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# Establishment of Evaluation Index System of Ecological Carrying Capacity in Changping District Pusalu Village

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## Abstract

Base on the establishment of evaluation model of ecological carrying capacity in Beijing shallow mountain area, according to the local conditions of Beijing Changping District Pusalu village, analyze and discuss ecological system composition of Pusalu village, define the index layer and sub-index layer of ecological carrying capacity and ecological stress, lay the foundation for evaluating ecological carrying capacity of Pusalu village.

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*Key words:* Pusalu village; Ecological carrying capacity; Index system;

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## 1. Overview of Pusalu village

The Pusalu village located at the junction of southwest of Beijing Changping District and Mentougou, which is embosomed in hills, governed by Changping District Liucun Town. This village belongs to arid mountainous area in the warm temperate zone with continental climate, sandy and rainless in spring, hot and rainy in summer, big temperature difference between day and night in autumn, cold snowless and dry in winter. The whole Pusalu village is in the mountainous area, governing area is 4 square kilometers, altitude is above 310 meters, terrain slope of the major part of it is bigger than 25 degrees, not suitable for carrying on construction, but the village has natural tourism resources. In recent years, travel development company carry on ecological scenic spots construction of Pusal Mountain jointly with the village, and it is evaluated AAA level tourist attractions in 2006.

## 2. Problem overview of Pusalu village

Accompanied with the development of Pusalu village, there emerge some problems shown as below: the growth of permanent population is slow, the transient population is mainly the tourism population and

the construction population, the transient population grows quickly as the village development, which bring huge pressure to the village; growth of the transient population and the higher living standard bring a huge resource consumption; there is not an effective management of the solid waste and sewage to match the village development; lack of infrastructure construction of tour guide and necessary infrastructure construction of public services; villager quality must wait; environment awareness should enhance.

**3. Establishment of evaluation index system of ecological carrying capacity**

*3.1 Establishment of index layer*

By research from the author, ecological carrying capacity of Beijing shallow mountain area consist ecological elasticity, resource carrying capacity, environment carrying capacity and human activity potential, ecological stress consist population stress, stress of resource shortage, stress of environment pollution and stress of ecological damage. Pusalu village don't exist obvious ecological damage, so ecological stress of it consist population stress, stress of resource shortage, stress of environment pollution shown as Fig. 1.

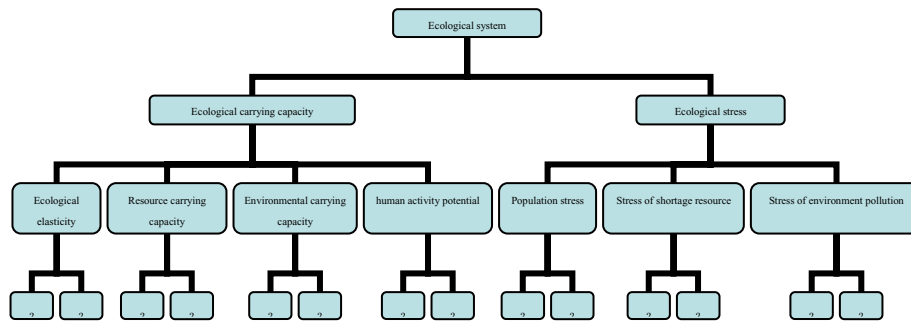


Figure 1 Index system of ecological carrying capacity of Pusalu village

*3.2 Establishment of sub-index layer*

*1) Sub-index layer of ecological elasticity*

Ecological elasticity consist five index such as climate, hydrology, soil, ground feature and coverage of ground feature, the establishment of sub-index layer of ecological elasticity of Pusalu village is shown as Table 1.

Table 1 Establishment of index layer system of ecological elasticity of Pusalu village

Options	Climate	Hydrology	Soil,	Ground Feature	Coverage of Ground Feature
<i>Composition</i>	Rainfall, temperature, hours of sunshine	Rainfall, runoff, evaporation	Soil type and proportion	Ground feature type and proportion, altitude	Forest, crops
<i>Detail</i>	Rainfall: average annual rainfall changes largely; Average annual temperature and hours of sunshine change slightly, view them as static value	Runoff: no river no lake Evaporation: mainly from soil evaporation and plant evaporation, average annual evaporation can be viewed as static value	Black sand soil	Static value	Coverage rate of forest show an up-trend, coverage rate of crops show a down trend
<i>Sub-index</i>	Average annual rainfall	None	None	None	Forest, crops

According to Table 1, establishment of index layer system of ecological elasticity is shown as Fig. 2.

2) *Sub-index layer of resource carrying capacity*

Resource carrying capacity consist four main index such as water resource, soil resource, mineral resource and tourism resource, the establishment of index system of resource carrying capacity is shown as Table 2.

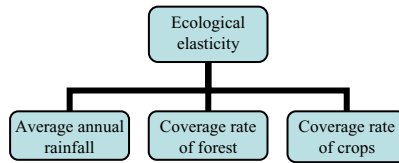


Figure 2 Index system of ecological elasticity

Table 2 Establishment of index system of resource carrying capacity

Options	Water Resource	Soil Resource	Mineral Resource	Tourism Resource
<b>Composition</b>	River, lake, total amount of water resource	Forest land, cultivated land and construction area	None	Level scenic zones and Tourism sites
<b>Detail</b>	River, lake: none Total amount of water resource: data is difficult to get, so using the total amount of water consumption to reflect it by the transform principle or non-repetitive principle.	Forest land: in essence the same as the coverage rates of forest Cultivated land: in essence the same as the coverage rates of crops. Construction area: it is difficult to get the original construction area, so substitute it with added construction area by the transform principle.	Relevant data and the mineral resource is poor.	Level scenic zones: evaluated AAA level tourist attractions in 2006 Tourism sites: using the advantages of natural tourism resource, explore a series of tourist attractions
<b>Sub-index</b>	None	Construction area	None	Level scenic zones and Tourism sites

According to Table 2, establishment of index system of resource carrying capacity is shown as Fig. 3.

3) *Sub-index layer of environmental carrying capacity*

Environmental carrying capacity consist four main indexes such as atmosphere environment, water environment, soil environment and acoustic environment. The establishment of index system of environmental carrying capacity is shown as Table 3.

Table 3 Establishment of index system of environmental carrying capacity

Option	Water Environment	Atmosphere Environment	Soil Environment	Acoustic Environment
<b>Composition</b>	Ground water, surface water and sewage	Overall quality of atmosphere environment, average quantity of SO <sub>2</sub> , NO <sub>2</sub> , PM10	Municipal solid waste(MSW), agricultural waste, construction waste	Region environment noise and traffic noise
<b>Detail</b>	Ground water: for effective protection measures, view it as static value. Surface water:poor Sewage:noindustry, mainly domestic sewage without treatment, view it as static value.	Overall quality of atmosphere environment: overall quality of air is good, apart from some sandy days in every year, so select number of sandy days to reflect in the ecological stress. average quantity of SO <sub>2</sub> , NO <sub>2</sub> , PM10: no industry, far away from urban, less polluter, high coverage rates of forest, so the average quantity of SO <sub>2</sub> ,NO <sub>2</sub> changes slightly, only PM10 changes as the number of sandy days, do not select it by non-repetitive principle.	Disposal rate of MSW: MSW mainly contains permanent population MSW and transient population MSW. Before 2003, no waste collection facilities; since 2003, 3 waste houses with clearing every 7days. Disposal rate of agricultural waste: only straw involved, view it as static value. Disposal rate of construction waste: mainly from repairing road and building, treat it by landfill, view it as static value.	Region environment noise: overall quality is good. Traffic noise: added vehicle is few, so the quality of traffic noise changes slightly.
<b>Sub-index</b>	None	None	Disposal rate of municipal solid waste	None

According to Table 3, establishment of index system of resource carrying capacity is shown as Fig. 4.

4) *Sub-index layer of human activity potential*

Human activity potential consist economic development and social development, the establishment of index system of human activity potential is shown as Table 4.

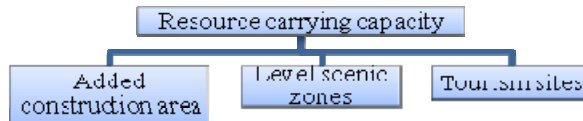


Figure 3 Index system of environment carrying capacity

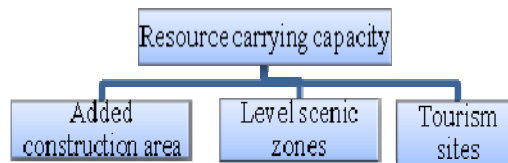


Figure 4 Index system of resource carrying capacity

Table 4 Establishment of index system of human activity potential

Option	Economic Development	Social Index
<b>Composition</b>	Gross products and three main industries	Infrastructure, living standard, products of agriculture and forestry, telecommunication
<b>Detail</b>	GDP: transformation from traditional agriculture to tourist trade pushes the development of economy largely, so select it as index.  Three main industries: there is few secondary industry, GDP come from primary industry and tertiary industry. Gross products of primary industry decreases, and that of tertiary industry increases, so select proportion of tertiary industry to inflect the transformation and its proportion in the GDP.	Infrastructure: in 2006, repair town-class road to make trip easy, so select town-class road area.  Living standard: average per capita net income shows an up-trend, so select it.  Products of agriculture and forestry: for the decrease of cultivated land, gross of agricultural products decreases; gross products of fruits changes, so select both of them.  Telecommunication: Penetration rate of connected computer increases slightly; Penetration rate of cable TV, penetration rate of fixed telephone and mobile phone increases rapidly, so select penetration rate of cable TV, fixed phone and mobile phone.
<b>Sub-Index</b>	GDP, proportion of tertiary industry	Select town-class road area, living standard , products of agriculture and forestry, penetration rate of cable TV, fixed phone and mobile phone

According to Table 4, establishment of index system of human activity potential is shown as Fig. 5.

5) *Sub-index layer of population stress*

Population stress consist permanent population and transient population, the establishment of index system of population stress is shown as Table 5.

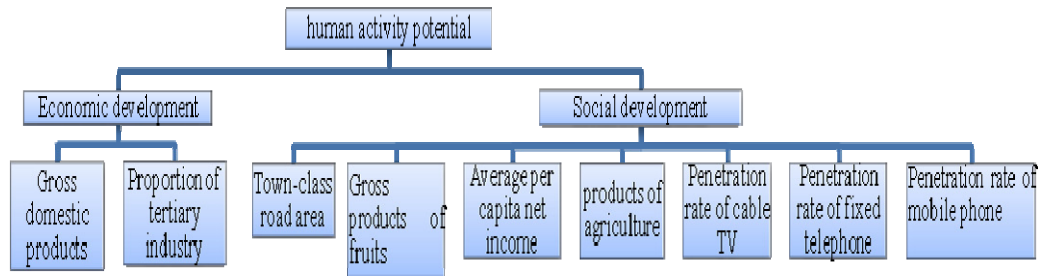


Figure 5 Index system of human activity potential

Table 5 the establishment of index system of population stress

Option	Permanent Population	Transient Population
<b>Composition</b>	Permanent population	Tourism population and construction population
<b>Detail</b>	Permanent population: show a slight change, select it	Tourism population: grow rapidly Construction population: grow rapidly
<b>Sub-Index</b>	Permanent population	Tourism population and construction population

According to Table 5, establishment of index system of population stress is shown as Fig. 6.

6) *Sub-index layer of stress of resource shortage*

There is not industry, so stress of resource shortage just considers the population growth and living standard, namely, it consist grain consumption, energy and water, the establishment of index system of stress of resource shortage is shown as Table 6.

Table 6 Establishment of index system of stress of resource shortage

Option	Grain Consumption	Energy	Water
<b>Composition</b>	Grain Consumption	Power Consumption	Water Consumption
<b>Detail</b>	Grain consumption: for imperfect infrastructure construction of tour guide, few tourism population board and lodge in village, permanent population and construction population bring a up-trend of grain consumption	Power consumption: population growth and living standard improvement mainly embody in the power consumption, so select gross power consumption.	Water consumption: population growth and living standard improvement bring increase of water consumption, so select it to reflect that waster consumption increases and total water resource decreases.
<b>Sub-Index</b>	Grain consumption	Gross power consumption	Gross water consumption

According to Table 6, establishment of index system of stress of resource shortage is shown as Fig. 7.

7) *Sub-index layer of stress of environmental pollution*

There is not noise pollution, so stress of environmental pollution just consist air pollution, water pollution and soil pollution, the establishment of index system of stress of environmental pollution is shown as Table 7.

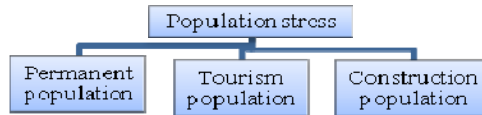


Figure 6 Index system of population stress

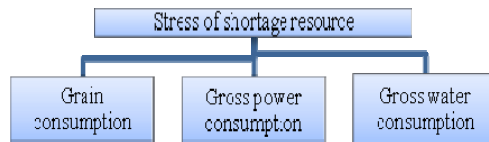


Figure 7 Index system of stress of resource shortage

Table 7 Establishment of index system of stress of environmental pollution

Option	Air Pollution	Water Pollution	Soil Pollution
<b>Composition</b>	Dust and sand	sewage	Quantity of MSW, agricultural waste and construction waste
<b>Detail</b>	Air pollution mainly is showed by dust and sand, so select number of sandy days	Gross sewage increases with the change of population growth, so select gross sewage flow	Soil pollution mainly embodies in the quantity of waste. For the population growth and living standard improvement, MSW increases, agricultural waste decreases as the cultivated land decreases, construction waste increase with the village development, so select three of them.
<b>Sub-Index</b>	Number of sandy days	Gross sewage flow	Quantity of MSW, agricultural waste and construction waste

According to Table 7, the establishment of index system of stress of environmental pollution is shown as Fig. 8.

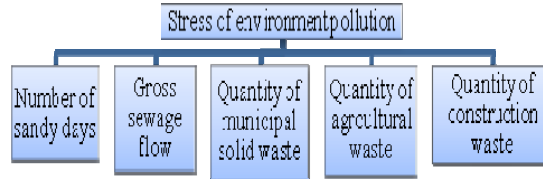


Figure 8 Index system of stress of environmental pollution

*Evaluation index system of ecological carrying capacity of Pusalu village*

After the establishment of index layer and sub-index layer mentioned above, evaluation index system of ecological carrying capacity of Pusalu village is shown as Fig. 9.

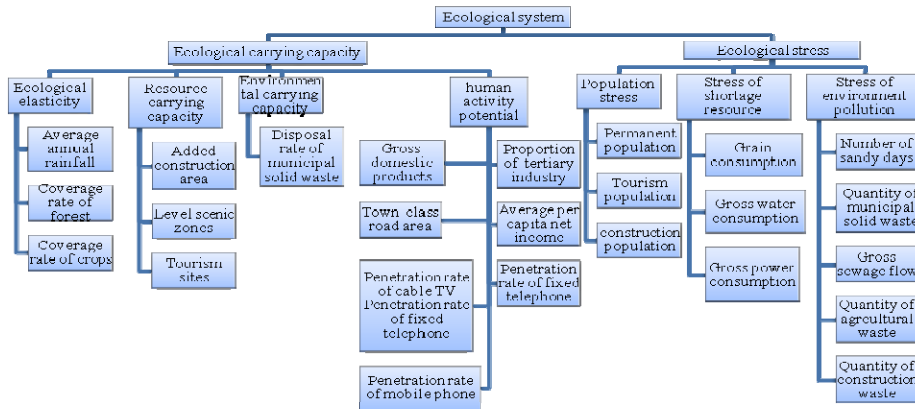


Figure 9 Evaluation index system of ecological carrying capacity of Pusalu village

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