

# The Evaluation of Ecological Architecture in the Qinggangba Small Watershed

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**Abstract:** This article analyzes the ecological architecture's present situation and function of it. It analyses and evaluates the watershed's ecological structure on some aspects such as the nutrient receipt and expenditure, agricultural product supply, watershed which is synthetically harnessed, pointing out that the watershed has already basically controlled the soil erosion, and established the agriculture of new soil and water conservation pattern by the long-term constant management. Land utilization structure, industrial structure, consumed structure has been adjusted reasonably. Energy's flow and transformation are tend to reasonable and efficient. Innocuous cycle come into being. The watershed makes a point of the principle of resources lasting utilization, and has some action for the same kind region.

**Keywords:** soil and water conservation, comprehensive control of soil erosion, ecological system

## 1 Preface

The Qinggangba watershed lies in the east of the Wuduo mountain, and belongs to the Tangbai drainage of the Yangtze River watershed. The total area is 19.8 square kilometers. It had 1,847 people in 1994, about 456 doors. It covers with granite and granite-gneiss, and the average precipitation of many years is 989 millimeters. Because of the historical reason, the ecotop is very vulnerable before the management. According to the water and soil conservation station's survey in Nanzhao County, average erosion modulus of the watershed is 3,380 t/km<sup>2</sup> in 1950's times, and soil losses is about 67,000 t every year. The A stratum and the B stratum is almost exhausted on many slopes, and the C stratum is out. In addition to the traditional depredation management, it results in the vicious cycle of "soil erosion- poor lands- ground ruin and lack of foodstuff- reclamation of wilderness- chopping the wood and selling the foodstuff- exacerbating the soil and water losses". The ecological environment encounter to be destroyed seriously, and the commons' life is very poor.

According to the principle of building eco-agriculture, the local people make the synthetic management including the mountain, water, field, wood, and road, from the 1950's, leading by the local government. It centres to build the basic farmland, to rehabilitate the plant cover, to strengthen the storage of soil and water, to alleviate the flood and drought damage. We adopt engineering measure as first leading, living creature as main body, and ordonnances each measure adaptation to local conditions. The watershed has preliminarily established an ecological protecting system for unification, entirety, stabilization, coordination through using lands reasonably and adjusting industrial structure. The watershed fulfills the virtuous cycle of ecological environment, and realizes new ecological balance.

## 2 Present situation

### 2.1 The structure of land use

The Qinggangba watershed's land utilization is extremely unreasonable before the management. There has many barren mountain and sparse tussock woodland, but the agricultural acreage is too little and the food can't be self-supplied. Through the management, land utilization structure get reasonable, and the proportion of agriculture, wood, silkworm and other land turned from 1 : 1.54 :

19.93 : 8.45 to 1:7.22:6.75:1.33. The face of slope is mainly planted lumber wood and tusser wood, and the thickness's foot of slope and the gutter channel is planted commercial forest, such as tung oil tree, rucommia. The engineering measure include damming and building the ground, and make use of everything to enlarge agricultural acreage, to build basic farmland. The watershed's land utilization structure is apt to be reasonable, and realized the supply balance of food, fuel, feedstuff, fertilizer...etc.

## 2.2 Industrial structure

The adjustment of land use structure promote the coordination development of agriculture, forest industry, graze industry and parerga. Economic structure has taken place a great changes. Traditional production habit which is mainly in agriculture has been changed, and some of labor force have turned to forest industry, graze industry and parerga. In 1994 total yield of foodstuff is 700,000 kg, grass and straw's yield 1,250,000 kg. The growth quantity of stand is 1645m<sup>3</sup>, lumber yield from felling 126 m<sup>3</sup>, fuelwood yield 1,920,000 kg. The cocoon yield is 45,600 kg. The animal yield is 92,400 kg. The total income of all industries is up to 1,080,000 Yuan. Among them: Agricultural income is 288,000 Yuan, and takes up 27%. Forest industry income is 82,900 Yuan, takes up 7.6%. Silk worm industry income is 128,000 Yuan, takes up 11.8%. Graze industry income 184,800 Yuan, takes up 17%. Parerga income is 399,100 Yuan, takes up 37%. The watershed realizes the equilibrium development, and the proportion that income occupied of each industry is basically coordination.

## 2.3 Consumed structure

In 1994, the watershed is beyond to self-supplied, and average foodstuff is 379 kg, average fuelwood 1,040 kg, grazing product (egg, milk, meat etc.) 50 kg. A part of foodstuff and fuelwood, a big part of lumber and grazing product, and all of cocoon and parerga product become the merchandise. The whole watershed go ahead from self-sufficient agriculture toward merchandise agriculture.

## 3 Structure and function

### 3.1 The energy input and output of the whole watershed

The Qinggangba watershed's energy input and output are listed in Table 1. Total input energy of the watershed is 32,923,000,000,000 J (not include the solar energy), total output energy 74,121,000,000,000 J. The ratio of output and input is 2.25. So it is high efficiency of energy revolving and the productivity level. From the table we can see that the biomass energy is main in the input energy, and takes up 93%, but the industry energy only takes up 7%. So the watershed's ecological running mechanism is reasonable, and ecological structure is stable.

**Table 1 The Qinggangba watershed's energy input and output table**

Item	input				Output				
	object		unit input fold energy (10 <sup>6</sup> J)	input fold energy (10 <sup>12</sup> J)	item	object		unit output fold energy (10 <sup>6</sup> J)	output fold energy (10 <sup>12</sup> J)
	unit	quantity				unit	quantity		
Seeds	kg	19,190	15.89	0.305	foodstuff	Kg	700,000	16.71	11.697
Organic fertilizer	Kg	10,000,000	1.34	13.390	straw	Kg	1,250,000	14.44	18.050
Roughage	Kg	900,000	14.49	12.996	fuelwood	Kg	1,920,000	19.60	37.632
Concentrate	Kg	100,000	15.90	1.590	timbering	Kg	88,200	20.74	1.829
Manpower	day	184,600	12.58	2.322	fruit	Kg	15,000	16.32	0.205
Animal power	day	4,799	58.14	0.279	Brute product	Kg	92,400	13.02	1.203
Electricity	Kwh	70,000	12.56	0.879	Cocoon	Kg	45,600	22.19	1.012
fertilizer	Kg	54,000	21.06	1.162	Fabrication increment	Yuan	390,000	6.29	2.453
total				32.923					74.121

### 3.2 The whole watershed energy flow's situation

Every year, input energy on the farmland is 16,218,000,000,000 J, output energy 29,764,000,000,000 J, and the ratio of output and input is 1.84. Among the output energy, 31% is for the watershed, 49% for graziery production, 18% for agriculture production, 2% for the market.

The input energy on forest industry and fruit industry is 566,000,000,000 J, output energy 19,599,000,000,000 J, and the ratio of output and input is 34.63. Among the output energy, 89.4% is for the watershed as food or fuel, 10.6% for the market.

The input energy on sericulture is 754,000,000,000 J, output energy 21,102,000,000,000 J, and the ratio of output and input is 27.99. Among the output energy, 81% is for the watershed as fuel, 8% is Put into output system after its Value increased by transformed into the industry and processing, 11% for the market.

The input energy on graziery is 14,586,000,000,000 J, output energy 1,203,000,000,000 J, and the ratio of output and input is 0.08. This ratio is low mainly because the availability of work stock is low. Among the output energy, 33% is for the watershed, 67% for the market.

The input energy on industry and parerga is 799,000,000,000 J, output energy 2,453,000,000,000 J, and the ratio of output and input is 3.07. The output energy is almost all for market.

All in all, 59% of the output energy is for watershed, 7% not be used (such as food, straw and other surplus), 11% for the market place, 23% outside the watershed after circulation or conversion. The total output energy of the whole watershed is 9,940,000,000,000 J (including the conversion part). The total input energy is 2,041,000,000,000 J (electricity, artificial fertilizer etc.). Therefore the watershed's energy availability, output utility and social utility are all higher.

### 3.3 Material circulation in the watershed

The Qinggangba watershed produces vegetable product 3,973,000 kg (including food, feedstuff, straw, fuelwood, lumber, fruit). Except 349,000 kg (food, straw and surplus) is not be used and 256,000 kg is directly for market, the rest of 3,368,000 kg participates in the watershed's circulation. Among them, 300,000 kg return to the soil as dead litter, 3,068,000 kg as night soil after convert by person or nimal. These materials turn into the vegetable produce again after resolved by microorganism. The circulation of "plant-animal-microorganism-soil-plant" is shaped, and the energy get full use.

## 4 Structure evaluation

### 4.1 The analysis of soil nutrient's receipt and expenditure

The Qinggangba watershed's soil nutrient receipt and expenditure are listed in Table 2. In a year, the watershed input azote 59,330 kg, phosphor 18,340 kg, potassium 57,230 kg. The production contains azote 55,130 kg, phosphor 9,540 kg, potassium 22,010 kg, and the surplus are respectively 4,200 kg, 8,800 kg and 35,720 kg. It is extremely beneficial to improve soil and enhance the land productivity.

**Table 2 The Qinggangba watershed's soil nutrient receipt and expenditure table unit: t**

income					Expenditure				
item	object	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	item	object	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
seeds	19.19	0.33	0.1	0.16	foodstuff	700	11.28	3.64	5.88
Organic fertilizer	10,000	47	18	57	straw	1,250	5.25	1.995	6.3
Artificial fertilizer	54	8.64	0.0	0.0	fuelwood	1,920	21.28	1.501	3.61
Dead litter	300	3.36	0.237	0.57	fruit	15	0.05	0.045	0.24
total	/	59.33	18.337	57.73	total		55.13	9.541	22,013

## 4.2 Analysis of agricultural product and byproduct's supply and desideration

(1) foodstuff: The yield of foodstuff of the watershed is 700,000 Kg in a year, and a person needs 300 kg for a year, so there needs 550,000 kg. It needs seeds 20,000 kg, and the feeding stuff 100,000 kg. The gross demand quantity is 670,000 kg. The foodstuff surplus is 30,000 kg.

(2) fuel: The yield of fuelwood of the watershed is 1,920,000 kg in a year, and a person needs 800 kg for a year, so there needs 1,478,000 kg. The fuelwood surplus is 442,000 kg.

(3) forage grass: The yield of forage grass of the watershed is 1,250,000 kg in a year, and the cattle and goat need 1,000,000 kg for a year. The forage grass surplus is 250,000 kg.

(4) lumber: The cumulation of live stumpage of the watershed is 1,500 m<sup>3</sup> in a year, and the fall is 30725 m<sup>3</sup>. Now the total cumulation of live stumpage is 126 m<sup>3</sup>. The growth is beyond to the fall.

(5) animal product: Total animal product of the whole watershed is 92,400 kg, such as birds, egg, meat etc. According to the current consumed standard, and a person needs 15 kg for a year, so there needs 25,000 kg. The surplus is 67,400 kg.

All in all, all kinds of products have surplus, and the watershed realizes the balance of supply and desideration.

## 4.3 Benefit analysis

(1) Economic effect: In 1994 the whole watershed's gross earnings is 1,080,000 Yuan, and per capita income is 586 Yuan. The net per capita income is 373 Yuan. It is higher than the average level of whole county. Compared with the year of 1957, the gross earnings increase 999,200 Yuan, the per capita earnings increase 335 Yuan.

(2) Social benefit: Because of the basic farmland increase, the commons's foodstuff get dependable assurance, and realize self-supplied. At the same time, it returns the agricultural and animal products about 500,000 kg to the society to sell, and efficiently adjusts the market.

(3) Ecological benefit: Ecological benefit: According to the calculation of actual data, the watershed blocks runoff flow 11,970,000 m<sup>3</sup> every year, the silt 38,470,000 kg, and reduces the losses of flood and drought 56,800 Yuan. The watershed basically decrinates the flood, and helps the downstream reservoir to adjust the flood and build the lands.

## 4.4 The evaluation of ecologic system artificial regulation

The Qinggangba watershed soil and water conservation ecosystem is a new agriculture ecosystem which establish under mankind's severely interference. During the processes of building, management and utilization, artificial regulation is decisive. During the management, we adopt the strategy that take the water conservancy and water and soil conservation engineering as outrider, and take the forest industry development as main body, aiming at the problem that the soil erosion is serious, and the flood and drought is frequent. We resolve the problem of soil erosion and the relation of keeping water and using water, and deracinate the flood and drought. Aiming at the problem of more people and little land and the problem of poor economy, we adopt the policy that enlarge the tillage, and develop the diversified business. The problem of foodstuff shortage have been resolved in radically, and also increased the economic effect. We persist in the principle of lasting utilization, and increase the input of the organic fertilizer. The fertility of soil is unceasingly hightened and preserved. We insist that the lumber yield from felling is higher than the production output, and make the ecological benefit is relatively stable and gradually increased.

## 5 Conclusion

(1) The Qinggangba watershed has set up the eco-agriculture of new soil and water conservation pattern through the management, and controlled the soil erosions. The structure of land use, industrial structure and consumed structure all get the reasonable adjustment. The productivity level is enhanced. The energy flow and conversion is apt to reasonable and efficient. Circulation capacity of product is intensified. The watershed realizes virtuous cycle of ecosystem.

(2) The Qinggangba watershed has already realized a series balance, including the nutrient balanced, amount of water's supply and desideration balance, foodstuff supply and desideration balance, fuel supply and desideration balance and lumber supply and desideration balance. The function of this system is about to perfect. The production is basically not influenced by market price, and the watershed's ecosystem have definite stability and indelibility.

(3) The Qinggangba watershed's artificial regulation makes a point of the principle of resources' lasting utilization, and have a certain value to expand.

(4) The Qinggangba watershed's achievement is the result of long-lasting and synthetical management, takeing small watershed as an unit.

#### **References**

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