On the Tactic Status of the Water Resources in the Development of the Northwestern Part of China

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Abstract: The water resources are the basis of eco-environment construction, production of industry and agriculture, and adjustment of economy structure. WR varies among different areas, and years and seasons also in the Northwestern part of China. There are fewer amount of WR per capita, but the efficiency of WR is very low and even extravagant in the areas. The extremely lack of WR causes serious problems in eco-environment and economy development. WR is very important in the development of Northwestern part of China that is the main area of the Development of Western China. Although water harvesting and water saving are effective measures in the present, they can't be used as a permanent cure because of the limitation of the WR in the area. The best way of the improvement of the WR in the area should be based on the project of water introducing, especially the project of introducing water from the South to the North in the Western part of China. It is a great cause not only for the present and the country but also for the future and the whole people of China.
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Water, the source of life, distributes variously among districts or through times. Many countries or districts are suffered a lot from drought and flood. The main problems of China occur in the Western parts, especially in the Northwestern part of China (hereafter as NWPC) which has serious problems of desertification and water shortage. Water is very important in the development of Northwestern part of China (hereafter as DNWC), and we can say, that where there is water resources (hereafter as WR), there is oasis. Desert is accompanied with no WR. A best way of harnessing rivers should begin with the mountains which is the origin of the rivers, whereas planting trees benefit the mountain harness a lot. And now comes the WR, which determines the results of the afforestation. If we can't solve the problem of WR, the construction of eco-environment and economic development will not be carried out evenly. WR is the chief factor that affluences DNWC. The hope of all China is DNWC, and the hope of NWPC is WR.

1 Estimation of WR

WR is scarce and varies in NWPC among different areas, years and months. At the same time, there are some sticky problems such as low efficiency of WR and severe wastes in the areas.

1.1 Lack of WR per capita

The 5 provinces and regions in NWPC, most of its parts located in arid and semi-arid areas, cover an area of 2.97 million square kilometers which equals to one third of the total area of China. Its amount of WR is 223 billion cubic meters which is only one twelfth of that of China. The amount of WR per capita area is a quarter of that of China. The land area of the Yellow River basin occupies 8.3% of that of the whole country, and the total amount of WR 2.6%, the amount of WR per capita 873 cubic meters which is 31% of the average value (2816 cubic meters) of the territory and is far below the warning level of 2000 cubic meters of the standard level of the world. The middle part of Gansu Province, the southern part of Ningxia Hui Autonomous Region, the western part of Shanxi Province, which are the 3 most poverty-striken areas in China, have a low precipitation and a poor WR both in ground and underground,

affecting the industry and agricultural productions and the lives of the local people.

1.2 Uneven distribution of WR among districts

The location which is far from the sea, landforms and meteorological aspects, determine the uneven distribution of WR among districts. From the precipitation distribution, we can get the main point that the most part of NWPC is located in the west of under 400 millimeters isohyet and dry with low rain fall. Most part of Shaanxi Province, the southeastern part of Gansu and Qinghai as well, the mountainous areas in Western and Northern Xinjinag Uygur Autonomous Region belong to semi-humid transition areas with a rainfall between 400 and 800 millimeters. The most part of Gansu and Ningxia, the northern part of Shaanxi, the northwestern parts of Qinghai and Xinjiang, stand in the semi-arid water shortage areas with a precipitation between 200 and 400 millimeters. The desert areas of Gansu and Ningxia, the Chaidamu Basin in Qinghai, the Tarim Basin and Jungar Basin in Xinjiang, locate in arid areas with less than 200 millimeters rainfall, especially the Tarim Basin and Chaidamu Basin with less than 25 millimeter rainfall, are the least precipitation areas in China. Difference is also occurs in the same province or regions. For example, the half areas of Xinjiang is in the northwestern part of it, which occupy a 93% of the total amount of WR of Xinjiang, whereas the southeastern part 7%.

1.3 Fluctuations of WR among years and months

The continuous plentiful period of the Yellow River is less than 5 years, but the continuous dry period of it is more than 11 years. If we define a index reflecting the variation of WR among years, that is, the maximum of annual precipitation divided by the minimum(the extreme value ratio, hereafter as EVR), we get the conclusion that EVR of NWPC is larger, and decrease gradually to the Southeastern part of China. The EVR in NWPC inland areas is from 5 to 6, while the EVR to the south of Qingling Ranges and the Huaihe River is only from 2 to 4. The variation of WR is determined by the distribution of the rainfall. In spring, that is from March to May, WR is needed earnestly but the water discharge is only from 20% to 30% of the whole year, resulting the problem of dry spring. As a general, the rain season in NWPC is from June to September, which has a quota of 70% to 80% of the annual precipitation. At this times, the high rain intensity and low WR efficiency cause the severe soil and water losses.

1.4 Low efficiency and waste of WR

Different results are due to the different styles of development and utilization of WR. A lot of problems exist in NWPC, such as the low standard of the engineering, old equipment lacked of repairing, poor conveyance engineering system and severe wastes. The effective efficiency of WR in farming is low, which is from 30% to 40% in the areas using runoffs, and 60% in the areas using the well water, and far lower than the developed countries that has a 80% effective efficiency of WR. The total amount of WR is 46 billion cubic meters in Xinjing from which 94% is consumed in farming. The total irrigation quota in Xinjiang is 11,025 cubic meters per hectare, and the efficiency of WR in ditch is 46%. The total irrigation quota in Yinchuan Plain of Ninxia is 10,980 cubic meters per hectare. The efficiency of WR in Minqin County, Ganxu Province, is only 28%. In spite of the ditch management in Guanzhong Plain of Shaanxi, the average efficiency of WR from ditch is about 50% or so.

The industry is one of the most water consumed field in NWPC, its severe waste, low efficiency of circulation and reuse, intensify the contradiction between need and supply. Leakages take place in the WR transition of NWPC occasionally. The survey showed that leakage rate is 4.6% compared to the supply, and the city number in NWPC which have above 5% leakage rates cover half of the surveyed 31 cities.

2 Main problems due to the scarce WR

The NWPC was a rich land with fertile farmland, high coverage of forests and grasslands, and

plentiful WR in history. Nowadays barren landscape in NWPC has been the results of a lot of reasons such as the warmth tendency of global climate, uncontrolled expansion of population, and irrational use to the natural resources by mankind.

2.1 Problems in eco-environment

The scarce WR in NWPC causes a lot of problems in eco-environment, namely, drought, soil and water losses, salinization, desertification, etc.

2.1.1 Drought

Most part of NWPC belong to the arid and semi-arid areas with low rainfall and dry climate. Recently, the climate is getting more and more dry due to the deforestation of the natural forests of protection in most mountains and the warmth trend of the world.

The precipitation can only afford 42.5% of the demand for wheat growth in Huangshui River, Qinghai. The less rainfall of only 100 millimeters or more in the period of wheat growth in the middle part of Gansu causes the reduction of wheat yield. 120 thousand hectares of farmland has given up for recent 30 years as no WR for irrigation use in Hexi Corridor, Gansu. Limited WR and demand for production and life use in large scale has been a contradiction that restricts the stable industry and agricultural production in turn.

2.1.2 Soil and water losses

The high intensity rain in the rain season causes the soil and water losses in NWPC. The total erosion area in the Yellow River Basin is 430 thousand square meters. The highest erosion occurs in the district of the more & coarse sediment in the middle reaches of the Yellow River, and the annual erosion modules are from 5,000 to 10,000 tons per square meters, and the maximum is got to 40,000 tons per square meters in this areas. The average annual sediment discharge of the Yellow River is 1.6 billion tons per square meters, and 0.4 billion tons of silt is deposited in the riverbed in the lower reaches of the Yellow River. Thus the level of the riverbed has raised 10 centimeters every year, and suspension and danger river courses occur in the lower reaches that threaten the treasure and the lives of the local people.

2.1.3 Salinization

Salinization originates from the parent material rich in salt that is the internal environmental factor, and the external factors of irrational irrigation such as excessive quota and no drainage works. In some areas, the surface flow is developed and utilized in deep degree, but the underground water is seldom used so as to bring about the larger evaporation of the phreatic water and the secondary salinization.

According to the national soil survey data from 1979 to 1983, the land areas of solonchak and solenetz is 134 thousand hectares in Yinchuan Plain, Ningxia, which accounts for 40.6% of the irrigated land. There are more than 2,100 hectare land of solonchak and solenetz in 1980’ in the Jingtaichuan irrigation areas in Gansu which is established in 1960’. As an average, the area of solonchak and solenetz constitute the effective irrigation area from 15% to 30%, and the maximum occur in the irrigation areas of the lower reaches that the ratio of is 50%.

2.1.4 Desertification

Water shortage accumulates the desertification. Where there is WR, there is oasis in the arid and semi-arid areas in NWPC. Desert covers the land with few rainfall and little phreatic water. Due to the scarce WR, the farmland, the forest and the water surface area are all below the average level of the country. 52.8% of the national land of desert, gobi, land of solonchak and solenetz, and naked rock stands in the NWPC.

The southern edge expands 1 to 1.3 meters yearly in Taklamagan Desert, Xinjiang. Pishan County, Minfen County of Xinjiang has moved its capital twice since 1949, and Cele County thrice. The edge of the Guerbantongut Desert in Xinjiang expands 2 to 3 meters, from inner to the outer, yearly, and 9 meters as the maximum. Every year, the newly produced desert area in Qinghai is 667 square kilometers, and the water level of the Qinghai Lake is lowered 12 centimeters yearly in the recent 30 years. Kubuq Desert,

Moumsu Desert, and other deserts in Ningxia distributed along the Great Wall, which expands 3 meters southeastward, caused the 500 square meters farmland into desert yearly.

2.2 Problems in economy development

WR is a key factor not only to the agriculture, but also to industry and other enterprises. It is connected to the lives of people in large scales.

2.2.1 The effect to agriculture

The ratio of ensuring irrigation areas (hereafter as REIA) is very low in NWPC due to the scarce WR. REIA in Guanzhong Plain, Shaanxi, is 59.6%,; the Northan Shaansi 66%; Hexi Corridor, Gansu, 71.5%; Qinghai 68%; and Jungar Basin, Tarim Basin, Chaidam in the inland rivers, 59.2%, 83.9%, 82.2% respectively. The excessive consumption to WR in the upper reaches of Shiyanghe River causes the amount of WR decreasing from 0.5 billion cubic meters in 1950' to less than 0.15 billion cubic meters in 1990' in Minqin Basin, Gansu. The farmer can only cultivate 9,333 hectares of farmland out of 29,300 hectares farmland, the other farmland is given up and gradually become the desert due to the scarce WR.

NWPC is an interlock areas of agriculture and animal husbandry in China. Animal husbandry is the main part of the GDP. But the spring drought often causes the death of the animal due to the shortage of WR. The aquatic products industry, which may have a bright future , hasn't formed in large scale.

2.2.2 The effect to industry

NWPC is rich for its energy and mineral resources and can be constructed as the main base of the important national petroleum, natural gas, energy, nonferrous metal and salt chemicals. Traditional industries, such as metallurgy, machinery, chemicals, textile, food, leather and papermaking, are the main consumer to WR. Those above mentioned industries need WR as their fundamental factor, but the limited WR confines the normal circulation of the enterprises. Expanded reproduction for those enterprises is difficult indeed.

2.2.3 The effect to the people life

In NWPC, Xian, Xianyang, Baoji, Yingchuan, Shizuishan, Qingtongxia, etc. are the cities using underground water completely; and Xining, Tonchuan, Tianshui, Xifeng, etc. are the cities that use the underground water as the main WR; whereas Lanzhou, Yanan, Baiying, etc. are the cities using the surface water as its main WR. Lets have a thorough scan to NWPC, we'll find that the underground water in a lot of cities are dug up excessively, and the short supply of water has influenced the daily life of the cities. Among them is Xian which has a surplus of WR estimating 0.3 to 0.5 million cubic meters daily. The surface sink has taken place in some areas in Xian city due to the excessive exploitation of WR in underground. It will have a dangerous future if we can't cut the exploitation of phreatic water. The water is as expensive as oil and it is hard to fetch in some rural areas in NWPC.

3 The main rules of WR in the eco-economic constructions

WR is the basis of eco-economic construction in NWPC. All circles will prosper with WR, but every enterprises will wither without WR.

3.1 The basis of eco-environment construction

The eco-environment of NWPC is fragile extremely. Though we have got achievements for a long time, we have sacrificed our eco-environment terribly. We must learn this example in present DNWC. The essential prerequisite for DNWC is the construction of eco-environment. So long as the eco-environment is improved, the plentiful resources can be exploited well, and the funds, techniques, and personnel can be introduced into NWPC from the east part of China or from abroad. The WR is the core of eco-construction. In the inland of NWPC, it is desert-oasis ecology and irrigation farming economy, while in the east part of NWPC, it is the ecology of natural type or water harvesting type and

the standard natural economy including the irrigation farming economy in some plains of the reaches of the Yellow River. WR is also the key factor that maintains the oasis ecology and the development of the social-economy. The development of the eco-economy is depended on the development, utilization and protection of WR.

3.2 The basis of industry and agriculture

NWPC is at the heart of the Eurasia Continent and far from the sea with dry climate. WR is also the base of o lot of fundamental constructions such as traffic, communication, electric power and architecture etc. Those fields must have enough WR as their foundation.

3.3 The basis of adjustment of economy structure

WR is the basis of the adjustment of economy structure which are the basis of DNWC. The largest enterprise is agriculture which consumes 90% of the total WR except Shaanxi. Through the water allocation by the utilization of more WR in forestry and animal husbandry, it is helpful for the adjustment of the economy. The industrialization and urbanization in NWPC are correlated deeply with the construction of the town and township that can consume more population in cities. Thus the water supply system should be constructed in the towns and townships. Through the water allocation and management in every fields, we can establish a new eco-economy model that posses the NWPC features.

4 The main ways for the development of WR

4.1 Guideline

NWPC is not only the water shortage areas but also the main battlefield in the Development of the Western China. The development of WR should firstly supply the need for eco-environment construction, harnessing the severe environmental problems and constructing a beautiful NWPC with more greens. At the same time, the WR should be used in industry and agriculture. And the allocation of water must be paid more attention to. We should collect water as more as possible and reduce the wastes of WR and raise the water efficiency. But the best measure of the improvement of the WR in the area should be based on the project of water introducing, especially the project of introducing water from the South to the North in the Western part of China.

4.2 Main ways

There are three essential ways to solve the WR problem. They are water harvesting, water saving and water introduction.

4.2.1 Water harvesting

Water harvesting is a kind of method that collects and stores water from raining, surface water and underground water. There are three types of water harvesting.

The way by engineering. It is the most important measure that collects more WR. It can be divided into 2 groups. One is the large scaled engineering projects such as reservoir. The other is medium and little engineering such as silt dam, pond, well, bench terrace.

The way by plant. It refers to the tiny engineering such level trench, level bench, and fish scale pit, as well as the forest stand, bushes and grasslands. They can protect soil and water all together.

The way by farming. Through the disposition of the crops in fields, it is useful to intercept, save and use the rain and water.

4.2.2 Water saving

Water saving is an essential way to use water. It includes three types.

The way in farming. It is by means of renovation on irrigation works, irrigation techniques,

cultivation, and management.

The way in industry. Great attention should be paid to the circulation and reuse of WR by means of administrative management and economic measures.

Others. Through the water price renovation, it is possible to restrict the WR amount in urban daily use and entertainment field, etc.

4.2.3 Water introducing

Although water harvesting and water saving are good methods to the rational use of WR, they can't be used as a permanent and fundamental way in some districts or years as the limitation in the areas. Water introducing is the key and fundamental measure to solve the problem. There are two types of water introducing.

Introducing from the basin itself. It happens in different districts in NWPC. There are some projects which has been completed, such as the project of introducing Datonghe River to Qingwangchuan Plain, the project of introducing the Yellow River to the Yanchi, Huanxian and Dingbian, etc. It is a effective way about the water shortage problem but has nothing to do to the total poor and limited WR in NWPC.

Introducing from the basin outside. It is a fundamental way to solve the WR problem in NWPC. The project frame of introducing the Yantze River to the Yellow River has been passed through by the experts and the government. After the project, the WR shortage problem can be solved thoroughly, as well as the flood problems in the lower reaches of the Yellow River which is at the east part of China. So it is a project for all China, and for the whole people in China. It is a great cause not only for the present but also for the future.

We have a dream that the people in NWPC have enough water for environment, economy and daily life uses. The dream will come true under the correct leadership of the government and the hard struggles of the local people. We are confident to the perfect utilization of WR and successful greening projects in NWPC. A beautiful and richly endowed NWPC will stands up in the inland territory of China!

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