Ecosystem and biodiversity conservation planning in Hiroshima City, Japan

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Abstract—The ecosystem and biodiversity conservation plan in progress in Hiroshima City was reviewed. Hiroshima City had prospered as a castle town, but severely suffered from A-bomb damage at the end of World War II. Since then, Hiroshima City performed greenery activities with restoration and planted trees in public facilities. At present, Hiroshima City is promoting a 3rd tree-planting campaign. As part of this campaign, the master plan of greenery of Hiroshima City is being laid. This plan aims not only at beautification in city area but also at ecosystem and biodiversity conservation in expanded city areas. In this paper, we report on the development of the situation in Hiroshima City since the end of World War II and the conservation planning of greenery which, for the most part, concerns zoning.

Keywords: environmental planning, exploitation, greenery, urbanization, zoning.

1 Introduction

Urbanization is a big problem not only in developed countries but also in developing countries. This is a modern and urgent affair in the world. For much of recorded history, we have viewed the natural environment as a resource to be exploited. However, our attitude toward nature has began to shift profoundly as the negative effects of our industrialized economy have become clearer and more catastrophic (Rookwood, 1995). In an urban environment, greenery space within a city is indispensable for the well being of citizens. Moreover, animals exist not only natural and rural landscapes but also urban landscape (Gilbert, 1989). Japanese urbanized cities, according to the political definition, numbed 13, including the Tokyo metropolitan area. Hiroshima City (34°23'N, 132°27'E) is one of these urbanized cities, and has a population of about 1.1 million in 740 km² of territory, making Hiroshima the largest city in the Chugoku District of western Honshu, Japan.

Of course Hiroshima is very well known for the atomic bomb catastrophe in 1945 at the end of World War II. The destroyed downtown area of Hiroshima City has now completely recovered, has tall modern buildings, and shows almost no signs of the atomic bombing damage. Suburban areas near the city are mainly hills, river tributaries and small river planes. In the 1960s in this area, there were a lot of rural forests. At present, however, these secondary forests are being exploited by urbanization or abandoned due to their low commercial value.

In 1997, a committee charged with solving these serious environmental challenges was established by the Hiroshima City government. A senior author was designated a committee member and specialist for landscape ecology in the committee. Landscape ecology can provide the planners and designers with a conceptual framework within which they can include relevant structures and processes (Golley, 1991).

Within the fiscal year 1997 (through March, 1998), the committee met four times to discuss new plans for urban greenery and strategies for ecosystems and biodiversity in the city. The project’s final product “Master Plan of Greenery in Hiroshima City” will be published in March, 2000. In 1997, the first year of the project, we discussed basic strategy for ecosystem and biodiversity conservation. In this process, the senior author proposed several methods of ecosystem
and biodiversity conservation based on landscape ecology. Many proposals were submitted and become the materials for discussions seeking the best way toward an eco-city. Through this process, the ideas and proposed contributions to landscape ecology were very useful and constructive.

2 Situation of greenery

2.1 History of greenery

Though A-bomb burned most of Hiroshima City in 1945, the city was able to re-establish itself through a greenery movement. In the first greenery movement, in 1957, trees were planted along Peace Boulevard, which passes through the central city. Consequently, the central city is now rich in greenery. In the second greenery movement, in 1975, a greenery fund was established, and excellent greenery institutions received an official commendation. At present, the third greenery movement the origin of which was 1997's green Festa in Hiroshima City, is in progress.

2.2 Changes in greenery

Land-use maps using air photographs were produced by the Department of Urban Planning in Hiroshima City (1988) with a resolution of 250m × 250m which was satisfactory for rough classification of land-use type (Nakagoshi, 1998). From these maps, it becomes evident can be recognized that Hiroshima City consists of a delta urban zone and a surrounding forest zone.

Around 1948, residences were concentrated in the central delta and farmland existed along the valleys (Fig.1). However, around 1970, which marked a period of rapid growth, residential areas expanded and farmlands changed to residential areas. Around 1994, a forest, which had not been cleared at that time, was developed and had changed to residential area. From the quantitative viewpoint, forest areas occupied 77.4% of the city area in 1948, 74.1% in 1970 and 67.0% in 1994 (Fig.2). During the period from 1948 and 1970, forest areas decreased 3.3%. In period between 1970 and 1994, it decreased by 7.1%. This indicates that forest development is advancing at an increasing rate. Farmlands occupied 18.9% of the city area in 1948, 15.2% in 1970 and 9.6% in 1994. Clearly farmland is also disappearing rapidly. Residences occupied 3.7% of the city area in 1948, 10.7% in 1970 and 23.4% in 1994. This suggests that residence area is explosively increasing in a period of and rapid urbanization. From these data, we conclude that residence development has caused a forest detriment.

Fig. 1 Changing of land use in Hiroshima City. Investigated area is the full administrative area of Hiroshima City. Fuchu-cho and the west part of Kata-cho in 1994. In this paper Hiroshima City includes these two town (cho) area and its own territory. Grid size is 250m × 250m and land-use type is classified into forest, farmland and residence.
2.3 Actual vegetation

Investigations of actual vegetation were also carried out by conservation authorities (Department of Urban Planning in Hiroshima City, 1998). According to their findings, natural forest occupies 0.3% of the city area, secondary forests dominated by evergreen trees: *Quercus glauca*, *Pinus densiflora*, etc. occupies 65.9%, plantation of *Cryptomeria japonica, Chamaecyparis obtusa*, etc. occupies 19.5%, secondary forest dominated by deciduous trees: *Quercus serrata, Castanea crenata*, etc. occupies 4.7%, bamboo break occupies 0.3%, cut-off area occupies 0.7%, paddy fields occupy 4.5%, upland fields occupy 2.3%, orchards occupy 0.6%, and grassland of *Miscanthus sinensis, Sasa palmata*, etc. occupies 1.2% (Fig. 3).

2.4 Hiroshima, in comparison with the other cities

This plan compared total forest area, and forest area per capita with the other cities in the political definition (Fig. 4). The ratio of forest in the Hiroshima City area is 64%. This ratio is the second highest of all. Both Sapporo and Sendai have much forest, too. However Tokyo, Nagoya, and Osaka have little forest in their city areas. In a comparison of forest area per capita, Hiroshima City is second among all the cities (Fig. 5). From this, it is obvious that Hiroshima City has a significant, which should be protected, compared with the other cities.

2.5 Hiroshima citizen questionnaire

Before commencing planning, questionnaires about greenery were mailed out to citizens. Its purpose was to conduct a survey of greenery awareness in 3000 persons of twenty years and over,
living in the city. The respondent percentage was 45.1%. 95% of respondents answered that forest areas in Hiroshima City should be protected. 40% indicated that Hiroshima City does not have a lot of greeneries because forest areas surrounding the city have been exploited by land development. Many citizens of Hiroshima felt that the forest areas surrounding the city should be protected. As for volunteer activity on greeneries, many citizens of Hiroshima felt that they wanted to join activities such as park clean up, also of cleaning park and decorate their houses with flowers. Citizens motivation was high.

Fig. 4 Forest area in the 13 urbanized cities in Japan

Fig. 5 Forest area per capita in the 13 urbanized cities in Japan

3 Planning

3.1 Role of greeneries and evaluation of its function

There was knowledge about general functions of urban greeneries (Takahara, 1988). In the Master Plan of Greenery in Hiroshima City, the role of greeneries in urban regions is distinguished into “existence” and “use”. In order to define the roles which greeneries play in the city, functions and roles were defined from five points of view.

These five points were: environmental protection, conservation of ecosystem, recreation, disaster prevention and landscape composition. And open space was selected and estimated from overlay of open space functions. As a hypothetical estimation, the city area was classified into five zones from regional characteristic, and these regional characteristics were overlaid to estimation of open space function.

3.2 Zoning

The Master Plan of Greenery in Hiroshima City proposed zoning based on open space point of view. In this approach, the city area was classified into five zones: Inland zone, New urban zone, Aogakiyama zone, Delta urban zone and Island zone (Fig. 6).

In the Inland zone a large forest exists around the city area. Forestry and recreation mainly use this zone. This zone suffers severe damaged from exploitation. Three factors contribute to this zone problem. First, protection of the basin including the river in the valley is imperative because the environmental role of this zone is the cultivation of water source and a place of forestry. Second, the presence of a plant and wildlife community environment is needed to promote conservation of the ecosystem. Third, the role of forest parks (Nakagoshi, 1994) is important to
expand the recreational function of these areas.

In the New urban zone there are sloped open spaces around housing developments and isolated open space on the hillsides. There are two problems in this zone. First, protection of the forest in relation to urban planning is required because almost all housing development is concentrated in this zone because Hiroshima City has very little flat land. Second, the establishment of greenery and water connection is needed to conserving precious plant communities along the river and making open space of line in this zone (Adams, 1989).

The Aogakiyama (resembling a greenbelt) zone constituted original landscape of Hiroshima with six rivers in the Delta urban zone. But the open spaces composing Aogaki and decreasing with the advance of a sloping urban area. This zone is a greenery framework which surrounds the Delta urban zone. This zone also guards against unnecessary expansion of urban areas, and has a habitat of birds.

In the Delta urban zone there are relatively large open spaces and for flatlands. This zone faces two problems. First, positive urban greenery of private land greenery, road greenery, factory greenery and roof greenery and needed, because these areas have little or no greenery to begin with in the first place. Second, Motoujina, Hijiyama and Ogon-san mountains need to be protected as citizen’s greenery areas, because these are important landmarks and natural habitats (Touyama, 1994) in this urban area.

Finally forest areas and natural coastline exist in the Island zone which composes a beautiful landscape including islands in the Seto Inland Sea.

4 Discussion

There are four main points of difference between the previous policy on green and Master Plan of Greenery in Hiroshima City: Cities closed to citizen are the nucleus of making planning; this plan synthesize greenery; this plan is based on general estimates and self-government must announce these resolution officially. In the first point, a Master Plan of Greenery unique to Hiroshima City is needed because each self-government can make its own master plan. Original features of Hiroshima City include harmony of six rivers and greenery that were pointed out by cities who completed the questionnaire. In the second point, this plans general on greenery and includes not only making park and protection of greenery but also the various greenery activities of citizens. In this meaning, we were pleased to see that Hiroshima City sent out questionnaires to the citizens, and tried to a sense hold of citizen’s awareness about greenery activities and to incorporate citizen’s activities into this plan. Third, it is important that the plan is based on law not notification by government. Fourth, according to announce, city has appealed for cooperation on protection and greenery on private land to both citizens and companies. Hiroshima City will
announce in 2000.

There are good points of the Master Plan of Greenery in Hiroshima City. The good points are that the plan refers not only to the situation of greenery but also to the history of greenery. It also utilizes past policies to ensure greenery and is based on citizens attitudes form the survey about greenery. The data also specifies five zones and arranges roles of greenery in each zone.

On the other side, however there are problems. Conservation ecosystem is adopted as role of green, but there are many latent problems concerning functions of network formation in particular. This makes suitable network formation difficult. Because habitat connectivity is not observable. This could be estimated by connectivity of wildlife movement in fact (Merriam, 1990). Also there are cases in which security of a large habitat is better than a large green network (Simberloff, 1992). Habitat connectivity based on real data is referenced in studies that assess the impact of isolation on forest bird communities in agricultural landscapes (van Dorp, 1990) and the use of landscape indices to predict habitat connectivity (Schumaker, 1996). In all cases, it is important that we recognize landscapes as systems and use methods of landscape ecology in land management (Haber, 1990).

General urban greenery is certainly going to get citizen support by appearance of legal planning which are premised on participation of citizens. Moreover it reflects wisdom and enthusiasm of community planning in each self-government, after which various community planning groups will carry out. But in order to realize of a long term planning goals, cooperation between administration and citizen is greatly important.

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References


