

# City Development and Green Space Protection

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## ABSTRACT

The author has analyzed the ecological problems caused by city development and the comprehensive benefits of green space (e.g. ecological, social and economic benefits). The important role of green space in city sustainable development was discussed. Through benefits analysis of green space in city development in Kunming City, the author offered specific measures for green space protection in Kunming: strengthen plant management according to law; enhance nation awareness of plant protection; rationally plan city green land system; and use scientific forms of green lands.

*Key Words : Sustainable development, Green space, Comprehensive benefits, Effects, Protection*

The acceleration of citification makes ecological environments worse and worse. City development should be a sustainable development based on sustained development of ecological environments so that the economic development could be fit to the bear capacity of resources and environments. To ensure sustainable city development, it is necessary to improve city ecology and protect green space.

## I. ECOLOGICAL ENVIRONMENT PROBLEMS CAUSED BY CITY DEVELOPMENT

A city is a center of politics, economy and culture of society. The more developed of social economy, the more citified of a city. City development is based on the utilization of space and environment resources. Improvement of the citification brings up high development of social

economy and increasingly serious ecological problems as well.

### 1. Air Pollution

Air pollution comes from city industry and citizen life. Main pollutants are dust, powder, smog, sulphur oxide, carbon oxide, etc. Air pollution causes diseases of respiratory tract and cardiovascular system, furthermore, it is a dangerous carcinogenic factor.

### 2. "Hot Island Effect"

High density of population and buildings release large quantity of heat and cause the temperature in city higher than that in its suburb. This kind of phenomenon is called "hot island effect". Generally speaking, average temperature of a year in a metropolis is 0.5°C to 1°C higher than

that in its suburb, especially in summer.

### 3. Water Pollution

Water pollution is mainly from industry and living wastewater. Clean water, needed by human survival and city development, is polluted day by day. Polluted water is harmful to health and restricts the social economy development.

### 4. Noise Pollution

Noise pollution comes from communications, industries and constructions. Noises make people feel agitated and ineffective. What is more, it can cause neurasthenia.

### 5. Loss of Biological Diversity

Biological diversity is the material base of human survival and improvement. City development destroys the ecological environments and largely decrease species in the area.

## II. COMPREHENSIVE BENEFITS OF GREEN SPACE

In a broad sense, green space means areas of garden green land, water, farmland, forest and so on, which can protect human living environments. In this paper the green space in a narrow sense means garden green lands in city, especially the green plants in gardens. Increasingly serious ecological problems have restricted sustainable city development. Without the sustainable development of ecological environments, human society cannot make progress continuously. Garden green lands, especially green plants in gardens, improve ecological environments of a city. The comprehensive benefits of green land, namely

ecological, social and economic benefits, provide bases to city sustainable development and indicate the future of the city.

### 1. Ecological Benefits

#### 1) Absorb CO<sub>2</sub> and release O<sub>2</sub>

CO<sub>2</sub> and other harmful gases produced in the city development pollute the natural air. Photosynthesis of green plants absorbs CO<sub>2</sub>, releases O<sub>2</sub> and regulates the balance of CO<sub>2</sub> and O<sub>2</sub> in the air. Generally, 10m<sup>2</sup> of trees in city can release enough O<sub>2</sub> for one man's breath.

#### 2) Improve mini-climate of a city

Transpiration of plant leaves surface can regulate air temperature and humidity. Transpiration can also absorb solar radical heat, relieves the "hot island effects", and improves the mini-climate of a city. The transpiration can decrease environments temperature to 7.6°C, increase air humidity to 33%, and decrease the effective solar radiation to 32%.

#### 3) Relieve powder pollution

Plants, especially trees, can slow winds and sink large dusts in the air. Leaves absorb mass of airborne dusts with their rough and downy surfaces and their secreted sticky oil and juice. It was measured that a hectare of pines can absorb 36.4 tons of dusts in a year.

#### 4) Absorb harmful gas

Almost all plants can absorb certain harmful gases without being harmed. This decreases the concentration and harms of harmful gases in the air. Research indicates that a hectare of pines can absorb 720 kg of SO<sub>2</sub>.

#### 5) Destroy harmful microbes

When plants absorb dusts, microbe carriers and

microbes themselves were decreased in the air. Besides, many of plants secrete microbe-killing materials. Researches have proved that microbes in 1m<sup>3</sup> air at departments is 400 times more than that at parks.

#### 6) Subside Noises

Plants, especially closed woods or hedges, can effectively subside noises by reflecting and absorbing solar wave. In an average, green land combined with trees, bush and lawn can subside noise to 5 decibels.

#### 7) Protect biological diversity

Green lands give habitats to plants and animals and offer conditions for improving species diversity. Especially in city, botanical gardens and zoos play important roles in recovering and surviving destroyed biological diversity. For example, since 1984 Kunming Botanical Garden has saved 2600 species of plants, including 106 species of endangered plants.

## 2. Social Benefits

1) Beautify the environment, offer fine fallow and entertain place

Green lands alleviate hard lines of city buildings, enrich city scenery, beautify environments, form natural spaces in city, and offer rest and entertainment places to citizens.

2) Good for physical and psychological health

High work pressure and long indoor time cause many diseases that are harmful to people's physical and psychological health, which cannot be cured by medical treatments. Grass, trees and water in undulate green lands call people to join and fuse in them. In green lands, people enjoy the sunlight, release their fidgety and pressures through physical exercises.

3) Display culture and characters of the city

Every city has its special culture and characters. Forms and styles of green lands show culture and local characters of a city.

4) Improve people's comprehensive qualities

A green land is an organic unity of ecology, culture, art and science. During the course of enjoying and protecting green lands, people improve their culture and art qualities, cultivate their affections, mould their temperaments, and improve their comprehensive qualities.

5) Prompt correlated industries

Green lands improve the ecological environment of the city, beautify the city, and prompt correlated industries such as tourism and real estate.

## 3. Economic Benefits

1) Direct economic benefits

Direct economic benefits mean the benefits that can be measured directly by money. The direct economic benefits of green land include service profits of green land, such as income of park ticket; and garden greenery income, such as sale nursery stocks.

2) Indirect economic benefits

Indirect economic benefits mean potential benefits that do not present directly through money. The ecological and social benefits of green lands are also indirect economic benefits and can be counted by equivalent substitute method. It is reported that a ten-year-old tree can produce 31,000 dollars of O<sub>2</sub>, and its value in protecting air pollution is 62,000 dollars. Besides green land brings considerable benefits to related industries.

### III. PROTECTION OF GREEN SPACE

Green development should supplement and complement with city development. Fast growth of economy gives finance, material and manpower supports that are necessary to green land development; Green land brings fine ecological environment and prompts city development. High-level green land brings high benefits to surrounding commerce land and considerably increases the value of real estate. Green land is good for people's health and quality improving and makes people construct city with health and activity. So green land and city ought to supplement each other in development. But the fact is not like this. City development narrows the usable space. To seek for direct economic value, people are driven by short-term benefits. Green land development cannot meet the needs of city development. Green lands in city are substituted by other lands and distribute unbalance. Eager for instant and quick profits, mass use of low green lawns and flowerpots decreases the effective green area and ecological benefits of green lands. On a long-term point of view, it does greatly harm to the sustainable development of a city. The key for city sustainable development is to coordinate long-term and short-term benefits, to coordinate ecological, economic and social benefits, to effectively utilize limited green lands, to rationally arrange green lands, and to actively protect green lands. Kunming is the political, economic and cultural center of Yunnan Province and is called "Spring City" for its spring like climate all year long. With the city development, especially the success of the "EXPO99", green land development in Kunming gains considerable achievements. Green land rate in built areas increased from 20.58% to 28.84%. Greenery cover rate increased from 23.79% to 30.06%. Per capita area of public green land

increased from 5.81m<sup>2</sup> to 7m<sup>2</sup>. The achievements are encouraging and there still exist many deficiencies.

#### 1. Existing Problems of Green Lands in Kunming

##### 1) Irrational distribution and low greenery cover rate

The distribution of green lands in Kunming is unbalanced. In Wuhua and Panlong urban districts, high land price and dense buildings cause shortage of planned green lands and lowness in per capita index. Take Panlong District as an example, in this district green land rate is 6.45%, greenery cover rate is 10.29%, and per capita public green land is 0.47m<sup>2</sup>. 40% of the city green land and 40% of per capita public green land lie in three parks at Xishan and Guandu suburban districts. On the view of ecology, only when greenery cover rate is more than 50%, city ecological environment can be improved effectively. The greenery cover rate in Kunming (30.06%) is far from the standard. Especially in urban, very low greenery cover rate does little good to mass of people, cars and buildings.

##### 2) Imperfect green land system and low green land benefits

There is no points, lines and areas combinational system of green land formed in Kunming. There is a low ratio of green land in streets, squares, living quarters and units. Few large area of woods or shelterbelts in urban cannot effectively improve the city ecological environment. The greenery form of more in lawn and less in trees does not fit to Kunming. Mass of lawns beautify the environment and improve the greenery cover rate in short term. But the green quantity and ecological benefits of lawns are low. 10m<sup>2</sup> woods release same O<sub>2</sub> as 25m<sup>2</sup> lawn. Trees, bushes and lawns combined

green land yields 4 to 5 times of ecological benefits than pure lawn. Furthermore, to keep lawn, it needs large amount of fresh water, which is seriously deficient in Kunming.

### 3) Flat in local characters

Kunming is attractive in spring-like climate all year round, mystery and old folk custom, and colorful plant resources. But the green lands in Kunming utilize mass of forms, styles and species from other cities instead of its own local characters and culture.

## 2. Protection of Green Lands in Kunming

To protect green space is to protect our survival environment. According to the strategy of sustainable development, sustained development of green lands in Kunming needs to rationally treat the relationships of short-term benefits and long-term benefits, needs to improve ecological, economic and social benefits of green lands.

### 1) Strengthen greenery management according to law

Strengthen the functions of greenery supervise departments. Strictly prosecute behaviors of invading green lands and damaging plants according to "the Kunming regulations on city greenery".

### 2) Improve the nation awareness of green protection

Adopt welcomed forms and use broadcasting, TV, newspaper, advertisement and other media to improve the awareness of environment and greenery of leaders and citizens. Instruct all citizens to take part in the protection of green land.

### 3) Rationally plan the green land system

Rationally plan the green land system in view

of integration, long-term and feasibility. Develop green lands to a crisscross network with rational points, lines and areas combination, and with suitable and stable species groups. Make the most ecological benefits of green lands. Bring local history, culture and folk costumes into green lands to stress the local characters of Kunming.

### 4) Adopt more rational green land forms

Restricted by various conditions, it is impossible to largely increase the area of green land in Kunming. We should advocate the combined form of trees, bushes and grasses, widely plant woods and shelterbelts, widen and deepen the present green land systems, and improve the quantity and ecological benefits of green lands. In the two urban restricts we should advocate vertical greenery, roof greenery and empty greenery so as to improve the greenery cover rate and to improve the ecological environment. In order to make full use of underground spaces with compound space methods, we can move communications, basic equipments and commerce to underground and leave the ground as collecting and distributing squares and parks to solve the shortage problem of green lands in Kunming. In short, by adopt more rational forms of green land, we can enlarge area of green land and protect the green space actively and effectively.

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