean, renewable energy, but also decreases community dependence upon local resources for fuel, thereby significantly improving the health of rural people by eliminating the practice of indoor biomass burning. As the wealth gap between urban and rural areas grows wider, adequate access to health and education services have suffered, moving China's leaders to prioritize rural poverty and the social issues that accompany it. Identifying effective means of helping rural people integrate into the growing market economy is not an easy task, however, and addressing the issue using ecologically sustainable solutions creates an even more complex goal—but these two challenges are central to GEI's biogas work southwest China.

BIOGAS—THE GEI APPROACH

By approaching rural development from an energy use perspective, GEI has been able to tackle a number of related issues, including deforestation and climate change, health concerns, and poverty. The World Health Organization (WHO) estimates that burning biomass causes the indoor air pollution responsible for over 1.5 million deaths per year, over 400,000 of which occur in China alone, with women and young children by far the most affected groups. In monitoring rates of Chronic Obstructive Pulmonary Disease (COPD), bronchitis, and lung cancer over an eight-year period, WHO also noted a rise in all three diseases in China's

GEI staff and farmers at the Tibet site monitor growth of organic produce. Photo Credit: Global Environment Institute

rural areas while rates declined in urban regions. With respiratory diseases still one of the leading causes of death throughout China, the rural rise in these cases is a crucial concern.

The environmental impact of using biomass as fuel in rural China is also enormous. In 2006 the UNDP estimated that timber harvested near rural communities accounts for much of the nearly two million tons of biomass burned every day worldwide. The greenhouse gas emissions created through the process of burning wood is compounded by the effects of deforestation, especially in areas with rich biodiversity, such as western China. Biogas from animal dung prevents deforestation and also reduces the risk of disease from untreated animal waste. In places where animal dung is directly burned as a fuel source, however, collection is often ad hoc, leaving the uncollected dung to leach into groundwater sources and contaminate water that communities and ecosystems depend upon. Over the past twenty years, water tainted with animal wastes and poor sanitation has been linked not only to reduced crop yields, but more alarmingly, to heightened rates of water-borne diseases. Powering rural development with clean, renewable energy such as biogas is thus an approach that addresses both the vast environmental and human health detriments of indoor burning.

While dually practical and environmentally sound, developing biogas-based rural initiatives is not always easy. In China, scores of government-subsidized rural biogas initiatives have failed in the past, in part because they have generally been inappropriately large in scale and thus inefficient and difficult to maintain. In addition, past projects tended to overlook the necessity of local involvement in long-term, sustainable integration of new energy systems. Adding to these circumstances was poor technology and insufficient maintenance, which meant that only a fraction of the systems built between 1973 and 1980 were still in operation by the early 1990s. China has long recognized the potential of biogas as an energy source, having implemented widespread biogas projects in eastern provinces as early as 1973. These industrial-sized projects also utilized animal waste as their primary energy source, often operating on or near the premises of large-scale pig farms to minimize transportation needs. When GEI began implementing its biogas projects, therefore, this technology was not radically new. GEI's approach to using the technology, however, was.

Noting the primary causes that had hindered successful biogas project development in the past, GEI took measures to ensure that its own initiatives last beyond the timeframe of GEI's project activity by innovating the financing of the biogas systems, and by engaging local people in both project planning and operation. At the rural program's first project site in Yunnan's Lijiang County, GEI worked with local government officials to introduce a financing system for the biogas tanks that included significant investment by participating farmers. By organizing farmers into cooperatives with collective resources, GEI was able to establish a guarantee fund through which farmers borrowed and repaid loans for the cost and maintenance of the systems. This approach established personal investment in the new energy source. By using a farmer cooperative-supported scheme, GEI's Yunnan site was host to the first instance of China's rural farmers successfully acquiring loans from their local bank, which has enjoyed high returns in the two years since the fund's establishment.

All GEI sites use single household-scale up-floating biogas systems with a straightforward construction that eases farmers' access to maintenance requirements. The scale of the systems is small enough to ensure easy installment and flexibility to the needs of each project site. Farmers use biogas to provide everyday energy needs and to fuel various GEI-led community development initiatives, which have included organic agriculture and animal husbandry. In turn, these initiatives help increase villager incomes and build links to the outside market. In Tibet, where biogas initiatives introduced by other programs had faltered because of the systems' tendency to freeze during winter, GEI has placed the biogas systems inside farmers' greenhouses, where higher temperatures reduce the danger of freezing and malfunction. Such considerations have helped ensure project longevity at different sites with radically diverse sets of climates.

A HEALTHY IMPACT

In each of the areas where GEI's program operates local villagers were originally relying almost entirely upon biomass, usually firewood harvested from local forests, for fuel. Though natural gas was also available, inadequate access and high costs prevented most villagers from using the fuel on a regular basis. Because most biomass cooking devices in these areas are partially—if not entirely—unventilated, the impact of indoor burning is particularly harsh, and with a three-person household burning an average of five tons of wood per year, the ecological impact was similarly significant.

A Sri Lanka project participant tests a biogas stove.
Photo Credit: Global Environment Institute

In Tibet, farmers participating in GEI's projects relied primarily on yak dung to provide fuel for cooking and heating. Because yak dung is difficult to light directly, villagers were using wood and paper to stoke their fires, further adding to both local resource depletion and to increases in harmful suspended particles inside their households. This process also involved expending extensive human energy collecting fuel, as wooded areas in Tibet are scarce. With the arrival of biogas as an alternative, health issues linked to indoor burning were significantly alleviated and sanitation concerns improved as an animal waste-based energy system increasingly motivated community-wide organized yak dung collection.

All four of GEI's rural development sites employ biogas tanks that both provide fuel for everyday household activities and produce compost as a byproduct. Farmers use this rich organic fertilizer to increase productivity without having to rely on harmful chemical pesticides to protect their crops. Cleaner water sources have also contributed to thriving agricultural activity. At each GEI site, participating farmers are often their community's only source of organic produce, and selling their surplus crops has consistently increased family incomes across the board. In 2007, GEI's first biogas and organic agriculture project in Lijiang, Yunnan

> **"In 2006 the UNDP estimated that timber harvested near rural communities [in China] accounts for much of the nearly two million tons of biomass burned every day worldwide."**

Province became an independently registered organic food company. Called the Lijiang Snow Mountain Organics Company Ltd., the operation kept many of the project's initial participants involved in as shareholders and employees, and now supplies fresh organic produce for Yunnan as well as for markets as far away as Hong Kong and Beijing. In places where inhaling indoor particulate matter amounted to the equivalent of smoking nearly two packs of cigarettes a day, residents can now breathe easy.

STRENGTHENING COMMUNITIES

In addition to improving health both directly by reducing indoor air pollution and indirectly through reduced animal waste and organic agriculture, GEI projects also build community ties. Because protecting rural environments depends upon the capability of local people to make a living without exploiting the land, the success of GEI's projects is intertwined with community development initiatives. Aimed at providing a source of income that is both sustainable and environmentally sound, GEI's development initiatives have paired biogas with organic agriculture cultivation, honeybee husbandry, and rabbit rearing. These three activities have helped increase local villagers' incomes by providing a means of actively participating in a set of niche markets with a steadily growing demand.

While often beginning with only a few households, these activities have evolved with the growth of their respective projects. The Lijiang Snow Mountain Organics, which became a locally managed, private company set up by GEI project participant farmers, is an example where health benefits and community development intertwine. This significant step is an example of the ways that GEI's projects offer rural people alternative means of benefiting from a growing national economy without having to leave their villages and sacrifice traditional lifestyles.

Overall, project coordinators have reported unanticipated support and success. After just one year of operation in Sichuan, projects have already met initial target numbers for reduced firewood dependency, lessening the community's environmental impact both by decreasing wood burning emissions and slowing deforestation. In Sri Lanka, where GEI's presence marks the first instance of the Sri Lankan government's collaboration with an international NGO, six months of operation in the energy-poor country have earned the support of farmers and local government alike.

CONCLUSIONS

While GEI's rural program operates at the community level, its engagement of multiple social sectors highlights the new direction that environmental problem solving is taking. Environmental protection can no longer exist in a vacuum, separate from economic considerations, and developing societies are at the forefront of experimentation for this new approach. Effective policies now require dialogue across multiple sectors of society, and increasingly, among nations with vastly different cultures and levels of development. With this idea in mind, the Global Environmental Institute is confronting environmental challenges both at the local level and, through its recently inaugurated Environmental Governance Program, between governments on an international scale. By finding solutions that fit within the diverse demands of our world today, GEI is confidently helping achieve development that is socially, economically, and ecologically sustainable.

Emmy Komada was a translator and communications officer at GEI's office in Beijing from August 2007 until August 2008. She now works in the city as a freelance writer and can be reached at: ekomada@gmail.com.

SPOTLIGHT

Greener Wishes for Grasslands in Inner Mongolia: Green Longjiang

By Zhang Yadong

Hailar means black in Mongolian. The river got its name from the dark green grass growing on both sides of its banks. From a distance, the Hailar River looks like a black belt lying under the blue sky. Our destination, Chenbaerhu Banner, near Hailar City, is also known as the "Grassland of Paradise," due to its particularly beautiful grasslands.

CHENBAERHU'S UNBREAKABLE CHAIN

On 9 July 2008, Xu Qiang, a volunteer from Green Longjiang (*Lüse Longjiang*) and I followed Cong Lulu, the project manager, to an elementary school in Chenbaerhu Banner to carry out some environmental education activities with the children. From Harbin we took the train, arriving in Hailar the following night and then took a taxi to Chenbaerhu Banner. On the way, the driver asked us the purpose of our visit. The driver was impressed by our work and the fact that we had come so far to teach children about grassland preservation, and told us our efforts had contributed to the extraordinary beauty of this year's green grassy fields. Hearing the comments from the taxi driver, we were very eager to see the beautiful green grassy fields. After driving for 20 minutes out of Hailar, we were amazed by the green fields stretching to the horizon in all directions, dotted with groups of cattle and sheep partially hidden in the massive green. We felt so honored that we are able to devote ourselves to protect this beauty.

After we arrived at Chenbaerhu Banner, we rushed to prepare the content for the afternoon class on environmental education. At that moment, we realized students of Mongolian language elementary schools might not be able to understand our Mandarin. Cong Lulu was quite concerned about this as she was responsible for delivering a speech on the relations between climate change and grassland ecosystems. After meeting with the principal of the elementary school our concerns disappeared. He took care of the language barrier problem and arranged for students with good Mandarin skills in the top four classes, as well as some school teachers, to attend the activities.

The activities started at 3:00 in the afternoon with Cong Lulu delivering her speech to two classes of students, while Xu Qiang and I were busy with outdoor activities. At first, we were worried we would have trouble handling 70 students all at once, but things went smoothly. The first warm-up activity was called "untangling a chain." We had a group of six students to link hands and then we twisted them up. Then we asked them to untangle themselves while still holding hands, which they found easy to do. However, we then added more people into the group and amidst lots of giggling the students found it increasingly difficult to untangle the lengthening chain. Through this activity, students learned the

> **"We believe that education transforms human behavior and we hope by our work to make environmental education more accessible to children to enable them to influence their families with their knowledge of grasslands."**

The outdoor activity "untangling a chain." Students learned the importance of biodiverity in order to perceive a grassland ecosystem. Photo Credit: Green Longjiang

importance of conserving biodiversity in an ecosystem, for the chain (ecosystem) is harder to break when more people (species in an ecosystem) are in the group and linked together. We hope students will remember what they learned in these activities and put more care into their valuable grasslands.

After the activities, we asked each student to write a letter to one person who had not attended the class to tell them what they learned and what they plan to do in the future to preserve the grasslands. It was so rewarding to watch these smiling students sit down and write letters to their friends and families in beautiful Mongolian script. Cong Lulu was pleased by the students' intelligence and enthusiasm in the lectures as well. When the activities came to an end, we felt exhausted, but satisfied. We were delighted that the environmental education project inspired these young students to care more about the grasslands, sowing the seeds of hope for future grassland protection.

GREEN LONGJIANG

In late 2006, Green Longjiang began its grassland conservation work with investigation and conservation work focused on migratory bird species at the E'erguna Water Basin between China and Russia. In 2007, we expanded our grassland protection work in this area, with support from the BP Foundation, to cover the surrounding area of the E'erguna Water Basin and established a tri-state bird species monitoring network in China, Mongolia and Russia under the (CMR) International Conservation. Under this agreement, Green Longjiang was responsible for a large part of the public outreach, environmental education, social research, and training of young local volunteers.

The project operating in Inner Mongolia will last for one more year, and we plan to include much more educational content. We believe that education transforms human behavior and we hope by our work to make environmental education more accessible to children to enable them to influence their families with their knowledge of grasslands. Only then we will be able to see more youth working to protect the grasslands for the future.

To learn more about Green Longjiang, please visit www.greenlj.ngo.cn. Zhang Yadong is director of Green Longjiang. He can be contacted at zhangyadonghaobang@126.com.

COMMENTARY

Green Student Forum: Beijing's Secret Garden of Growing Environmental Health Advocates

By Daniel Pulver

Shen Cheng's father is an engineer for a cement factory in his hometown of Huaibei in China's central Anhui Province. In an interview with me in a crowded, dingy restaurant in Beijing's university district, Shen Cheng warmly recalled, "There was a small hill near my home when I was growing up. We would catch insects, pick the flowers and climb the trees there. It was our 'secret garden.'" But that was a long time ago. "Now, the trees are covered in white powder and look sick. I hear stories of kids with inflamed lungs from breathing the dust in the air from the factory's dynamiting rock to make cement." Rather than follow in his father's footsteps, Shen Cheng left the coalmines and cement dust of Huaibei to attend Beijing's Forestry School and joined Green Student Forum (GSF) in 2003.

Zhang Qian grew up in the small industrial town of Baotou on the steppes of Inner Mongolia in an area undergoing rapid desertification. She recalled sandstorms so fierce she was forced to stay inside for days. On a walk through her campus's tree-lined paths in Beijing she shook her head as she remembered, "The sky was bright yellow and it hurt to breathe the air. Many people in the town got sick from the sand." Zhang Qian is in her first year at the Urban Horticulture department of Beijing's Forestry School and recently became a volunteer for GSF.

EMERGENCE OF THE GREEN STUDENT FORUM

These opening stories are ubiquitous in China, a nation that is undergoing rapid development often at the cost of environmental and human health. A 2005 survey by the World Health Organization (WHO) found that 71 percent of China's seven major waterways failed to meet water quality standards and up to 74 percent of the Chinese population live in an area where the air pollution exceeds WHO standards.[1] Unfortunately, these statistics show few signs of immediate improvement.

Most of the participants in GSF bring with them similar personal stories of the toll pollution can have on the health of family, friends and community. Accompanying many of these stories is a sense of helplessness. In China, growing up with pollution is a normal occurrence. "As a child, you don't question it. You see people get sick and you're upset and you want to do something about it, but you don't think there's anything you can do," explained Shen.

Yet in the meetings of GSF, these students and others like them have found a burgeoning community of young conservation activists working to change the way people interact with their environment. They also have found a way to get the information and experience they need to begin to get China's environmental health record back on track.

GSF was founded in 1996 by prominent reporter Wen Bo and now imprisoned social activist Hu Jia, along with students of the Beijing Forestry University.[2] It was created as a forum for students interested in environmental protection to share activism ideas and experiences and GSF has evolved into a gateway for students into the world of environmental activism. The organization has grown into a network linking nearly 270 student environmental groups on university campuses throughout China with programs aimed at capacity building and raising local environmental awareness.

The Beijing branch, which serves as the head office, plays many different roles in the student community. While existing as an NGO in its own right, planning activities and training student volunteers

nationwide, GSF also acts as a communication hub for the multiple student environmental organizations located in many of Beijing's prestigious universities.

In the small office tucked away in a residential neighborhood, GSF students from Beijing's Forestry, Communication, Technology, Mining and Resources and other universities congregate for planning sessions and to exchange ideas for upcoming activities. Programs range from energy and water conservation, recycling initiatives, and community outreach to communication with international NGOs regarding Chinese development projects.

Although it has no full-time staff and runs solely on volunteer power, GSF is able to operate on a modest budget from funds provided by international nonprofit donors such as Pacific Environment and Global Greengrants Fund as well as by drawing support from partners such as Greenpeace China and Friends of Nature. The GSF Beijing office is managed by a chief director and three board members, all of whom were active members during their time studying in Beijing and who have gone on to work for other NGOs while lending their spare time to running the office and planning activities.

ACCOMPLISHMENTS AND INITIATIVES

Perhaps GSF's most successful collaborative achievement is its monthly walks along Beijing's compromised river system. Led by a professor of Beijing history, these walks follow the banks of Beijing's famous rivers, taking in the history and the culture of the waterways, as well as measuring the changes to habitat and water quality. "Only by understanding the river's history and culture can we understand the river's present situation and protect its environment," one student volunteer commented, strolling down its concrete banks. Participants measure the water's pH levels, observe the state of the fish population, and trace the course of the river through the city's cement channels and frequent sewer pipe outlets, marking spots where plastic bags and other pedestrian trash accumulates. This pollution gets carried downstream to the provinces of Liaoning and Hebei where it joins with runoff from steel and paper factories dotting the banks of the rivers, turning the waterways into little more than open sewers by the time they reach the sea.

On one spring river walk, the group passed a team of city trash collectors maneuvering the waterways in a small boat, dredging out the larger

Workers skim trash from the canals of Beijing with fishing nets.
Photo Credit: Daniel Pulver

pieces of trash with a flimsy fishing net. "I don't think a lot of people realize how serious the problem is," a volunteer commented as an elderly man swims laps through the same water that just a mile back was mingling with the effluent from sewer drains. Minutes later the group passes a sign forbidding swimming and fishing in the river due to high levels of pollution.

GSF has expanded the river walk program to other audiences in an effort to educate the general public about environmental issues. Volunteers have presented pro-environmental skits and colorful picture books to elementary school classes and encouraged teachers to adopt environmental protection as an early educational topic. Students also have reached out to the city's elderly participating in early morning group exercises in public parks and handing out leaflets outlining energy-saving techniques and explaining the link between reducing energy use and breathing cleaner air. Enthusiastic GSF volunteers even sang conservation-themed songs with the singing club that gathered in the early morning mist in one park. Last year the GSF's outreach efforts were rewarded with substantial media coverage and a plaque for positive work in the community.

PROVIDING FOR THE FUTURE

While providing students with an opportunity to participate in environmental activism, GSF presents a much greater service to its student volunteers by offering them training and experience work-

ing in their first professional NGO setting. For most student volunteers, Green Student Forum is their first experience with environmental nonprofits. GSF's board of directors, all of whom have graduated and are working in other environmental NGOs, give training lectures to volunteers. Subjects include financial management, budget calculations, organization of materials and activities, basic office skills, media relations, English language, time management, publicity, and fundraising. GSF also organizes lectures in Beijing on various environmental topics given by visiting professors and graduate students. This training puts GSF student volunteers in a unique position to succeed in the field of nonprofit work in China's NGO sector after graduation, lending students the skills, knowledge, and passion necessary to work towards change in a challenging and sometimes hostile environment. Shen Cheng, who leads the training initiative, lists tight government control, lack of human and financial resources and a still nascent international network as obstacles facing many Chinese NGOs. But he remains positive as he reiterates that the goal of China's green NGOs is "to solve the problem, not increase the conflict."

Chinese environmental nonprofits have seen a dramatic increase in their numbers and activity level since the 1994 government regulation granting independent status to NGOs and most have naturally congregated in Beijing. Students who come to the city and get involved in student conservation often stay on to work in the burgeoning environmental protection and health field. Green Student Forum's staff exemplifies the influence that student activism groups can have on the future of their participants. Shen Cheng, a board member of GSF and prior dedicated student volunteer, went on to work at Roots and Shoots in China and then moved to his current position at International Fund for Animals Welfare where he is its sole representative in China. On the side he still plans GSF training workshops for students.

Su Jianhua, another GSF board member, works for the Beijing-based NGO SynTao which monitors corporate social responsibility in China. She is currently collecting information on companies' dedication to environmental health and protection. Su got her start in the field of environmental health when she joined GSF's Green Reporter Training Program in 2001. She described GSF as an "organization with a lot of important things going on as well as [a] great platform to improve myself."

There are also students who are motivated to use their newfound knowledge and experience to address issues that affected their hometowns. Zhang Qian, who remembers the dust storms of her childhood in Inner Mongolia, wants to use her degree in urban horticulture and her experience in GSF to alleviate the same symptoms here in Beijing. She is learning how trees are effective at blocking wind and reducing airborne particulates and also serve to cool down ambient temperatures in the scorching Beijing summers. She explained "trees clean the air and make it easier for people to breathe, especially children and older people. It's also important that people realize the impact their actions, whether planting trees or saving water, have on the environment, and also on their own health."

GSF empowers China's student community to channel their frustrations with the current environmental health situation into positive action. For volunteers like Zhang and Shen, GSF's greatest accomplishment is giving students the necessary network, skills and experience to turn their dreams of a greener, healthier secret garden into a reality.

Dan Pulver has researched various aspects of China's environment for Pacific Environment and BlueWater Network. He graduated from Carleton College with a degree in Chinese Literature and a minor in Environmental Studies in 2006. He can be contacted at pulverdaniel@gmail.com.

NOTES

1. World Health Organization. (2005). *Environmental Health Country Profile- China.* [Online]. Available: www.wpro.who.int/NR/rdonlyres/1BAA5515-9571-4383-BA1D-169BDD4A8C38/0/China_EHCP_EHDS_9jun05.pdf

2. Hu Jia, who first became active in the Chinese environmental movement, went on to advocate for AIDS awareness and human rights in China and was arrested in April 2008 for 'inciting subversion.'

3. Coonan, Clifford. (2008, April 4). "Hu Jia, China's Enemy Within." *The Independent.*

SPOTLIGHT

Exploring China's River Heritage with China Rivers Project

By Kristen McDonald

"Many Chinese do not understand how beautiful this place is. The people here live so harmoniously with the river. That is the spirit of this place."

—Great Bend trip participant

Mao Zedong once proclaimed, "Doing is itself knowing." This concept is at the heart of the China Rivers Project, an organization promoting appreciation for China's rivers through whitewater boating trips. China Rivers Project, founded in 2007 as part of the U.S.-based Earth Island Institute, focuses on China's threatened western river canyons, including the upper Yellow and Yangtze rivers, the Mekong River, and the Nu River. China Rivers Project trips serve as a platform for journalists, researchers, conservationists, government officials, and business leaders from China and elsewhere, to learn from each other in creating a constituency to protect China's threatened river heritage. In addition to conducting rafting trips, China Rivers Project seeks to promote consensu ds among conservation groups in China around how to protect China's last remaining river heritage.

SAYING "ZAIJIAN" TO THE GREAT BEND OF THE YANGTZE

A core strategy of China Rivers Project is exploring and documenting outstanding rivers in China that will soon be transformed by dams. In April 2008, China Rivers Project organized an eight-day trip on the Great Bend of the Yangtze River, where several hydropower dams are in various stages of planning and construction. This section of the Yangtze abounds with contrasts: spectacular 10,000-foot-deep gorges and ancient stone-hewn Naxi villages are interspersed between mile-long dam construction sites.

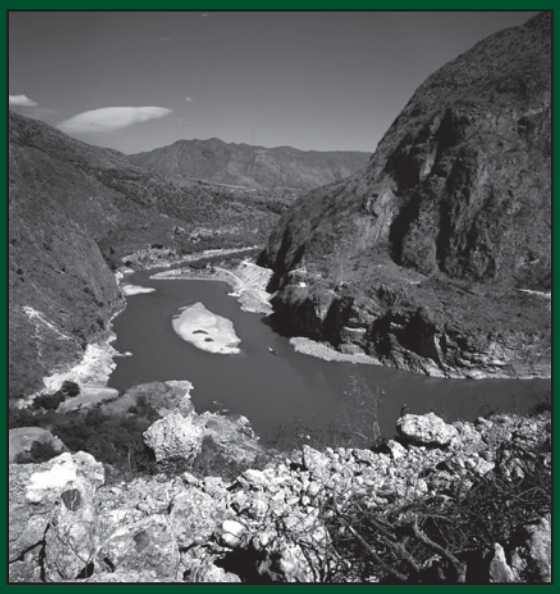
The 28 participants on our "farewell" trip of the Great Bend shared with each other river history, previously undiscovered geology, and glimpses into ancient Naxi culture. Some rowed the Yangtze's world-class rapids for the first time. As one budding oarsman, a journalist from Beijing enthused, "It is very moving to see how we can get down the river with our own power."

CCTV's travel channel came along on the expedition, with plans to broadcast a special on the Great Bend to millions of television viewers in China. China Rivers Project hopes such stories will help change perceptions of why rivers are valuable to China. Some of China's planned dams may be necessary, but river trips are a time to explore other river values—values that are lost when dams are built.

STARTING OUR JOURNEY

China Rivers Project co-founder Travis Winn participated in his first boating trip in 1998 in a remote canyon in China when he was 16 years old. Soon after, he made the decision to help whitewater enthusiasts he had met in China learn to boat. "You have to come back to China and teach us how to do this," Travis' new friends insisted. He started learning Mandarin and began to lead river trips in Sichuan, Yunnan, and Tibet in 2003.

I met Travis in 2005, while living in the Nu River valley and researching the local politics of dam building. In my free time I would marvel at the turquoise blue pools and exciting rapids formed by constrictions in Nu River's narrow canyon walls. When I learned Travis was also interested in the Nu River, I volunteered to see if I could get a boating permit. With its stunning scenery, ethnic diversity, and steep rapids, we knew the Nu had a bright future as a rafting hotspot.



A small hydropower station is being constructed on a tributary of the apex of the Great Bend of the Yangtze River, shown here. Photo Credit: Li Hong

But like many of China's best boating destinations, local governments have plans to tap the Nu River (not to mention many of its tributaries) to produce hydropower for export to other provinces. The neighboring Lancang River, where Travis and I organized our second trip together in 2006, has already lost much of its recreational value for boaters. The reservoir created by the 300-meter Xiaowan Dam will soon cover historic sites and displace isolated villages along the remote gorge section we used to boat. We realized while leading these trips that river exploration in China could become a powerful outreach tool for river conservationists, such as Yu Xiaogang of China Green Watershed. Yu—famous for bringing the plight of the Nu River to Beijing and successfully delaying construction of a series of dams—joined us on the Mekong River's "farewell" journey in 2006 and later joined China River Project's advisory committee.

GROWING A CONSTITUENCY FOR RIVER CONSERVATION IN CHINA

China Rivers Project faces an uphill battle. Not only is China's hydropower industry mighty, but the demand for whitewater recreation has only barely started to grow. After several Chinese rafters drowned in 1989 in a race to complete a "first descent" of the Yangtze, many Chinese viewed rafting as dangerous and suitable only for experts. Since then, most people who boat on the Yangtze and other world class whitewater in China come from outside the country and pay top dollar for trips led by foreign outfitters.

However, China's growing urban middle class population is increasingly eager to reconnect with natural landscapes, lost culture, and China's history, all of which can be found in the remote canyons of western China. Now, a few domestic outfitters offer day trips, and rafting equipment can be purchased in China. China Rivers Project seeks to encourage responsible boating industry practices and to tap into this new wave of outdoor enthusiasm to get journalists and government decision-makers on the rivers.

China Rivers Project is in part inspired by the U.S. example, where a nearly 50-year-old river conservation movement has resulted in close to 200 rivers and river sections being permanently protected from dams and other development. This outcome is in part thanks to boaters, who often develop deep connections with the rivers they explore. But in the United States and other countries, the river conservation movement also includes citizens concerned with the impact of water pollution on the health of their children, fishing communities facing rough economic times, and Native Americans whose ancestors have longstanding utilitarian and spiritual ties to rivers.

China has its own unique river heritage, one that is in many ways more alive than our own in the West. On the upper Yangtze, for example, the river is home to mythical golden spirit yaks that rise from the water, and ancient rock carvings that whisper prayers into the rushing waves. Further downstream, the Yangtze is surrounded by terraced hillsides, built by hand starting thousands of years ago, and fishing communities who still use handmade nets and lines. The concept of "river culture" is well known in China and describes traditions of barge commerce on the middle Yangtze. And still further downstream, the Yangtze's fertile valley forms the most productive rice-growing region in all of China.

China Rivers Project's next trip will start in early 2009, when we will return to the Great Bend of the Yangtze to see what has changed since our last trip in April 2008. We hope to see you on the river!

Kristen McDonald, Ph.D., is native to Oregon, a raft guide and the director of China Rivers Project. More information can be found at www.chinariversproject.org, or by emailing kristen@chinariversproject.org.

COMMENTARY

Mining in China: A Primary Ecological and Human Health Concern

By Saleem H. Ali

People naturally don't like the dark. Who would want to be a miner digging galleries?
—Chronicler from Han dynasty, Wang Chung Lun Hong, A.D. 82[1]

The pessimists will be proved wrong. Chinese mining multinationals will be a permanent feature of the future and they will, I have no doubt, increasingly strive for excellence in their performance.
—Sir Mark Moody-Stuart, Chairman Anglo-American Mining Group, 2006[2]

Considerable international attention has been accorded to China's environmental record with the publication of popular books such as Elizabeth Economy's The River Runs Black, which often incriminate the mining sector for creating ecological damage. The impact of the mining sector is considerable at both the level of human health as well as environmental pollution. While exports from China are often marked by manufactured goods, the country's rapid economic growth has largely been spurred by its natural resource base that has been harnessed at an unprecedented level over the last fifty years. Domestic minerals fuelled much of China's early industrialization and were a major component of Chairman Mao's early plans for development of the country. Judith Shapiro (2001), in her landmark volume Mao's War Against Nature, described how Mao had been willing to even donate royalties from his own writing to ensure that the mineral resources of Panzhihua (located 350 kilometers north of Yunnan's capital Kunming) were developed to the fullest extent.

Raw materials have been pivotal in most cycles of large-scale industrialization through either export revenues or for their necessity in infrastructure development. For China, primary industries, particularly mining have been essential, for infrastructure development. The natural resource endowments of the country are enormous and with the rapid growth of technologies and investment opportunities by domestic and foreign companies, mining has grown phenomenally in China over the past decade. In 2006, mineral mining accounted for 4.8 percent China's gross domestic product (GDP) and mineral trade accounted for 21.6 percent of the country's total trade (USGS, 2007).[3] Coal mining is also a huge industry in China with production increasing about 66 percent between 2001 and 2006.[4] Due to concerns about climate change there has been considerable research already on this sector and the country is reforming this sector. However, given the low cost of coal and its relative abundance, it is more likely that China will invest in ways to mitigate coal mining impacts with "clean coal" technology investment rather than reducing coal production.[5]

THE MAJOR PLAYER: IRON

Iron ore has always been the backbone of infrastructure development because of its importance in steel manufacturing. China is the world's leading producer of pig iron[6] and crude steel (34 percent of global total), with an output that is more than the combined total production of Japan, the United States, and Russia (which ranked second, third and fourth, respectively).[7] Steel production is highly energy intensive and thus results in the need

for even greater mining of coal—a highly polluting industry—which accounts for nearly 70 percent of China's energy demand.

In addition to increasing the demand for coal, the iron ore bonanza has had unexpected manifestations such as the rise of "magnet fishing" in the streams of Anhui Province. Community members are flocking to streams with magnets extended on fishing poles to find lumps of iron ore washed down from waste rock at nearby mines, hoping that the rising price of iron will allow them to sell the lumps and earn more than fishing—in great part due to the fact that fish stocks decrease in rivers where mine tailings are dumped.[8]

Figure 1 shows the rapid rise in China's iron ore production from domestic mining. Within five years, China's share of global iron ore production has more than doubled, but is now expected to slow down as stocks are depleted and the government attempts to temper the impact of such rapid growth on the environment and communities. However, the growth of minerals production is not confined to iron ore. The range of nonrenewable materials that are being extracted in China is staggering in some areas.

Exports

The connection between pollution and exports is also highlighted by Chinese government officials. For example, in 2007 Hu Chunli, director of the government's Industrial Development Research Institute, noted:

> As much as 20 percent of China's energy consumption goes into producing products for export. The Chinese government is determined to curb the excessive export of high energy-consumption and environment polluting products such as steel products. Policies may include further increasing export taxes, export licenses and restrictions on steel product projects.[9]

Small-Scale Mines

Small-scale mines employ an estimated six million people and account for large shares of mining in many sectors. An estimate by a Canadian researcher in 2005 concluded that more than 75 percent of China's bauxite, 65 percent of manganese, 51 percent of phosphate, and 43 percent of coal mining is mined at the small scale (Gunson, 2005). Additionally, the iron ore content of the ores on average has been declining, which means mines must operate—and pollute—longer to earn profits. Large-scale mines account for about 20 percent of total iron ore production, while medium- to small-scale mines produce the bulk of the ore. According to data collected by the United Nations Conference on Trade and Development there are 48 major mines, while there are close to 8,000 total iron mines in the country, most of which produce ore of less than 30 percent iron content (UNCTAD, 2007, p. 33-35).

ENVIRONMENTAL HEALTH AND SAFETY

Occupational Health

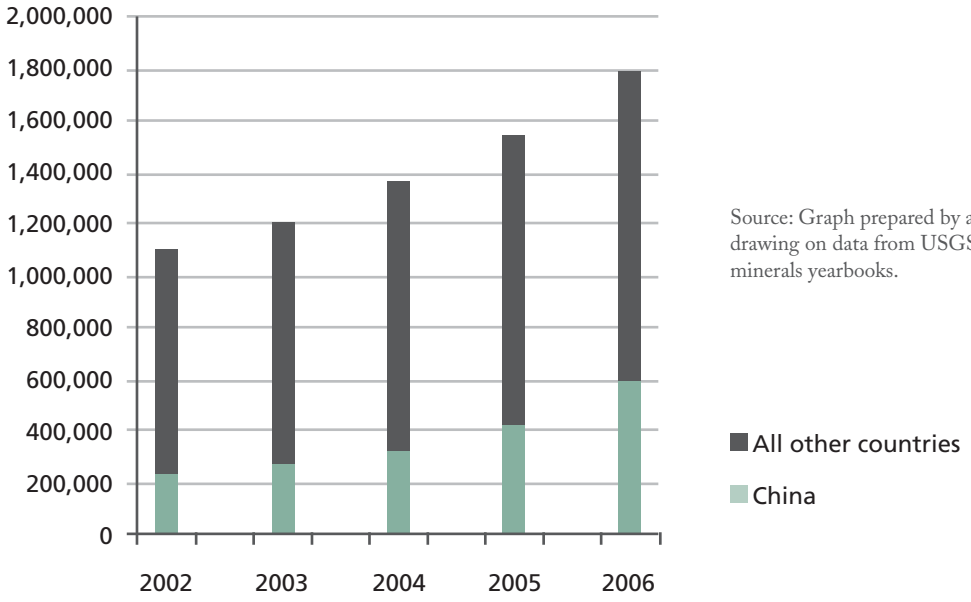
Global attention on Chinese mining has been largely focused on occupational hazards in the coal mining industry, which has an unenviable safety record. Indeed the health and safety performance for Chinese coal mining is orders of magnitude worse than global standards. For example, a study by the U.S. National Energy Technology Laboratory in 2006 concluded that for every one fatality per unit of coal produced in the United States, the comparable rate in China is between 200 and 250.[10] Changes in the mining laws; a projected investment of $60 billion from 2007 to 2011 on safety improvement mechanisms; and the closure of around 23,000 small coal mine with poor safety records are expected to make substantive improvements in this arena (Basu, 2008). The United Nations Development Programme also has

Table 1: China's 2007 Production of Nonferrous Metals

NONFERROUS METALS	MILLIONS TONS	PERCENTAGE CHANGE OVER 2006
Zinc	3.4	18.9% Increase
Copper	3.14	Same
Lead	2.44	5.7% Increase
Electrolytic Aluminum	11.16	34.6% Increase
Alumina	17.77	48.7% Increase
Lead	2.44	5.7% Increase

Source: Source: China Mining Association, 2008
Note: In 2007, production of the top 10 nonferrous metals in China was 21.31 Million Tons, representing an approximately 20 percent increase over the previous year (China Mining Association, 2008).

Figure 1: China's Iron Ore Production as a Share of Global Production (Thousands of Metric Tons)



Source: Graph prepared by author drawing on data from USGS minerals yearbooks.

started a $14.42 million project for improved coal mining safety education and training in the five Chinese provinces of Anhui, Guizhou, Henan, Liaoning, and Shanxi.[11] According to official accident data released in 2008, the accident rate has already gone down by 20 percent through these measures, though Chinese mining unions have often disputed accident reporting accuracy.[12]

Pollution

While some progress is apparent on the health and safety front, the environmental impact of mining still remains unresolved. One particular area of concern with regard to environmental pollution is the growth of small- and large-scale gold mining. Though during the height of the communist era, gold mining was banned as a diversionary extravagance, extraction of gold can be traced back in Chinese history to the Song Dynasty. Since 2007, China is now the world's largest gold producer (surpassing South Africa which held the top spot since 1905), to meet its demand for the prized metal, which jumped 23 percent, making it also the world's second-largest consumer after India. Using mercury for the amalgamation process to extract gold from rock is widespread in China at mines big and small and represents a major concern for bioaccumulation in freshwater fish that are a primary source of protein for many communities. While mercury is generally well-recovered in large-scale mining processes that use amalgamation, with an emission factor of ~0.79-g per gram of gold production, far less of the toxic metal is recovered in the small-scale mining process, resulting in an emission factor of ~15-g per gram of gold production (Streets, 2005).

Those mines that do not use mercury use cyanide for processing the gold, which has its own share of environmental and health concerns. There have been several accidents involving cyanide spills at Chinese gold mines in recent years. In September 2007, a house built on top of a cyanide pool in a gold mining area of Henan Province collapsed and 9 people died by falling into a two-meter deep pool of cyanide solution.[13] A hydrogen cyanide gas leak from a gold mining plant in Beijing's suburban district of Huairou killed three people and left another 15 hospitalized in 2004. Three years earlier, 11 tons of liquid sodium cyanide leaked into a tributary of the Luohe River in Henan Province.[14] The potential for tort litigation in this area may lead to some changes in regulatory enforcement of cyanide safety, but so far no major legal settlements have been documented.

Safe Closures

With thousands of mines all over the country in these boom years, Chinese environmental officials should pay more attention to closure and remedia-

Table 2: China's Exports and Imports of Nonferrous Metals (2007)

NON-FERROUS METAL	EXPORTS (PERCENT CHANGE)	IMPORTS (PERCENT CHANGE)
Copper	119,000 Tons (-50.9%)	12.26 Million Tons (+93%)
Copper Concentrate		3.46 Million Tons (+26.8%)
Aluminum	490,000 Tons (-50.9%)	203,000 Tons (-50.7%)
Alumina		3.94 Million Tons (+24.9%)
Lead Concentrate		945,000 Tons (+14.5%)
Zinc Concentrate		1.55 Million Tons (+178.1%)

Source: Source: China Mining Association, 2008
Notes: In 2007 the total export quantity of Cu, copper products, Al, aluminum products, Zn, Sn, Sb, and Mn) was 3.18 million tons, representing a 11.5% year on year decrease.

tion issues. Since mining is inherently obsolescent, closure and ecological restoration of mining projects is a necessary part of the planning process for new ventures. Without such planning, companies can walk away from a legacy of pollution with impunity. Consider the example of mercury mining in China, which officially ceased in 2001 after 600 years of operations all over the country, particularly in Guizhou, Shanxi, Henan and Sichuan. More than 100 Mt of calcines and other waste rocks have been produced as a result of the mercury mining in Wanshan District (Guizhou Province) alone, which was the "mercury capital" of the country. As a result of the mining, the soil concentration of mercury in the surrounding area is 24.3 to 348 mg/kg, which is 16 to 232 times the maximum mercury concentration allowed for soils in China. Mercury concentrations in adjoining waterways were also found to be highly elevated over six years after the mining stopped, ranging from 3.2 to 680mg/L. Given the biopersistence of mercury, the concentration of methylmercury in grains from this region is also as high as 0.14 mg/kg (Jiang et al., 2006). While health agencies usually allow for up to 0.5 mg/kg of mercury in meat products such as fish, a lower amount in carbohydrates such as grains can be far more potent because of a higher volume of carbohydrate consumption in human diets.

THE CHALLENGE

A major challenge to combating environmental pollution from mining is data. Data on pollution from mining is hard to obtain because impact categories are highly diffuse and dependent on the kind of mineral being extracted. Second, researchers gather most of the data on pollution in open access areas rather than at point sources. In such measurements there are often competing sources of pollution, which make ambient measurements hard to trace to a particular source. Most of the studies in this regard have been done in Yunnan, which has a high mining footprint and is also a biodiversity hotspot and hence of considerable research interest.

There has been an increase in the overall land acreage being used for agriculture, which has led to serious concerns that farm runoff will make it more difficult to analyze mine pollution. A recent study of agricultural expansion in Yunnan estimated that from 1960 to 2003 the push towards increased crop yield led to a 99-fold increase in fertilizer usage and doubling of pesticide usage. Interactions between these agricultural chemicals and pollutants from mines in waterways and lakes makes impact categorization more difficult (Li et al., 2007). Careful monitoring of effluent from pollution sources and waterways will be essential in years to come to identify the sources of major impact and to direct enforcement action or policy reform accordingly.

Although China's growth is being built on the assumption of continued mining, it is clear that past mining practices cannot be sustained in the future. The government has identified 60.7 billion tons of iron ore reserves, and is expected to identify more than 100 billion tons with better exploration techniques. The Ministry of Land and Resources, is now using international models to explore new deposits which could also increase estimates of China's identified reserves of copper ore by 20 million tons and bauxite by 200 million tons by the end of 2010 (USGS, 2007). All the new projects that will commence in coming years for these reserves will hopefully be planned with greater care if the country is to avoid an ecological crisis of immense proportions.

PROSPECTS FOR GREENING CHINA'S MINING INDUSTRY

The Chinese government has recognized the human and environmental threats that mining poses to the country and has begun to target those threats from several fronts. First, the government appears to be cognizant of the energy inefficiencies within the steel manufacturing system and has been taking measures to reduce the energy consumption of the sector as well as energy intensity (the total energy consumption per unit of GDP). According to the government's own calculations, the overall consumption of energy by China's major steel producers fell by 8.8 percent in 2007 and energy intensity fell by 2.78 percent for the first half of 2007 (which is still below the government's target of 4 percent). Aluminum production, which is also highly energy inefficient in China, is rapidly on the rise due to the expansion of smelting capacity and bauxite mining (there are currently over 300 bauxite mines in the country).[15]

It is difficult to gauge whether these recent improvements in energy efficiency have led to significant reductions in pollution, for data on air and water pollution have only recently become more accessible, but the quality of this data is uneven (*Editor's Note: See lead feature article in this volume*). The Chinese government has prioritized energy efficiency to increase energy security and decrease the pollution associated by coal burning.

Second, there appears to be a marked shift from polluting domestic mining production to imports. Box 1 highlights some of the data in this regard for 2007, which shows that some decline in mineral mining is occurring as the country shifts towards imports. The shift to importing metals is partly demand driven but also cost and environmental considerations. Many of the most profitable mines are now in Africa and environmental regulatory compliance is minimal, often reducing production costs. China's investment in Zambia has been particularly striking with an $800 million investment in the copper mining sector announced by President Hu Jintao in 2007.[16]

Moving Forward

The first step to improve environmental performance in the Chinese mining industry will entail exerting regulatory authority over all mining areas. Over the last three years, the Ministry of Land and Resources has identified over 65,000 unlicensed mines, 4,500 unauthorized excavations, about 1,000 unauthorized prospecting sites, and over 1,300 illegal transfer issues of mining rights. The ministry has shut down over 8,000 illegal mines over this time period, but many quickly reopen (Basu, 2008).

A coherent policy will also be needed to institutionalize the small-scale mining sector in China. With the help of the British government and the World Bank, there has been some movement to mainstream this sector through the establishment of a Chinese branch of an international program called "Communities and Small-Scale Mining." Led by researchers at the Chinese Academy of Sciences, this program aims to focus on this sector to improve its potential for providing livelihoods as well as increasing its environmental and social performance.[17]

Making the connection between the environmental and human costs of mining and direct economic impacts on other competing sectors may also improve the performance of the mining sector at multiple levels. The resources of the southeastern mountainous regions of the country have been particularly important in this regard and continue to play a pivotal role in China's economic development. However, this is also the most environmentally sensitive and ethnically diverse part of the country. Tourism has thus flourished in this area as well and there has been growing concern about the negative impact pollution from extractive industries might have tourism. While mining and tourism sectors can coexist, continuing deterioration of environmental indicators may start to have a negative impact on the tourist economy as well (Huang, 2008).

The mining sector has played a pivotal role in propelling China to Olympian heights of development by most measures. However, the environmental impact of this rush now needs greater scrutiny from the government as well as from the international community to ensure that the ecosystems are not irreparably damaged by extraction and can be restored to a state of biotic and social functionality.

Min Zheng provided valuable research assistance for this article.

Dr. Saleem H. Ali is associate professor of environmental planning at the University of Vermont's Rubenstein School of Natural Resources and the author of Mining, the Environment and Indigenous Development Conflicts. *He is also a member of the environmental and*

social stakeholder advisory group for DeBeers Corporation. He can be reached at: saleem@alum.mit.edu.

REFERENCES

Andrews-Speed, P., Guo Ma, Bingjia Shao and Chenglin Liao. (2005). "Economic responses to the closure of small-scale coal mines in Chongqing, China", *Resources Policy* 30 (1), 39-54.

Basu, Indrajit. (May 29, 2008). "China boosts domestic mining." *UPI Asia Online*. [Online]. Available: http://upiasiaonline.com/Economics/2008/05/29/china_boosts_domestic_mining/6152/.

Gunson, A.J. (2005). *Mercury and Artisanal and Small-scale Gold Miners in China.* Vancouver BC: Masters Thesis, University of British Columbia, Department of Mining Engineering.

Huang, Ganlin. (2008). *Mining and Tourism: Comparing Spatial Patterns, Socioeconomic contributions and environmental impacts in China.* Burlington, Vermont: University of Vermont, Rubenstein School of Natural Resources, doctoral dissertation.

Jiang, Gui-Bin, Jian-Bo Shi and Xin-Bin Feng. (2006). "Mercury pollution in China." Environmental Science and Technology, Vol. 40, No. 2, pp. 3672-3678.

Li, RQ, M Dong, Y Zhao, LL Zhang, QG Cui, and WM He. (2007). "Assessment of water quality and identification of pollution sources of plateau lakes in Yunnan (China)." *Journal of Environmental Quality* 36, no. 1 (February): 291-297.

Ottens, Berthold. (2005). "Mining in China – A 3000-year tradition." *Mineralogical Record* (January/February)

Shapiro, Judith. (2001). *Mao's War on Nature.* Cambridge UK: Cambridge University Press.

Sinton, Jonathan E. (2001). "Accuracy and reliability of China's energy statistics." *China Economic Review* 12, no. 4: 373-383.

United States Geological Survey. (2007). *China: Minerals Outlook.* [Online]. Available: http://minerals.usgs.gov/minerals/pubs/country/.

United Nations Conference on Trade and Development. (2007). *The Iron Ore Market—2006-2008*. Geneva, Switzerland, United Nations Conference on Trade and Development, May, p. 103.

NOTES

1. Text quoted by Ottens, 2005.

2. Speech before the China Mining Congress, November 15, 2006.

3. Most aggregate statistics have to rely on data from the Chinese government which has come under some scrutiny by researchers such as Sinton, 2001. However, we have little alternatives in terms of other sources and where possible field work has been used to verify the likely veracity of aggregate data.

4. China Heat Net. (October 2006). "How big is China's coal production?" (In Chinese). [Online]. Available: http://www.chihe18/1161092171216116.htm.

5. The Wilson Center commissioned a research paper in this regard in 2007, accessible online at: http://www.wilsoncenter.org/topics/docs/coalmining_april2.pdf

6. The term "pig iron" refers to the first intermediary product extracted from raw ore through heating in a blast furnace with a form of carbon called "coke." In early production, the molding of the ingots along a central runner resembled suckling piglets and gave the product its unlikely name.

7. Most of this iron accounting for this production is believed to be mined in China but figures on actual mine output from Chinese mines versus scrap usage and iron imports are not delineated. China is also the world's largest scrap (over 5 million metric tons annually) worth nearly $5 billion in 2006 (USGS, 2007).

8. Reuters News Service: Angling for Iron Ore in China's Streams, October 23, 2007.

9. Quoted in an article for Interfax China Metals: October 19, 2007 at: http://www.minesandcommunities.org/article.php?a=8253.

10. This estimate was based on annual data from 2005 and average statistics across numerous years would be a preferable comparison. Michael Moser, "Coal Mine Safety in the U.S. and China." Presentation at Resources for the Future, Washington DC, February 1, 2006.

11. The project details are available at UNDP's China website: http://www.undp.org.cn/

12. News story on fatality loss from Forbes magazine, January 13, 2008. [Online]. Available: http://www.forbes.com/afxnewslimited/feeds/afx/2008/01/13/afx4524639.html.

13. Reuters News service, September 28, 2007.

14. Cyanide incidences are tracked by the Mineral Policy Institute in Australia: http://www.mpi.org.au/campaigns/cyanide/cyanide_spills/.

15. Mineral Zone http://www.mineralszone.com/minerals/bauxite.html.

16. "China launches mining program in Zambia." (2007, February 4). *The Washington Post*. http://www.washingtonpost.com/wp-dyn/content/article/2007/02/04/AR2007020400536.html

17. See the web site of the program in Chinese: http://www.casmchina.org.

FEATURE BOX

From Rural Electrification to Biofuels: NREL's China Program

By David Kline, Monisha Shah, and Bill Wallace

The U.S. Department of Energy's National Renewable Energy Laboratory (NREL) is the premier U.S. laboratory engaged in renewable energy and energy efficiency research and development. NREL also pursues a program of technical support, R&D collaboration, and other cooperative activities with international partners. NREL's China program began in 1995 with the signing of a Protocol of Cooperation between the U.S. Department of Energy (DOE) and China's Ministry of Science and Technology. The majority of NREL's China work is sponsored by DOE. The U.S. Environmental Protection Agency (EPA) and the UN Environmental Programme's Solar and Wind Resource Assessment (SWERA) program also have supported NREL work in China.

NREL's China program illustrates the value of a longstanding and consistent bilateral program in terms of strong relationships between government departments, institutions, and individuals in the two countries.

EARLY RENEWABLE ENERGY WORK IN CHINA

In its early years, NREL's cooperation with China covered a wide spectrum of technologies including renewable and hybrid rural power systems, grid-scale wind power, biomass electric power, and geothermal heat pumps. NREL also provided technical support to the development of the Township Electrification Program—a major priority of the Chinese government to promote development in poor rural areas. NREL also has conducted biomass, wind, and solar resource assessments for some regions of China and worked to facilitate partnerships for energy business development.

In the 1990s, NREL developed a number of pilot experiments with hybrid renewable energy systems in China, as power solutions for remote areas. (See photo). Those projects were part of a DOE/NREL Village Power program that installed and evaluated off-grid systems in a number of countries.

The Wind Technology Partnership (WTP) and EPA provided technical assistance on wind policy and program analysis and developed advanced analytic methods for the economic assessment and planning of wind power prospect areas.

EPA's Integrated Environmental Strategies (IES) program also sponsored NREL work in China. IES aims to build capacity in developing countries in the quantitative analysis of co-benefits: improved local air quality and other environmental, economic, and health benefits that result from strategies to reduce both local and greenhouse gas emissions. The IES-China program began in Shanghai where the final results informed the air quality portion of Shanghai's 10th Five-Year Plan. [*Editor's Note: See "Breathing Better" commentary in CES 9 for details*].

NREL was also involved in the second phase of the IES-China program that focused on China's efforts to make the 2008 summer games in Beijing the world's first "Green Olympics." The IES-Beijing project built capacity to conduct a National Co-Benefits Assessment for China. In addition, the Beijing phase of the IES-China program included a study to examine possible ways to institutionalize co-benefits through various policies, laws, and institutional frameworks. The third phase of IES-China will be a national study focusing on identifying the most cost-effective measures in reducing local and global emissions for specific sectors.

NREL has been working with Chinese counterparts to promote rural electrification, such as this wind and solar initiative in Inner Mongolia. Photo Credit: NREL

CURRENT NREL ACTIVITIES

NREL's China activities currently include three primary areas: biofuels, grid-scale wind, and rural electrification.

Biofuels

In December, 2007, DOE and the U.S. Department of Agriculture (USDA) signed a Memorandum of Understanding with China's National Development and Reform Commission (NDRC) calling for R&D and technical cooperation on biofuels. NREL coordinates the U.S. technical work, which is also supported by Oak Ridge, Argonne, and Pacific Northwest National Laboratories. The biofuels cooperation includes the following areas:

- **Biomass resource assessment:** exchange of methods, software tools, strategies and technical support for the development of a resource assessment strategy for China.

- **Biochemical conversion processes:** collaboration between NREL and Tsinghua University to characterize Chinese feedstocks and evaluate proposed biochemical conversion techniques and strategies.

- **Thermochemical conversion processes** (led by Pacific Northwest National Laboratory)**:** collaborative R&D on thermochemical strategies for biofuels production.

- **Biomass sustainability and life-cycle analysis:** an examination of the environmental impacts of biofuel cycles and strategies for sustainable production.

- **Rural and agricultural development strategies** (led by USDA)**:** analysis of agricultural and development strategies for raising rural economic well-being.

Wind Power

NREL is continuing its collaboration with HydroChina, the key wind analysis and planning group in China. NREL and HydroChina have developed advanced economic assessment and planning techniques for large-scale wind farms. NDRC plans for HydroChina to use the resulting methods in the implementation of China's 30-gigawatt wind power target—a target which may be increased severalfold. In fact, NREL and its partners will support an effort led by Lawrence Berkeley National Laboratory to develop a 100-gigawatt wind power scenario for China.

Rural Electrification

NREL has supported China's ambitious rural electrification efforts since 1995, in partnership with the Institute of Electrical Engineering (IEE) of the Chinese Academy of Sciences. Most recently, NREL and IEE developed software that provides system design and sustainable finance guidelines for hybrid renewable rural electric systems. The basis of this work supports China's Township Electrification Program, which is aimed at providing electricity to the smallest and most remote settlements in China; the program was used in a World Bank pilot program in Xinjiang Autonomous Region from 2007-2008.

Other Activities under the US-China Strategic Economic Dialogue

NREL supports other areas of cooperation under the Strategic Economic Dialogue, including the Eco-Cities partnerships, which helps cities in China

> **"NREL…[has] a strategic opportunity to help China capitalize on several times more grid-connected wind power than called for in current official targets."**

and the United States to come together to learn about sustainability issues of common concern. For example, the Eco-Cities initiative has partnered Greensburg, Kansas—which is pursuing a "green recovery" from a devastating tornado—with Mianzhu in Sichuan Province—a city which is rebuilding after the May 2008 earthquake. Denver and Chongqing are also beginning an Eco-Cities partnership, focused on trials of electric-drive vehicles.

KEY RESULTS

NREL has had the opportunity to contribute to China's renewable energy programs for a decade and a half, seeing those programs become some of the most comprehensive and ambitious in the developing world. The trust gained during that time has provided valuable opportunities to both sides. For example, NREL has had the opportunity to comment on China's Renewable Energy Law during the drafting stages. NREL and its partners also have a strategic opportunity to help China capitalize on several times more grid-connected wind power than called for in current official targets.

The effectiveness of the capacity-building partnerships is illustrated by the engagement of the former IES team at Tsinghua University in high-level, international efforts such as the U.S.-China Strategic Economic Dialogue. At the same time, NREL researchers have also gained valuable experience and insights from their Chinese colleagues through data on the operation of off-grid power systems and frank discussions of the lessons learned from China's rural electrification, and other program efforts. The currently emerging research partnerships in biofuels should provide significant benefits to biofuel programs in the United States, China, and other countries.

For further information, please contact David Kline, david_kline@nrel.gov; Bill Wallace, william_wallace@nrel.gov; or Monisha Shah, monisha_shah@nrel.gov.

SPOTLIGHT

Filling a Gap in Environment and Health Work in Southwest China: The Yunnan Health and Development Research Association

By Zhang Kaining and Jackson Tung

BUILDING A NETWORK TO ADDRESS ENVIRONMENTAL HEALTH

The world is like a living "person." We have various specialists who understand parts of this "person" such as the heart, brain, and bone; however, we need a field that focuses on how to integrate the various specialists to improve the overall health of this "person." To apply this analogy to growing environmental health problems in China specifically, we need to integrate environmental science specialists and health science specialists and combine them with social, political, and economic scientists to effectively bring positive change. China—particularly the biodiverse rich, but economically poor southwest—is in great need of such multidisciplinary networks to better analyze and address the country's complex and dangerous environmental health problems.

The Chinese nongovernmental organization (NGO) Yunnan Health and Development Research Association (YHDRA) focuses on the integration effort of the various specialists in environment and health. YHDRA is not positioned to be the specialist in any one discipline, but rather to serve as a "glue" to help various specialists work together efficiently and effectively to achieve environment and health objectives for the people and natural environment in Yunnan Province. This initiative of YHDRA was launched in 2007 with funding from the Rockefeller Brothers Fund.

SHIFT FROM REPRODUCTIVE HEALTH TO ENVIRONMENT AND HEALTH

YHDRA's previous incarnation—the Yunnan Reproductive Health Research Association (YRHRA)—was founded in 1994 to address reproductive health issues focusing on under developed communities (including many ethnic minorities). YRHRA learned early on that single disciplines, such as clinical science, could only achieve limited results in improving reproductive health. YRHRA integrated communications programs with the understanding of ethnic minority's organization structure and achieved break through results in reproductive health.

In 2007, YRHRA changed its name to YHDRA to expand its scope from reproductive health to all health issues. Environment and health became a major focus, with financial support from Rockefeller Brother's Fund. YHDRA continued its multidisciplinary approach to accomplish results.

MULTIDISCIPLINARY TEAMS AND PROJECTS

At present, YHDRA has four multidisciplinary teams to study and address environmental health issues in four communities in Yunnan. In addition to conducting their own field research in specific areas the four multidisciplinary teams organize workshops and discussions between the teams to

"China—particularly the biodiverse rich, but economically poor southwest—is in great need of such multidisciplinary networks to better analyze and address the country's complex and dangerous environmental health problems."

promote idea exchanges and guide future actions. Inter-team activities strengthened the capacity of the multidisciplinary teams.

(a) Zongshuying Team was established in January 2007 to focus on environment and health issues. This team has 15 core members covering the disciplines of anthropology, ecology, economics, environment engineering, journalism, law, medicine, politics, and sociology.

(b) Mengla Team is the second YHDRA team established in April 2007 in the Mengla area (near the Laos border along the Kunming to Bangkok highway). This team of 10, who cover the fields of anthropology, economics, epidemiology, development, population, and resources, focus on issues such as rubber tree plantations and asbestos use.

(c) Waka Team is a unique team that examines Migrants such as ethnic Zang villagers as they migrate from high altitude areas to the valleys in Yunnan. The seven team members whose expertise covers agriculture, ecology, economics ethnography, forestry, health promotion, and nutrition began work in August 2007.

(d) Heijing Team focuses on environmental damage and repair associated with economic transition from a decaying industrial (salt production) town to a tourist attraction. The work began in August 2007 and includes eight researchers in the areas of anthropology, ecology, environment resources, public health, and sociology.

Besides the research team, YHDRA has carried out two online initiatives (done in partnership with the Social Science Research Council); one publication activity; and four on-the-ground integrated environmental health projects. The two websites and publication work include:

- **Environment and Health Information Website (http://www.chinaeh.org/)**

- **Environment and Health Literature Hub (http://ceh.resourcehub.ssrc.org/)**

This hub is a bilingual, searchable online database that serves as a resource on environment and health in China. It includes profiles of people and institutions working on these issues in China and around the world, and links to relevant articles, books and reports.

In 1990s, YHDRA (Formally known as YRHRA) closely worked with rural women in reproductive health. Photo Credit: YDRA

• Environment and Health Publications
Regular publications include the *Environment & Health Newsletters* and Translations. The newsletters contain extracts of reviewed literature, team activity highlights, and preliminary findings and analysis of the integrated projects. The translations contain selected English language articles that address key issues on environment and health.

In YHDRA's integrated projects environment and health relevant factors such as the rural poverty and development, pollution caused by industrialization, migration, health care services, and ethnic minority cultures were identified, discussed, and preliminarily analyzed. Different environment and health hypotheses were examined in real life situations and these cases offer potentially important information to policymakers. The projects are listed below.

(1) Dianchi Wetland Project
This project focuses on the changes of the wetland ecosystem around the polluted Dianchi Lake in Kunming. Topics studied include community response and the government regulations.

(2) Asbestos Roof Project
This project looks into the use of asbestos roofs in rural communities and their health risks. Project tasks include analyzing the current situation of asbestos use in roofing, exploring reasons behind its popularity and discussing efforts for asbestos replacement based on knowledge and needed attitude changes among villagers.

The use of asbestos as a roofing material is increasingly common in rural areas of Yunnan Province, posing health threats to both residents and the workers who produce the roofing materials. Photo Credit: YHDRA

(4) Rubber Tree Project
This completed project studied the expanding rubber tree plantations in southern Yunnan and their negative impact on water supply of the local communities.

(5) Eco-migration Project
This completed project focused on an ethnic Zang village in the warm valley area of the upper Long River. This entire village was moved from a cold mountainous area in Sichuan Province to Yunnan. The project looked into the environment and health challenges faced by the villagers as the village's location changed.

WE ARE THE GLUE

After nearly two years of implementing environmental health initiatives at YHDRA, establishing multidisciplinary teams and conducting integrated projects became this NGO's unique niche. Integrating different disciplines to accomplish the goals of environment and health improvements is YHDRA's forte. We do not strive to be the best in any one discipline; we work hard to be the "glue" that ties all the necessary disciplines together to protect the human face behind environmental challenges in China.

For more information on YHDRA please see: http://www.yhdra.org/. Jackson Tung is chief scientist at YHDRA. He can be reached at tungjackson@gmail.com. Zhang Kaining is the Environment and Health Project officer of YHDRA. He can be reached at knzhang49@139.com.

COMMENTARY

Green Eggs and Ham: Struggles in Swallowing Ecotourism

By Monica Liau

In the children's book Green Eggs and Ham *by Doctor Seuss the two main characters have a long and rhyming argument about the possibility of trying new things.*

Professor Li is the head of tourism development and research at Yunnan Normal University in Kunming, China. A man of influence, Li speaks regularly at tourism conventions and consults on high profile development areas in nature reserves like Gaoligongshan and Xishuangbanna. He also brushes aside the catchphrase "sustainability" when it comes to tourism and scoffs at the term ecotourism. Time and time again he has lectured me that the kind of economic development China needs and the sustainable environmental practices advocated by international NGOs and donor organizations clash considerably. At times, as he argues against applying a foreign tourism model to Yunnan, spittle begins to form at the edges of his mouth.

Li argues that since Yunnan is one of China's poorest and least developed provinces, sustainable "green tourism," as defined by the World Tourism Organization (WTO), is a luxury that Yunnan can not afford. Furthermore, most domestic tourists have no interest in, and often do not care to pay more for the privilege of having a "low-impact, responsible tourism experience." In short, with no demand for "eco-tourism," there is no market advantage for poverty-stricken residents in Yunnan who are hoping for a new quick form of household revenue. At the end of the day, he tells me, nobody in China really wants sustainable tourism development. Nobody wants it "green."

Xiao Tang, who works for The Nature Conservancy office in Kunming, points out that while most tourist destinations in Yunnan—especially the nature reserves—do want to be able to *advertise* "Green Tourism," it remains a label devoid of action. Yunnanese want "green profit," Xiao says, but they don't want to pay the "green costs." In this, they are no different from average poor tourist entrepreneurs elsewhere in China. The branding is as easy as printing a sign, but the practice itself is too complicated, too risky, too expensive, and too slow for most localities to undertake without technical assistance, managed funding, and local motivation.

Setting the states rhetorical commitment to "sustainable development" aside, there is a schism in Chinese society regarding the conflict of balancing environmental and economic needs. The debate is a fight between those who trumpet the desperate need for sustainable development and those who desperately want to throw off the binds of poverty that hold millions of Chinese in its grasp. As long as Professor Li's zero-sum premise forms the debate, it remains an argument without answer.

ECOTOURISM VS. TOURISM

People speaking about ecotourism tend to use certain terms interchangeably: sustainable tourism, "green" tourism, backpacking, adventure tourism. These terms bleed together, and are as confusing to the researcher as they are for the reader. For the simplicity of this article, I am using the term "ecotourism" in accordance to the World Tourism Organization 2002 International Forum definition. This means ecotourism is "all forms of tourism in which the main motivation of tourists is the

Illegal logging in Nature Reserve, Southern Yunnan Province. Photo Credit: Monica Liau

observation and appreciation of nature, which contributes to its conservation, and which minimizes negative impacts on the natural and socio-cultural environment where it takes place." (See Box 1).

The standard Western definition of "ecotourism" is a small group of tourists who experience a natural area with minimal environmental impact, minimal creature comforts, and economic benefit to local communities. In Chinese, on the other hand,. ecotourism is usually translated as "Shengtailuyou" (生态旅游), which simply means tourism that explores a natural environment. This involves both the small "backpacking" experience, but also includes more popular mass bus tours.

THE CURRENT STATE OF TOURISM IN YUNNAN

Tourism, green or otherwise, is particularly important to Yunnan's economic development strategy. Yunnan is China's most geographically and ecologically diverse province; its main wealth is its abundance of natural resources. Biologically speaking, Yunnan is a treasure house. In addition to holding 18,000 of China's 30,000 species of plants, Yunnan houses 85 percent of the country's endangered flora and fauna, many of which live within its 198 nature reserves.[1]

Most residents' income is based on the exploitation of these resources through dams, mining, timber, agriculture…and tourism. Every year, millions of tourists, both domestic and foreign, come to Yunnan. In 2007, Yunnan's tourism revenues increased by 20.4 percent from the previous year.

According to the official 2007 government census, domestic tourism for the whole country increased by 15.4 percent since 2006 (9.5 percent in real terms.) The future of tourism in China, and therefore Yunnan Province, is going to be geared chiefly towards domestic tourists, who will continue to be the main marketing target for tourism. This influx of tourism—particularly domestic tourism—and tourist money proffers an attractive economic incentive to poor Yunnanese. However, increased volume of visitors also raises serious questions about the ecological impacts that some of China's most sensitive nature reserves and scenic areas have to absorb as tourism is developed in those areas. With a growing population of 43.33 million,[2] some habitat loss is inevitable; nevertheless, Yunnan has as much to lose by unsustainable tourism in the long-term as it does to gain in the short-term.

Tourism's Impact on Yunnan

Creating sites for tourists is a large endeavor, and takes a lot of resources and construction in order to create a place of at least minimal comfort and convenience. Aside from the immense amounts of petroleum tourists need to burn in order to get to this remote province, there are serious environmental impacts that tourism development causes in nature reserves. Dramatic strips of deforestation appear in the course of building housing and roads. The ubiquitous trinket shops use energy and, when unmanaged, prey on local natural resources. Demand for food from new restaurants and residents encourage poaching and fish dynamiting. The need to flush increased waste unquestionably impacts water quality, especially when facilities lack their own water treatment centers[3]. In many nature reserves, the poorly managed expansion of infrastructure, tourism facilities, and tourists threatens the future beauty and health (and therefore marketability) of the very places tourists are paying to see.

Catering to standard mass tourism requires large infrastructure networks and hotels, and if not carefully managed these can deliver serious impact. For instance, Lugu Lake, located at the far northeastern tip of Yunnan Province, is a high altitude lake set deep in the mountains. Famous throughout

China, Lugu Lake has recently become a popular new tourist destination. The increased tourist traffic encouraged widened roads, new hotel construction projects and other negative environmental and ecological impacts. Now, the once pristine lake suffers from seasonal algal blooms. This problem is caused by an influx of erosion run-off, a product of deforestation and poorly managed construction projects. It is also due to a wastewater infrastructure unable to handle the increased load of solid waste spurred by tourism. Livestock and human manures are not adequately filtered before running into the lake, and tour guides now suggest that people refrain from swimming in the lake, or drinking from it without adequate filtering. There has also been a marked increase in garbage wastes, especially plastic bags which choke the shores.

POSITIVE ASPECTS OF TOURISM

Yunnan has one of the lowest environmental health indices in China, according to the *2007 China Statistical Yearbook*. It's easy to look at the negative impacts that tourism has on environmental health, but Zhang Kaining who heads the Yunnan Health and Development Research Association (YHDRA) also insists that tourism can have a very important positive health impact on communities touched by its development. [*Editor's Note: See Spotlight Box on YHDRA in this issue of CES*]. For instance, Mr. Zhang has worked extensively in several "tourism hotspots" in Yunnan such as Dali, located four hours west of Kunming. "When I started working [in Dali] in 1969 there was a high infant and mother mortality rate among the women forced to travel from their mountain towns to have their babies," he says. "There were no roads, one town phone and no easy ways of travel. Now, tourism money has developed transportation infrastructure and also allowed the government to invest in clinics of better quality, it's much easier [for the women]." Mr. Zhang goes on to insist that "an increased tourism economy is almost always followed by a dramatic decrease in infant and mother mortality rates. Tourism definitely enables the mountainous areas [to] get better transportation and communication, therefore is important in terms of saving lives of pregnant women or [elderly] people."

Tourism also dramatically improves education rates by increasing the value and relative affordability of education. According to Mr. Zhang, while many ethnic groups give preference to boys, "many guides for tourism are girls, so families begin to see their value–if you give a girl opportunities to attend school, she can earn a lot of money and be respected by the entire community. I heard villagers tell me 'oh look at all the girls, they are so successful, I want my daughter or granddaughter to be better educated.'"

> **"In many nature reserves, the poorly managed expansion of infrastructure, tourism facilities, and tourists threatens the future beauty and health (and therefore marketability) of the very places tourists are paying to see."**

According to Jackson Tung, chief scientist of the YHDRA, some communities also actually improve the physical environment of their town through tourism. Heijing, originally a salt mining town, went into economic decline due to extensive deforestation, a result of firewood needed to maintain the salt industry. Local people, to stimulate the flagging economy, decided to develop the town and its infrastructure to encourage tourism. Because the mountains and hills were bare, the town planted trees to mitigate erosion, and improved the waste-management infrastructure. "Because of the focus on tourism, the town ended up being a lot more environmentally conscious of things like trash and sanitation," says Dr. Tung. "People in Heijing are environmentally conscious, but they are financially motivated."

THE CRUCIAL FACTOR IN DEVELOPING SUSTAINABLE TOURISM IN YUNNAN

As far as tourism is concerned, there is a fissure between agendas of environmental NGOs and Chinese government organizations charged with environmental safeguards, and the agendas of organizations charged with stimulating economic development. Therefore, the tourism development

BOX 1. Defining Ecotourism

While definitions of ecotourism are plentiful, the WTO provides one that is fairly straightforward with three aspects on enhancing sustainability of tourism sites. These are:

- **Economic sustainability:** generating prosperity at different levels of society and addressing the cost effectiveness of all economic activity. Crucially, it is about the viability of enterprises and activities and their ability to be maintained in the long term.
- **Social sustainability**: respecting human rights and equal opportunities for all in society. It requires an equitable distribution of benefits, with a focus on alleviating poverty. There is an emphasis on local communities, maintaining and strengthening their life support systems, recognizing and respecting different cultures and avoiding any form of exploitation.
- **Environmental sustainability:** conserving and managing resources, especially those that are not renewable or are precious in terms of life support. It requires action to minimize pollution of air, land and water, and to conserve biological diversity and natural heritage.

planning process is fragmented. NGOs, government institutions, and private enterprises all work to develop tourism according to different agendas, in different parts of Yunnan.

An important factor often overlooked in developing effective tourism models is the value of private sector investment in areas that are looking to be opened to tourism. "In order for a strategy in ecotourism to work to optimize community benefits," says Amelia Chung, who has worked extensively on ecotourism projects with both the Nature Conservancy and the Global Environment Institute (GEI) "it is crucial that a private sector is involved." This is difficult as many NGOs don't want to involve the private sector. However, Amelia says the best role for NGOs is to serve as a temporary intermediary between local communities and the private sector. "NGOs must have an exit strategy," she says.

Tian Feng, an expert on ecotourism who is conducting a survey on ecotourism for Conservational International (CI) in Western China goes even further, insisting that "tourism is a business, business is money, and money is driven by the market and economic principles. NGO's like to use ecotourism as a conservation tool, but the reason so many [ecotourism] test sites are defective is because people forget basic economic principles."

MAKING ECOTOURISM MORE PALATABLE

Andrew Scanlon, who works in one of China's most famous Nature Reserves, Jiuzhaigou in Western Sichuan, says the definition of "ecotourism" needs to be reconsidered. "Western ecotourism standards do not necessarily apply to China," he says, "and backpacking may actually be worse for reserves than developing a small fraction of the reserve for high tourism use and leaving the heart of the reserve unopened and undeveloped."

Smart Travel and Greener Jobs

Sustainable tourism development strategies in China should not attempt to completely reduce the volume of tourist traffic through higher pricing. China is too big and has too many people moving around for this model to work, and the local economies depend on volume. However, this does not mean there is no way to emphasize smart, low impact development while also helping to invigorate and reinvent the local economy. Yunnan needs to deploy a development model that produces high levels of labor-intensive green employment. Local residents who rely on selling trinkets and curios that use local or unsustainable materials, driving large polluting buses, and building roads can instead work to support sustainability. These could include jobs such as walking tour guides, path maintenance crews, and driving (if necessary) smaller vehicles that burn clean fuel.

In addition to encouraging greener transportation in and around the scenic areas, Yunnan tourism will also benefit from a more diverse and low impact transportation network outside the parks themselves: cleaner airplanes, light rail, and green buses that deliver tourists from site to site. Since travel to Yunnan produces pollution in other provinces as well, any reduction in the consumption of aviation fuel would produce national and international benefits.

Guiding the Market

Such a program requires a strong government agenda to provide initial funds and training, and to create incentives to coordinate private business investment with NGO investment in order to create a stronger movement that could in turn (along with strong media campaigns) help encourage market demand in the minds of the average domestic tourist.

According to Tian Feng, this demand is already developing. While the tourism industry's ideas are slow to change, he says, his survey has found that more and more young Chinese people don't want to join mass tourism groups. "They want to find something more special," he says. "So there is a potential market, but people don't have many options." Feng Ruixi, program manager of the conservation education department at the Panda Research Base in Chengdu, concurs that attitudes among young Chinese people are already changing. She says that people in cities are becoming more and more interested in experiencing nature, and are starting to understand and appreciate its importance. At the Panda Research Center, she and her team work with young students, traveling to their classrooms to teach them about the role of wild animals, and proper behavior that should be followed in Nature Reserves. "Instilling the next generation with an appreciation and understanding of nature is important," she says. "Bridging the gap between city dwellers and their environment will help with the future of ecotourism"

A persistent media campaign, therefore, would be a key factor in helping stimulate demand and slowly reorient the tastes and habits of the domestic tourists towards more sustainable experiences. China's government has huge media power over the country. This campaign could therefore reach beyond the current movement that merely lectures people on their duty to be green, and help promote a different type of tourism that shows how fun green tourism can be, and how travelers can support the green movement while touring. The programs could be short and educational but also interactive, endorsing outdoor activities like hiking, and the concepts of lower impact tourism. It would be a slow process, but the solution of a very complicated issue relies not only on conservation and policy, but also the voluntary support of the tourist dollar.

FINAL THOUGHTS

Tourism is an important tool for the future of many communities in Yunnan, but in order to preserve the environmental integrity and marketability of these places, conservation techniques need to be properly introduced and balanced with economic development. "Ecotourism" in its Western definition does not necessarily apply to China's current tourism needs, and therefore Yunnan's (and China) sustainable tourism merits a distinct model that can involve a well managed high volume of tourists.

Shoes discarded along the river bank, Northwest Sichuan Province, Songpan. Photo Credit: Monica Liau

Monica Liau graduated from Mt Holyoke College with concentrations in Environmental Management, Urban Planning and Chinese. In 2007-2008 she served as a Fulbright Scholar in Western China researching ecotourism development. She has lived in China for 2 years, moving across the country—Beijing, Haerbin, Kunming, and Chengdu where she currently resides as a free lance writer.

NOTES

1. Yunnan also attracts many tourists to the area due to its particular "human fauna." Namely, Yunnan is home to 25 of China's 56 recognized ethnic minorities, more than any other province in the country. 38 percent of the population is officially an ethnic minority. It is also relevant to mention that the majority of those communities that stand to benefit from tourism (and sustainable tourism) are chiefly poor ethnic minority communities.
2. Yunnan is experiencing approximately 10 percent population growth annually. Yunnan Census, 2004
3. Due to the rural nature of most nature reserve sites, there are rarely any wastewater treatment plants.

SPOTLIGHT

China Youth Climate Action Network: Catalyzing Student Activism to Create a Low-Carbon Future

By Li Li

China Youth Climate Action Network (CYCAN) is a national network consisting of seven student green groups (including Green Student Forum in Beijing) that links over 200 universities in China. It is the first national network of its kind to coordinate action on a specific green issue—climate change. In addition to directing Chinese students to take action to combat climate change on an individual level, CYCAN aims to facilitate a 20 percent reduction of greenhouse gas emissions in pilot higher education institutions in China before 2012, which could contribute to the national objective of promoting energy saving and emissions reduction.

HISTORY OF CHINESE YOUTH PARTICIPATION IN ENVIRONMENTAL ISSUES

Environmental activism among university students has grown considerably both in breadth and depth since the first student environmental associations was formed in the late 1980s. However, student engagement in the realm of climate change has only slowly evolved over the past decade

The development of student climate activism can be divided into three stages:

Stage 1: 1990-1996. During this period, university student environmental associations thrived—increasing to over 200 groups nationwide. Chinese youth activities were limited to on-campus interest-based promotion and broadcasting, as well as research pertaining to environmental topics.

Stage 2: 1996-2001. In the second stage, regional/province-based student environmental associations prospered across China, which facilitated increased interaction and communication among individual university green groups, especially with regards to large research studies and programs. For example, the Green Student Forum (established in 1996) was sponsored by multiple college student environmental associations in Beijing. The Green Student Forum fueled the development of Green Camps that offered training to university students and pioneering members of Chinese nongovernmental organizations. The number of province-based regional youth environment associations is estimated to be more than 30. [*Editor's Note: See Wu Haoliang's Commentary in CES 8 for information on these emerging regional environmental youth associations*].

Stage 3: 2002-present. Over the past six years, the Internet and new media further facilitated the development of Chinese youth environmental associations. With the growth of both college and regional student associations—often supported by the national government and large NGOs—youth environmental associations have successfully promoted their agendas and programs on a national scale. For example, the Chinese Undergraduate Cooperation Forum, with the support of the International Fund for China's Environment, now hosts an annual gathering of Chinese youth environment associations. The Youngster Environmental Camps, supported by the Chinese Environmental Culture Committee, also has nurtured many talented youth in environmental protection.

Milestones in Student Activism Around Climate Change

The growing number of student environmental associations and growing interest in climate change among students laid the foundation for the creation of CYCAN. Greenpeace China was a major early player in helping to put the issue of climate change on the agenda of student activists, such as in 2004 when they conducted seminars on how youth could take an active role in dealing with climate change. Key milestones demonstrating a growing student activism around climate change include:

> **"…CYCAN aims to facilitate a 20 percent reduction of greenhouse gas emissions in pilot higher education institutions in China before 2012…"**

2005: In November, the International Renewable Energy Conference was held in Beijing. One month later, the UN Framework Convention on Climate Change Conference of the Parties 11 (COP11) was held in Montreal, Canada. Representatives from Chinese student environmental associations attended both meetings. In the COP11 conference, Chinese students for the first time spoke as observers. Together with their global peers Chinese students also helped formulate and support the 2005 Montreal International Youth Declaration "Our Climate, Our Challenge, Our Future."

2006: The Clean Development Mechanism (CDM) Committee of Beijing University—the first student association researching CDM—started exploring the field of environmental policy and technology to cope with global climate change. The CDM Committee formed the Joint Initiative for the Future, which sponsors climate change-themed gatherings on a monthly basis. For example, the New Energy Generation of Greenpeace recently presented their research on "The Coal Recourses of Shanxi Province."

2007: In April, with the support of the Disney Foundation, Taking It Global—China Global Youth Community carried out the first survey on Chinese youth's awareness of climate change. The survey was conducted in colleges and universities in more than 10 provincial capitals. The survey revealed that 99.8 percent of the Chinese students had heard about or had some knowledge of the theories and potential dangers of climate change and 98.41 percent believed that climate change is approaching. However, when asked who is responsible for addressing climate change, only 2.38 percent of the Chinese students believed they had a responsibility—the majority believed that government, businesses, research institutes, and even the general public (not including the students) should shoulder the responsibility. When asked about specific activities on climate change, nearly all the students indicated a willingness to make a contribution, but 80 percent had no idea how. This survey indicates a challenge in raising awareness, but also underscores a vast untapped resource for student involvement in climate change activities.

In June 2007, the fourth Chinese Undergraduates Environmental Organization Cooperation Forum was held in Wuhan with the theme "Climate Change and the Youth's Environmental Awareness." One hundred policy experts, researchers, and student leaders from China and abroad devoted to climate change participated in this forum. During the forum, participants discussed how Chinese students could address climate change through cooperation with other organizations. Late in the summer of 2007, with the support and cooperation of all the organizations that attended the fourth Chinese Undergraduates Environmental Organization Cooperation Forum, CYCAN was established.

ESTABLISHING THE CHINA YOUTH CLIMATE ACTION NETWORK

Since its founding in August 2007, CYCAN has been sponsored by six student organizations: (1) Beijing University's CDM Research Center is in charge of technological applications for operating, analyzing, and composing the reports; (2) Taking It Global is responsible for public relations and financing; (3) TUNZA-NEAYEN, part of the UN Environment Programme, has taken charge of communications; (4) Solar Generation of Greenpeace is responsible for propagating advocacy projects and guiding climate change projects; (5) China's Green Beat covers publicity and project promotion; and (6) Green Student Forum, having rich network resources, has led outreach programs in universities and colleges nationally.

After establishing CYCAN, colleges were recruited to launch a pilot project—Green Campus. In 2007, 23 universities in 22 provinces, including the University of Hong Kong and the University of Macau, participated in this pilot project. As of December 2008, CYCAN participant colleges covered every province on mainland China, as well as Taiwan.

Green Campus Program

Green Campus is a project based on intensive investigation and research, supported by powerful

data surveys, with simultaneous assessment in the use of energy-saving equipment, public awareness, and management patterns. Green Campus seeks the best energy-saving solutions on campus to reduce greenhouse gas emissions, including surveys and data analysis of energy consumption, analysis reports on saving energy, and youth participation in energy management. Green Campus also is building a network of universities and NGOs to implement energy management policies on campuses. To date, Green Campus has been launched in about 40 universities and one high school. CYCAN staff will write a report on the results of the pilot to presented to the Chinese government and related organizations of the United Nations, with the goal of soliciting support and advice to expand the Green Campus nationwide. Other CYCAN accomplishments and major activities include:

- September 2007: Established the CYCAN website (www.cycan.org).
- November 2007: Issued the bimonthly bulletin "GO GOOLER."
- December 2007: Representatives from CYCAN went to Bali to witness the UN Framework Convention on Climate Change COP13.
- March 2008: CYCAN representatives went to the South Pole to experience the E-base, and witnessed the melting pole and other climate change impacts.
- May 2008: Launched a database of energy consumption in Chinese universities.
- July 2008: CYCAN representatives were invited to participate in the Asian Youth Climate Change Summit Forum in Hong Kong.
- August 2008: Developed a green Olympics project, and participated in green Olympics activities; CYCAN representatives went to Taiwan to participate in environmental training camps.
- October 2008: CYCAN representatives were invited to participate in the Asian Youth Energy Summit held in Singapore.
- November 2008: CYCAN representatives attended Governors' Global Climate Summit in California.
- December 2008: "20 energy-saving actions campaign," sponsored by CYCAN and WWF-China was launched simultaneously in over 100 Chinese universities; CYCAN representatives were invited to attend the UN Framework Convention on Climate Change COP14.

NEXT STAGE: CHINA'S STUDENTS BECOMING AN IMPORTANT CLIMATE CHANGE FORCE

Since its establishment, CYCAN has paid great attention to learning and communicating with outsiders, as demonstrated by the many conferences we attended in the last two years. We hope that we can promote global interaction by learning and communicating with each other, and cooperating to promote mutual development. CYCAN's central goal is to help build the awareness and capacity of China's students to play an active role in addressing global climate change.

Li Li is president of China Youth Climate Action Network. He can be reached at mlmhslili@gmail.com.