

Selecting Location of Urban Parks with GIS in Nagasaki City

by

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Recently, the urban park performs various roles such as evacuation, scenery and the ecosystem as well as a playground of regional inhabitants. In this study, selecting location of urban park was carried out using GIS (Geographic Information System) in Nagasaki City, where urban park area per capita is below national average. The proposed sites of new urban park were selected from attribute data including existing park, population and distance from evacuation. Additionally, land cost was calculated from land price data and inexpensive sites were qualified as final proposed ones.

1. Introduction

In urban area, most of which is covered with artifacts, the parks play various roles such as an evacuation in the disasters, relaxation of the air pollution, noise interception and inhabiting space of animals / plants and the scenery as well as a playground and relaxation area of regional inhabitants.

However, Japan which have urbanized rapidly is behind European and North American countries in park improvement. Urban park area per capita in Japan is merely 8.1m² in the survey of 2001, while it exceeds 20m² in the European and North American countries. Especially in Nagasaki City, it is 6.6m², below the national average in 2002, and the extension of the urban park area is earnestly required (Fig.1).

For locating urban parks, it is necessary to consider various aspects, e.g. populations in the vicinity, security of the evacuation place, effective utilization of the existing open space. Thus selecting location of urban parks from attribute data such as population distribution, evacuation aptitude, land price, land use, using

GIS (Geographic Information System) for Housing Basis Park in Nagasaki City was carried out in this study.

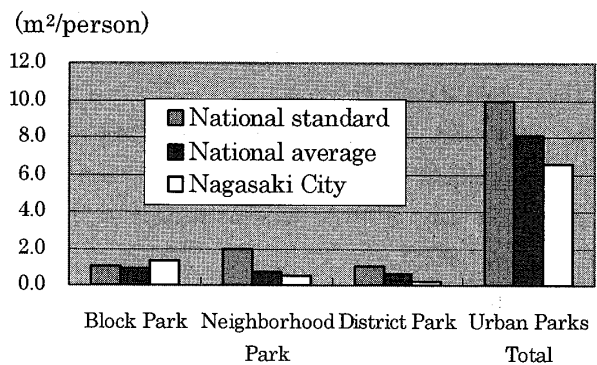


Fig.1 Present status of park improvement in Nagasaki City

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Table 1 Types of Housing Basis Park

	Scale (ha)	Lure distance (m)	Target population
Block Park	0.25	250	2,500
Neighborhood Park	2.00	500	10,000
District Park	4.00	1,000	40,000

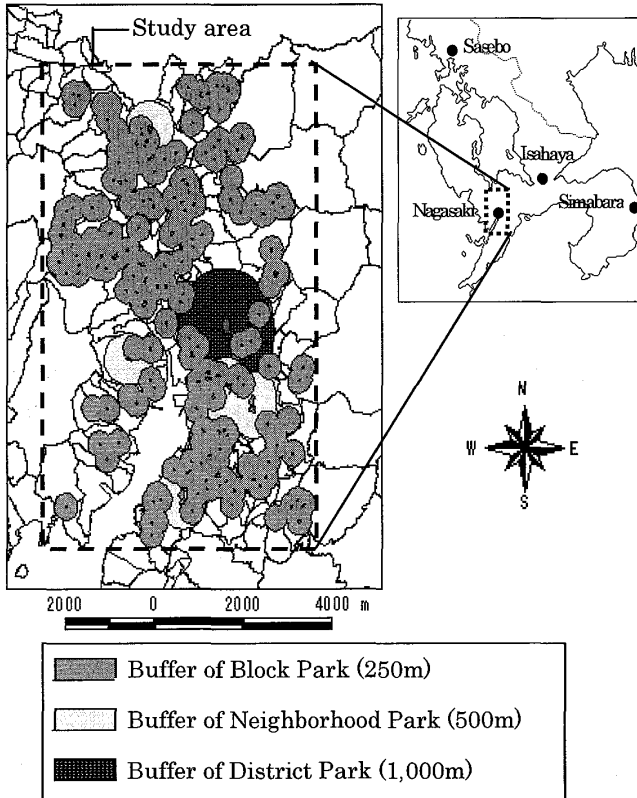


Fig.2 Study area and urban park distribution

2. Input data

In this study, ArcView was used for GIS analysis. The study area was shown in Fig.2, including the central part of Nagasaki City. In the following, characteristics of input data are summarized.

1) Town field data (Polygon)

The town field was input from Digital Map 2500 of the Geographical Survey Institute (GSI), and then the population data of basic resident register in fiscal year 2000 was added.

2) Urban park data (Polygon)

The 1 / 10,000 topographical map of the GSI was digitized. About 190 Housing Basis Parks in the central urban district of Nagasaki City were included in the study area. The result of buffering analysis on each Housing Basis Park using lure distance is also shown in Fig.2. The types of Housing Basis Park are shown in Table 1, where lure distance are configuration standard, determined by the Urban Park Law, and target population is the number of served population of each urban park, which is calculated from the

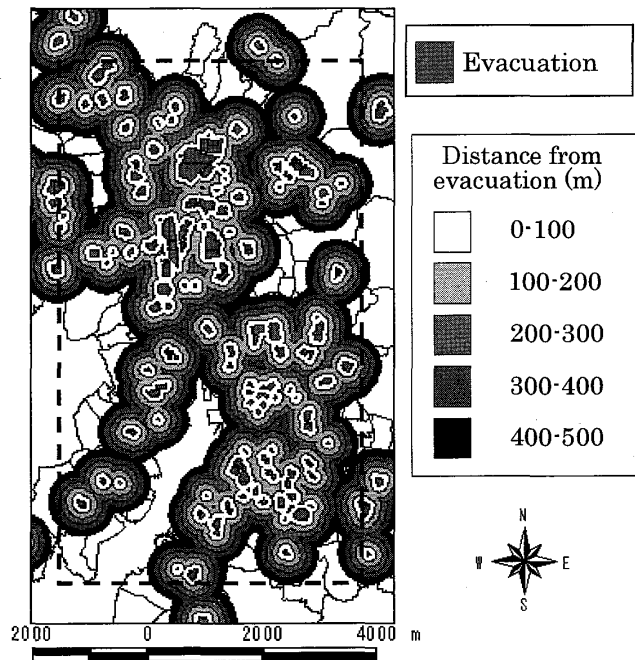


Fig.3 Distance from evacuations

country improvement goal and urban park scale.

3) School and Urban Basis Park data (Polygon)

Those were input from Digital Map 2500. Polygon data of school and Urban Basis Park were prepared as evacuation places with urban park polygon data. The distance from the existing evacuations is shown in Fig.3.

4) Land price data (Point)

The land price surveyed by the country and the prefecture in fiscal year 2002 in Nagasaki City¹⁾ was input using the Address Matching Service²⁾ (Fig.4).

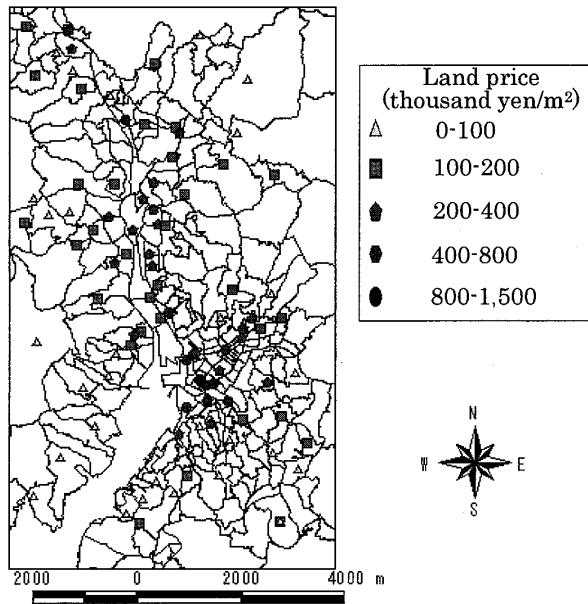


Fig.4 Land price (Point data)

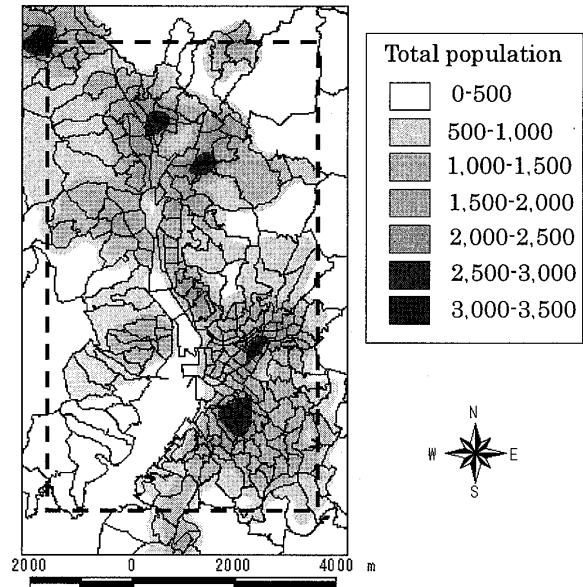


Fig.5 Distribution of total population within the lure distance for each grid

3. Result

3.1 Total population within the lure distance for each point

The distribution map of total population within the lure distance for each point was developed from population data of each town. It is possible to compare the population within the lure distance for each point with the target population of each Housing Basis Park. Those were analyzed by using the Area Distribution Method³⁾, which assumes uniformly distributed population in each town. Firstly, population data of each town is converted into the grid of which the length of one side is 10m. Then, total population within the lure distance was calculated and the result for Block Park is shown in Fig.5.

3.2 Selection of park location

In this study, the location of urban park was selected with following conditions.

- I .The outside of the lure distance of existing Housing Basis Parks.
- II .The distance from the existing evacuation is over 500m. (The districts over 500m from all of the existing evacuations were regarded as difficult

Table 2 Broader conditions for selecting park location

	Total population within the lure distance for each point(target population)	Distance from evacuations (m)
Block Park	2,000 (2,500)	200
Neighborhood Park1	10,000 (10,000)	100
Neighborhood Park2	8,000 (10,000)	200
District Park	28,000 (40,000)	200

zones for the first evacuation in the Central Disaster Prevention Council⁴⁾.)

III . Total population within the lure distance from each point is above target population (See Table 1) .

The areas that satisfy all of these conditions were searched by the mapping analysis of the GIS software. However, no area was found that satisfied all of the conditions for any types of Housing Basis Parks.

Therefore, it could be concluded that urban parks are sufficiently located on the conditions of national law. The fact that almost all areas are within 500m from the existing evacuation in the study area is the major reason of that no location was remained as proposed site (Fig.3) .

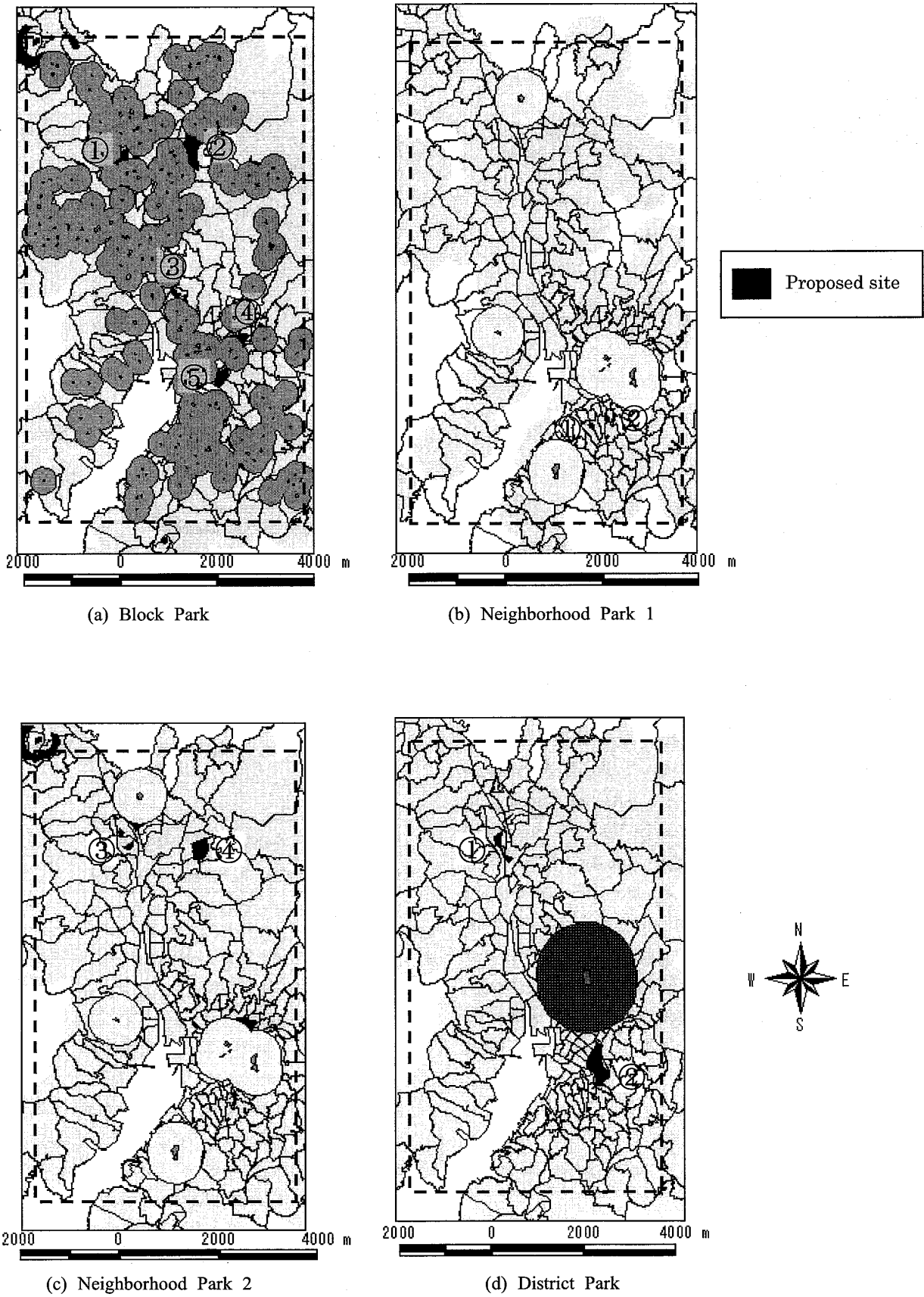


Fig.6 Result of park location selection with the broader conditions

Thus, in order to choose the new park location, the authors proposed the following process. Firstly, we choose the areas out of the lure distance of the existing parks with the most total populations within the lure distance. Then, the site far from the existing evacuation is identified. The broader conditions for selecting each types of park location are shown in Table 2. On those conditions, five proposed sites were extracted for the Block Parks, four for Neighborhood Parks and two for District Parks (Fig.6).

4. Land cost estimation of proposed sites

By multiplying area (m^2) of Housing Basis Park, determined by the Urban Park Law, using land price interpolated from point data, the land cost for park construction was calculated (Table 3). For Block Park, the result showed that the construction was relatively low-cost for four districts, where land cost is about five hundred million yen, except Furukawa town. Especially, it is advisable to construct a Block Park in Ishigami and Tsuji towns, since the area satisfying the conditions is the most widely distributed and the lowest land cost. Ishigami and Tsuji towns also show the lowest land cost for Neighborhood Park. However, Inada, Nakashin and Nakakoshima towns, even with the expensive land cost, retain 10,000 target population. Finally, for District Park, the most applicable location is Shimizu, Miyoshi and Ohhashi towns, since another candidate is markedly high-cost of 24 billion yen.

5. Conclusion

In this study, selecting location of new urban park was attempted considering the lure distance, the target population, distance from the existing evacuations. Subsequently, all types of the Housing Basis Parks were selected from attribute data. However, no suitable site was found for locating new urban parks on the legal conditions. The reasons of this result, include utilization of the Area Distribution Method and inapplicability of the Urban Park Law and the Central Disaster Prevention Council determines.

For the father analysis, the more detailed data e.g. the grid data of population, were needed since it was analyzed by using Area Distribution Method. In this study additionally, the inclination and altitude should

Table 3 Result of the land cost estimation

(a) Block Park

Location	Land price (thousand yen/m ²)	Estimated land cost (million yen)
1.Shimizu	240	600
2.Ishigami and Tsuji	160	400
3.Hamahira 1 Chome	275	690
4.Shindaiku	240	600
5.Furukawa	750	1,880

(b) Neighborhood Park

Location	Land price (thousand yen/m ²)	Estimated land cost (million yen)
1.Inada and Nakashin	250	5,000
2.Nakakoshima 1 Chome	330	6,600
3.Shimizu	240	4,800
4.Ishigami and Tsuji	160	3,200

(c) District Park

Location	Land price (thousand yen/m ²)	Estimated land cost (million yen)
1.Shimizu, Miyoshi and Ohhashi	220	8,800
2.Kajiya and Aburaya	600	24,000

be included for the farther analysis because Nagasaki City is a typical hillside city, where over 70% of the urban area is located in the hillsides.

References

- 1) Nagasaki Prefecture(2002), "Standard price list of investigation of land price", pp.1-12,pp.107-124 (in Japanese).
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- 3) Ohba, T. (2001), "Introduction of the region analysis by Arc View", Seibundou, pp.158-167 (in Japanese).
- 4) Central Disaster Prevention Council (2002), <http://www.bousai.go.jp/jishin/chubou/taisaku/houkoku/siryou2-2-1.pdf>.