Poverty reduction and water governance: lessons from and problems in Northwestern China

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Abstract

Great achievements have been made in poverty reduction in Northwestern China, an area which contains a higher than average proportion of 55 different ethnic minority groups, with over half of the villagers being self-supporting, and where the main factors leading to poverty are adverse natural conditions, shortage of available water, weak infrastructure and backward social development. By analyzing the institutional framework relating to the water sector and the meeting of different water requirements (i.e., the human right to water, the environmental right to water, and economic development), as well as presenting case studies on two model villages and two kinds of important water infrastructures (i.e., the water split and silt dam), the role of good water governance in China’s development-oriented poverty reduction process is identified, with particular focus on lessons that can be learned. In conclusion, lessons are drawn from the aspects of policy and management, balancing different and competitive water requirements as well as short-term and long-term benefits of the poor, and stakeholder participation.

Keywords: Northwestern China; Poverty reduction; Water governance; Water rights

1. Introduction

In China, the most populous developing country in the world, poverty reduction has been an important issue in national economic and social development since the establishment of the People’s Republic of China (PRC) in October 1949. In 1978, there were 250 million poverty-stricken people in the country\(^1\), with the overwhelming majority living in rural area, especially in western (including Chongqing

\(^1\) A poverty-stricken person, according to the poverty standard designated by the Chinese Government, means a person whose net income per capita per year within his/her household is no more than 500 CNY; 1990 price standard (about 61 US$) (State Council of the PRC, 1994). In broad or common terms in China, a poverty-stricken person is someone who does not have sufficient clothes or food to live on.


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municipality, the provinces of Sichuan, Yunnan, Guizhou, Shaanxi, Gansu and Qinghai, and the autonomous regions of Ningxia, Xinjiang, Tibet, Inner Mongolia and Guangxi) and central regions. This poverty-stricken population, however, had decreased to 125 million in 1986, and the number of poor people who were suffering from an insufficiency of clothing and food was only 23.65 million by the end of 2005, according to Mr Liu Jian, the Director of the State Council Leading Group Office of Poverty Alleviation and Development (Liu, 2006). This achievement has attracted worldwide attention. According to a report published by the World Bank, since 1980 the reduction in number of the poor in China has accounted for 70% of the total reduction in all developing countries (Wang et al., 2004); in 2005, United Nations Development Programme (UNDP) announced that China had realized the goal of halving the number of the poor, one of the Millennium Goals (UN Millennium Project, 2005). The World Bank’s sponsored Scaling Up Poverty Reduction: A Global Learning Process and Conference was held in Shanghai, China in 2004 and affirmed: (a) Chinese achievement in the field of poverty reduction, and (b) the method of development-oriented poverty reduction adopted in China; this was illustrated by the 14 case studies about China that are collected in the conference case study materials (World Bank, 2004). Sound water governance, including by water institutions, has played an important role in making the above achievements possible. This paper discusses the lessons learned from the role of the water sector in poverty reduction in Northwestern China where most of the poor lived or live, especially those lessons on breaking the vicious cycle of environmental deterioration and development (and particularly for poverty reduction in environmentally vulnerable regions).

2. The geography of Northwestern China

Northwestern China as discussed in this paper includes, in the sense of administrative regions, the provinces of Shanxi, Shaanxi, Gansu and Qinghai, the autonomous regions of Ningxia, Xinjiang and Inner Mongolia (see Figure 1). In the topographical sense, Northwestern China covers half of the Qinghai-Tibet Plateau, the majority of the Loess Plateau, the Inner Mongolian Plateau, the Tarim

Fig. 1. Northwestern China and the location of the case villages. Northwestern China is highlighted in grey; A: Location of Hatutala village (Kulun Township, Tongliao Prefecture, Inner Mongolia Ethnic Autonomous Region); B: Lingshangyuan Village (Yanchuan County, Shaanxi Province).
Basin, the Jungger Basin, the Qaidam Basin, the Tianshan-Yinshan ranges and almost half of the Kunlun-Qinling ranges. In general, most parts of Northwestern China belong to the arid zone, and a few to the semi-arid zone; precipitation in general can be up to 550 mm (while in the Tarim Basin, the Turpan Basin and the Qaidam Basin it is up to 25 mm) and irregular, and the ecosystem/environment there is vulnerable. Therefore, Northwestern China suffers from a rugged terrain, a shortage of water resources and arable land, poor transportation conditions and serious soil erosion. The situation in the Loess Plateau is typical: the topography there includes the gullied plateau landform common in Gansu, while the gullied hill landform is common in Shanxi, Shaanxi and parts of Inner Mongolia. Low precipitation (250–550 mm) with most “falls in the summer, usually short, intensive storms”, together with the unsustainable farming practices undertaken for several thousands of years, have caused severe soil erosion, scarcity of water resources, and a further shortage of arable land (World Bank, 2004). In 1994, soil erosion existed in an area of 450,000 km², and accounted for 70.3% of the total area of the Loess Plateau (Sun et al., 2006).

The social geography of the region is diverse. There are 55 ethnic minority groups in China, and all (but mainly Hui, Uygur, Mongolian, Tibetan, Kazak and Dai) can be found in the population in Northwestern China, and the proportion of ethnic minorities to the total population is relatively high. For example, ethnic minorities account for 46.32% of the population in Qinghai, 60.26% in Xinjiang, 35.98% in Ningxia, 21.62% in Inner Mongolia, and 9.26% in Gansu. The rate of the illiterate and semi-literate population aged 15 and over is comparatively high: 6.4% in Shanxi, 13.46% in Inner Mongolia, 15.56% in Shaanxi, 21.11% in Gansu, 24.77% in Qinghai, 17.49% in Ningxia, and 8.21% in Xinjiang (NBS, 2004).

As to the economic geography of the region, agriculture is labour intensive and so is important to the poor rural population in Northwestern China, where the main crop is wheat. Another important element is that over half of the villagers are self-supporting, and this makes it difficult for these people to become involved in the market economy.

In general, the distribution of the poverty-stricken population in China has displayed obvious geographical characteristics since 1994, and the main factors leading to poverty are adverse natural conditions, weak infrastructure and backward social development (Information Office of the State Council, 2001).

### 3. The role of water governance in poverty reduction in Northwestern China

After the establishment of the PRC, the donation-oriented poverty reduction method (donating money or physical items to the poor to support their livelihood) was the main method employed in poverty reduction in China. However, in 1986, the Chinese government decided to replace the donation-oriented poverty reduction method with the development-oriented poverty reduction method as the main method employed. The two most comprehensive policy documents employed in poverty reduction are (a) the National eight-seven plan for aiding poverty-stricken people (State Council of the PRC, 1994) and (b) China’s Outline for aiding the poor and development in rural areas (2001–2010)

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The former was issued by the State Council on 15 April 1994 and was designed to help 80 million poverty-stricken people in rural areas, over a period of seven years (1994–2000), giving them the ability to obtain sufficient clothes and food to support themselves through development; it completed its historic mission in 2000. The second document was issued by the State Council on 13 June 2001, and was planned to deal with poverty reduction in the first decade of the 21st century in China.

The role of water governance in poverty reduction has been well acknowledged. “[W]ater management is a good investment: not only can it contribute to poverty reduction, but it can do so in ways that are affordable and . . . generate wealth”, for it can contribute to four key dimensions of poverty reduction, i.e., enhanced security of livelihood, reduced health risks, reduced vulnerability, and pro-poor economic growth (Poverty-Environment Partnership, 2002).

Sound water governance in Northwestern China should embed a water rights system that clarifies the human right to water, the environmental right to water and the need for water for economic development, while balancing the short-term living needs and long-term developing needs of the poor, as well as considering all factors that could promote stakeholder participation. Water governance is essential for the poverty reduction process, and this notion will be discussed in the following four sub-sections from the aspects of the institutional framework, the human right to water, the environmental right to water, and the need for water for development respectively.

3.1. The institutional framework relating to the water sector

The basic goal of poverty reduction in China is to solve the problem of the basic need for clothes and food of poverty-stricken people. The natural conditions in Northwestern China have determined that poverty reduction has a close link to water-related matters.

In order to implement the development-oriented poverty reduction work effectively, the Leading Group of the State Council for the Economic Development of Poverty-stricken Areas was established in June 1986 (renamed in 1993 as the State Council Leading Group of Poverty Alleviation and Development). The Leading Group is responsible for organizing, directing, coordinating, supervising and examining poverty reduction work throughout China. The governments of most provinces, autonomous regions, municipalities, prefectures (cities) and counties have also established corresponding organizations to take charge of local poverty reduction drives. The various departments of government, including water-related departments, at different levels, are responsible for poverty reduction work in their corresponding authorities. The main water-related departments are the Competent Departments of Water Administration (CDWAs) and the Competent Departments of Communication Administration (CDCAs) at different levels. At the central government level, they are the Ministry of Water Resources (MWR) and the Ministry of Communication respectively. At the local level, including the provincial, prefecture (city) and county level, there are also competent departments, such as the bureau of water administration and the bureau of communication administration. Further, the Chinese government encourages international as well as national NGOs to play roles in poverty reduction in all fields, including the water sector. For example, in order to strengthen the work of poverty reduction in Northwestern China, the MWR had spent 14,500,000,000 CNY (about 181.25 million US$) of the 29,500,000,000 CNY water conservation construction fund allocated to it by the State Council in rural areas, with greater focus on securing rural safe drinking water projects and constructing silt dam projects for conserving water and soil (Li, 2006).
3.2. *The human right to water*

Water is essential for life. However, water resources are quite scarce in Northwestern China, and the scarcity has become a main cause of poverty. Access to water for meeting basic human needs is an important component of human rights; the human right to water is a basic human right, and it constitutes an essential element of a sound water rights system under water governance (CESCR, 2002; Hu, 2006). Although the term “the human right to water” is not employed in China’s official documentation, there exist many laws and policies that emphasize, protect or give priority to the supply of water for domestic use (Hu, 2006). The Chinese Government, therefore, has been dealing with some vital aspects of the role of the human right to water in poverty reduction. For example, solving the problem of the shortage of drinking water for people and household animals in poor rural areas has been an important task in poverty reduction.

In accordance with articles 2 and 3 of the *Temporary rules on work concerning domestic and livestock drinking water in rural areas*\(^3\), the definition of difficult access to drinking water with reference to human beings in Northwestern China may be summarized as: (a) in terms of distance, the nearest water-drawing point for a village is more than 2–4 km from the village, or more than 100 meters in altitude; and (b) in terms of quantity, during periods of drought, the per capita per day water supply is under 10 kg in the north, i.e. south to the line of Yangtze River. Regarding the definition of difficult access to drinking water with reference to livestock, in accordance with the *Temporary rules on work concerning domestic and livestock drinking water in rural areas* 1984, the quantity for larger animals is less than 20–50 kg per day, and for smaller ones, it is less than 5–20 kg per day.

According to the *National eight-seven plan for aiding poverty-stricken people*, one of the common characteristics of poverty-stricken regions is difficult access to drinking water for human beings and livestock. In the goal of strengthening the construction of fundamental infrastructure or facilities (which is one of the three goals in the plan), the first sub-goal is largely to resolve the problem of difficult access to drinking water for human beings and livestock in poverty-stricken regions. Among the fundamental methods directed by the plan, accelerating the development and utilisation of unused surface water is listed. Regarding funding, 1,000,000,000 CNY (about 12.5 million US$) Food-for-Work Fund\(^4\) is planned to be employed mainly in constructing roads and solving the problem of difficult access to drinking water for human beings and livestock in poverty-stricken regions. Coordinating the implementation of Food-for-Work Programs in poverty-stricken regions, CDWAs are required: (a) to adopt various measures to solve the drinking water problem for people and animals, and (b) to earnestly solve the poverty problems of immigrants resulting from the construction of dams, and of people living in sandbank areas or the areas that may be used for flooding control.

In China’s *Outline for aiding the poor and development in rural areas (2001–2010)*, resolving the problem of difficult access to drinking water for human beings and livestock in poverty-stricken regions by 2010 is an important element in further improving basic living and production conditions in those regions, as well as in enhancing the life quality and comprehensive quality of the poor—one of eight content or methods provided by the outline. The CDWAs, and in particular the MWR, are required, in

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\(^3\) The official Chinese version of this is available online at the Water Resources Bureau of Shansi Province webpage [http://www.sxwater.gov.cn/oldweb/zcfg/NCJSYSFLFG/NCJSYSFLFG1024.htm](http://www.sxwater.gov.cn/oldweb/zcfg/NCJSYSFLFG/NCJSYSFLFG1024.htm) (30/03/2007).

\(^4\) “Food-for-Work” is a development-oriented poverty reduction method in China, under which money or physical items are given to those who work for government-organised or government-funded projects.
compliance with the unified requirements of the State Council, to regard aiding the poor and development as important tasks imposed by the State, and to earnestly implement this outline, by combining with their authorities, such as Ministry of Agriculture, Ministry of Land and Resources.

In accordance with the above standard for difficult access to drinking water for human beings, there still remained 24.23 million persons in rural areas, the overwhelming majority in Northwestern China, who were short of drinking water at the end of 1999. In order to resolve this problem, from 2000 to 2002, the MWR and the former National Planning Committee allocated funds worth 5,700,000,000 CNY (about 71.25 million US$) from State Bonds; by the end of 2002, 580,000 various drinking water projects had been constructed in rural areas, including 100,000 central water supply projects and 480,000 small projects for single households. Through these projects, the daily water supply could be increased by 2.4 million m$^3$, and, therefore, the majority of the people who had been listed as suffering from a persistent shortage of drinking water were able to access drinking water (Department for Irrigation, Drainage and Rural Water Supply of the MWR, 2003).

The projects designed for resolving the problem of difficult access to drinking water vary in type. The major types employed include wells, reservoirs, water splits, silt dams, etc. Of these types of project, water splits and silt dams are of great value in terms of learning due to their multiple functions, besides being used to resolve the problem of the shortage of drinking water, such as protecting or improving the environment, and promoting development in poverty-stricken regions. These two types of project will be discussed in some detail later.

Under the mechanism of development-oriented poverty reduction in China, the MWR has funds allocated to it by the State Council, and is also responsible for cooperating with international counterparts in projects funded by the latter. The MWR has implemented many programmes for dealing with drinking water problems in poor regions. For example, it has been implementing the Motherland water pit program in Northwestern China together with the China Women Development Foundation.

3.3. The environmental right to water

The environmental right to water is also an important component of a sound water rights system, for “the environment is ... entitled to receive a minimum amount of water of proper quality in certain places for its beneficial order or sustainable ability” (Hu, 2006), and this has been provided or reflected in a wide range of law and policy at both international and national level (Dyson et al., 2003). To some extent, Chinese laws have adopted certain provisions to address environmental water demand. For example, the environmental right to water should be reflected in plan formulation and be taken into consideration in the development and utilisation of water resources; fulfilling the environmental right to water is, therefore, the duty of government (Hu, 2006).

As mentioned above, natural conditions in Northwestern China are far worse than in the rest of the country, particularly since there is lack of water in most parts of the region, the coverage rate by forests and grassland is quite low, and the ecosystem is vulnerable. The situation with regard to water and soil conservation is, therefore, quite severe. Under the National eight-seven plan for aiding poverty-stricken people, the CDWAs were required (when coordinating the implementation of the Food-for-Work Program in poverty-stricken regions) to: (a) accelerate the management of small watersheds in an integrated manner; and (b) to build a small-sized water conservancy infrastructure.

The following aspects concerning the environmental right to water are stated in China’s Outline for Aiding the Poor and Development in Rural Areas (2001–2010):
(a) further improving the ecological environment is encompassed in its overall goal;
(b) under the fundamental policy of pursuing comprehensive development, constructing a water conservancy infrastructure is emphasized;
(c) under the fundamental policy of sustainable development, development-oriented poverty reduction must be combined with the protection of natural resources and ecological construction, pursuing a healthy circle between natural resources, the population and the environment, and therefore enhancing the capability of sustainable development in poor regions;
(d) continuing to focus on crop cultivation and aquaculture and poultry raising is listed as one of eight content or methods provided by the outline; within this, following the principle of improving the eco-environment, the protection and construction of the ecological environment are required to be strengthened in order to achieve sustainable development; and
(e) when determining the location of projects concerning water conservancy, water and soil conservation (such as restoring forest land or grassland from cultivated land) or natural resources development arranged under the Grand Western Development Programme, priority shall be given to poor regions under the same terms and conditions.

It is clear that, in order to maintain a healthy ecosystem in Northwestern China, the water sector, through water governance, plays an important role in poverty reduction. However, the measures for meeting the environmental requirements for water or conserving water and soil have usually been integrated with measures designed for social and economic development.

3.4. Water for development

Water is needed for the development of poverty-stricken regions for many different reasons—for example, for planting crops, trees and grass. However, as mentioned earlier, precipitation in Northwestern China is not only low but also intensive in summer months. Therefore, to realise the goals of the strategy for development-oriented assistance for the poor, one vital problem to be solved is how to store the surplus water in summer for the development requirements of the whole year, as well as improving the ecosystem and protecting the environment.

Under the National eight-seven plan for aiding poverty-stricken people, the CDWAs were required, coordinating the implementation of the Food-for-Work Program in poverty-stricken regions, to:
(a) accelerate the construction of basic farmland and the comprehensive management of small basins;
(b) build a small-scale water conservancy infrastructure;
(c) utilise resources in mountainous regions and develop small-scale hydropower; and
(d) to earnestly solve the poverty problem of immigrants (caused by the construction of dams) and of those living in the sandbank areas or in areas used for flood control.

The CDCAs were required to actively develop hydro-transportation in the poverty-stricken regions if the required conditions for developing water transportation existed.

In China’s Outline for aiding the poor and development in rural areas (2001–2010), the following statements relate to water requirements for development:

(a) further improving the basic living and production conditions in poor regions, enhancing the life quality and comprehensive quality of the poor, strengthening the construction of the fundamental infrastructure in poor villages, improving the ecological environment, and gradually changing the backward economic, social and cultural aspects in the poor regions are encompassed in its overall goal;
(b) under the fundamental policy of pursuing the development-oriented poverty reduction method, the development of local natural resources is encouraged;
(c) under the fundamental policy of pursuing comprehensive development, the construction of a water conservancy infrastructure is emphasized;
(d) under the fundamental policy of sustainable development, poverty reduction development must be combined with the protection of natural resources and ecological construction, pursuing a healthy circle between natural resources, the population and the environment, and therefore enhancing the capability of sustainable development in poor regions;
(e) the problem of drinking water for both people and livestock shall be solved on the whole or by-and-large in poor areas; and
(f) projects concerning water conservancy, water and soil conservation (such as restoring forest land or grassland from cultivated land) and natural resources development, arranged under the Grand Western Development Programme, shall give priority to poor regions when determining the location, under the same terms and conditions.

In practice, many measures, such as the transformation of sloping cultivated land to terraced fields, construction of silt dams, building water splits, and creating other fundamental infrastructure or facilities in order to promote production, have been taken to improve the sustainable production capability of the poverty-stricken regions. Of these, the construction of silt dams and the building of water splits shall be employed as case studies in sections 4.2, 4.3 and 4.4 later.

4. Case studies

Although proper written policy on poverty reduction and water governance is very important for alleviating the problems of the poor, accurate implementation of policy in an integrated way is vital. The following four cases, the first two from a regional perspective and the second two from an infrastructure approach, will reveal the real role of good water governance in poverty reduction in Northwestern China (see Figure 1 which shows the location of the case study villages).

As already mentioned, precipitation in Northwestern China in general is very low. However, intensive rainfall in summer always lead to floods, which have many negative outcomes, in particular to local communities, such as loss of property, soil erosion, farmland destruction, and even loss of life, etc. Therefore, incorporating flood control into a poverty reduction process is necessary and very important. Further, through collecting and storing flood water, by deploying infrastructures such as dams, storages and splits, water shortages could be relieved to a great extent, and more water could be used to meet different water needs. Flood control can play an important role in the development-oriented poverty reduction process by creating a more secure, stable and sustainable environment, as will be seen in the following case studies.

4.1. Case study I: Hatutala Village

Located in the west of Kulun Township (Tonglia Prefecture, Inner Mongolia Ethnic Autonomous Region), Hatutala Village has a population of 738 people belonging to 184 households, and has a land area of 23,000 mu (about 1,533 hectares), of which 5,888 mu (about 393
hectares) is cultivated land (State Council Leading Group Office of Poverty Alleviation and Development, 2006a).

The natural conditions in the village are quite poor, especially the shortage of water resources due to the lack of precipitation, land erosion and poor land fertility. In 1990, the village was famous for its extreme poverty: with an average net income per capita per year for the entire village of 500 CNY (about 60 US$), 386 villagers belonging to 104 families were classified as poor, according the Chinese national poverty line, i.e. 52.3% of the villagers were poor. In 2003, Hatutala Village was listed as one of the villages at prefecture level that should be the focus of poverty reduction measures, and a poverty reduction plan for the village was formulated under the direction of the government, combined with the participation of all stakeholders, especially the villagers themselves. Under the poverty reduction plan, some fundamental infrastructure or facilities were to be constructed with funds from various channels, such as central and local government, and banks, as well as the villagers themselves, so as to reduce poverty through development. It was proposed that first, basic human needs should be satisfied, and then agricultural and herding production improved, while emphasising the protection and improvement of the ecosystem and the environment.

Good water governance has played a vital role in the implementation of the plan. In 2003, seven wells were developed in the village, which: (a) produced safe drinking water sources, and with further construction of piped water facilities, drinking water could be supplied to every household; (b) improved hygiene conditions for the villagers; and (c) allowed the conversion of 1,000 mu (about 66.7 hectares) of land into irrigated land. In 2004, a small dam was built by utilising a gully 2–3 metres deep. The dam, with a height of 8.5 metres, can store 580,000 m$^3$ water, with a permanent storage of 280,000 m$^3$ water. The dam has been employed not only in developing new pieces of irrigated land with the total area of 2,000 mu (about 133.3 hectares), but also in flood control. Further, it has improved the ecosystem and environment of the village.

In the utilization of the land, water and soil conservation has been taken into consideration. For example, afforestation has been widely implemented. At present, the village has a woodland area of about 20,000 mu (about 1333.3 hectares) used for protecting the farmland free from erosion, of which there is 9,000 mu (about 600 hectares) of forests. This makes the forest coverage rate of the village 38.4%. Consequently, the land erosion problem is now under control, and the condition of the land, especially its fertility, has been greatly improved. Although, from a short-term or partial perspective, increased forestry actually increases water supply problems (as mature trees use a lot of water), the above long-term effects shall be properly taken into account to ensure the conservation and sustainable utilisation of water resources, as well as to improve the eco-environment, for forests play an essential role in preserving the landscape, reducing flooding, supplementing groundwater, as well as improving local climate.

While conducting the work of poverty reduction, education and training have also been provided. A labour training centre, with an area of about 2,000 m$^2$, has been built. At the centre, scientific knowledge is spread, law and policy are learned, and various cultural activities take place. For example, 120 training sessions with 3,000 attendees have ensured that every family has at least one person equipped with the necessary scientific and policy knowledge, including that concerning water governance.

Thanks to efforts from all sides, by 2005 the average net income per capita per year of the villagers increased to 3,200 CNY (about 400 US$). By the end of that year, the number of poor villagers had decreased to 34, and the number of poor families to 12.
4.2. Case study II: Lingshangyuan Village

Lingshangyuan is situated on the Loess Plateau, 15 km southeast of Yanchuan County city centre, Shaanxi Province, and covers 6,500 mu (about 433.3 hectares) of land, of which 2,400 mu (about 160 hectares) are cultivated (State Council Leading Group Office of Poverty Alleviation and Development, 2006b). Surrounded by high mountains and deep gullies with only a narrow and winding path for communicating with the outside, short of drinking water, lack of arable land, Lingshangyuan Village was inconvenient to reach, short of modern information, and simple in terms of agricultural structure due to only wheat and/or corn were planted. In 2000, the village had only 217 mu (about 14.5 hectares) of basic arable farmland able to produce a stable yield, and this made the per capita area of basic farmland only 0.68 mu (about 450 m²). The per capita grain production was only 274.7 kg, while the net income per capita was only 605.7 CNY (about 73.8 US$); Lingshangyuan Village was an extremely poor village at this time.

In order to reduce the poverty of the village, following the principle of “guiding by the governments, integrating development of all aspects, regarding the village as a whole”, a poverty reduction strategy for Lingshangyuan Village was outlined in 2001. During the implementation of the strategy, the following work relating to water governance was implemented:

(a) a basic infrastructure and facilities for improving the living and production conditions was constructed. Three water storage ponds have been built: two of them used to supply drinking water for villagers and their livestock (and to achieve this, an 800 m main pipeline has been constructed together with 2,000 m of branch pipes pipes); the third one is connected to an 800 m length of main pipeline, with a further 1,300 m length of plastic branch pipes, and deployed for watering 400 mu (about 26.7 hectares) of high quality Chinese date orchards.
(b) water and soil conservation was strengthened. Two silt dams have been built at two appropriate sites for collecting silt, and it is expected that 130 mu (about 8.7 hectares) of arable land with good fertility may be formed within 3–5 years. Further, in order to prevent the soil from being eroded, some of the cultivated land has been converted into terraced fields.
(c) the ecosystem and environmentally-friendly agriculture were promoted. In terms of afforestation, 350 mu (about 23.3 hectares) of apple orchards, 400 mu (about 26.7 hectares) of Chinese date orchards and 120 mu (about 8 hectares) of apricot orchards have been developed. These orchards can not only produce income for the villagers, but also conserve water and soil. In addition, the borders of 7 km length of road have been planted with trees.

Four years of poverty reduction efforts, within which good water governance has played an important role, have greatly helped the poor in Lingshangyuan Village. In 2005, the net income per capita of the village increased to 2,800 CNY (about 350 US$).

4.3. Case study III: the construction of water splits

Water splits are containers (shaped like a jar, bottle or pot) built underground to collect precipitation for future use. They were invented by workers living in the Loess Plateau thousands of years ago. A water split of 36 m³ volume can collect 50–80 m³ of precipitation, enough to provide a household of 3–5 persons (plus their livestock) with drinking water for a year, or enough to be used to water crops covering...
an area of one mu (about 667 m²). Thus, water splits are usually employed to meet the minimum human water requirement for life and production. Traditionally, water splits are built from soil, lime, stone or brick. However, this kind of water split can only last for a few years and the water collected in it is easily polluted. To improve this, the modern water split system has become more complicated, using mainly water splits made of cement. The water collection process of the modern water split system has a positive environmental function, since it prevents silt from being washed away due to heavy or intensive rain, on the one hand. On the other hand, the water collected could also be used for planting trees or grass.

Due to their effective use in practice, small investment required and short-term construction period, water splits have been widely employed in poverty reduction efforts in Northwestern China. The biggest programme is the Water Split for Mother Program sponsored by the China Women Development Fund and supported by the CDWAs. The programme was implemented initially in Northwestern China in 2001, and was later expanded to southwestern China. The achievement of the implementation of the programme is outstanding. By the end of 2005, for example, 19.1 million CNY (about 2.39 million US$) had been invested in the programme for 122 administrative villages in 12 counties in Ningxia, and 12,265 water splits had been built. As a result, the difficulty of access to drinking water for 50,000 villagers has been resolved, and these people, no longer being compelled to spend more time collecting or fetching water, can engage in production, which enable them to have more income (CWDF, 2006a). In Inner Mongolia, about 26.75 million CNY (about 3.34 million US$) has been invested in 199 administrative villages of 32 counties, and 2,432 water splits, 969 wells and 133 small-scale central water supply projects have been built; this has benefited 92,300 people and 401,000 livestock, and led to 198 mu (about 13.2 hectares) of cultivated land being irrigated (CWDF, 2006b). In Qinghai, 18.73 million CNY (about 2.34 million US$) has been invested, with 6,125 water splits built in 77 administrative villages of 6 counties, and 40,175 people and 296,146 livestock benefiting from the programme (CWDF, 2006c). As for Gansu, 39.51 million CNY (about 4.94 million US$) has been invested in 203 administrative villages of 67 counties, and 18,415 water splits and 31 small-scale water conservation facilities have been built; these facilities have resolved the difficulty of access to drinking water for 137,217 people and 180,000 livestock, and facilitated the irrigation of 15,000 mu (about 1,000 hectares) of cultivated land (CWDF, 2006d).

4.4. Case study IV: the construction of silt dams

A silt dam is a barrier that is built across a (usually dry) gully, in order to stop the flow of silty water after intense rain, to allow silt to settle at the bottom, and to let silt farmland be formed in the most natural way. The earliest historical written record of man-made silt dams can be found in the History of Fenxi County (which is located in Shanxi Province). It reveals that, during the Wanli period (1573–1619) of the Ming dynasty, diligent villagers built silt dams to obtain silt land. On the Loess Plateau, it has been proved that silt dams can contribute to long-term social, environmental and economic sustainability. Amongst other things, silt dams play the following roles:

(a) stopping silt and preventing silt from flowing into the Yellow River, thus decreasing sediment in the river, and further lessening the flood danger caused by the river;
(b) stopping silt and forming silt land which is highly fertile, and further enhancing crop yield, thereby increasing the income of the villagers;
(c) harvesting water in wet seasons and making the rational and effective utilisation of water resources possible;
(d) using the water collected by the silt dam to resolve the difficulty of access to drinking water for people and livestock, for irrigating cultivated land, or for planting trees or grass;
(e) supplying water for ground aquifers and making the utilisation of groundwater sustainable;
(f) creating good quality ecosystems in the surrounding areas or improving the ecosystems of the silt dams, and further improving the ecosystem in the middle stream of the Yellow River; and
(g) using them as bridge roads by connecting each side of the gullies, and further improving communications in the region (Zhou, 2005).

Due to the benefits above, the Chinese Government has been paying special attention to the construction of silt dams since 1949, and particularly since 2001. By 2002, according to one official report, 112,045 silt dams (36,816 in Shaanxi, 37,820 in Shanxi, 6,630 in Gansu, 17,819 in Inner Mongolia, 4,936 in Ningxia and 3,877 in Qinghai, accounting for 96.3% of the total) had been built, and 4.5 million mu (about 300,000 hectares) of silt farmland had been formed, so 21,000,000,000 m$^3$ of silt had be stopped (State Council Leading Group Office of Poverty Alleviation and Development, et al., 2002).

Investigations and studies reveal that the silt dams built on the Loess Plateau have played an important role in poverty reduction. For example, about 28,000,000,000 tons of silt has been prevented from flowing into the Yellow River and, therefore, good soil has been preserved. Further, many hundreds of hectares of silt farmland land have been formed with good fertility. Silt farmland accounts for only 9% of the cultivated land on the Loess Plateau, but the yield per year of silt farmland accounts for 20.5% of the total annual yield, since the yield per mu of silt farmland is 2–3 times that of terraced fields, and 6–10 times that of sloping land. The flood control function of silt dams prevents the life and property of villagers from being endangered or lost. The silt dam system built in Qiligou, located in Huan County, can collect 1.6 million m$^3$ water per year, and this water is employed to supply drinking water to the villagers and meet the production requirement of local enterprises. At the Huapei watershed, located in Dingxi County, the construction of silt dam systems has not only completely resolved the water shortage problem, but also led to the development of 2,000 mu (about 133.3 hectares) of irrigated farmland, as well as the transfer of 500,000 m$^3$ to other watersheds. In addition, 90% of silt dams are also being employed as roads, which has made communications in the county very convenient, and further promoted the development of the market and culture. At Qiuyuangou watershed, the construction of silt dam systems has not only led to the development of 2,700 mu (about 180 hectares) of irrigated farmland, but also improved the permanent flow of the streams to double in quantity. At Wangmaozhuang watershed, located in Suide County, the construction of silt dams has led to the development of 400 mu (about 26.7 hectares) of high quality silt farmland, and, further, the structure of the land at the watershed has become more sustainable and environmentally friendly. Most of the sloping cultivated land has been restored as woodland or grassland, and the proportion of cultivated land has decreased from 57% to 28%, while that of woodland has increased from 3% to 45%, and that of grassland from 3% to 7% (State Council Leading Group Office of Poverty Alleviation and Development, et al., 2002).

At Abuhai watershed, located in Inner Mongolia, 47 dams have been built, which control the water and soil conservation in an area of 44.7 km$^2$, and have improved the utilisation structure of the land. The percentages of cultivated land has been restored as woodland or grassland, and the proportion of cultivated land has decreased from 57% to 28%, while that of woodland has increased from 3% to 45%, and that of grassland from 3% to 7% (State Council Leading Group Office of Poverty Alleviation and Development, et al., 2002).

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the annual yield increasing from 1,335 to 2,764 tons, and the per capita net income of the villagers increasing from 1,656 CNY (about 207 US$) to 2,430 CNY (about 304 US$) (Sun, 2003).

But what about the consequences downstream at the estuary of the Yellow River if there is little or no flow of silt, and can those consequences be mitigated? Although there will always be some flow of silt into the Yellow River (one of the longest rivers in the world), and the completion of the construction of silt dams at all sites in the upstream and midstream sections will take a long time, a reduction in the flow of silt will definitely have some adverse affects, such as decreasing the speed of new land forming at the estuary. The ongoing new land formation at the estuary can bring benefits to individuals, entities or communities along the river or at the estuary, for example (a) providing more fertile land for peasants to cultivate or (b) providing land access to the Victory Oil Field (one of the biggest oil fields in China, which is located at the estuary)—exploring crude oil on land is cheaper than exploring under the sea. However, taking the overall health of the ecosystem of the Yellow River basin into consideration, paying attention to the fact that the present flow of silt has been leading to huge investment in flood control and water treatment, recognizing that the improvement of covering rate of forest and grassland is very helpful for dealing with climate change, and thinking over the surviving and developing needs of millions of the poor in Northwestern China, these above adverse affects should be ignored and mitigating them would be unfair. As one of the documents issued by the Global Water Partnership points out, “IWRM is a process which promotes the co-ordinated management and development of water, land and related resources, in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems” (Global Water Partnership, 2000). And here, in the Yellow River basin, a reduction in the flow of silt will not imperil the safety and sustainability of any vital ecosystems.

5. Conclusion

Undoubtedly, great progress has been made in poverty reduction in Northwestern China. Through the poverty reduction activities in this region, there are some lessons to be learned as well as certain matters still to attend to, as outlined below.

(a) **Priority policy and integrated management are vital**

A proper outline policy should be formulated for a particular poor region, and certain vital matters should be focused on and given priority. Regarding the water sector, integrated management should be implemented in all aspects. The human right to water, the environmental right to water and the requirement of water for production, for example, should been considered in a holistic way. CDWAs should be allocated funds in order to enable them to implement relevant programmes or projects concerning water and poverty reduction.

(b) **The content of the human right to water should be expanded**

The problem of access to drinking water by the poor and their livestock is one of the most important elements in poverty reduction regarding water governance. However, for the poverty-stricken people in Northwestern China, this problem is just one aspect of the human right to water. It is well known that, for the overwhelming majority of the poor in that region, each villager has approximately an area of 667 m² cultivated land on which to plant crops, or up to 1,500 m² of grassland for raising animals, and that s/he lives on such a small plot of land. Without this land, s/he could not survive. To this extent, it is apparent that access to sufficient water for watering this small plot of land is the basic human need. That is to say,
the definition of the human right to water given in the General Comment 15 (Committee on Economic, Social and Cultural Rights, 2002) is insufficiently broad to secure the human right to water for the poor living in the rural areas of Northwestern China.

(c) The environmental right to water should be secured

It is noted that the protection of the ecosystem or the environment should be a matter of priority, since meeting the water requirement of the environment can help to make poverty reduction more sustainable. This is because, if the poor’s living and productive conditions are not radically changed, and the poor are not strong enough to fight natural calamities by themselves, they will easily sink back into poverty following natural disasters; that is to say, the vicious cycle of environmental deterioration and development for poverty reduction in environmentally vulnerable regions can not be broken. Many paragraphs concerning this aspect can be found, for example, in the vital two documents issued by the State Council mentioned above (State Council of the PRC, 1994; State Council of the PRC, 2001). This aspect has been given a narrow sense in practice, however, and it should become a priority regarding the use of water in industrial development.

(d) Water for industrial development should be supplied without damaging the human right to water and the environmental right to water

No industrial production activity can be conducted without using water, although to varying extents. As a result of the weak ecosystems or the environment in Northwestern China, the need for water for industrial development in the market sense should now be fulfilled as the last priority. If water for industrial development is given top priority, then the eco-environment in Northwestern China will decline, without doubt, and this degradation will certainly make the region poorer.

(e) Short-term and long-term benefits for the poor should be well balanced

To achieve development and to prevent those who have been lifted out of poverty from returning to poverty again, fundamental infrastructure or facilities need to be constructed. However, if the investment in a project is considerable or the benefit of the project only can be enjoyed after a long time, the poor have no incentive to participate. For example, building a large silt dam needs substantial investment and the silt farmland can take 5–7 years to form, which gives the poor no incentive. On the other hand, the poor show more interest in building a small silt dam which requires less investment and enables the silt farmland to be formed with a few years.

(f) Stakeholder participation, particularly that of the poor, is vital for long-term poverty reduction and post development

The participation of the poor is vital in development-oriented approaches to combating poverty. It is a fact that the majority of the poor in Northwestern China have not received sufficient education, and that a proportion of them are illiterate or semi-literate. In the process of participation, they can be educated or trained, which will further help them to well understand that the short-term and long-term benefits should be reasonably balanced in a sustainable development-oriented poverty reduction process. Also, in poverty reduction effects, many international aid resources have been used. Experience shows that, although financial aid is necessary, the lessons and knowledge of the management brought by the aid programme is of even greater value.

Although the above six lessons can be learned, some problems still remain unresolved. Among others, how the institutional ecology principle—which is well discussed by Saleth & Dinar (2004)—should be implemented in this region is very controversial. There are some indigenous people who are used to, and enjoy, living in the remote areas where water is quite scare and the ecosystem is very weak. Is it reasonable for government to force them to make migrations in order to conserve water resources or
nature? Or, should the government make them rich by supplying water to meet their water needs, including basic human needs as well as needs for economic development, by constructing expensive facilities with public funds?

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