

# Water Harvesting in Damaidi Village, China

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## Abstract

*Damaidi village lies in the Xizhuang watershed in the western part of Yunnan province, China. In recent times the local population has increased, family structure has changed, and livelihood strategies such as labour migration, tea cultivation, and livestock raising have become increasingly important. Improved water harvesting has reduced women's work, improved maize yields, and encouraged the establishment of tea plantations. However, struggles between power holders have led to conflicts over irrigation and drinking water. This case study shows that improved water harvesting can improve the livelihood security of poor people and reduce women's work.*

## Introduction

Water is a crucial natural resource for local livelihoods. It is also the main driving force behind soil erosion in Xizhuang watershed. The People and Resource Dynamics in Mountain Watersheds of the Hindu Kush-Himalayas Project (PARDYP) in the Xizhuang watershed has had two aims in relation to water. The first is to carry out scientific research by establishing a hydro-meteorology monitoring network to study the dynamics of water resources in the watershed. The second is to carry out action research on the building of water tanks, the establishment of local irrigation systems, and the building-up of local capacity to sustainably manage these resources.

The two main characteristics of Damaidi village's access to water is the seasonality of rainfall and the location of springs within the watershed. The amount of rainfall varies greatly between the wet and dry seasons. About 80% of each year's rainfall falls in the May to October season. Damaidi village has limited access to water resources as it is located in an upland area and most of the area's springs lie below at the bottom of the mountain.

The availability of water in this village improved greatly after PARDYP built four big drinking water tanks, four big irrigation water tanks, and 34 small irrigation water tanks in this village in 2000. These improvements led to greatly reduced time taken to collect drinking water, irrigate crops, and dilute pesticides. It also led to improved local agricultural productivity. This paper explains the impact of these projects. It also explains the impacts of water harvesting projects on local village governance and relates the water issue to local social, economic, and political aspects. This paper begins with a historical overview of the project site of Damaidi village, describes the water harvesting projects, and then analyses the benefits and conflicts arising from these initiatives.

## Change In Damaidi Village

Major economic reforms began in China in 1978 with the establishment of the Household Responsibility System where farmlands were contracted out to individual farmers. The reforms in forestlands happened in 1982 by contracting out their management. These were turning points for local resource management in Damaidi village.

### People and resource dynamics

#### *Population growth and family structures*

In 1983 Damaidi village had 58 households with 330 members and an average household size of 5.7 people. By 2003 the population had grown to 434 members in 94 households with an average family size of only 4.6 members. From 1983 to 2003 the population increased by 31% and the number of households increased by 62% (Figure 10.1). The average household size decreased by almost one person.

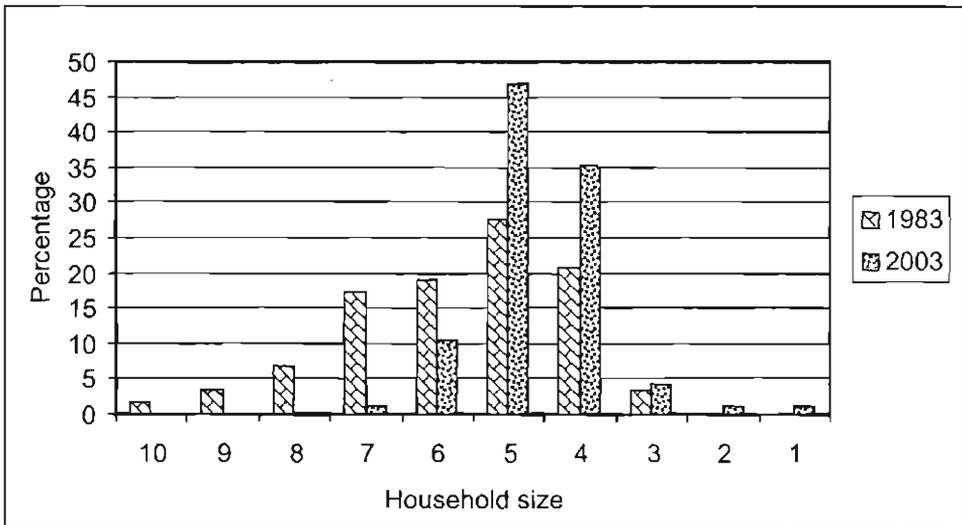


Figure 10.1: **Size of households in Damaidi Village, 1983 to 2003**

In Damaidi, population increases have resulted in a decline in the amount of cultivable land per person although this has not happened to all households. Since the government redistributed land in 1983 the total land of each household has remained the same regardless of the increase or decrease in the size of families. Hence, for those households whose members have decreased since 1983, such as those only producing daughters who leave the family home on marriage, the per person land area has increased. But, those families with more sons and therefore daughters-in-law have seen their per person land areas decrease. The total number of households has increased, but household sizes have declined. Some smaller households lack labour and land and some have become poor (see Table 10.1).

#### *Land use change and labour migration*

There are three types of land in Damaidi village. The best land (Type I) covers 14.2 ha. It mostly lies in the middle level parts of the village, in sloping areas, and on very fertile sloping lands at the bottom of the village. The secondary land (Type II) covers 5.3 ha in the upper parts of the village. The poor quality land (Type III) covers 6.5 ha in the high and infertile

mountainous areas above the village. Before 1982, due to low agricultural productivity and the non-availability of other sources of food, the crops maize, wheat, buckwheat, and oat were planted on all these lands. Two crops per year can be planted on the Type I and II lands with maize in the wet season (May-October), and maize and wheat in the dry season (November-April). Type III lands only support a single crop of buckwheat or oats once a year. Even with all of these lands under agricultural production, the local people could only produce food to feed themselves for about 10 months of the year.

After the Household Responsibility System was introduced, the system of compulsory communal labour was abolished and individual households became responsible for managing croplands. This and increasing labour out-migration has seen land use change from subsistence to more cash cropping. This change is reflected in the turning over of much of the high altitude Type III lands to grasslands or forestlands and the establishment of 5 ha of tea plantations on lower altitude Type III lands in 1986. It was households with more land per capita that planted tea to improve their economic situation (Table 10.1).

**Table 10.1: Economic stratification in Damaidi Village, 2003**

Rank	No. of households	Indicator	Livelihood situation
Rich	12	2 floor cement house	4 households have government employees and 8 heads work outside the village
Above average	54	Have colour TVs and money invested	Some members employed as teachers. Most have areas of tea and some have livestock
Below average	22	1-floored mud-built house and black and white or no TV. No money to investment	Some households get income from tea, some from livestock, and some from working outside
Poor	6	Not enough food	less labour, less land, or household member is handicapped

## Socioeconomic dynamics

The local economy of Damaidi village has changed from a largely subsistence economy in 1983 to a more diverse economy with a mix of livelihood strategies. Traditional agricultural production has lost its core position in local activities as outside work, tea cultivation, and livestock have emerged as new sources of income.

Labour migration started in 1983. Of Damaidi's 94 households 80 have members working away from home. Of the other households four belong to local leaders who receive regular salaries. In 71 households the menfolk spend the dry season working away on labouring jobs such as logging, building construction, and mining. These activities can yield US\$242-363 per year per family. In seven households both men and women work outside the village the whole year. This gives them high incomes and they rent their village land out to others.

Local people planted 5 ha of tea in 1986 and 6 ha in 2001-2002. All village households have some tea bushes. Ten households have old areas of tea over more than 0.2 ha. One mu (0.06

ha) of tea plantation will normally yield 65 kg of tea leaves which can give a cash income of US\$97-121 per year.

Fifteen households keep goats with a total of 902 goats in the village, and 28 households raise cattle with a total of 97 cattle. It is mostly old people and children who look after livestock. One goat can be sold for \$24-36 and a cow for \$97-121.

Before 1982, the communist ideology practiced in Damaidi village was based on the common life model of communal production. After that individual households became differentiated through their different livelihood strategies. Before 1982 local farmers produced food commonly and benefits were shared through the Gongfen which calculated people's share based on their labour inputs. In Damaidi village, male and female agricultural labour was given a nearly equal value. These benefits were distributed at the end of each year. After the introduction of the Household Responsibility System land was distributed to every household based on their population irrespective of their number of men and women. Households thus became the unit of demand, consumption, and production.

Almost all Damaidi men work outside the village during the dry season and return for the wet season to work on the fields planting and harvesting maize and then planting wheat. A local saying says goes, "When the hoar frost descends, every man leaves the village." After the men leave to work outside all household tasks fall on the shoulders of the women.

Initially all outside jobs were physical labouring jobs such as in logging, infrastructure construction, and mining. These are most suited to men and so many of them spend about half of each year working outside the village. In recent years women have also started to find outside jobs in restaurants and handcraft industries. However, they do not earn enough to provide the main income for their families.

In Damaidi tea is harvested three times from March to October. The harvesting and processing is carried out by women. Households with more tea than they can harvest hire in other women to help, paying them \$0.06 per kg of fresh tea harvested or \$0.96 per day. Raising pigs and collecting pine needles for livestock bedding are women's other major year-round tasks.

### **Social-political dynamics**

The local socio-political system has changed since the Community Organisation Law was implemented in 1998. There are now two main competing power groupings inside the village. One is led by the new community administrator whilst the other is led by the former communist party secretary. They compete over the management of local affairs. At the higher level they both have support networks in Lijiashi Administrative Village. The local communist party secretary is in-line with his counterparts at Damaidi village and Lijiashi Administrative Village and represents the old authority of the community. The new community administrator is in-line with the administrative governor and represents the new generation of power holders. This power structure has had a significant effect on local water harvesting projects.

### **Water Harvesting Projects**

Water has long been the scarcest resource in Damaidi. This meant that local people were restricted to growing opium, maize, and wheat. Although irrigation water was very scarce

there was enough for drinking due to the dense forest cover and sparse population. Much forest was cleared for grain production after the Great Leap Forward in the 1960s. In addition, population increased rapidly and a shortage of drinking water began to be felt. Local people had to carry water from the top of the mountain or bring it the long distance from Wanjiacun village. At that time one family member had to spend about half of each day fetching water.

In 1976 Damaidi village was granted \$726 to build a drinking water system. However, the money was not enough to complete the system. So, villagers prompted the communist party secretary to ask for more money from upper level government. The request was refused. The uncompleted system was made up of a big water tank by a spring and a waterpipe which led to the village, although not to individual households. Local villagers had to carry water from the end of the pipe.

In 1999, sponsored by the new community administrator and a local teacher, a few households wanted to build a small water system that linked the waterpipe to their houses. The previous twenty years of waiting in line to collect water from the pipe had inspired many villagers to become involved in this plan and 79 households joined in. The teacher's brother was the leader of the county water bureau. Due to this link the group of 79 households were given \$3027 plus \$14 per person to extend the water system. With these funds they rebuilt the spring water tank, built three drinking water tanks behind the village, and fitted a network of water pipes through the village. The first tank holds 5m<sup>3</sup> of water and supports eight households, the second contains 27m<sup>3</sup> and supports 38 households, and the third tank contains 29m<sup>3</sup> and supports 33 households. Three small individual tanks and one middle water tank were built for the 14 households who due to distance or high altitude were not in the group of 79.

In 2000, the PARDYP project began in Damaidi village. It identified the lack of irrigation facilities as a major problem. The project thus began to support the building of an irrigation system. This system includes one large tank holding 96m<sup>3</sup> and 34 small tanks to receive rainwater for irrigation. In 2002, the government gave further assistance for building a further two large irrigation tanks. These tanks together form Damaidi's water harvesting system irrigating a combined total of 9 ha of land (Table 10.2, Figure 10.2).

**Table 10.2: Area irrigated from different sources in Damaidi village**

	Irrigated land area (ha)
Irrigation system	4.66
Drinking water system	1.18
Small tanks	3.2
Total	9.05

Source: field household surveys, 2003

## Benefit and Conflicts of Water Harvesting

These water harvesting projects have largely overcome drinking water and irrigation shortages in the village. The seasonal irrigation from the large tanks, supplementary water from the small tanks, and water from the drinking water tanks guarantees the growth of maize and the availability of water for pesticide and fertiliser application. As a result, local maize production has increased and less labour is needed. The water taps within the village mean that villagers no longer have to carry water in from outside. Land productivity has improved and local labour has been made available for other tasks such as tea production. However, conflicts have arisen between the old and new power holders and between men and women over managing the new water system. Figure 10.3 diagrams the impact of the changes.

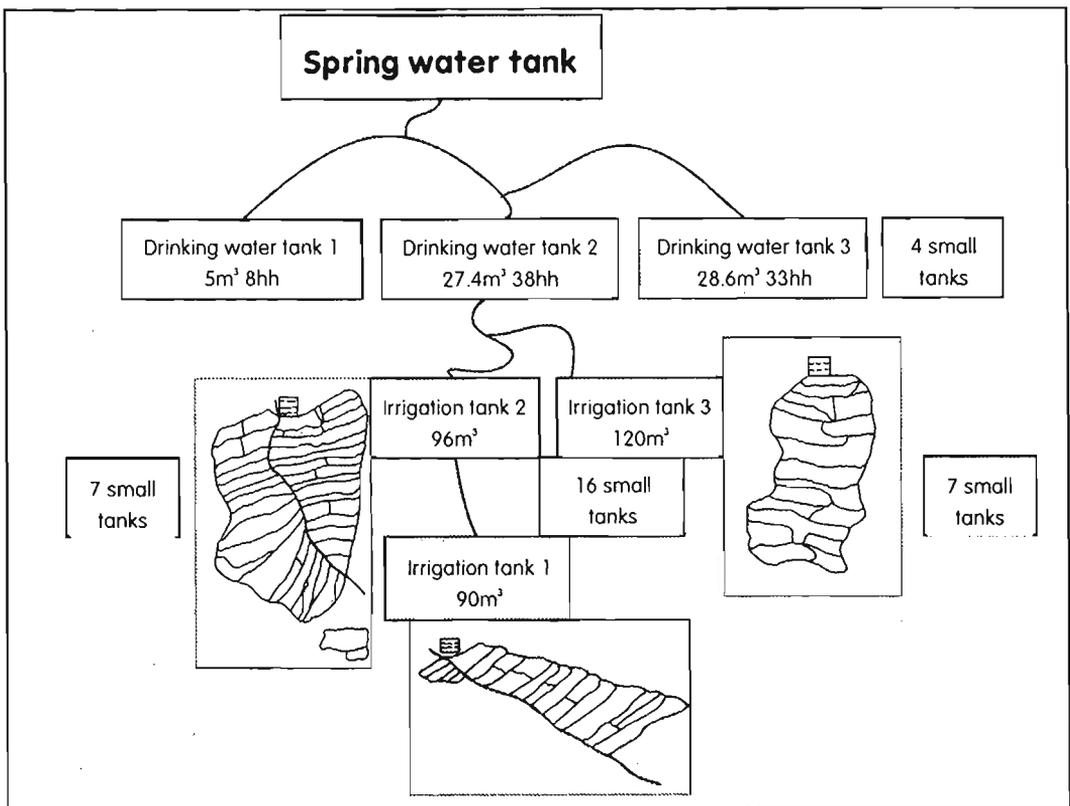


Figure 10.2: Damaidi water harvesting system

## Benefits

### *Saving women's labour*

The new water harvesting system has saved much labour that previously went to carrying drinking water. The group of 79 households used over 19,000m<sup>3</sup> of water in 2001 which would have needed more than 19,000 working days to carry from the traditional source. As most men work outside the village this task would have fallen to women for much of the year.

Previously it was the carrying of water to irrigate the maize fields which took the most labour. In the local system, where maize seedlings are planted out from nursery beds, it is crucial that they are irrigated immediately and thoroughly. On average, three working days are needed to plant and irrigate 0.06 ha of maize. Currently, one labourer is enough to finish the same work by irrigating directly from the water harvesting system. The water system irrigates 9 ha of land and therefore saves 271 working days every year. This means that 9,771 less working days are needed in a year. This does not include the labour cost of carrying water to prepare pesticide and fertiliser. It is the women who most appreciate the new water harvesting system.

### *Improving maize yields*

There are two ways of growing maize in Damaidi village. The first is to directly plant seeds and the second is to grow-on seedlings in a nursery and then transplant them into the fields. On

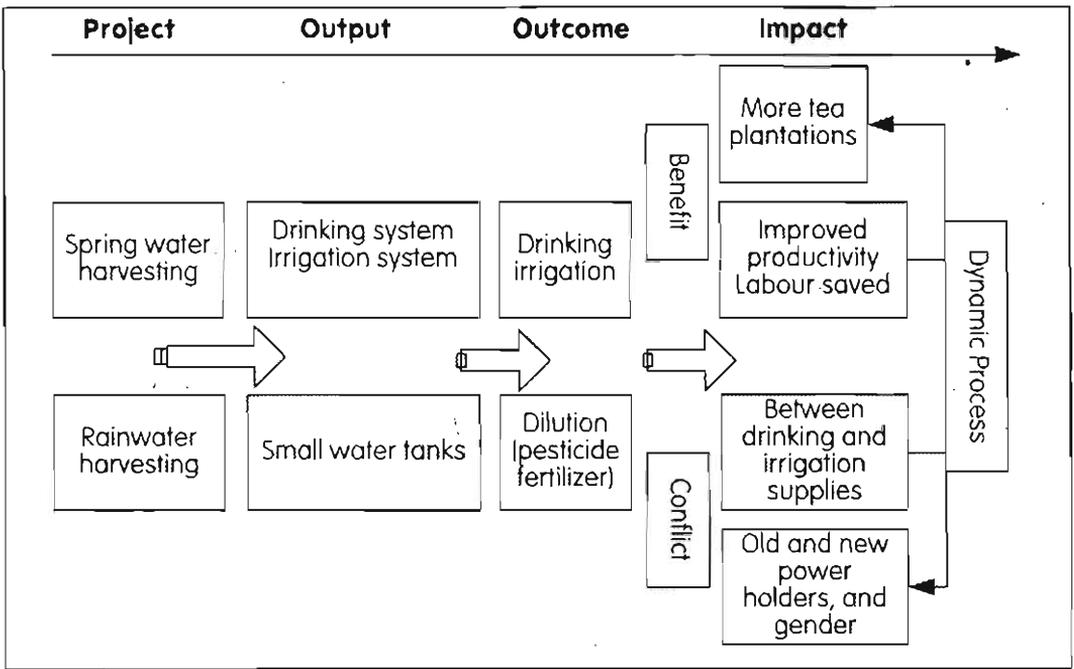


Figure 10.3: Impacts of water harvesting projects in Damaidi Village

average, 0.06 ha (1 mu) of maize planted by direct seeding produces 300 kg of maize, whilst transplanting them gives a higher yield of 350 kg plus. The transplanting technique relies on raising good quality seedlings. Previously most maize was grown by the seeding method as the lack of irrigation made it difficult to do transplanting. With the new system over 5.8 ha of maize is transplanted and only 1 ha of land is seeded. Since the building of the small tanks transplanting has replaced seeding on a further 3.2 ha of land. The transplanting of seedlings is now mostly used as it gives the highest yields.

*Tea plantations*

In Damaidi, tea cultivation is more profitable than growing maize as 0.06 ha of tea can yield 65 kg of tea which can be sold for \$97-121 at the normal market price of \$1.69/kg in 2002. In the same year the 350 kg of maize produced on the same area fetched only \$42. Moreover, the costs of growing maize are more as chemical fertiliser and pesticides cost about \$254 per ha compared to just \$54/ha for tea. Many farmers have moved over to tea growing. This first happened in 1986 when large-scale labour migration meant there was less pressure on the land for providing for local livelihoods and 5 ha of tea was planted on the Type III lands. Maize continued to be grown on the Type I and II lands for livestock feed.

The second major planting of tea happened in 2001/02. This time most Type II lands and some Type I lands that had been used to grow maize (total 6 ha) were turned into tea plantations. The new availability of irrigation water improved maize yields on Type I and II lands giving sufficient production from a lesser area. The extra land was planted with tea. There is now competition for labour between tea and maize as they are both harvested between March and October. The labour saved by the new water system has led to the planting of tea.

The 34 small tanks were originally built for irrigating 3.2 ha of maize lands. However, 1 ha of this area has been planted with tea (Appendix 3). These small tanks are useful for diluting the pesticides and fertilisers that are frequently applied to the tea bushes.

The new supplies of irrigation water have encouraged the planting of tea plantations. This happened for a number of reasons. After 1982, local people developed strategies to deal with their difficulties in sustaining their livelihoods. These included labour migration, maize planting, tea cultivation, and livestock feeding. Following the implementation of the Household Responsibility System labour migration increased. The availability of irrigation water improved maize yields and saved much labour. Maize is grown in Damaidi just for feeding livestock. Local people's hopes for improving their living standards revolve around labour migration and tea plantation. Except for the seven households who gave up tea growing and work outside the village, most households feel that there is only a limited demand for their labour as they have limited literacy and are only suited for labouring jobs. For these people the growing of tea is their greatest hope. They have enthusiastically introduced a new variety of tea (Yunkang #10) into Damaidi. Four households now raise tea over all of their land. They intercrop tea and maize in the first and second years and do not plant maize at all once the bushes have grown up.

## Conflicts

Conflicts often happen in Damaidi village in the dry season over demands for drinking and irrigation water. In the November to May period the amount of springwater dwindles. Before the irrigation system was built, water from the main spring was enough to provide drinking water all year round. However, since the irrigation system was connected through the drinking water tank for the main irrigation season at the beginning of May, almost all the water goes for irrigating fields. This conflict continues for about one month after the maize is planted.

To try and overcome this conflict, the 79 user households ruled that every person had the right to consume  $12\text{m}^3$  of water per year. Those who consumed more had to pay a fee. For using less than  $0.5\text{m}^3$  an extra  $\$0.24/\text{m}^3$  was payable whilst for amounts above this  $\$2.42/\text{m}^3$  had to be paid. Villagers were prohibited from wasting water or using drinking water to irrigate crops.

This regulation was later overruled by the local power holders led by the new community administrator and the teacher. These people are local leaders and retired government employees who live in the area and use a lot of water. Their water needs amounted to more than  $12\text{m}^3$  per person. For example, the local teacher's household had the highest consumption in the village using  $524\text{m}^3$ . This group reduced the drinking water fee to only  $\$0.006$  per cubic metre for everyone.

Most members of the other power group work outside of the village and have lower water demands. When they earn money and build new houses in the village they have to pay a  $\$0.84$  per room water fee. They opposed this new regulation and got the support of the communist party secretary and the old community administrator to oppose it. But the other group countered that they had organised the building and funding of the drinking water system and the new regulation remained. This conflict led to the dismissal of the old community administrator from the post of water manager.

It is not easy for the water system manager to satisfy the different interests of the two groups. What has happened is that the current manager is almost powerless and more drinking water

is being diverted to irrigating crops. This sometimes leads to drinking water tanks being emptied as the water flows to the irrigation tanks. Also, some villagers arrange with tap owners to pipe drinking water to their fields as drinking water is cheaper than irrigation water.

This conflict has a negative impact on local women. May is the busiest time of the year for them as they are busy harvesting tea and planting maize. They also have the added burden of having to go and fetch water before they can start cooking. It is mostly the men who divert drinking water to irrigate crops and the women end up having to negotiate for drinking water with women whose tanks still have water.

## Conclusions

The establishment of a water harvesting system in Damaidi village has benefited the local community by saving labour, improving maize yields, and releasing land and labour for growing tea. However, a serious conflict has emerged between the new and old power groups over access to water. This has had a negative impact on local women. This has happened since 1982 as the population increased, household size decreased, and diverse livelihood strategies such as labour migration, tea cultivation, and livestock feeding were adopted.

The saving of labour and improvements in maize yields has most benefited the poor in Damaidi as they have the less labour and land. Many poor households have come to rely on tea growing for a large part of their incomes. In general, women grow the tea whilst men go to work outside and send money home. Now, in some households, the menfolk are returning home earlier than before to help their wives with the tea harvest.