Study on the Intensive Use of Rural Cemetery Lands from the Perspective of Multiple Functions

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Abstract According to the investigation and study on the land use of different cemeteries in rural areas, the intensive land use of four cemeteries, including the public cemetery, traditional cemetery, vertical cemetery, and ecological cemetery, was evaluated. According to the data analysis, it is suggested to choose right cemetery according the practical conditions of each area, to take full use the multiple functions of cemetery lands and improve the intensive use.

Key words Rural cemetery land-using, Multi-functions, Intensive use

The cemetery is byproduct of human civilization. Due to the distinctive ethnic features in various areas, different forms of cemetery, including burial, burial at sea, cremation, tree burial, *etc.* Deeply influenced by the traditional concept that men should return to the lands, Chinese people generally prefer the traditional burial, which is both simple and hygienic, and follows the natural rules. However, with the improvement of people's living standards, people tend to compare with each other on the both the size and luxury of the cemetery, which result in a weird competition for land between the alive and the dead. Since new China was founded, both the national and provincial government issued a series of laws and regulations on the management of cemeteries, aiming to propagate the advantages of cremation and civilized cemetery. But due to a neglect of management, the civil administration department, which is in charge of the cremation, don't care about how people deal with the ashes after the cremation. Consequently, the land occupation after the cremation is even more serious than that of the traditional cemetery. On this basis, the paper explores to discuss the intensive and multi-functional use of cemetery lands.

1 Land use status of cemetery

1.1 Forms The ultimate goal of cemetery reform is to cremate the bodies and then bury the ashes in a scientific, ecological and economical way. There are currently four types of cemetery. First, public cemetery: to place the ash urn in the commercial cemetery or village social welfare cemetery; second, vertical cemetery: to place the ash urn in the ash tower, ash wall or underground palace, *etc.*; third, traditional cemetery: to build a grave in the family grave field or farmlands; four, ecological burial, such as burial at sea, tree burial, flower burial, lawn burial, *etc.*.

1.2 Land use of cemetery As regards the land use of cemetery, it was recorded as early as in Ming Dynasty that some powerful and rich people build tombs on the farmlands for the sake of good "feng - shui", as a result, the farmers lost their dependence on the farmlands. China, with large population but few farmlands, values the lands very much, especially the farmlands. In order to solve the problems of land occupation by cemeteries, Chinese government issued a series of policies about the reform of cemetery policies. However, due to the influence of traditional concept and folk customs, the issue of cemetery land occupation hasn't been solved radically. For example, 10 010 000 people died in China in the year of 2012. Counted according to 2.75m^2 of public cemetery per capita (including the lands for greening, roads and services)[1] and 3 - 5m^2[2] per capita in rural areas, about 3 000hm^2 lands were occupied by the cemeteries, and this figure also presents an increasing tendency.

1.2.1 Public cemetery and vertical cemetery. As China has wide area and complex terrain, the land use of cemetery presents different features in different areas. In the suburban areas and the countryside in plain areas with limited land resources and dense population, it is not rare to see the public cemetery and public cemetery. Each public cemetery takes up about 0.8m^2 - 1.5 m^2 area with complete facilities and reasonable layout. But taking into account the convenience and "feng - shui", the public cemetery is usually located in the suburban forest area and farmlands with easy access and better soil conditions. The land use of public cemetery directly results in the decrease of farms and forest in China.

The vertical cemetery takes full use of both the aboveground and underground space. For example, there are ash towers in both Fushou garden in Xiaoshu Mountain and Funan village in Daxing Town, Hefei city. But the standing ash towers leave a dark and misfortune impression on nearby residents.

1.2.2 Traditional cemetery. Since the construction public cemetery is still at the initial stage in rural areas, people in some areas still prefer the traditional cemetery. For example, the cremation rate in Yunnan Province was only 29%[3]. In some countryside,

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even though the bodies have been cremated, the ashes are still buried. Compared with the traditional cemetery, the cremation is completely useless, which is not only a waste of people's money, but also a serious pollution to local environment[4]. The cremation of bodies calls for a huge investment in the construction and maintenance of funeral parlors. Besides, the burial after the cremation also occupies large areas. In contrast, although the traditional tombs take up lands, they will disappear as time goes by. Therefore, it is rare to see the land competition between the alive and the dead mentioned above. During the 5 000 years'history, countless of people died, but the areas occupied by tombs are still in little proportion. In addition, the vegetation growing on the tombs matches perfectly with local ecology. But it is still undeniable that modern tombs have destructed large areas of farmlands.

1.2.3 Ecological cemetery. Without taking up any land, burial at sea starts to become popular in some areas; other forms, such as the tree burial, flower burial and lawn burial, however, are still not acceptable to traditional Chinese. In addition, a small proportion of people choose deep burial without leaving any gravestone aboveground.

2 Evaluation on the intensive use of multi-functional cemeteries

2.1 The intensive use of multi-functional cemeteries The intensive use of lands means to increase the land use capacity and space and satisfy people's need for lands[4]. While the intensive use of cemetery lands is to place more ashes or coffins in the smallest areas[5]. Since the ancients, the lands for cemeteries make it possible for the alive to honor the dead. Besides, the green vegetation in the cemeteries can also play an ecological function.

There are generally three ways to realize the intensive use of multi-functional cemeteries: first, to improve the land use intensity of land use, that is, to increase the number of ash urn per capita, and take full use of the aboveground and underground space; second, to compound various functions, that is, to reasonably plan the use of lands, and give full play to the composite functions of cemeteries; third, to realize the recycled use of cemeteries[6]. Besides, the multi-functional use of cemeteries should take into account the maximum economic, social and ecological benefits[7].

2.2 Construction of the assessment system According to the studies of Zhao Li, Li Xiubin, Yang Chi, *etc.*[8-10], the evaluation index should be selected based on a series of principles, including the principles of sustainable development, systematic principle, *etc.*. Therefore, three indexes, such as the land use rate, land use structure and the sustainability of land use, were selected (Table 1).

The score and weight of each index were calculated according to the method of Delphi method by model(1)[11]:

$$W_i = \frac{\sum_{j=1}^{n} E_{ij}}{n}$$

W_i refers to the weight of the ith index; E_i is the score of the ith index given by the experts; n means the number of experts. The detailed weight of each index can be referred to in Table 2.

Table 1 The index system for assessing the intensive use of multi-functional cemeteries

Objective	Evaluation factors	Sub-factor	Details
The intensive use level of multi – functional cemeteries	Land use intensity	Density of cemeteries	Total number of cemeteries/total land area
		Volume	Total area of cemeteries/total land area
		Fixed asset per cemetery	Total input/total number of cemeteries
	Land use structure	Greening rate	Greening area/total land area
		Output per hectare	Total output/total land area
	Sustainability of land use	Recycling index	The total cemetery area per 100 years/total land area
		Recultivation index	Non – hardened land/total land area
		Traffic	Accessibility

Table 2 The weights of index for evaluating the intensive use of multi-functional cemeteries

Objective	Evaluation factors	Weight	Sub-factors	Weight
The intensive use of multi-functional cemeteries	Land use intensity	0.5	Density of cemeteries	0.2192
			Volume	0.1308
			Fixed asset per cemetery	0.15
	Land use structure	0.275	Greening rate	0.1296
			Output per hectare	0.1454
	Sustainability of land use	0.225	Recycling index	0.0788
			Recultivation index	0.0887
			Traffic	0.0575

Then the intensive use degree could be obtained from the model (2) below:

$$F = \sum_{i=1}^{n} (F_i \times W_i) \quad (2)$$

F refers to the comprehensive index of the intensive use of multi-functional cemeteries; F_i is the figure of certain evaluation factor, W_i is the weight of that evaluation index, n means the number of factors. The raw data was then standardized.

2.3 Assessment of the land use of different cemeteries

2.3.1 Selection of the samples. The samples of four different cemeteries, including the public cemeteries, traditional burial,

vertical cemeteries and ecological cemeteries, were selected from South Anhui Province.

As the only one commercial cemeteries in Ningguo City, Dukou Cemetery occupies an area of 23333 m^2, serving about 50 000 population. There are totally 6 000 burial sites, 1.3 m^2 each. 40% of the area is covered with vegetation. Its construction costed RMB 13 600 000, RMB 4650 each with a cycle of twenty years.

As one of the social welfare cemeteries, Zhangcun cemeteries, Ningguo City occupies 6 700 m^2 area, serving 4 328 villagers. The whole area includes 40% area for vegetation and roads and 20% area for supporting facilities, such as parking lot. There are about 600 burial sites, 1.5m^2 each. The government invested RMB 1 500 and charged RMB 2 800 for each cemetery.

As for the traditional burial, the Hebian Group, Longting Village was selected as the sample. The group occupies a total area of 1.38 hectare with 193 population. About 207 tombs with different costs and sizes are scattered in the farmlands and forest. According to the statistics, the 207 tombs takes up for 890 m^2 with a greening rate of 56% and a construction cost of RMB 678 000.

Haihui Tower in Jinlu Village was selected as the sample of vertical cemetery. Haihui tower is 39 meters high with seven stories, occupying an area of 1 500 m^2. The tower is available for 7 000 ash urns, 30cm × 20cm × 19cm each. Each costs RMB 1 180 000, which is paid at once but can be preserved eternally.

The lawn cemetery in Martyrs' cemetery, Ningguo City was selected as the sample of ecological cemetery. The cemetery occupies 2 000 m^2, with 30 burial sites. It costs RMB 300 000. Now it has become free public parks.

2.3.2 Analysis of the assessment results. The standardized raw data was introduced to the model above to calculate the intensive use degree of different cemeteries.

Table 3 The ranking on multifunctional and intensive use of different cemetery land-using

Forms of cemetery	Score	Ranking
Ash tower	53.557 8	1
Lawn tomb	49.678 726 4	2
Cemetery mound	41.999 068	3
Commercial cemetery	35.739 116	4
Social welfare cemetery	25.000 314 4	5

The assessment for the intensive use of lands hasn't been standardized[12], and it is also rare to see the studies in the field. Therefore, the study would be of practical significance only when it sampled from the same areas by reducing the influence of external factors to the lowest.

By a comparison, the intensive land use of vertical cemetery is the highest, while that of rural social welfare cemetery is the lowest. That of the traditional burial is even higher than the public cemetery. The reasons lie in the fact that the traditional tombs are usually built in local farmlands which cut down the needs for some supporting facilities, such as parking lots and roads. Besides, people often grow some vegetation on the tombs, wich matches perfectly to the surrounding environment. But we should neglect the fact that the tombs built in these years are becoming larger and more deluxe. The surface is usually fixed with ceramic tiles without any growing vegetations. The tombs have lost its original ecological functions. The lawn cemetery, as the newly – emerging one in recent years, could achieve a greening rate of 80% and create great recreational values for the public. And the lawn cemetery is also easy to be recultivated. Although the commercial cemeteries in urban city and the social welfare cemeteries in rural areas have high density and volume rate, the uniform functions and hardened ground result in very limited land use structure. The recycled use of cemeteries is also impossible.

3 Thoughts

The ultimate purpose of cemetery reform is to reduce and remove the dependence of bodies and ashes on lands. But according to the investigation, more than 57% people still prefer the traditional burial , about 11% , 11% and 7% people would choose the tree burial, burial at sea and flower burial, respectively. Only about 2% choose the ash wall while nobody choose the ash tower[13]. As Chinese people are greatly influenced by the traditional ideas, the traditional cemeteries cannot be replaced in a short term. Therefore, we should take into account the practical conditions and make full use of the cemetery lands.

3.1 To promote ecological cemetery To bury the ash urn is generally accepted in rural areas, which doesn't reduce the occupation of lands. In order to save the lands, it is suggested that the ash urn should be placed in the public cemetery. In building the new cemetery in rural areas, the greening and ecology should be taken into consideration. For example, to grow vegetation instead of using ceramic tiles; to grow some trees to defend fires; to use degradable urns; to bury the ashes for growing trees, flowers and lawn; to practice "on – line cemeteries", that is, to place the ash in the ash tower and honor the dead on the internet; if there is any necessity to build a cemetery, it is suggested that it is deeply buried without leaving any mound. The burial and vegetation could be combined together.

3.2 To beautify the cemetery environment In consideration of the large – scale agricultural production, it is suggested to adopt the public cemetery on a large scale in the plain area. In order to give full play to the recreational functions of the cemetery landscape, the cemetery could be built at the barren mountainous areas to improve the local ecology; On the other hand, the landscape of cemetery should be scientifically designed and planned[]. Moreover, to innovate the design of cemetery details, that is, to highlight the exquisite and aesthetic functions of the cemetery.

3.3 To reform the cemetery land use patterns The basic function of cemetery is to place and honor the dead, and the directest way to improve its intensive use is to improve the volume rate per unit. First, it is suggested to adopt the vertical cemetery. The government should actively propagate the advantages of vertical cemetery and make the public aware of its functions. Second, to

improve the recycling use of cemetery. In Taiwan, the cemetery is recycled every twelve years. By learning its experience, we can legally prescribe the years that a cemetery can be used, and strictly control the area of each cemetery, so as to promote the recycling. Third, by US laws, the area of cemetery is uniform. We can also learn from US and legally prescribe the area of each cemetery. Only in this way can the waste of cemetery lands be stopped.

4 Conclusion

The lands for cemetery is a special part of Chinese history and culture. Since a both economical and ecological cemetery has become the basic requirement for constructing a harmonious society, we should lay great emphasis on developing the multiple functions of cemetery lands according to the practical conditions in each area.

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