Assessing the Achievements and Problems of Rural Resource Management Programs in Western China: A Case Study from Gansu Province

By Seth Cook

In recent years, environmental problems in China's western regions such as water shortages, desertification and deforestation have generated considerable attention in the Chinese press. The government has responded with an array of measures designed to ameliorate these conditions, including sloping land conversion, the logging ban, and rural water supply initiatives. How effective have these programs been in rural areas? Using a case study of one project in Gansu province, with comparative reference to two other programs, my aim is to illuminate some of the achievements and problems of state-sponsored resource management in western China.

From 2000 to 2002, I conducted 11 months of dissertation research on a rainwater harvesting project in Gansu province, which is being promoted as a means of overcoming severe water constraints and poverty in rural areas. Rainwater harvesting is the collection and concentration of rainfall runoff, and has been used for centuries in northwest China to meet household water needs. Modern iterations both for household use and for irrigation are a recent innovation pioneered by Chinese scientists since 1988. Originally a provincial government program in Gansu, it has since spread to neighboring provinces. While quite successful in some respects, rainwater harvesting also faces systemic problems that are common to other rural development programs in China. The current focus on western regions in the central government's Western Development Program (*xibu da kaifa*) underscores the importance of a critical analysis of these issues.

Government Promotion of Rainwater Harvesting

The large-scale dissemination of rainwater harvesting in Gansu has occurred in two main phases: (1) the 1-2-1 program, which began in 1995 and centered on solving drinking water problems; and (2) the current focus on the use of stored rainwater for the supplemental irrigation of grain, orchards and greenhouses. The 1-2-1 program derives its name from the recommended proportion of catchment area, storage tanks and cropland targeted for irrigation. The idea was to build 100 m^3 of catchment area, and two concrete water storage tanks and irrigate one mu (1/15 hectare) of courtyard land devoted to cash crop production. In practice, the 1-2-1 program focused on building water tanks for household use, with roofs and courtyards serving as the principal catchment surfaces that channel water into the tank.[1] County and township governments together with county agricultural extension bureaus provided the concrete needed for water tank construction, with villagers supplying the sand and labor.

Since 1997, dissemination efforts in Gansu have shifted to include rainwater harvesting agriculture,[2] which aims to provide limited irrigation of crops, particularly grain, vegetables and fruit trees. Water tanks have been built adjacent to fields, with roads, hillsides and concrete surfaces serving as catchments. Precipitation stored during the previous fall and winter supplies enough water to irrigate crops during the critical period before the arrival of the summer rains. Supplemental irrigation via rainwater harvesting has led to substantial increases in yields of grain crops (e.g., corn and wheat) and fruit trees (e.g., apple, pear, and peach) in some localities (Li et al., 1995; Gao and Zhu, 1996). It has also facilitated the commercial production of vegetables in greenhouses, providing farmers with an alternative source of income. The implementation of rainwater harvesting in Gansu has led other northwestern provinces such as Ningxia, Shaanxi, Shanxi and Inner Mongolia to adopt similar programs aimed at disseminating rainwater harvesting for household and agricultural use.

On the whole, the 1-2-1 program has been quite successful. It has basically solved the drinking water problems of more than a million people in semi-arid rural areas of Gansu.[3] This is a major achievement, and has led to a dramatic improvement in the living standards of rural residents. The construction of water tanks in the courtyards of rural homes has eliminated the need to spend time and energy hauling water from distant sources, as farmers were forced to do in the past. This has freed up labor for other activities, such as the expansion of

animal husbandry, which had been restricted by water scarcity. Water harvesting has played a role in improving dietary patterns, particularly in terms of greater consumption of meat and vegetables, since production of these foods was limited in the past by lack of water. The increased availability of water for washing has also led to improvements in hygiene.

The success of the 1-2-1 program can be attributed to a number of factors. First of all, the program addressed a critical need of rural residents using a relatively simple, inexpensive technology. The program was well timed, in that it began in 1995 during a period of severe drought, which underscored the need to address rural drinking water shortages. The fact that it built upon indigenous water storage systems meant that it was already deeply familiar to farmers rather than something new that was imposed from the outside. Having depended on earthen tanks to supply drinking water in the past, farmers readily appreciated the value of concrete water storage tanks. The small scale of the tanks made them appropriate to the natural conditions of the area, as well as to operation by individual households, which are the primary unit of agricultural production in China today. Moreover, rainwater harvesting systems such as that promoted by the 1-2-1 program can produce immediate benefits, without the long construction delays associated with large-scale water conservancy projects. As soon as the tanks are completed, they can be used to store water for household needs. The fact that the program could be accomplished quickly in a given village accorded well with the short time horizons of local officials, whose terms are only three years long and who need to make their mark quickly if they are to rise in the bureaucracy.

The 1-2-1 program was able to harness local initiative where past rural development projects did not, because it was directly in line with farmers' need to assure subsistence and their sense of self interest. Unlike improvements to the land such as terraces, water tanks became the property of the household. They were something that farmers built for themselves, not for the government. For this reason, farmers have had a clear incentive to construct and maintain the tanks with care.

Compared with the 1-2-1 program, the record of rainwater harvesting agriculture has been far less impressive. While it appeared to be working well in a few showcase villages that I visited, it has not been as widely disseminated, and has run into a number of problems, such as farmer skepticism, inadequate technical assistance and relatively high start-up costs. While the technical viability of rainwater harvesting agriculture and its appropriateness to the region have been demonstrated both in scientific experiments and in the fields of a number of enterprising farmers, government agencies have not been very successful in disseminating it on a large scale.

It appears that provincial and county government agencies can accomplish simple projects of limited duration like 1-2-1, but tend to stumble when implementing programs that require sustained work with close attention to local context.

The contrasting achievements of household and agricultural versions of rainwater harvesting are indicative of state capacities in rural development. The 1-2-1 program was designed to address a relatively simple problem—essentially all that was needed to meet a household's drinking water needs was to build one concrete water tank and pave over their courtyard—and one that lent itself to top-down, bureaucratic implementation. It succeeded partly because it fit well into the campaign framework. Conversely, the agricultural applications of rainwater harvesting require continuous extension work over several years (and longer in some cases), as well as enough flexibility to meet the specific ecological and socioeconomic conditions in each locality—things which government bureaucracies are not as well suited to providing. Thus it appears that provincial and county government agencies can accomplish simple projects of limited duration like 1-2-1, but tend to stumble when implementing programs that require sustained work with close attention to local context.

Rural Resource Management: Problems and Contradictions

Many of the problems that I observed in my research on rainwater harvesting are systemic in nature and thus are relevant to other state resource management programs currently underway in western provinces. These problems, in turn, are often symptomatic of more fundamental issues such the target-driven nature of China's administrative system in rural areas, as well as the lack of accountability on the part of local cadres both to their rural constituents and to the dictates of central authorities. Under the

xiaguan yiji (one-level-down) management system which was implemented in the mid-1980s, officials at all levels were given full authority over their subordinates. As O'Brien and Li (1999: 171) observe, "one-level-down management has encouraged cadres to be hypersensitive to their immediate superiors at the expense of other interests, and it has increased the ability of superiors to get their underlings to carry out unpopular policies. Rural cadres may obey a directive from their bosses one rung up, even if they know it conflicts with a measure promoted by higher levels." A related issue are the incentives created by the cadre responsibility system (*ganbu gangwei mubiao guanli zerenzhi*) to meet fixed targets assigned by one's superiors (O'Brien and Li, 1999). Targets are assigned to tax collection and family planning, as well as other measures like tree planting. Each target is assigned a numeric value in the cadre's performance evaluation. In the case of tree planting, what matters is the number of trees planted in a given year, not how many trees survive one or two years later. The necessity of meeting fixed targets and pleasing one's immediate superiors, together with the brief tenures of most cadres in a given post, encourage short-term thinking and the tendency to favor display over substance in rural development and natural resource management.

Display over substance. Water collection tanks for rainwater harvesting agriculture built adjacent to roads were often intended as a showcase for official display. In many cases tanks were poorly constructed and lasted only a couple of years, but they fulfilled a purpose in terms of meeting bureaucratic targets and facilitating convenient inspection by visiting cadres. From an official standpoint, appearances are more important than whether programs actually work. As long as higher ups and other visitors are pleased with what they see on cursory tours of rural areas, then projects are deemed a success. The views of local people matter little, because officials are not directly accountable to their rural constituents, only to higher levels of the government bureaucracy. Furthermore, official visits to rural areas are carefully scripted, and there is little chance of local views being heard which contradict the priorities of the cadres arranging the visits. For this reason, officials have little incentive to produce lasting results, only to meet their targets in the current campaign. From the perspective of state agencies, whether or not a given program lends itself to display often matters more than its content. The emphasis on large infrastructure projects in the central government's current Western Development Program—as opposed to investments in areas such as primary education, health care and local road improvement which matter more to rural people—is partly a result of the imperative for display.[4]

Science and technology fetishism. The obsession with technological solutions to complex problems that characterizes China today borders on a religious faith.[5] While there can be no denying the importance of science and technology in China's development, in many rural development projects there is a clear tendency to value technology without reference to its ability to improve human welfare, just as there is an *a priori* preference for greater technological sophistication. I observed this in Gansu with respect to greenhouses irrigated by rainwater harvesting. There are at least three gradations of sophistication available in Gansu, but it is the most advanced types of greenhouses which are upheld as examples, and that local government officials show most often to visitors. The implicit assumption behind this is that the latest technology is the best, seemingly without consideration of whether it is suited to the actual conditions prevailing in an area. Rainwater harvesting is relatively low tech, and this has been a major source of its success. However, this simplicity is seen not as an asset, but rather as a liability. In fact, provincial and county government officials speak of the need to "raise its scientific and technical content." Ironically, high tech is glorified in spite of the fact that China has an excellent record in the development and dissemination of appropriate technologies such as rainwater harvesting, efficient cookstoves and biogas generators, which have benefited a much larger number of people than advanced technologies. For instance, more than 120 million efficient cookstoves have been disseminated in China, reaching seven out of ten rural households (Kammen, 1995). About five million household biogas digesters are in use today, mostly in the southern provinces, serving some 25 million rural people (Qiu et al., 1990).

The preference for technological sophistication is evident even in afforestation projects. As one report on a large shelterbelt system emphasizes, "the composition of [the] shelterbelt forest system was based on countless laboratory experiments involving computer modeling and wind-tunnel tests. As a result, the shelterbelt forest was planted in a configuration designed to provide optimum protection for vegetation and the surrounding environment" (Williams, 2000: 510). While afforestation is less of a technical problem than a social one (particularly a collective action issue), it is no accident that technical solutions are preferred. Social approaches open up the possibility of questioning and thus are potentially threatening to a party that has long presented itself as the arbiter of truth. Technical approaches, on the other hand,

facilitate the exercise of state power under the seemingly neutral guise of science.

Corruption. Corruption is symptomatic of a lack of accountability on the part of local government officials to both their rural constituents and to central authorities. It is often extremely difficult to detect, because cadres are adept at concealing evidence from visitors to their localities, whether they be higher officials or foreigners. For instance, villagers in Gansu told me that before representatives from a Chinese foundation visited their village to view a water harvesting project they had funded, local cadres arrived first to replace the lids of water tanks with ones which bore the foundation's name. The foundation representatives went away satisfied with what they had seen, when in fact they had viewed tanks that had been constructed with money from another organization. There were numerous other examples of cadre corruption that I encountered in my fieldwork, such as discrepancies in the number of bags of cement delivered to build water tanks as part of the 1-2-1 program. Another case was the reduction or even outright cancellation of grain and cash subsidies for sloping land conversion (*tuigeng huanlin*). Villagers in one of my field sites told me that the police set up roadblocks to levy charges on tractors, and that their vehicles were subject to five different types of taxes. Farmers who refused to pay were beaten up. Corruption is rampant in rural areas for a number of reasons: lack of accountability on the part of local governments, bureaucratic control over the distribution of resources and the expansion of township-level administration in the last two decades (Bernstein and Lü, 2000; Saich, 2001).

Top-down, one-size-fits-all approaches. There is a longstanding tradition in China of using large-scale campaigns to develop the economy, consolidate state power and achieve environmental goals such as afforestation (Economy, 2002). The Western Development Program is the latest example of this tradition. The government's predilection for mass campaigns is symptomatic of the tendency towards top-down, one-size-fits-all approaches to rural development and resource management that ignore local ecological, social, and economic differences. In China, there are often large variations within counties, let alone within provinces, so attention to these differences in formulating policy is paramount. However, state bureaucracies are not accustomed to conceiving and implementing context specific approaches, and this has been a major stumbling block to the dissemination of rainwater harvesting agriculture.

The sloping land conversion program, which has been conducted on a wide scale in Gansu and is part of central government policy to promote grass and tree planting in ecologically fragile areas throughout western China, typifies the limitations of the state's campaign-style implementation. The program arose from the center, not from the localities where it is being promoted, and so the program reflects central state rather than local perceptions of land use issues. As with past grass and tree planting projects, since local people were not consulted in the planning process, they do not necessarily see their interests as coterminous with the project, and may not participate conscientiously in its implementation. Apparently, tree survival rates are even lower than in previous tree planting campaigns—a stark commentary indeed, given the high seedling mortality rates of the past.[6]

The limited nature of local participation removes those who have the most at stake from the decision-making process, and also those who are most familiar with local conditions, and may be in a position to suggest solutions. Farmers know better than anyone else which lands (if any) are suitable for trees, which ones are best planted in grass, and which plots should be maintained in grain crops. But the farmers are not being consulted in making each county's crop retirement plan. Instead, the county government decides how much land to allot each year to crop retirement, then hands that figure down to the township government, which then draws up a plan of which lands will be included in the plan for that particular year. In two of my research sites that have been included in the plan, the only lands being retired are adjacent to roads, clearly meant for convenient viewing by cadres who will be able to drive by and inspect the program without having to get out of their cars. Several of my other research sites that lie close by were not included in the plan, and villagers believe this is because they do not have any land adjacent to the main road. Another feature of the sloping land conversion program is that in practice it does not seem to be exclusively targeting fragile hillside lands, which are the ones where planting grass really makes sense and were supposed to be the focus of the program. This is not only the case in Gansu. For instance, a former Ford Foundation program officer in China informed me that flat lands all around Zhongdian in Yunnan province were planted in trees to meet targets in this program.

The fact that sloping land conversion builds the interests of households into the program is positive, as is

the scale of state investment in terms of the commitment that it represents to environmental goals. On the other hand, there are doubts about its long-term viability. The types of vegetation created tend to be single species, so it is of dubious value ecologically, besides the potential for slope stabilization. Since there is little monitoring of its environmental impacts, there is no way to tell whether or not the program is actually stemming erosion. Another problem is the economic distortions created by grain subsidies, which have depressed the incomes of grain farmers in some areas.[7]

Many of the same patterns are also evident in the logging ban. The areas covered by the ban are determined by government agencies, without consulting local people or compensating them for the inability to harvest products from individually and collectively owned forests. Moreover, the lands covered by the logging ban are not exclusively primary forests, and include many secondary forests which are not necessarily critical in terms of biodiversity, but which rural people depend upon for their livelihoods (Xu et al., 2001). The policy is a attempt to stem deforestation through central planning, when in fact a large part of the forest loss was originally caused by central planning.[8] The logging ban is causing enormous hardship at the local level both because of the failure to distinguish between areas of greater and lesser ecological importance, and because of a preference for locking up tracts of forest land (often prohibiting the extraction of non-timber forest products as well as timber), rather than promoting sustainable use.[9] The logging ban's simplification of a complex landscape has facilitated bureaucratic administration, though at a high price in social and economic terms. As in the case of rainwater harvesting agriculture, the tendency towards simplification in sloping land conversion and the logging ban underscores the state's inability to cope with complexity and heterogeneity at the local level.

Conclusion

The problems with government-sponsored programs suggest the need for alternative approaches. In the case of rainwater harvesting agriculture, a more limited state role in the dissemination process may be needed. Rather than trying to manage all aspects of the program, county and township governments can focus on providing training and facilitating the creation of markets for affordable irrigation technologies such as micro-drip systems. This was the case for the successful National Improved Stove Program in China, which has led to the adoption of more efficient biomass stoves in some 120 million rural households. Nongovernmental organizations can also play a key role in market creation. For instance, the efforts of International Development Enterprises to promote drip irrigation systems geared towards small farmers in northwest China and elsewhere have been quite promising (Postel et al., 2001).

In the case of tree and grass planting programs, a more limited state role is also appropriate. Rather than township governments dictating to peasants where and when to plant ground covers—an approach which is almost certain to fail—local governments should encourage farmers to retire hillside lands on a voluntary basis once their food security needs have been met (a process which rainwater harvesting can facilitate). Once farmers are ensured of adequate grain supplies even in dry years, hillside plots can be planted in grass, which can serve as fodder for the expansion of animal husbandry. Provided that greater attention is given to the marketing of animal products—a role that county and township governments can provide—the expansion of animal husbandry can lead to higher incomes for farmers, as it already has in many cases. Other options include orchards and greenhouses for cash crop production. The common denominator is the need to pay close attention to farmers' preferences and maximize their choices. This in turn implies a qualitatively different role for the state in rural areas, namely less emphasis on control and more attention to the facilitation and provision of services.

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ENDNOTES

[1] In some of the villages I visited, the irrigation of courtyard cash crops was a part of the 1-2-1 program. However, in most villages in Yuzhong and Dingxi counties (where my field sites were located), the 1-2-1 program focused on constructing household tanks to meet villager's drinking water needs, and did not include an irrigation component.

[2] For a more extensive discussion of rainwater harvesting agriculture, see Cook et al. (2000) and Li et al. (2000).

[3] This is the case regardless of whose figures one uses, and even if government estimates are substantially downsized. In times of severe and prolonged drought, however, those households with only one tank would still suffer from water shortages. Furthermore, rainwater harvesting cannot cope with droughts that last several years.

[4] There are several other key reasons for the emphasis in the Western Development Program on major infrastructe investments like the Tibet-Qinghai railroad and road-building projects. The first is the belief that poor infrastructure is a major bottleneck to the development of western regions. The second is economic stimulus. As Kahn (2003) observes, the Chinese leadership is concerned that a slowdown of the economy could threaten its hold on power, and is pumping large amounts of money into infrastructure in western regions in order to keep the economy growing rapidly.

[5] China's successful launch of a manned spacecraft in October 2003 is the latest and perhaps most dramatic example of this phenomenon.

[6] Information on tree survival rates in the sloping land conversion program from Hein Mallee, Ford Foundation Beijing (personal communication, 30 July 2003). See also Smil (1984:13-15) for information on the dismal record of past afforestation campaigns. Smil notes that according to Chinese government sources, no more than one-third of seedlings planted since 1949 have survived. In many cases, survival rates were below 10 percent.

[7] Hein Mallee, Ford Foundation Beijing (personal communication, 30 July 2003). See also Xu et al. (2001).

[8] On the contributions of central planning to forest destruction, see Richardson (1990) and Ross (1988).

[9] Seen in a wider regional context, the logging ban has simply shifted unsustainable logging to neighboring countries, including Myanmar, Russia, Malaysia and Indonesia. China is even importing wood from countries as far away as Gabon, and is now the second largest timber importer in the world after Japan (Pearce 2001).