China Sensitization Tour
Groundwater Governance Project (GGA), October 2005

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1. Introduction and background

During the initiation workshop in New Delhi in April 27-28, 2005, it was decided that the project researchers should visit each of the five basin countries early in the project to increase the sensitivity towards and the ownership of the project.. The general goals of the sensitization trips were to increase awareness of the project within each host country, clarify the nomination process for fellows for the research and training program, locate potential research collaborators and mentors, and further develop research priorities and plans. The beginning of this process was made with a sensitization trip to China. The targeted cities were Wuhan, home to China University of Geosciences (CUG) and Zhengzhou, home of the Yellow River Conservancy Commission. The main host in China was CUG in Wuhan who coordinated the rest of the trip. The meeting in Wuhan was attended by both Mark Giordano and Sunderrajan Krishnan after which Sunder was accompanied by a CUG student and a post-doctoral researcher to Zhengzhou where Dr. Han Qiankun, Head of Hydraulic Engineers in Zhengzhou hosted them.

2. Objectives of trip

The objectives of the trip were:

1. Meet and initiate collaboration with organizations and institutions involved in groundwater management, research and media coverage that may provide fellows for the training and action research program and participate in research within the project

2. Present the project, its scope and to advocate for active involvement and commitment

3. Present a draft proposal for a research agenda for the project

4. Make initial steps towards recruiting the fellows for the training program

5. Get feedback from the institutions in terms of capacity building needs and priority research topics that could prove valuable in the more detailed planning of the courses and the research

Apart from these, there were some particular objectives for the China trip. In the New Delhi workshop, an issue that came to the fore was the weakness of English skills among Chinese government officials who were expected to be fellows for the training program. So, another objective of this visit was to:

6. See how to address the problem of bringing together the Chinese and their South Asian counterparts for participating in a common program.

3. Description of groundwater setting/problems in China, with special focus on the Yellow River Basin

China is the fourth largest country in the world and also the most populated with 1.3 billion people. In terms of water resources, the country is poorly endowed. The per capita water resources is only 2200 m^3/year, which is just one quarter of the world average. With rainfall showing high variation from 23 mm in the North-Western deserts to highs of 4000 mm in the South-Western mountains, the per capita water availability also shows a high geographic variation from 121 m^3/year, 343 m^3/year and 428 m^3/year in the Hai, Huai and Yellow river basins, respectively, to a high of 2521 m^3/year in the Yangtze river basin, 3328 m^3/year in Pearl river basin and much higher in some inland basins and the Southwestern parts (2002 annual report of Chinese Water Resources Ministry, from Jin, 2005). The water distribution shows a strong trend with the Southern, South-eastern and hilly South-Western parts having surplus of water and the Northern, North-eastern and North-Western areas having poor water availability.

Groundwater is an important source of water in the water-deficient regions of China – the Northern and the North-Western. On average, groundwater constitutes 20% of total water use in China (Jin et al., 2005). But the situation is very different in the North China Plains (NCP). Here, groundwater is approximately 50% of total water use – and in Hebei province 75% of water use is groundwater-dependent (Jin et al., 2005). The three Northern provinces of Hebei, Shandong and Henan, the core of the NCP and the lower reach of the Yellow River, constitute the most groundwater-intensive regions of China. As in many other parts of the world, poor surface water availability here leads to increasing use of groundwater, some of it being water that has been recharged over long periods – ranging from decades to centuries, especially in confined aquifers. Several areas are now using progressively deeper aquifers, resulting in problems that have surfaced in similar alluvial aquifers around the world: lowering depth to water table, land subsidence caused by dewatering of clay layers accompanied by increasing mineralization and human-induced pollution from industries and agriculture.

Compounding this situation are some other factors. Several rivers in North China are now exhibiting increasing periods of low or no flow in the down stream stretches, e.g. the Yellow river. The reasons stated range from higher upstream use to regional long-term changes in Monsoonal behavior. Furthermore, almost 50% of the Hebei plain overlies shallow brackish water. The extent of the brackish water layer is more than 200 m in the Huanghua area close to the Eastern coast and the Bohai sea and decreases to around 50 m in the inland Shenxian area, which is around 200 km from the coast (Jin, 2005). These factors of decreasing surface water availability and a large region with underground brackish water are causing increasing stress on the aquifers – on average the depth to fresh water is declining at a rate of 1-2 m/yr in the NCP.

In addition to groundwater related problems in agricultural areas, many urban areas are also experiencing increasing water problems. The Cangzhou urban area in the NCP has shown a decline in water tables of 80m in the last 30 years. The Zhengzhou area shows declines of 1-2 m in water tables every year. In Southern China, on the other hand, Nanjing city addressed its groundwater problems by lifting water from the Yangtze river and imposing water permits and a surface-water biased water fee structure (Shah et al., 2004). But such luxury of switching over to the surface-water alternative is not available in water resource-crunched Northern China. The way ahead here could be to increase the value or productivity of each m^3 of water through water saving, transitioning to lesser water-intensive livelihoods and importing virtual water in the form of food and other products.

Groundwater is in a difficult situation in other parts of China as well. In the isolated Western regions, the government is encouraging increasing development of groundwater resources primarily as a measure to address poverty. Being a low-recharge region - groundwater recharge modulus averaging around 50 mm/yr (Jin et al., 2005) - there could be problems there in the not-so-distant future. On the other hand, the Southern regions that have a surplus of water have substantial under-utilized groundwater resources. However, in these regions, there is poor incentive to develop groundwater in the face of plenty of surface water, especially in the Yangtze and Pearl river basins.

In many provinces and prefectures, detailed policies have been devised for drilling tube-wells, spacing between them, price of water extracted and sold (Wang et al, 2005??). However, for a country that has put major emphasis primarily on flood control and inter-regional water transfers, the effort on managing groundwater has been minimal as compared with managing surface water resources. Though innovative policies such as a volumetric pricing card (IC card) for the electricity used in groundwater abstraction are being tried out in some Northern provinces, the technicalities of implementing these policies look daunting even for the powerful Chinese government machinery.

4. Major institutions involved in groundwater research and management, their relative role and importance and some key issues

As in most countries, water management in China is formally and informally governed by a range of ministries, commissions, farm level bodies and other organizations. Further complicating this already complex picture, however, has been a shift in water management institutions needed to respond to the incredible economic and social changes of the past quarter century. This shift in institutions has occurred both at the highest levels of oversight within the government and at the pumps themselves.

Water in China is the property of the State as established in the Chinese constitution and reaffirmed in the 1988 water law and its 2002 update. Until recently, the focus of water policy in China was on engineering solutions to the development of water supply and protection from floods. Responsibility for water policy was also divided along the Ministry lines best suited to solve such problems individually. For example, the Ministry of Water Resources (MWR) had formal authority over surface supplies. Rural

groundwater, on the other hand, was considered as a mineral resource and primarily administered by the Ministry of Geology and Mineral Resources (MGMR), now called the Ministry of Land Resources (MLR). The MGMR/MLR was also largely responsible for the monitoring of groundwater resources, though the MWR also maintained its own observation network. Urban groundwater was the responsibility of the Ministry of Construction, since groundwater supplies were used to provide domestic supplies for the city development overseen by the ministry.

As the issues in water management in China have shifted from development to management, authority over water resources has also shifted from sectoral to integrated lines. The MWR has now been given the preeminent role as the leading government body responsible for overall water planning, monitoring, research, and development of water resources, including groundwater. The MWR also oversees national-level policymaking and inter-provincial policy coordination as well as flood and drought protection and control. The Ministry of Construction, Ministry of Land and Resources (MLR), and the Environmental Protection Agency (EPA) also participate in planning, research, development and protection of water resources.

Under the MWR, direct government involvement in agricultural groundwater management now occurs as part of *integrated groundwater development* programs operating under Water Resources Bureaus generally organized at the country or district level. In fact, as in many other countries, actual implementation of policies and regulations to control groundwater use, in particular in rural areas, has been limited to date.

Despite the role of government institutions, it is at the actual well that most actual decisions on groundwater use take place. Here too there has been substantial change over the last 25 years. Until the economic reforms of the late 1970s, agricultural production took place under collective organization. Similarly, the wells used to support that production were largely built and maintained by collectives, sometimes with financing from the state. After the reforms, production shifted to the household responsibility system and later to individual farm decision makers (Wang et al., 2000). Collective well management was then not always compatible with the new market forces at work. In response, reforms in well management occurred, and wells have been increasingly privatized, though often shared by multiple farmer-investors. In fact it has been estimated that at least 70% of wells in the North China Plain are now run privately and that private sources provide most groundwater financing.

To summarize, water management in general and groundwater management in particular has steadily shifted from oversight by many agencies to oversight by few. At the same time, actual management and ownership of wells has increasingly moved from collective to private hands. The challenge for the future is ensuring that the advantages of the new governance and ownership structures are maximized while possible problems, such as increased overdraft, are reduced.

5. Description of tour and people and institutions visited

Itinerary:
The sensitization tour commenced on Monday 24th October in Wuhan. Sunder gave a morning presentation to the Department of Hydrogeology, School of Environmental Studies, CUG on a subject related to his Ph.D. topic, "Geo-statistics for natural resources management". This was followed by informal discussions on the Groundwater Governance Project in which some technicalities such as the curriculum and research design were discussed. Mark joined that evening after attending a CPWF meeting in Zhengzhou. In the afternoon, Sunder was taken around to the local water supply agency where water from the Yangtze River is treated and supplied to the city of Wuhan.

Tuesday morning, Mark gave a presentation on the project, which was followed by discussions on the project design and how we can address the problem of having Chinese fellows in the training program. Importantly, the presentation was given in English, but the power point behind it had been translated to Chinese. This allowed a much wider understanding by the audience despite the fact that most at least nominally spoke English.

Then, Prof. Menggui Jin gave a presentation on "Water and Environmental Problems in China" which was followed by two PhD students presenting their thesis work. That afternoon, Mark and Sunder visited Wuhan University, Department of Hydraulics where the project presentation was repeated. The group in Wuhan University expressed interest in the project. Mark left for Beijing and his return to Sri Lanka that evening. The next day, Wednesday, Sunder left for Zhengzhou where he met Dr. Han from the city water engineering department. Dr. Han accompanied Sunder to local initiatives at harvesting rainwater, a look at the IC card system for regulating groundwater and at a water treatment plant of the Yellow river.

Two key items were highlighted in the meetings with reference to the project. First, there was concern about the availability of fellows with sufficient English skills. While such fellows might exist in universities, they were unlikely to be found in local or regional government agencies. Second, permission and agreement would be needed with national government agencies including with the Ministry of Water Resources. The Chinese partners could assist with this. While not discussed, the YRCC should also play a role here.

List of people met[1]*:*

Prof. Dr. Jin Menggui, mgjin@cug.edu.cn, School of Environmental Studies, CUG, Wuhan
Han Dongmei, dmeihan@163.com, Ph.D. student, CUG Wuhan
Sun Ronglin, rlsun@2003.cug.edu.cn, Ph.D student, CUG Wuhan
Liu Yan Feng, liuyf@cug.edu.cn, National Science Academy Post-doc, Wuhan
Lu Xiaohui, luxiaohui945@tom.com, Masters student, CUG, Wuhan
Prof. Liang Xing, xliang@cug.edu.cn, Dean, School of Environmental Studies, CUG, Wuhan

[1] Names given in Chinese format: Family name first, followed by given name

Prof. Dr. Lai Xulong, Director of International Cooperation, CUG Wuhan
Prof. Dr.Tang Zhang Hua, zhhtang@cug.edu.cn, School of Environmental Studies, CUG, Wuhan
Du Jinlong, Ph.D. student, CUG Wuhan
Prof. Dr. Qi Shihua, Deputy Dean , School of Environmental Studies, CUG Wuhan
Cao Yinglan, Lin Lirong (Ph.D. students who presented their research work), CUG, Wuhan
Dr. Ma Chuanming, Lecturer, School of Environmental Studies, CUG, Wuhan

Prof. Dr. Yang Jinzhong, jzyang@whu.edu.cn, Professor of Groundwater hydrology and hydraulics in Wuhan University

Dr Han Qiankun, Head of Hydraulic engineers in Zhengzhou and our point of contact for the govt. depts. in this city, hanqiankun@vip.sina.com.cn.
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Li Quoqing li.quoqing@126.com, Zhengzou City Water Dept.
Zhu Xin zhuxindeyouxiang001@sina.com, Zhengzhou City Water Dept.
Xu Yanling jiaoyang3195@sina.com, Zhengzhou City Water Dept.

The key contact person from all these individuals would be Prof. Menggui Jin from CUG, Wuhan.

Interested lecturers in the School:

From the visit, Prof. Menggui Jin and Prof. Jinzhong Yang were interested in being lecturers in the course. They also expressed interest in being involved in supervising research. Prof. Jin has been requested to identify other groups in China that would be interested in teaching within the School. In particular, they have been asked to look for Economists and Management researchers who are working on groundwater.

Research areas/topics:

According to the feedback, the Chinese counterparts expressed that it is feasible to choose 1-2 study areas (sub-basins or counties) and completely focus our research within those limited areas. The idea is that by focusing on small areas, actual experiments in management could be tried. If successful, the results would convince the local authorities of the importance of our project and increase the chances of on the ground impact.. In China, there seems to be considerable amount of work already at characterizing groundwater problems. There is good expertise in hydrogeology and groundwater modeling. This project lends an excellent opportunity to put together existing work and go towards problem-solving mode i.e. consider economic, political factors and suggest technical and institutional solutions. These groups are already involved in research in the Yellow river and North China Plains areas. Specific areas were given as suggestions:

1. **Fen river sub-basin of YRB**: The Fen is a major tributary of the Yellow River, located in what is considered to be the middle reach of the basin. The aquifers of the basin are said to be essentially contiguous with the basin boundaries, simplifying modeling efforts . Further, the lower areas of the basin have characteristics representative to some degree of the lower reach. Prof. Jin already has work occurring in the basin and has connections with local and regional officials whose permission would be needed to conduct significant work and whose influence would be needed for research uptake.

2. **Peoples' victory canal**: The Peoples' Victory Canal is considered a major achievement by the Chinese government. It is a large irrigation district in the NCP, just north of Zhengzhou. While the canal had numerous problems in its early years, these were later corrected and it is considered to be a major success. Conjunctive use of ground and surface water is an issue. There should be substantial hydrologic data available for the district and work there could be considered representative of irrigation districts within the YRB and NCP in general.

3. **Zhengzhou**: From Sunder's visit to the Zhengzhou area, it looks interesting. The government officials from the area also show earnestness and cooperation for the project. The city lies on the banks of the Yellow river and has borne the recent brunt of decreasing water flows in the river. It is now increasingly dependant on groundwater – currently 30% of the city's water resources are borne by groundwater. The city has 300 wells all owned by the government. These wells are very deep, 500m – 100m. The increasing dependence of the city on groundwater has led to depletion of the water table by 1-2 m / year. There is also high risk from pollution of the aquifer from water infiltrating from the Yellow river.

The surrounding rural areas also show great dependence on groundwater. The Xinmi rural area offers a potentially interesting study - an area has 700,000 inhabitants and an average annual rainfall of 650 mm. The farmers, especially those located in the hills are quite poor and suffer from low water availability. The government is therefore constructing watershed development projects in which the locally available rainwater is harvested and supplied to the farmers. Yao Zhengque from the Xinmi water resources department explained to us the working of this system. Water is collected in lakes and supplied through underground pipes to the farmers which have either underground storage tanks or use water directly. Eight such projects have been constructed in the area. In the valley area, there is more dependence on groundwater and the government is trying to regulate the water withdrawal through the IC card system explained below.

Zhuong-Mu area: The purpose of the visit to this village was to observe the recently introduced IC card system for regulation of groundwater. Currently, there are 400,000 farmers in the area who use 15,000 wells. Out of these, 300 wells have been equipped with the IC card system since three years back. The capital cost of each system is around Yuan 2,700 or US $338. Once the card is replenished the farmer can start pumping water. Currently the charge is just the same as the electricity charge since this is only an experiment and there are many other farmers who do not have this system. Once the card is famished, water cannot be pumped. The current premise is that even if the charge is the

same, just having such an IC card results in the farmer using water more prudently. The government authorities claim that this premise is being affirmed by their observation in during the last three years.

Comments/suggestions received on the project, course outlay and organization, research organization, etc.

It was felt that as designed currently, the project requirement of having fellows from China who are conversant in English is unrealistic. It is well nigh impossible to obtain government officials who can speak English, though many of them can read and understand English and can communicate with the help of an interpreter. The need of the project was very much appreciated by both university and government officials. It was asserted on several occasions that this project offers an opportunity to address pressing groundwater problems in China. It was felt that University researchers have no problem in spending an entire month for the training program, but the same cannot be said for government officials. At the same time, it is extremely important to involve government officials in the project to offer any meaningful suggestions and later acceptance.

6. Conclusions and recommendations

Despite the apparent problem of lack of sufficient English proficiency among the Chinese candidates for the Training and Research Program of the project, the original model of representing both South Asian and East Asian basin countries on the training and research program has been maintained. This is because it is perceived to be a significant attribute of the project to work inter-regionally, to develop a broad understanding of groundwater problems and management aspects among the fellows and to develop a lasting network of groundwater professionals within the five basin states.

Having made this decision it is also recognized that special language provisions may be necessary to ensure the best implementation of the training program. Depending on the proficiency level of the applicants, especially the seniors that will participate in the last week, simultaneous translation will be arranged.

Based on the suggestions coming up for study areas, it is recommended to select which area is more relevant and feasible for the project and develop a more detailed concept note to be evaluated separately for its scientific content as well as its coherence with other parts of the overall project.

7. References:

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