A CHINA ENVIRONMENTAL HEALTH PROJECT RESEARCH BRIEF

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Environmental Health Challenges in Xinjiang

By Erika Scull

Ecological and human health trends in the Xinjiang Uyghur Autonomous Region are grim. The growing negative impacts of air and water pollution, desertification, and overall ecological damage have turned Xinjiang into one of the unhealthiest regions in China.[1,2] In a comprehensive assessment of environment and health done by scientists at the Chinese Academy of Sciences, Xinjiang was rated as having the fifth worst (out of 30 provinces, municipalities, and autonomous regions) environment and health indices based on indicators relating to population growth, health status, level of education, natural conditions, environmental pollution, economics, and health care resources.[3] The life expectancy in Xinjiang, at 67 years in the year 2000, is also the fifth worst in China, following Tibet, Guizhou, Qinghai, and Yunnan.[4] Urumqi, Xinjiang's capital, was blacklisted in 2008 by the central government as one of the most polluted cities in China—with both severe air pollution and low quality water. [5] A 2008 report by the UN Environment Programme (UNEP) and the World Health Organization (WHO) underscored how Urumqi's severe air pollution was contributes to a high mortality rate from respiratory diseases, cardiovascular diseases, and tumors.[6]

ACCESS TO HEALTH CARE— THE URBAN AND RURAL DIVIDE

There are many factors besides pollution that may be contributing to poor health and high mortality rates in Xinjiang, including poverty, climate conditions, and access to health care. The UNEP/WHO report mentioned above stressed the importance of access to health care services when assessing the overall health risks in highly polluted regions. Moreover, the report emphasized that there are regional variations, specifically between rural and urban areas, that play a key role in determining the health risks due to pollution. Health risks from the environment disproportionately affect China's poor rural regions where less than 10 percent of the people have medical insurance. [7] The quality and availability of health care in China's rural areas generally lags behind urban areas, especially in relevant fields such as environmental oncology. Strikingly, although Beijing and Shanghai have some of the highest levels of air pollution in the country, they have the lowest health risk ratings for China in the UNEP/WHO report, because of such factors as good nutrition and better access to health care.[8] As one of the poorest and most remote regions in China, it is no wonder Xinjiang rates low in environmental health assessments.

Population Dynamics

The rapid increases in population over the past two decades is further straining limited resources in Xinjiang—in 2001, an estimated 500 Han Chinese arrived each week in Xinjiang looking for work.[9] This population increase not only strains health services, but also scarce natural resources like water. There is a discrepancy between the levels of service in urban versus rural areas, where most ethnic minorities live. With 80 percent of Xinjiang's health care services located in urban areas—which are now mainly populated by Han Chinese—little remains for the mostly rural Uyghur (and other minorities).[10] The result is many people in rural areas seek out the services of unregistered medical clinics that are often below standards and staffed by practitioners lacking professional training. Furthermore, a national law requiring medical students to be fluent in Mandarin prevents many ethnic minorities from getting a medical degree and servicing their communities.[11] The wealthier

Han Chinese in Xinjiang are more able to afford better health care than minority groups, which most likely better equips them to deal with health problems linked to pollution.

BLACKENED SKIES—AIR POLLUTION IN XINJIANG

In the *Annual Nationwide Urban Environmental Management and Regulation Report* released by China's Ministry of Environmental Protection for the year 2007, Urumqi was among the handful of cities in China to be blacklisted for having the worst air pollution in the country. Air pollution causes serious health problems, including lung cancer, asthma, cardiovascular disease, and premature death. The winter can take the harshest toll on human health in Xinjiang, when coal-burning is at its height. Burning coal releases nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulate matter (PM_{10} or $PM_{2.5}$)—all of which are dangerous in high doses. SO_2 not only damages crop and other flora, but can impair breathing and aggravate existing heart disease.[12] Particulate matter is known to cause respiratory diseases, as the fine particles permeate deeply into the lungs. Although mercury from burning coal is a serious problem in some parts of China, the coal found in Xinjiang has the lowest mercury levels in the country and therefore has not been associated with mercury-related health problems in this region.[13] Indoor air pollution is also a significant problem especially in rural areas, with disproportionate effects on women and children (See CEHP Research Brief: Environmental Health and Indoor Air Pollution in China).

Urumqi's heavy air pollution should not come as a surprise, since it is the number one coal-consuming city in China.[14] Xinjiang also provides the rest of China with 40.6 percent of its coal supply. This plenitude of coal ensures a cheap fuel supply for Urumqi and accounts for 67 percent of its energy use, while making the per capita coal consumption in the city four times the national average at 3.96 tons, the highest in the country. As Urumqi continues to increase the number of coal-fired power plants in the city—increasing its coal use by 47.8 percent between 2001 and 2006—the overall ambient air quality has been rated as grade III, the worst of the national air quality standards.[15] Urumqi's SO_2 and particulate matter levels are especially high, both of which often exceed grade III standards. The high SO_2 levels can be attributed to the lack of desulphurization technologies utilized in the city. According to the 2007 *Xinjiang Statistical Yearbook*, Urumqi had the worst NO_2 and SO_2 and the third worst PM_{10} levels among all major cities in Xinjiang for the year 2006. In addition, Urumqi had 119 days out of the year with air quality exceeding grade II—the highest number of days in the region.[16]

Xinjiang's air pollution stems not only from coal-fired power plants, but also coal mining, vehicle emissions, industrial factories, and underground coal fires. In 2007, an underground coal fire that had been burning for over 50 years in the Terak minefield near Urumqi was finally put out. (A report from a foreign journalist maintains that, contrary to official claims, the fire is still burning.[17]) It had been contributing to Urumqi's already dark skies by expelling 70,000 tons of toxic gases per year since the 1950s.[18] Underground fires are also hazardous for their capacity to cause land to cave in when the coal turns to soft ash below the surface.

THIRST AND CONTAMINATION OF XINJIANG'S WATER

Xinjiang is a unique arid ecosystem with an independent and self-balanced hydrological cycle—in that the total volume of water in the region is basically stable. Therefore it is especially fragile and vulnerable to human impacts. Xinjiang is surrounded entirely by mountains, with the Tianshan mountain range running through the center and dividing the province into two basins: the Junggar in the north and the Tarim in the south. The larger and more populated of the two, the Tarim Basin, is one of the driest places on earth. Its only water source is the melting glaciers of the surrounding mountains. Snow from the Tianshan Mountains melt to form China's longest inland river, the Tarim.

Water scarcity has historically been one of the biggest problems facing Xinjiang. Between the 1950s and 1980s, Xinjiang saw a huge decrease in the total surface area of its lakes, from 9,700 square kilometers to 4,953 square kilometers. Climate related drought and human activities are the two main causes for the shrinking of Xinjiang's lakes. In the late 1950s, thirteen dams were built on the upper reaches of the Kongque River for irrigation purposes. By 1964, Lake Lop Nor (*Luobupo*), which was fed by the river, completely dried up.[19]

With naturally salty water, Xinjiang also faces problems with water salinization. There are only three freshwater lakes in Xinjiang—out of a total of one hundred and thirty-nine. Over the past few decades, the salinity of Xinjiang's lakes has increased as many lakes have begun to dry up. As lake water depths have decreased, the proportion of salt in the water has likewise increased.[20]

Climate change is another problem that is affecting Xinjiang's water supply. Over the past four decades, Xinjiang's climate has gotten warmer by about 1 degree Celsius and its largest glacier—known as Number 1 Glacier—has shrunk by 20 percent, splitting into two parts in 1993.[21,22] In the short term, Xinjiang's melting glaciers will increase the amount of available water to the region's cities and residents, which may encourage further development, especially of water-intensive industries like golf courses and ski resorts. Xinjiang's GDP has already seen a 17 percent growth rate per year rate since 2005. But this increase in water flow is only expected to last about 40 years, after which Xinjiang's economy will literally be left high and dry with little water available to sustain its water intensive industries, agriculture, or growing urban centers. Ultimately, if nothing is done to counter climate change, within one century the glaciers in Xinjiang may disappear. Xinjiang's reliance on glacial water is one of the highest in Asia, and the disappearance of these glaciers would be catastrophic for the 20 million people living in the region.[23] Besides long-term water shortages, melting glaciers can also pose a threat by causing landslides or floods.

Water Resources and Population in the Tarim Basin

The fragile Tarim Basin in China's Xinjiang Uyghur Autonomous Region has been inhabited for thousands of years and the struggle for water is not new. The Tarim River once stretched to Lake Lop Nor and supported the ancient Loulan Civilization, but due to population increases and subsequent water shortages, Loulan City, one of the largest cities along the Silk Road, was eventually abandoned.[24] In recent history, the basin experienced substantial environmental pressure when the Xinjiang Production and Construction Corps (XPCC) began agricultural production in the 1950s. Between 1950 and 1970, the XPCC increased from less than 20,000 people to 420,000, and then to 460,000 by the year 2000. [25] As the population in this area grew, so too did the area of cultivated land—almost doubling between 1950 and 2000. This in turn led to a lower quality and quantity of water reaching the Tarim River's downstream areas. By the 1980s this large-scale agricultural enterprise shortened the Tarim River by 320 kilometers and severely degraded the land and water in the lower reaches of the Tarim River, which seriously affected human health—one of the factors causing an overall out-migration of people in this area in the 1990s.[26]

Cotton Production

Prior to 1980, 60 to 80 percent of the cultivated land in the Tarim Basin region was used for grain production, including rice.[27] By the 1990s, grain production was reduced to less than 30 percent of the cultivated land as cash crop production was increased to more than 70 percent. There were two reasons for the switch to cash crops in the Tarim Basin—economic incentives and water scarcity.

With China's rise to one of the global leaders in textile production and export in the 1990s, Xinjiang experienced a boom in cotton production. The historically high cotton prices led most of the land cultivators in the Tarim Basin to switch to the labor-intensive activity of growing cotton, which in turn led to more population growth, greater land degradation, and increased water scarcity. Large tracts of unused land were converted into cotton fields, which often involved reclaiming land previously considered unusable because of its higher salt content. To flush out the salt content of the land, large volumes of water from the river were drawn and then piped back to the river, thereby reducing the quantity and quality of the water arriving downstream. On the other hand, rice cultivation is also very water intensive and the water shortages that it produced probably played a larger role than economic incentives in the switch to cotton.[28]

Despite all of the challenges Xinjiang faces with water, in 2003 the central government issued a white paper on Xinjiang, calling for the continuation of the 1998 campaign to "Develop the West" that aims to raise economic growth in China's interior. This campaign has stimulated considerable infrastructure projects in China's poorer western regions. In Xinjiang, two of the main investments have been the expansion of the cotton industry and energy development projects, both of which place a high demand on water. Water in Xinjiang has historically been mismanaged with over extraction for cities and agriculture lowering the groundwater table in Xinjiang to 60 meters—one of the lowest levels in the world.[29] In response to these water shortages, China has plans to divert up to 10 percent of the water volume on the Irtysh and Ili Rivers, two rivers that its Central Asian neighbors, particularly Kazakhstan, heavily rely upon.[30]

Naturally Occurring Problems With Water

Not all of Xinjiang's environmental health related problems stem from human-generated pollution or degradation. This region has a number of naturally occurring problems that particularly affect drinking water. Xinjiang's water, especially in the south, has very low levels of iodine that have plagued the region's inhabitants with iodine deficiency disorder (IDD). IDD causes goiters—a swelling of the thyroid gland—and severely stunted physical and mental growth. In 1995, goiters had become endemic with a 43.29 percent occurrence rate among children between the ages of 8 and 10 in Xinjiang.[31] After some local government campaigns during the 1990s to increase awareness of the causes of IDD and encourage the use of iodized salt, a joint UNICEF-China collaboration was launched in 2000 to address the problem. This initiative has had great successes with the goiter rate among children ages 8 to 10 dropping below 15 percent. However, there are still obstacles for Xinjiang's poorest residents, as the price of iodized salt remains too high for them. One government solution has been to distribute iodine-releasing devices for cooking water.[32] Xinjiang is still struggling to meet the Universal Salt Iodination goal set by the UN in 1990 for a rate of 90 percent of households consuming iodized salt.[33]

Xinjiang is ranked in the top five provinces that have the highest proportions of excessive arsenic—caused by natural geological conditions—in their village wells. Arsenic was first discovered in Xinjiang's water in 1983 in a village called Kuitun in the Junggar Basin. The origin of the contamination began in the late 1960s when villagers switched from drinking river water with low-levels of arsenic to a well that was highly contaminated.[34] Over the next two decades, villagers developed serious health problems, including skin irregularities, fatigue, heart problems, and cancer.[35] In the mid-1980s, water with low levels of arsenic was provided for the villagers, however, the mortality rates from cancer and heart problems still remain abnormally high, though the skin

problems have cleared up. Arsenic also has been linked to reduced intellectual function in exposed children.[36]

Drinking water containing high levels of fluoride is another problem for residents in Xinjiang. The maximum level of fluoride allowed in China is 1 milligram per liter (mg/L). Water from Kuitun and some other areas in Xinjiang has been found to contain up to 21.5 mg/L.[37] High levels of fluoride can cause arthritis, tooth decay, and can impair children's physical and mental growth.[38] In addition, it has been found that fluoride can have detrimental health defects when combined with low iodine levels.[39] A study done on children in areas of Xinjiang with low iodine levels and high fluoride levels revealed that fluoride can exacerbate neurological disorders caused by iodine deficiency, including mental retardation, hearing loss, and degenerative effects on the central nervous system. [40]

OCEAN OF SAND—DESERTIFICATION IN XINJIANG

With almost 45 percent of its total land area covered by desert, Xinjiang is one of the most severely affected regions impacted by desertification in China. In 2004, Xinjiang's deserts were estimated to be expanding at a rate of 10,700 hectares per year, but this was a great improvement over previous years that had seen an expansion of 38,400 hectares a year.[41] The central and local governments have invested millions of dollars into reducing desertification in Xinjiang. Between 2000 and 2004, 1.43 million hectares of trees were planted, increasing forest cover 1.92 percent to 2.1 percent.[42] One government campaign, initiated in 2004, has invested 27 million dollars into methane gas facilities that use animal and human waste for cooking and heating fuel, which will obviate the need the need for communities to cut trees for firewood. About 10 percent of Xinjiang's rural population is now using methane, while also being encouraged to plant trees through another government campaign to halt desertification.[43]

In 2007, China's central government announced plans to reduce desert areas by 7.6 million hectares by 2015, through investments in planting trees, training professional forestry staff, setting up monitoring stations, and improving irrigation systems. The central government will cover 80 percent of the planned 2.46 billion dollars in investments with the remaining 20 percent coming from local governments.[44] Over the past few years, Xinjiang also received aid from foreign governments, including Japan and South Korea, to reduce desertification.

Most of Xinjiang's desertification is caused by excessive farming and over-grazing. Local people's use of wood for fuel also contributes to desertification, as trees act as a wind break, retain moisture and prevent erosion. Before the campaign to encourage the use of methane, the average rural family used 500 kilograms of wood per year.[45] Experts consider impacts of climate change—particularly reduced rainfall—as another challenge to the abatement of desertification.[46] Ecological consequences of desertification are cropland infertility, drinking water shortages, and sandstorms. Desertification can affect human health by increasing respiratory diseases and eye irritations. Hotan, a city in southern Xinjiang, has over 300 days per year of sand-filled wind, which has led to a marked increase in respiratory problems. One telling hardship from the desertification is that Qira County residents have had to relocate three times due to the encroaching sand.[47] (See CEHP Research Brief: Desertification and Environmental Health Trends in China.)

NUCLEAR TESTING

Between 1964 and 1996, China used Xinjiang for all of its nuclear testing.[48] The *Christian Science Monitor* reported that the 45 official nuclear tests led to radiation poisoning that resulted in an estimated 210,000 deaths.[49] However, it has been reported that secret nuclear testing has also been going on with grave effects on the health of the people in the surrounding areas.[50,51] An investigative

report by London's newspaper, *The Independent*, revealed that the areas surrounding the Lop Nor nuclear test site—on the eastern edge of the Taklimakan Desert—have a cancer rate that is 35 percent higher than the rest of China and higher than average rates of Leukemia, tumors, and birth defects such as cleft palates. An anonymous doctor claimed that during the testing period, 80 percent of the children he was seeing had cleft palates.[52]

CONCLUSION

Environmental health statistics for all of China are difficult to obtain and the quality of existing data is often unclear or disputed, particularly when one focuses on specific provinces or areas that are poor or politically sensitive like Xinjiang. One example of national data difficulties was illustrated in a June 2008 Center for Strategic and International Studies (CSIS) report that discussed the results of a joint World Bank and Chinese government report that estimated 750,000 people die prematurely each year due to air pollution in China. The CSIS report noted that the Chinese government reportedly would not release these figures because this sensitive information could harm social stability.[53]

The difficulties in accessing environmental health data for Xinjiang are due to a number of reasons. Xinjiang is an impoverished, yet resource-rich region that is strategically located on the border of eight central Asian countries. As the home to many different ethnic groups (e.g. Uyghur, Kazakh, Mongol, and Kirgiz), Xinjiang has been an area of social unrest and has an ongoing separatist movement. Tensions between minority groups and the central government—especially over the government-sponsored migration of Han Chinese into Xinjiang—have long affected the region.[54]

The central government's plan to "Develop the West" aims to address these issues by promoting economic growth through encouraging both foreign and domestic investments into oil and other natural resource exploitation, poverty alleviation, ecological restoration, and large infrastructure projects.[55] While investment and GDP have risen in Xinjiang, one of the pillars of the campaign, to promote environmental protection and restoration, has been weakly adhered to. Most challenging has been that investments into Xinjiang have encouraged more people and dirty industries from other parts of China to move into this ecologically fragile region.[56] Yet, even before the campaign, the region's health and the environment were suffering. According to Stanley Toops of Miami University, the "Develop the West" campaign is not the main cause of these problems, but this investment has certainly exacerbated the long-standing trends of pollution, environmental degradation, and land mismanagement.[57] The current negative trends regarding water supply, air quality, and public health in Xinjiang indicate a strong need to stem the flood of people and dirty industries and for more resources and projects to be devoted to energy efficiency, water conservation, and environmental protection. Such steps will be crucial to lower the environmental health burdens in this remote region.

Erika Scull is a Global Environmental Politics Master's student at American University's School of International Service and was a fall 2008 research intern with the China Environment Forum. She can be reached at: erikascull@yahoo.com.

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