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WATER RESOURCE IN QILIAN MOUNTAINOUS REGION AND ITS INFLUENCE ON ECO-ENVIRONMENT OF HEXI CORRIDOR

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ABSTRACT: Based on the water resources of the Shiyang, Heihe and Shule river basins in the Hexi Corridor and their original runoff volume, the actual annual water resources in the oasis of every county and town of the Hexi Corridor are calculated in detail. From the point of view of ecological balance, the ecological water requirement in oasis and farmland in this region are determined. Then, to basically keep the natural ecological balance of every county and town, the proper oasis area and farmland area are given.
KEY WORDS: Qilian Mountains, Hexi Corridor, oasis, farmland, water resources

The Qilian Mountains lies between Gansu and Qinghai provinces, which stretches from the Wushao Ridge in the east to the Dangjin Mountain Pass in the west. It consists of 7 mountains and valleys which run from WNW to ESE direction and is about 1,000 km long and 250—300 km or more wide, 3,500 m or more high for main body and 5,000 m or more above sea level for mountain peaks. The average relative height between their northern slope and the Hexi Corridor is 3,000 m or more. The tectonic landforms make water systems of the Qilian Mountains as radiation-lattice distribution, and the radiative center is situated near the point in 99°E, 38°20′N. Three inland water systems rising in the Qilian mountainous region and flowing to the Hexi Corridor are Shiyang, Heihe and Shule rivers ranging from the east to the west. In general, their mountainous basins divide the northern slope of the Qilian Mountains into eastern, middle and western sections.

The western region of Gansu Province starting from the Huanghe (Yellow) River in the east is defined as Hexi region, which covers an area of about 27.1×

$10^4\ km^2$, 59.8% of Gansu Province's total area, including three natural geographical regions, towards the north, the Qilian mountains region, the Hexi Corridor and Beishan mountains region (Mazong, Heli and Longshou mountains, etc.). The Hexi Corridor, a long and narrow plain, extends from the Gulang Gorge in the east to the Gansu-Xinjiang border in the west, which is 1,100 km long, from several to a hundred odd kilometers or more wide and 1000—1500 m high above sea level basically, covering an area of about $11.1\times10^4\ km^2$, 41.0% of the Hexi region's total area.

Water resource is the most important natural resource in the Hexi Corridor. In order to satisfy the requirement of industrial and agricultural construction, some researchers have calculated the water resource for the Qilian Mountains and the Hexi Corridor[1-2] several times. But they were just limited in the whole corridor or Shiyang, Heihe and Shule river basins. The rough results can not provide scientific basis of developing programmes for every county and town in detail. Especially, in the study of water resources component and transformation rule between surface and underground water in the Hexi Corridor, actual water resources amounts were frequently estimated excessively high. This made water resources in some areas be unduly exploited. As a result, the serious ecological imbalance phenomena appear.

Based on the water resources of the Qilian mountainous region basins of the Shiyang, Heihe and Shule river systems and their original runoff volumes, this paper calculated actual water resources in oasis of every county and town in detail and then the proper areas of oasis and farmland were determined.

I. WATER RESOURCES IN THE QILIAN MOUNTAINOUS REGION

The water resources types in the Qilian mountainous region are principally atmospheric precipitation, glacier and surface water. Precipitaion, the major water resource, controls glacier development and river runoff volume formation, distribution and variation.

1. Precipitation Resources in Mountainous Region

The correlation between annual precipitation of all the meteorological (or hydrological) stations in every river basin in the Qilian mountainous region and altitude possessed S-shape[3], which can be approached with a cubic curve. The Huangyang, Heihe and Shule river basins can stand for eastern, middle and western sections of the northern slope of the Qilian Mountains, respectively. In brief, S-shaped curves are divided into three parts and annual precipitation in the middle part (altitude: 2,400—2,700 m for Huangyang River area, 2,600—3,100 m for

Heihe River and 2,800—3,600 m for Shule River) appears linear decreasing with altitude, whereas linear increasing for the upper and lower parts (Fig. 1).

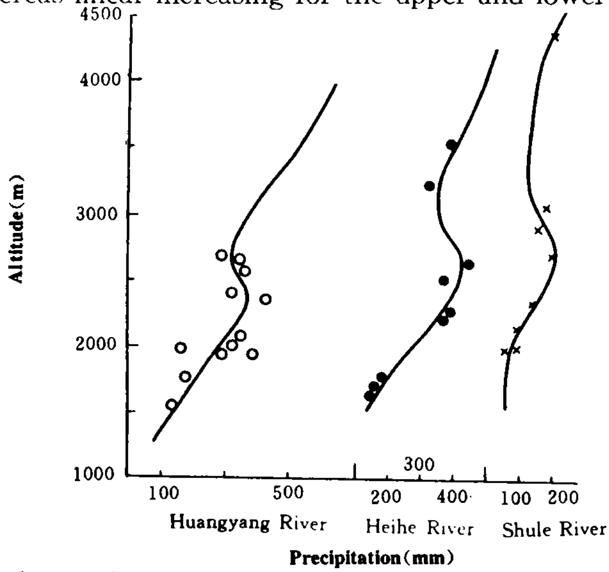

Fig. 1 The correlation between annual precipitation and altitude in river basins

When imitating these three parts with linear equations respectively, high errors may appear due to sparse stations. So, the mean increment or decrement of annual precipitation at different altitudes is calculated (Table 1). The annual precipitation of every section at different altitudes in the northern slope of the Qilian Mountains is also gained: 300 — 650 mm for eastern section, 200 — 450 mm for middle section and 150—300 mm for western section. Such a distribution is mainly due to the origin and transporting direction of water vapor and the vertical zonation of mountainous region.

Table 1 The mean increment or decrement of annual precipitation at different altitudes in various river basins on the northern slope of the Qilian mountainous region

		Huangyang R.	Heihe R.	Shule R.
Lower part	Altitude(m)	1.800—2.400	1.800—2.600	1.800—2.800
	Increment(mm)	150	186	137
	Increment rate(mm/100 m)	25.0	23.3	13.7
Middle part	Altitude (m)	2.400—2.700	2.600—3.100	2.800—3.600
	Decrement (mm)	67	88	78
	Decrement rate (mm/100 m)	22.3	17.6	9.8
Upper part	Altitude (m)	2.700—4.000	3.100—4.000	3.600—4.500
	Increment(mm)	317	140	96
	Increment rate(mm/100 m)	24.4	15.6	10.6

Based on the calculation and statistic results, the area of the Qilian mountainous region in Hexi area is 7.40×10^4 km^2 and the mean annual average rainfall is 284.1 mm, which is 2.1 times that in the Hexi Corridor. The mean annual rainfall in mountainous region basins of river systems of Shiyang, Heihe and Shule rivers are 457.2 mm, 360.2 mm and 172.6 mm, respectively, which are 2.2, 2.7 and 3.6 times that of eastern, middle and western sections of corresponding the Hexi Corridor plain basins (Table 2).

Table 2 The amounts of the mean annual precipitation of the Qilian mountainous region basin and the Hexi Corridor plain basin of every river system (mm)

Basin	Mountainous regon basin①			Mean annual rainfall in Hexi Corridor plain basin (mm)②	Arnual rainfall ratio of mountain to plain basin
	Area (km^2)	Total of annual rainfall (10^3 m^3)	Mean annual rainfall (mm)		
Shiyang R.	11.110	50.80	457.2	204.8	2.2
Heihe R.	27.150	97.80	360.2	133.7	2.7
Shule R.	35.760	61.71	172.6	48.1	3.6
Total	74.020	210.31	284.1	135.6	2.1

In the Hexi Qilian mountains region, not only the rainfall is abundant, but also the changing rate, usually expressed by the deviation coefficient Cv③, is small. Based on the annual rainfall, C_v can be obtained as 0.10—0.20, 0.15—0.25 and 0.20—0.40 for the eastern, middle and western sections, respectively. We find that the C_v values in the eastern and middle sections are less than the most areas of South China, which is favourable to forest and herbaceous plant development.

2. Glacier Resource in Mountainous Region

The Qilian Mountains is high and large. Rich precipitation appears at mountainous region above the altitude of 4,100—4,200 m because there often exists the cumulonimbus (Cb) and nimbostratus (Ns) over these regions. They accumulated and stored in the form of ice and snow, and then modern glacier, a special existence form of the water resoure, called as "high mountainous solid reservoir".

Based on the glacier research data[5] of the Hexi Qilian mountainous region, the glacier areas of mountainous region basins in three river systems of Shiyang, Heihe and Shule rivers are 64.82, 420.55 and 849.38 km^2, respectively, and the total is 1,334.75 km^2. The glacier reserves is 21.43, 136.70 and 457.36 $\times 10^8$ m^3, respectively, and 615.49 $\times 10^8$ m^3 in total. The modern glaciers of the Hexi Qilian mountainous region are distributed mainly over the middle and western sec-

① From Literature [1], P. 40

② Calculating based on the rainfall data of meteorological station at present in the Hexi Corridor from the begining to 1990.

③ $C_v=\sqrt{\frac{\sum(R_i-\bar{R})}{n-1}}$, where R_i is the precipitation in the i-th year number, $\bar{R}$ is the mean annual precipitation, n is the number of years.

tions, and po... at the eastern section.

3. Surface Runoff Volume in Mountainous Region

Real productive significance appears only when rainfall and glacier resources are turned into surface runoff and transported out of the mountainous region. The runoff volumes in the mountainous region depend on the difference between rainfall and evaporation, and surface conditions.

Based on research data[6], there were no forest at the western section of the Qilian Mountains' northern slope, and perpendicular natural vegetation zonation are divided into desert, steppe, forest-steppe, shrub-steppe, meadow-steppe and ice-snow from bottom to top in their eastern and middle sections. Above the lower limit of forest-steppe (2,500—3,200 m above sea level), the difference between annual precipitation and evaporation is always positive. Meanwhile precipitation increases, air temperature decreases and the positive difference increases along with the rise of altitude. Comparing forest-steppe mountain with shrub-steppe (3,200—3,700 m above sea level) and meadow-steppe (3,700—4,200 m above sea level), in moutainous region, the former has higher temperature, more evaporation and less positive difference between rainfall and evaporation. Through measuring and calculating[1] in mountainous region, the runoff volumes produced in forest-steppe were less than 1/4 of the total, whereas the two latters are 3/4 of the total.

In the Hexi Qilian mountainous region, there are 23 rivers having hydrographic stations, with control basin areas of 6.24×10^4 km^2, 30 brooks (no hydrographic station) with an area of 3.68×10^3 km^2 and other shallow mountainous regions with an area of 8.32×10^3 km^2, from which the mean annual runoff volumes of the whole mountainous region are 70.45×10^8 m^3 and 12% of them are glacial melted water. The annual mean runoff and glacial melted water are 15.91×10^8 m^3 and 3.8% for Shiyang River, 38.10×10^8 m^3 and 8.3% for Heihe River, 16.44×10^8 m^3 and 28.5% for Shule River, respectively[1].

II. ACTUAL WATER RESOURCE IN HEXI CORRIDOR

1. The Original Runoff Volumes

The Hexi Corridor is an unbalanced area of climate resources, light and heat are abundant but rainfall is only 35—200 mm. Under the natural rainfall conditions, there appears semi-desert and desert landscape. Whereas the rainfall in the Qilian mountainous region is comparatively rich. Fifty-seven inland rivers or brooks originated from mountainous region can provide original runoff volume of

$69.96\times10^8\ m^3$ per year for the Hexi Corridor plain region, which makes up 99.3% of the total runoff volumes in the Hexi Qilian mountainous region, in which 15.67×10^8, 37.95×10^8 and $16.34\times10^8\ m^3$ are from these three river systems of Shiyang, Heihe and Shule rivers, respectively. They irrigate different oases in the Hexi Corridor for several decades and form giant discontinuous oasis belt, which is 1,100 km long, on the northern slope of the Qilian Mountains.

In order to serve for the distribution of agriculture, forestry and stock raising, the actual annual original runoff volumes of every county and town, defined as the difference of the total amount (including the inflow from out and origin by itself) and outflow of the rivers or brooks in every county and town, are computed: $1.12\times10^8-5.94\times10^8\ m^3$, $1.32\times10^8-8.82\times10^8\ m^3$ and $3.60\times10^8-6.44\times10^8\ m^3$ for Shiyang, Heihe and Shule river basins, respectively.

2. The Irrigating Water Depth in Oasis of Every County and Town

There are atmospheric rainfall, surface water and underground water[7]. For calculating convenience, according to Chen Longheng[1], we approximately regarded the actual annual original runoff volumes of every river in every county and town in the Hexi Corridor as annual surface water resource completely used for agriculture, forestry and stock raising, not including the water cnosumed by livestock.

Based on irrigating rate, utilizing rate and natural supplement resources of underground water in recent years in the Hexi Corridor, the net utilizing rates of the actual annual original runoff volume in the Shiyang, Heihe and Shule river basins are given as 65.5%, 59.0% and 40.8%, respectively. Moreover, refering to the information of local water conservancy divisions, the net utilizing rates of actual annual runoff volume in every county and town are estimated approximately. Now, the net surface water resources, namely the actual annual irrigating water volumes, for agriculture, forestry and stock raising in every county and town can be calculated. Then, averaging them over the existing oasis areas there, the actual annual irrigating water depth is 105—710 mm (Table 3).

3. Actual Water Resource in Oasis of Every County and Town

The water volumes stored in soil are given as below[8]:

$$B = (R + G + P) - (H + E + F) \qquad (1)$$

where R is atmospheric rainfall, G is the supplement of underground water, P is the irrigating water depth; H is the transpiration of crops, E is the evaporation of surface and F is the surface runoff volume.

The terrain in the Hexi Corr'dor oasis is plain and rainfall is rare , then the

Table 3 The actual annual water resources of the oasis of every county and town in the Hexi Corridor

	Actual annual runoff volume (10^3 m^3)	Net utilizing rate of actual annual runoff volume(%)	Actual annual irrigating water (10^3 m^3)	Oasis area at present① (10^4 ha)	Annual mean irrigating water (m^3/ha)	Annual depth of irrigating water(mm)	Annual rainfall (mm)	Actual annual water resource② (mm)	Actual annual water resource② (10^3 m^3)
Gulang	1. 1220	66	0. 7405	7. 04	1051. 9	105. 2	360. 7	465. 9	3. 2799
Wuwei	5. 9876	70	4. 1568	17. 33	2398. 3	289. 8	158. 4	898. 2	6. 9008
Jinchang	4. 9272	65	3. 2027	13. 90	2304. 1	230. 4	185. 1	415. 5	5. 7755
Minqin	3. 4200	65	2. 2230	13. 08	1699. 5	170. 0	115. 0	285. 0	3. 7276
Shandan	1. 3199	60	0. 7919	5. 85	1353. 7	135. 4	196. 2	331. 6	1. 9396
Minle	4. 0630	60	2. 4373	8. 13	2998. 5	299. 9	328. 2	628. 1	5. 1065
Zhangye	5. 8676	60	3. 5206	9. 96	3534. 7	353. 5	129. 0	482. 5	4. 8057
Linze	1. 4019	65	0. 9112	3. 53	2581. 3	258. 1	113. 4	371. 5	1. 3114
Gaotai	1. 4542	66	0. 9598	4. 29	2237. 3	223. 7	104. 4	328. 1	1. 4076
Jiuquan	8. 8219	50	4. 4110	10. 73	4110. 9	411. 1	85. 3	496. 4	5. 3264
Jinta	7. 6800	43	3. 3024	4. 65	7101. 9	710. 2	59. 9	770. 1	3. 5810
Yumen	6. 4400	42	2. 7048	6. 25	4327. 7	432. 8	61. 8	494. 6	3. 0913
Anxi	5. 5830	42	2. 3449	3. 57	6568. 3	656. 8	45. 7	702. 5	2. 5079
Dunhuang	3. 5950	42	1. 5099	2. 34	6452. 6	645. 3	36. 8	682. 1	1. 5961
Total	61. 6333		33. 2168	110. 65					50. 3577
Average		57			3480. 1	348. 0	141. 4	489. 4	

① Calculating based on the data in Table 3-2-2 and P 161 of "Water and land resources and their rational development and utilization in Hexi Region of Gansu Province", 1985 (No open).

② The annual actual water resources (the water layer depth) in Jinchang and Yumen cities were calculated by using the rainfall of Yongchang and Yumenzhen stations.

surface runoff volume lost seldom and the most part of them leak into the soil layer. But little amount leak into the deeper soil layer, and the most part soak cultivating layer of soil and major distributional layer of shrub and grass roots. For example, the annual leakage in the Shiyang, Heihe and Shule river basins are about 13—25 mm, 4—17 mm and 2 mm respectively. In addition, the amount of irrigating water leaking into deeper soil layer approximately equals the amount of the supplement of underground water received by upper soil layer. Therefore, F and G in equation (1) can be regarded as zero. If evaporations $(H+E)$ are ignored, the actual available annual water resources are given as followws:

$$B = R + P \tag{2}$$

According to equation (2), the total actual annual water resources in the oasis of every county and town of the Hexi Corridor are 285 — 770 mm, which is 1.3—18.5 times that of the local annual precipitation. Basically its distributional trend decreases from west to east. The total actual annual water resources in oasis of the Hexi Corridor is 50.36×10^8 m^3 and the depth of average annual water layer is 489.4 mm, which is 3.5 times that of the mean annual precipitation (Table 3).

The oasis of every county and town in the Hexi Corridor, known as a famous grain base and the principal production area of sugar, oil, meat and melon, receives rich irrigating water from the Qilian mountainous region. More than 30% of the grain production and 70% of the commercial grain in Gansu Province are supplied here. Hence, if there were no the Qilan Mountains, there were no such a rich oasis area in the Hexi Corridor. In fact, these inseparable and dependent relationships also exists between other mountains and their oasis in the arid area of northwest China.

III. THE PROPER AREAS OF OASIS AND FARMLAND

1. The Proper Area of Oasis

1.1 *The ecological water requirement for oasis*

"Desert became oasis, if there were water, oasis became desert, if no water". This means that water is the ecological basis of oasis in desert area. Only when the oasis of the Hexi Corridor was established as a harmonic and high-effecient irrigation ecological system, can we keep its prosperous development. So, we should properly determine the ecological water requirement in the Hexi Corridor first, and then accurately estimate their actual water resource load-volume, finnally, give their proper size of area.

Naturally, the Hexi Corridor belongs to the sparse shrubs and arbor-steppe landscape. Comparing the measured and inquired water requirement for forest with the values calculated by applied climate methods[9], we find that the annual water requirement for maintaining arbor forest normal growth and forming fuel forest approximates to 410—580 mm calculated by Zhang Baokun, and water requirement for arbor forest growth and forming timberland is nearly 640—850 mm computed by the revised H. L. Penmen formula. The annual water requirement by shrub is only 1/3—2/3 of that by arbor fuel forest, but they are more than that by grass. According to these values and other data of proper water requirement by various forests[10], the annual ecological water requirement by oasis in every county and town in the Hexi Corridor is 400—500 mm (Table 4).

Table 4 The proper oasis area of every county and town in the Hexi Corridor

	Auunal ecological water required for the oasis(mm)	Annual water difference between supplement and requirement for oasis(mm)	Changed oasis area(10^4 ha)	Proper oasis asea(10^4 ha)
Gulang	400	65.9	1.16	8.20
Wuwei	400	−1.8	−0.07	17.26
Jinchang	400	15.5	0.54	14.44
Minqin	450	−165.0	−4.80	8.28
Shandan	400	−68.4	−1.00	4.85
Minle	400	228.1	4.64	12.76
Zhangye	400	82.5	2.06	12.01
Linze	450	−78.5	−0.62	2.29
Gaotai	450	−121.9	−1.16	3.13
Jiuquan	450	46.4	1.11	11.84
Jinta	500	270.1	2.52	7.16
Yumen	500	−5.4	−0.06	6.18
Anxi	500	202.5	1.44	5.02
Dunhuang	500	182.1	0.85	3.19
Total			6.61	117.24
Average	443			

1.2 *Proper oasis area*

As to oasis of every county and town, the difference between actual annual water amount and ecological water requirement is defined as the water index of proper oasis area. Suppose S (10^4 ha) is the existing oasis area, H (mm) is actual annual water resources, H' (mm) is the annual amount of ecological water requirement, $\triangle H$ ($H-H'$) is the annual difference of them, then the oasis area which should be changed [$\triangle S'$ (10^4 ha)], determined by $\triangle H$, and proper oasis areas [S'(10^4 ha)], determined by annual actual water resources, can be computed by the following two equations:

$$\triangle S = \frac{\triangle H \cdot S}{H'} \quad (3)$$

$$S' = S + \triangle S \quad (4)$$

According to Table 4, the actual annual water resources of Minle, Jinta, Zhangye, Anxi, Gulang, Jiuquan, Dunhuang and Jinchang towns or counties satisfy the ecological water reauirement for the existing oasis area, and there remains a small surplus. So the recent oasis should be expanded by $0.54\times10^4-4.64\times10^4$ ha. In Yumen and Wuwei cities, their relationship are proper basically. While for the reason of balance, the existing oasis areas should be reduced by $0.62\times10^4-4.80\times10^4$ ha in Minqin, Gaotai, Shandan and Linze counties. In general, according to the annual actual water resources in the Hexi Corridor, existing oasis areas could be expanded by 6.61×10^4 ha, that is, proper oasis area could be 117.24×10^4 ha, which is 10.6% of the total area of the Hexi Corridor.

2. Proper Farmland Area in Oasis

2.1 *The ecological water requirement for farmland*

More than 90% of farmland area in oasis of the Hexi Corridor have planted grain, and about 70% of them is spring wheat. Therefore, based on the index of water requirement by spring wheat[10-11] and local climatic characteristics, the annual ecological water requirement of farmland in every county and town are determined as 450—650 mm (Table 5), which is the best amount for producing "addition-effect" and "coordination-effect" between crop energy and ecological factor, such as light, heat, soil, fertilizer, seed, and so on[12]. Compared Table 4 and Table. 5, the ecological water requirement in farmland is 12.5%—33.3% more than that in oasis, that is, ecological water conditions suitbale for oasis can not satisfy the demands of crops. For keeping a long-term harmonic developing and high-stable crop yields in oasis, the appropriate ratio of farmland area in oasis of every town and county must be determined.

2.2 *The proper farmland area*

A good structure of oasis consists of forest, grass land and farmland in a appropriate ratio. For a harmonic and high-efficient ecological oasis system, the area of forest and grass land should occupy at least 40%—50%[13] of the total. Considering the natural environment of oasis in the Hexi Corridor, we supposed that actual annual water resources over 60% of proper oasis areas of every county and town can be used to determine the proper farmland areas (S''), then

$$S'' = \frac{H' \cdot 60\%\ S'}{h} \tag{5}$$

where the means of H' and S' are the same as before; h is the amount of ecological water requirement for farmland.

From Table 5, the proper farmland area, calculated from equation (5), is about 45%—53% of the proper oasis areas of every county and town in the Hexi Corridor. The actual annual water resources of 60% proper oasis area in Jinchang, Minle, Zhangye, Jinta, Jiuquan, Yumen, Gulang and Anxi are so abundant that farmland area should be expanded by $0.83\times10^4-3.16\times10^4$ ha, whereas the recent farmland area in Minqin and Wuwei cities should be diminished by 2.43×10^4 ha and 0.59×10^4 ha, respectively, only in this way can they maintain proper level. The others remain balance basically. To the whole Hexi Corridor, the proper farmland area determined by the actual annual water resource of 60% oasis areas should be 57.98×10^4 ha, which is 9.32×10^4 ha larger than that now. The investigation for the actual used irrigation water of the existing farmland in these areas shows that the theoretical values and actual conditions are almost identical. For example, the existing farmland area in Minqin oasis is about 6.16×10^4 ha, whereas the real cultivated farmland is less than 4×10^4 ha for serious short of irrigation water, which is identical with the results calculated above (Table 5).

Table 5 The proper farmland area in the proper oasis area of every county and town in the Hexi Corridor (10^4 ha)

	Ecological water requirement for farmland (mm)	Proper farmland area	Farmland area at present*	Ratio of proper farmland to proper oasis	Difference of farmland area between proper and existing
Gulang	450	4.37	3.22	53	1.15
Wuwei	500	8.28	8.87	48	−0.59
Jinchang	450	7.70	4.54	53	3.16
Minqin	600	3.73	6.16	45	−2.43
Shandan	450	2.59	2.65	53	−0.06
Minle	450	6.81	4.97	53	1.84
Zhangye	500	5.57	4.23	48	1.54
Linze	550	1.43	1.58	49	−0.15
Gaotai	550	1.54	1.36	49	0.18
Jiuquan	550	5.81	4.45	49	1.36
Jinta	650	3.31	1.85	46	1.46
Yumen	650	2.85	1.75	46	1.10
Anxi	650	2.32	1.49	46	0.83
Dunhuang	650	1.47	1.54	46	−0.07
Total		57.98	48.66		9.32
Average	546			49	

* The Statistical Bureau of Gansu Province. The Statistical Almanac for Gansu Province (1986). Beijing: China Statistical Press, 1987, p. 121, 123−124.

After planning and regulating for oasis and farmland areas of every county and town in the Hexi Corridor as mentioned above, there will be a good disposition of water, heat and light on them. Moreover, if the local people adopt a series of necessary scientific methods of agriculture, forestry and stock raising, prevent the oasis from desert storm damages and protect natural environment, a stable, harmonic and high protective-ability and productivity irrigating ecolgical systems will be gradually established in the Hexi Corridor.

IV. CONCLUSION

According to the calculation of the water resources of the Shiyang, Heihe and Shule river basins in the Hexi Corridor and their original runoff volumes, it shows that the actual annual water resources in the oasis of every county and town of the Hexi Corridor are 285—770 mm, which is 1.3—18.5 times that of the local annual precipitation. From the point of view of ecological balance, the ecological water requirement in oasis in every county and town is 400—500 mm and that in the farmland is 450—650 mm. On the basis of the above mentioned calculation, to basically keep the natural ecological balance of every county and town, the proper oasis area should be 2.92×10^4 ha—17.26×10^4 ha, and that in the whole Hexi Corridor may be expanded to 117.24×10^4 ha, which is 6.61×10^4 ha larger than now; the proper farmland area should be 1.43×10^4 ha—8.28×10^4 ha and that in the whole Hexi Corridor may be expanded to 57.98×10^4 ha, which is 9.32×10^4 ha larger than that now.

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