To Promote Continued Advance in Agriculture by Establishing Good Ecological Environment

—Construction Achievements and Experience of Soil Water Conservation Ecosystem in Qingangpa Watershed

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Abstract: The Qingangpa watershed is an example project of ecological environment construction of soil water conservation in China. Its ecological landscape has been greatly improved, social and economic benefits raised significantly after being harnessed unremittingly for tens years by local masses. This article presents the major methods and experiences of comprehensive control of soil erosion in this watershed to provide use in the similar areas.
Keywords: soil water conservation, comprehensive harness, ecosystem

Qingangpa watershed, subordinate to Tangbai river system of Yangtze River basin, located in the south of Funiu Mountain, on Sikeshu town, NanZhao county, Henan province, has 19.8km^2 in total area , 213m—939m in height above sea level, 37° in average slope and 989mm in the mean annual precipitation.

In the small watershed, there are 68 natural villages, 1,847 persons, 121.4hm^2 of total cultivated lands, 1,697 hm^2 of forest lands, 54.5 hm^2 of pasture lands.

On history grounds, soil and water loss was very serious in the watershed before synthetic harness. According to survey and investigation by Nanzhao Soil Water Conservation Station in 1950s, the Qingangpa watershed erosion modulus was 3,380t/ (km^2 • y), lost soil 67,000t a year. A–horizon and B–horizon of soil were denuded nearly end, C–horizon was outcropping on slope. The local masses gave a summation to the watershed as: high mountain, deep ditch, many stones; few cultivated land, small table, thin soil layer; drying seedling to die without rain in five days; forming a river on the land by a heavy rain. On July 14, 1957, a rain with only 170mm in precipitation led to flood and debris flow, washing off 12 hm^2 cultivated lands, five dikes, which caused enormous losses. If precipitous topography, easily weathered rocks, frequent storm and low degree of cover were internal factors to give rise to enormous soil erosion in Qingangpa watershed and backward agricultural mode of production and natural resources plundering were external factors, its result of all these factors brought about vicious circle of ecosystem, inverse succession, slow development so far as to stagnate in agricultural economy. The total grain yield was about 125t and 1,845kg per hectare yield and 94.5kg for the average annual grain a person and the total output value of 80,800Yuan, RMB and net income a person, 38Yuan, RMB. The life of the masses was very poor.

To extricate themselves from poverty, since the late 1950s, under the leadership of local government, the masses have launched comprehensive way to mountain, river, farmland, forests and roads in the watershed. The focal points of harness were constructing farmland with high productivity and resuming vegetation in order to strengthen soil and water conservation, lighten drought and water logging disasters. By suiting various measures to the local condition from top to bottom by taking engineering as a precursor, and forest as the principal part, they formed a united, complete, stable, harmonized protection system. At present, there is 18.2 km^2 of accumulative total area for harnessing soil erosion in the watershed, and the degree of erosion control reaches 91% .The major measures are: 2 reservoirs, 59 hill ponds, 24,000 check dams, a 2,300 m irrigation canal, a 29,000 m floodway, 8,500 m dikes, 107.5 hm^2 high productivity farmlands, 47.3 hm^2 irrigated lands, 449 hm^2 forest area, 286.7 hm^2 forest reservation area.

The watershed harnessed has been established progressively, becoming the agricultural ecosystem of soil water conservation model and realized basically “forest and grass on precipitous slope, terraced field on gentle slope, garden plot on plain by river tableland in ditches.”

The considerable development have been made in the agriculture, forestry, animal husbandry, sideline, fishery. The total agricultural output value and income a person, have been enhanced significantly, compared with harness done in the past. The total agricultural output has increased 575,000kg. The unit grain output has risen to 2,790 kg/ha, the average grain a person produces has gone up from 150kg to 500kg. The total agricultural income has raised one million Yuan RMB, the average income a person has gone up from 100 to 1,500 Yuan, RMB. Even more significant changes of ecological landscape in the watershed include: naked hills which used to be have been becoming green luxuriant forest with birds singing and flowers blossoming in spring, shaded by foliage and pleasantly cool in summer with rich fruits and animals in groups in autumn, green pines and beautiful snow image in winter. Meanwhile, benefit of water and sand reducing is evident too. According to hydrological observation data by Nanzhao Soil Water Conservation Station, the watershed erosion modulus has been cut down from 3,380 t/km^2 to 82.2 t/km^2 a year. The largest infiltration at initial abstraction is 111mm, and the steady seepage a hour is 3mm. The flood control and detention capacity can amount to 870,000 m^3, flood-peak reducing more than 50%, sand reducing 97.5%. On July 15,1985,peak-making rainfall amount was 161mm for 3 hours with that peak-making discharge was 186 m^3/s under the condition of largest rainfall 73.3mm storm for 60 minutes, but it is only 91.8 m^3/s after cutoff and infiltration by soil water engineering as well as flood detention and storage capacity.

On summarizing characteristics and experience of soil water ecosystem in the watershed construction, there are four protective systems: engineering measures, vegetative measures, tillage practices and management.

1 Engineering protective system construction

In engineering protective system construction, that is combining the mainstay with general engineering, impounding with irrigating on the basis of overall plan, check dams are built up in rill, ponds in branch gully, reservoir in main gully cut off in river. Four lines of protection have been laid out from top to bottom on slope. The first is excavating listing basin or cavern preparing land on steep slope, terracing on gentle slope, digging floodway to enhance storage–drainage capacity on the foot of slope .The second is constructing check dams in hill for sediment farmland in order to control sand discharge down. The third is madding ponds, weirs and dams in branch gully to regulate runoff and develop irrigation. The last is cutting off river, building dams, diverting the course of the river to make farmlands, erecting overflow dams to lift erosion basic point and guard against undercutting. In the engineering standard aspect , the engineering resist flood appearing once for 20 years. Every engineering has been strengthened and utilized. As for the time-space order, the slope protection system is built first, then check dams. When the capacity of slope protection is low during the initial stage, check dams intercept sands from slope to form gully-dam lands. And, the mainstay engineering in high cost as reservoirs and ponds etc are built in the lower river to impound the runoff, while, the river dykes are built to protect farmlands to let the watershed form a complete engineering system.

2 Vegetative protective system construction

Plants are the main body of ecosystem. The key measure to improve ecological environment and control soil erosion, is to resume and develop arbors, scrubs and grasses vegetation. For this reason, four plant protective sections have been built appropriately according to engineering measures layout and soil nutrient in Qingangpa watershed. The first is forest section for conservation of headwaters on upstream steep slope, whose characteristics are high mountains, steep slopes, thin soil, thick stones and serious breakdown. In this section, the major measures are planting and rejuvenating remnant oak forests, at the same time breeding arbors, scrubs and grasses with good headwaters conservation in combining with forest-grass reservation. The second is commercial forest section on gentle slope of middle reaches, whose characteristics are gentler slope (25—10) but serious sand-gravel surface erosion on it. In this

section, the major measures are breeding commercial forests with stress on mason pines mixed, and tussah forests to breed silkworms so as to add economic income. The third is forest for engineering necessity which are distributed mainly over check dams, gully-clam lands, area around reservoirs and ponds, river banks. The forth is greening-beautifying forests beside four sides (house side, village side, roadside and waterside).

3 Tillage practices system construction

Contour tillage and horizontal-ditch plowing are carried out in the watershed, meanwhile, rotation of water crops and dry crops, intercropping and interplant are also done, so as to ameliorate the soil, add the effective soil nutrients, and decrease soil erosion. For example, rotation of soybean and corn can enhance fertility. At the same time, loess soil is admixed into leaking water and fertilizer lands to ameliorate the soil, deep plough soil in serious sealing farmlands to add organic fertilizers.

4 Management system construction

Management becomes the key measure on the basis of soil erosion control. To ensure that water-soil conservation ecosystem can establish towards normal succession, artificial regulation and control are laid extreme stress on in Qingangpa watershed adhering to the principles of regulation and control in macrocosmic, doing vigorously in microcosmic. On one hand, management of hydro projects and soil water conservation projects are strengthened, so as to make the most benefit of it. On the other hand, the cutting quantity to forest is required less than growing quantity, which excessive pruning and grazing are limited. And organic fertilizers are applied in to farmland to improve soil structure and enhance capacities of water storage and fertilizers conservation.

Reference

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