LOWLAND TECHNOLOGY INTERNATIONAL Vol. 16, No.1, 26-35, June 2014
International Association of Lowland Technology (IALT), ISSN 1344-9656

DEVELOPMENT OF AN EVALUATION SYSTEM FOR PARKS IN NEIGHBORHOOD COMMUNITIES – CASE STUDY IN KITAKYUSHU CITY, JAPAN

Liyang Fan [1,2], Yui Konishi [2] , Hidetoshi Fukahori [2] , Weijun Gao [2] and Zhu Wang [1]

ABSTRACT: Parks are an important aspect of an ideal city. In the "neighborhood development" concept, the public park is the core of a neighborhood block, which is one of the basic components of the city. Using the neighborhood parks in Kitakyushu, Japan, as a case study, this research proposes an evaluation system for parks in urban area. First, the study uses GIS to identify each neighborhood park and define the neighborhood community. It then classifies neighborhood parks according to the land-use pattern of their communities. Next, the study develops an assessment index and used it for principal component analysis. Finally, based on the results of the analysis, the study comprehensively evaluates the community and park system in Kitakyushu city, Japan. The findings suggest that comparative evaluation between the different parks can help in understanding the characteristics and problems of existing information.

Keywords: Neighborhood community, neighborhood park system evaluation , GIS, space syntax, principal component analysis

INTRODUCTION

Background

Parks are availability, proximity, and specific recreation facilities. They were intended for people of all classes, so they could breathe air purified by sun and trees. Park can serve as a communication center for the surrounding residential area, helping to keep a city lively. Witten. Witten et al. found evidence of an association between locational access to parks and physical activity (Witten et al. 2008). They can also be important for older age groups and children, who tend to spend more time in parks and open spaces. Parra et al. (2010) suggested that residential building environments are associated with perceived active park use and pointed out the importance of surrounding environment (Diana et al. 2010). Hence, there has been much research into making open spaces effective for these age groups (Nordh et al. 2013). Finally, parks and open spaces can help to maintain a microclimate and a natural environment (Toshifumi et al. 2010).

The urban public parks movement was born partly in response to the crowded and substandard housing and working conditions of the urban poor in the late 19th century. With the development of the society, their importance is very well known for maintaining the environmental quality and sustainability. Barbosa et al. (2007) highlights the need for additional green space to be a created and existing green space to be protected in light of increasing development pressure. Systematic conservation planning techniques have been applied in many areas around the world (Herzele et al. 2003; Higgs et al. 2012). Applying systematic conservation planning in human dominated landscapes poses significant challenges, including the need to address multiple objectives, the likelihood that many priority areas will not be available for conservation and may degrade and alter in their availability over time. Japan uses the "neighborhood development" concept (Kato 2008). In this concept, open space – generally in the form of a public park system – forms the core of the neighborhood community, which in turn is one of the basic components of a city (Makiko et al. 2010).

To provide a good quality of service, parks must keep pace with changes in the city and in lifestyle. However, social conditions and people's demands change with time, and it is important to be able to determine whether parks can meet the changing requirements. Weiss et al. (2011) estimated the relationship between neighborhood compositional characteristics and measures of park facilities,

[1] Department of Civil Engineering and Architecture, Zhejiang University, Yuhangtang Road No.388, Zhejiang Province, P.R. CHINA, happylamb68@hotmail.com
[2] Department of Architecture, The University of Kitakyushu, Hibikino1-1, Wakamatsu-Ku, Kitakyushu, Fukuoka, JAPAN
Note: Discussion on this paper is open until December 2014

illustrating that attention to neighborhood disamenities can appreciably alter the relationship between neighborhood composition and spatial access to parks (Weiss et al. 2011). Thus, there is a need to develop an evaluation system for parks and open spaces.

Previous Research

There has been much previous research on parks (Nicholls 2001; Talen and Anselin 1998). Many communities and organizations would like to improve community parks to increase physical activity, yet the impact of such improvements is seldom evaluated. Given limited resources, cost-effectiveness is a concern among community-based organizations that would like to optimize their investments (Cohen et al. 2012). Some other focused on park's contribution to population energy balance. For parks to influence physical activity at the population level, conditions are necessary (Lotfi and Koohsari 2009). Parks must be available, properly equipped, and well attended, and users must be active. Furthermore, physical activity in parks might be used to represent levels of participation in physical activity by their surrounding population. Whatever the park study focuses on, the park reconstruction should keep in touch with the development of the society. So in Japan, some researchers supply some new concepts of Park building. Shusaku and Junne (2008) proposed park planning for the reconstruction of Kagoshima City. Other studies have focused on parks and the social activity of residents. For example, Maki (2010) discussed maintenance of green space by residents, and Yoshihiro et al. (2010) researched the relationship between pedestrian amenity and public open space in urban greening. Some researchers have also considered the ageing society. Eikichi et al. (1999) discussed the relationship between use of ageing group and scale of the park. Others have tried to evaluate the use of an existing park system in city reconstruction. For example, Saadeldin and Satoshi (2002) evaluated and classified neighborhood parks in Fukuoka in term of design quality.

Research into parks and open spaces is a growing and complex topic. However, most of the studies described above have focused on only one park and analyzed it from only one aspect; thus, there is a lack of research on comprehensive evaluation strategies.

Research Objective and Framework

Based on the existing research and neighborhood theory, generally speaking, the open space (in Japanese pattern refers to the neighborhood park) should have adequate area, good connection to service area and commercial area, efficient accessibility for residents in the community and well-designed constitution of the park system (neighborhood park and block parks). This study is aimed to give out a comprehensive evaluation system for existing condition of parks.

Fig.1 shows the framework for this study, which focused on designated neighborhood parks in the city plan of Kitakyushu, Japan. The approach was to describe geographic information for these parks, based on geographic information system (GIS) data, and identify neighborhood communities, as defined by the development policies for urban parks in Japan. Parks were then classified by their land-use pattern, according to the GIS export data, and one object was selected from every pattern for analysis. The next step was to develop an assessment index based on area and map data from GIS functions, and on accessibility, calculated according to factors in space syntax theory (Hillier and Hanson 1984). Finally, values were introduced for principal component analysis.

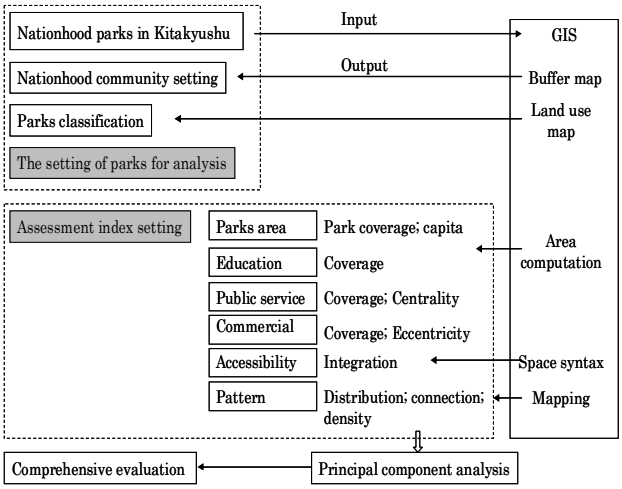

Fig. 1 Research framework

THEORIES AND METHODS

Neighborhood unit theory

Neighborhood unit theory (Perry 1975) is an early diagrammatic planning model for residential development in metropolitan areas. It was derived from prevailing social and intellectual attitudes of the early 1900s by Clarence Perry. The theory continues to be used as a means of ordering and organizing new residential communities in a way that satisfies contemporary "social, administrative and service requirements for satisfactory urban existence". The theory suggests that a neighborhood community should have at least one elementary school, enough open space

for the residents, public services located in the center of the community, commercial areas located at the edge of the community and connected with other communities, a city road that surrounds the community instead of going across it, and a convenient pedestrian system.

In 1956, Japan established development policies for its urban park system (Kato 2008) based on this theory. Policies include district parks, neighborhood parks and block parks, as illustrated in Fig.2. Each neighborhood community has an area of about 100ha, and includes one Neighborhood Park and four block parks. In addition, there should be one district park for every four neighborhood communities. The whole park system – from community level to city level – includes block parks, neighborhood parks, district parks, comprehensive parks and sports parks (only block and neighborhood parks are relevant at the neighborhood community level).

In this research, the pattern of open space (refers to neighborhood parks) and community described in Neighborhood unit theory is considered as the pattern with high service efficiency. In other words, the open space in these communities can serve better to the residents. The factors defined in the following research are to evaluate whether existing neighborhood communities in Japan follow the initial Neighborhood unit theory.

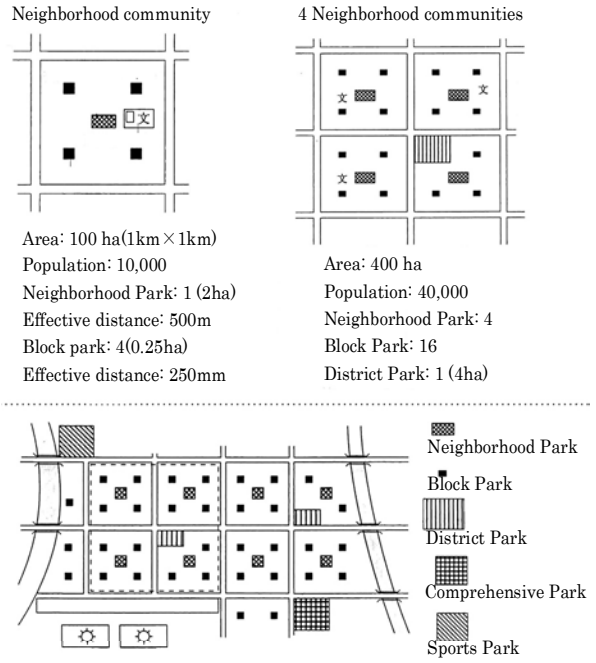

Fig. 2 Japan's urban park model

Space Syntax

Space syntax is a theory that was developed by Hillier and Hanson (Hillier and Hanson 1984), (Hillier 1999) to analyze spatial configurations and the relationship between social function and built environment. It is a two-stage method for representing and measuring the pattern properties of open space in the built environment. The first stage is to represent continuous open space as a series of linked elements, such as maximal 'convex' spaces or longest 'axial' lines (Fig.3a); the second is to calculate various relational properties of the geometry based on an 'axial map' (Fig.3b).

This concept can be applied to spaces ranging from a domestic interior space to a large-scale urban system. Several indexes are used to estimate the 'axial map'.

(1) Connectivity (Ci) counts the number of spaces that intersect directly with space i.

(2) Depth (D) is measured in steps; it represents the minimum number of spaces that must be passed through to go from one axial space to a destination (Fig.3c).

(3) Integration reflects the degree of assembly of each space. There are two kinds of integration value: global and local (Fig.3f). Global integration is measured in the whole area with the full radius of the system, whereas local integration is measured within a certain radius. Most of the measures for local integration are set as 'radius 3 integration'.

(4) Intelligibility (R^2) of urban pattern is a part–whole relationship between local and global properties of motions within spaces. An adequate level of

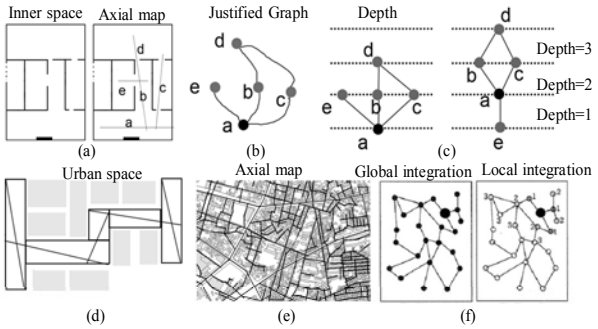

Fig. 3 The theory of space syntax and the index

Fig. 4 The neighborhood parks and communities

intelligibility is a key determinant of human behavior in urban environments. In space syntax theory, the local property of an open space is qualified by connectivity, while the global property of the space is estimated by integration. Intelligibility is the strong positive relation between global and local integration. The higher intelligibility value reveals the stronger relationship between the local and global properties.

This research uses AXWOMEN3.2 in ARCGIS3.2 to calculate the integration described above.

Principal Component Analysis (PCA)

PCA is a mathematical procedure that converts a set of observations into a set of uncorrelated variables, referred to as principal components. The number of principal components is less than or equal to the number of original variables. The principal components selected are those with higher weight factors. All of the principal components are guaranteed to be independent.

SPSS (Statistical Package for the Social Sciences) was used for the PCA.

Methods

Japan's urban parks development policies define neighborhood parks in a way that clarifies the relationship between a park and a community. Neighborhood parks are defined as serving to the community about 2ha in area, geographically located in the center of a neighborhood, and accessible to pedestrian users within a radius of 600 m, via sidewalks and other safe access points, as Fig.2. Hence, this study takes the neighborhood parks as the center, and uses a buffer map to extract the buildings within a 600 m radius: this area is defined as the neighborhood community served by the park.

We identified neighborhood communities for all 96 neighborhood parks in Kitakyushu (Fig.4). Most of these communities comprise residential, commercial and industrial areas. Furthermore, the city of Kitakyushu has both a coastal and a mountain area. In consideration of the geographic features and the land use, neighborhood parks and the surrounding community that they serve can be classified by land-use pattern into nine groups, as outlined below:

(A) Residential area occupies almost all of the community.

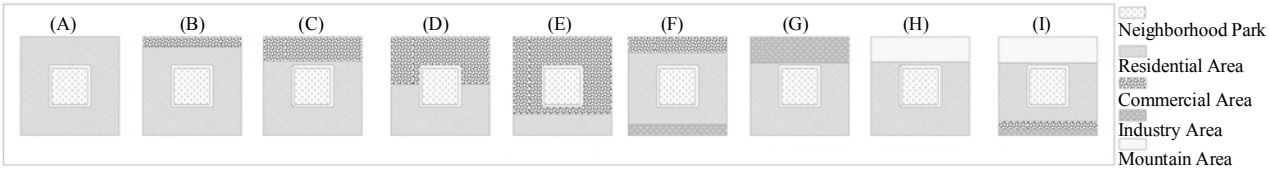

Fig. 5 The land use pattern for parks

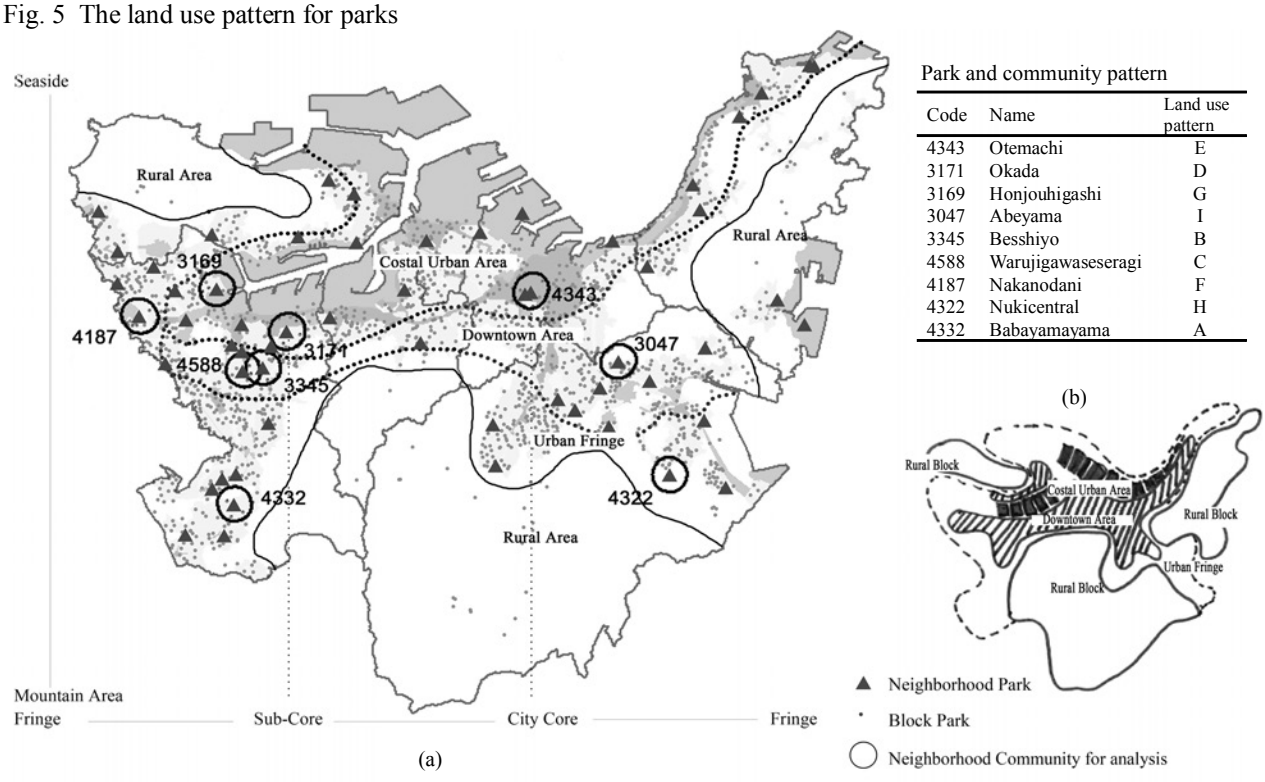

Fig. 6 The research objectives and land use pattern

(B) One commercial street passes through the community.
(C) The commercial area in the community is less than half of the whole area.
(D) Around half of the community is occupied by a commercial area, and a neighborhood park divides the two zones.
(E) Over half of the community is occupied by a commercial area.
(F) Both a commercial and an industrial area occupy part of the community.
(G) There is an industrial area in the community.
(H) The community is located beside the mountain area, and includes a residential area only.
(I) The community is located beside the mountain area, but includes a small commercial or industrial area. The patterns of groups are shown in Fig.5.

Since it is difficult to analyze all the neighborhood parks and communities in Kitakyushu, we analyzed only some of the parks in the first stage of the research. Parks were chosen based on the city plan. The city is divided into three blocks, as shown in Figs. 6a and 6b: a coastal frontage area, a downtown area and an urban fringe. The study separated all the neighborhood parks according to these three areas, and categorized them by land-use pattern. The three main patterns were defined as typical land-use patterns for the area.

ASSESSMENT INDEX FOR PARKS AND NEIGHBORHOOD

The Composition of Variable

Based on neighborhood unit theory, the study set up six variables for evaluation:
(1) Park area: coverage rate (CP) is the rate of park area to community area. Population density (DP) is the rate of population to community area. They suggest population and park area of nine communities;
(2) Education: elementary school area coverage rate (CE) is the rate of building area of elementary school to community area. It is a value to suggest the existing condition of education facilities in communities;
(3) Public service: coverage rate of public service (CS) is the building area of public service divided by community area. Centrality index (PC) is the distance between park and center of public facilities divided by the distance between the community center and its edge. These two indexes evaluate the existing condition of public service facilities and their location;
(4) Commercial service: commercial coverage rate (CC) is the building area of community facilities divided by community area. Eccentricity index (EC) is the distance between commercial center and community edge divided by the distance between community center and its edge. These two indexes suggest commercial space in communities and their location .
(5) Accessibility: evaluated by the integration value, according to the space syntax theory that explained in section 2.2. These indexes suggest the efficiency of the road system which includes: global integration (max, average) to evaluate the road accessibility in the whole community; local integration (max, average) to evaluate the road accessibility to the park; Intelligibility (R2): to evaluate the coherence between the part and the whole
(6) Pattern: These indexes are image factors that represent the relationship between block parks and neighborhood parks. The equally distributed building density, block park distribution and grid-shaped connection between the block parks are a more efficient way to determine movement between block parks and

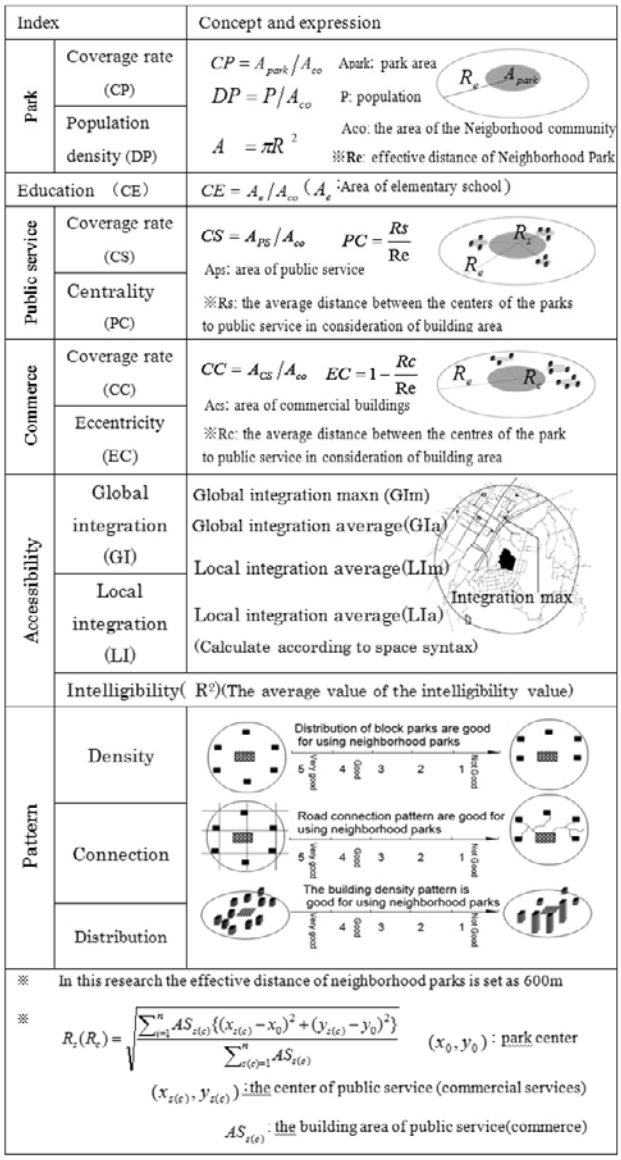

Fig. 7 Evaluation variables

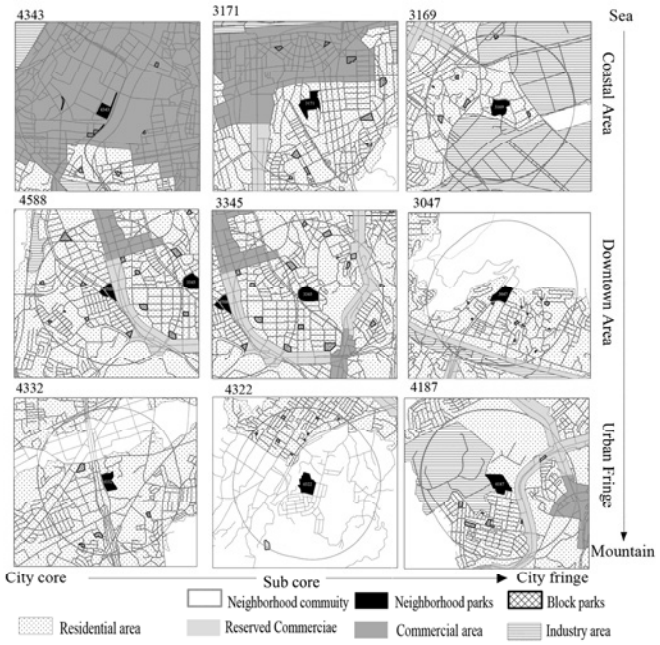

Fig. 8 The land use pattern

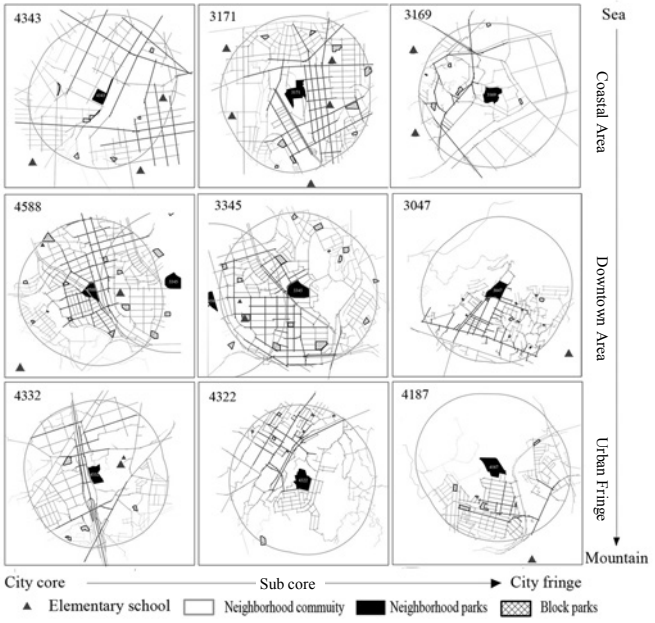

Fig. 9 The global integration value

neighborhood parks than the unequally and natural pattern. GIS is used here to map out the patterns.

All the variables and their calculation methods are described in Fig.7.

Factor Setting

Fig.8 is the graph of land use pattern for these parks. In coastal area, the city functions are separated by function blocks, because the commercial area and industrial area in this part of city is larger than other two areas. Furthermore, from the city core to the urban fringe, the commercial area is decreased. The communities in the downtown area are mainly formed with residential area. However, still have a little commerce or industry.

Different from the coastal area, the commercial areas and industrial areas are always in the form of street instead of block. Compared with the parks in the above two areas, the communities in the urban fringe hardly have commerce, most of them are covered by residential areas and restricted by the geography features.

Figs.9 and 10 illustrate the results of the integration value (represented by the weight of the line) and the location of the elementary school.

Fig.9 shows the global integration, illustrating accessibility of the road system in the whole district. Accessibility is high in the commercial area, but low in the industrial area. In the coastal and downtown areas, the global integration value is high, because of the grid-mesh pattern of the road system. In contrast, in the urban fringe, the road system has to follow the geographic features, and the global integration value is low. However, the residential areas in the urban fringe are built in what is almost a mesh road system, whose integration value is higher.

Fig.10 shows the local integration, illustrating the accessibility of the nearby area. The local integration value is not directly related to the global integration value. The communities in the coastal area have good global and local integration values, especially for the park in the sub-core area (3171). The integration values for the communities in the downtown area are not, on average, as high as the global integration value. However, some roads still provide good accessibility for the nearby community. The local integration values for the communities in the urban fringe area are better than the global integration values, especially in the residential part.

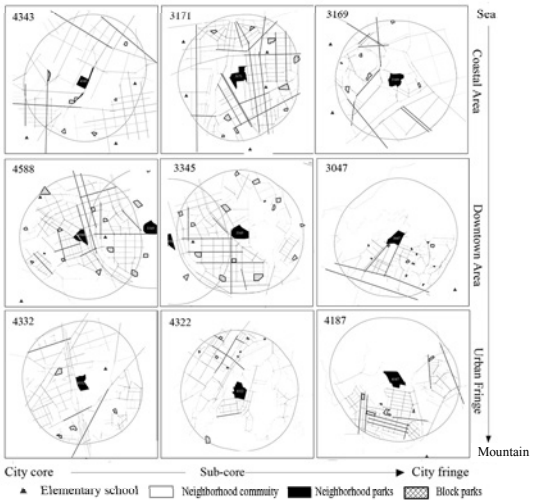

Fig. 10 the local integration value

The graph also shows the distribution of elementary schools. From the city core to the city fringe, and from the coast to the mountain part of the city, the elementary school area in the communities decreases. In

communities 3047, 4322 and 4187, elementary schools are lacking.

Table1 Variables settings and component matrix

	Variables									Principal components		
	3047	3169	3171	3345	4187	4322	4332	4343	4588	1	2	3
CP	0.021	0.024	0.039	0.045	0.032	0.023	0.022	0.021	0.018	0.4875	0.53	-0.6116
DP	0.005	0.006	0.009	0.009	0.005	0.003	0.003	0.013	0.008	0.8863	-0.2525	-0.0452
CE	0.017	0.009	0.109	0.033	0.089	0.002	0.01	0.057	0.026	0.7465	0.2149	-0.0626
CS	0.017	0.01	0.108	0.32	0.09	0.003	0.01	0.14	0.027	0.595	0.108	-0.6415
PC	0.13	0.21	0.17	0.368	0.164	0.104	0.368	0.99	0.134	-0.4671	0.8274	0.2512
CC	0.009	0.057	0.23	0.029	0.02	0.003	0.01	0.11	0.29	0.6394	0.1734	0.7183
EC	0.98	0.91	0.85	0.961	0.918	0.829	0.942	0.56	0.827	0.4677	-0.7689	0.2974
Gln	0.82	1.248	2.082	0.959	0.998	0.677	0.813	1.546	1.363	0.878	0.0536	0.3473
Gla	1.05	0.815	1.23	0.998	0.653	0.227	0.559	0.965	0.296	0.6057	0.1316	-0.4948
Lln	4.494	4.205	5.614	4.939	4.678	3.714	4.961	5.306	4.49	0.8425	-0.0805	-0.2322
Lla	1.51	1.657	2.25	1.84	1.769	1.51	1.647	2.344	1.87	0.9479	-0.2803	0.0855
R^2	0.27	0.482	0.532	0.441	0.377	0.261	0.229	0.286	0.463	0.5939	0.6352	0.2501
D	1	2	4	5	2	1	2	4	5	0.8027	0.0793	0.1112
C	4	3	5	4	4	2	2	2	5	0.4303	0.7963	0.2377
Di	2	3	4	3	3	2	3	4	3	0.9056	-0.2219	0.0605

Principal Component Analysis and Neighborhood Park Rankings

This study used PCA for comprehensive evaluation of the parks. Table1 shows the result of variables setting and component matrix for the three principal components that were extracted, it also shows the weight assigned to each factor. Among the three principal components, the study selected the highest value. The first component was firmly related to accessibility; the second to connection and location of public services and the commercial area; and the third to the percentage of public services, the commercial area and open spaces.

Fig.11 shows the result for PCA. Overall, the first principal component had more effect on park efficiency then the other two components. The third principal component had less effect. Thus, accessibility was the most important factor.

The comprehensive value can indicate the service efficiency of a neighborhood park, which suggests whether a park can. The parks in downtown areas have a higher value, meaning that they serve the communities more efficiently. However, park 3047 has some problems; in particular, the second component was especially low. Among the three parks in the coastal area (4343, 3171 and 3169), park 3171 had the highest comprehensive value and park 3169 the lowest.

The parks in the urban fringe generally had low comprehensive values; park 4332 was one of the highest among these parks.

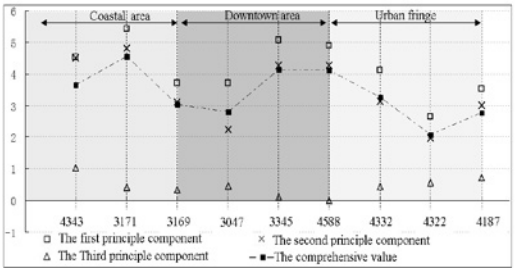

Fig. 11 The result for principal component analysis

EVALUATION FOR PARKS

Parks in the coastal area (4343, 3171 and 3169):

Park 4343 (Rank 4)

The community with park 4343 belongs to pattern E. The park is located in the center of the city, and most of the community comprises a commercial area. The park area is limited and population density is high, which lowers the service efficiency. The global integration of the community is high, in line with the commercial function. In contrast to other parks in this community, the neighborhood park is located in the commercial district. The global and local integration values around the park are low, suggesting that the connection between the park and the residential area is weak. Furthermore, the accessibility of the west part is low, possibly due to the presence of the industrial area. The block parks are in good proportion to the community, and the building density is generally high. However, connections between block parks and neighborhood parks are weak. To improve accessibility of parks for residents, it would be necessary to enlarge the park area according to the real situation, and increase the connection between block parks and neighborhood parks.

Park 3171 (Rank 1)

This park is located in the suburban area. No more than half of the community is covered by commerce, and the park is located in the residential area, as pattern D. Park 3171 was the park that most efficiently served the surrounding neighborhood. Both the global and local integration values are high around the park, and the district is covered by a grid-shaped road system. Building and block parks are averagely distributed, with a grid road connection. The road system in the east part is not well shaped and lacks block parks. However, accessibility of the west part is weak, which is not good for its use by the elementary school. Further, the commercial eccentricity is lower, which means that the commercial area is too near the park. Therefore, any future development should take into account pedestrian access to the elementary school.

Park 3169 (Rank 6)

This park is located in a coastal area in which the eastern part is mainly industrial, as pattern G. The global and local integration values around the park are low. Because of the industrial area, building density distribution and block parks are mostly in the west that road connections are weak. Integration for the residential area in the west is also low, and there is no elementary school in that area. In this case, the park acts as a partition, interrupting the connection between the residential area and the industrial area. The connections between the block parks are thus important and need to be increased. There is also a need to develop an efficient pedestrian system for the elementary school, public services and the commercial area.

Parks in the Downtown Area (4588, 3345 and 3047)

Park 4588 (Rank 3)

The community with park 4588 belongs to pattern C. This park is located in the downtown residential area. The total area and the per capita area are smaller than for the other parks. Global accessibility is high around the park, which is useful for the development of commercial streets that pass through the center near neighborhood parks. However, integration for the peripheries is low, especially in the west part. The two elementary schools in the west part do not have good accessibility.

Park 3345 (Rank 2)

This park is located in the downtown area, with pattern B. It has a large area and high population density. The public service area is larger than in other communities, and the park is located in a place where both global and local integration values are high. The commercial area is in the form of a commercial street, located on the southwest edge of the community. The southwest part of the community has a grid-shaped road system. Thus, accessibility of this part of the community is high, connecting the commercial street with the residential area. The east part of the community is inferior, possibly due to insufficient road connections.

Park 3047 (Rank 7)

This park is located in the downtown area, with half of the land covered by a mountain, as pattern I. Global integration for this community is high in the residential area, the south of the community. There are two road connections, with high local integration, connecting to the commercial area, which is located on the boundary. Hence, the south community has strong vitality. However, Fig.9 shows that the block parks are mainly located in the southeast area, where the integration value is low. There are no efficient links between block parks and neighborhood parks, the road connections to the commercial streets are not highly accessible, and the community lacks an elementary school. These issues need to be addressed to improve the service efficiency of the neighborhood park.

Parks in the City Fringe Area (4332, 4322 and 4187)

Park 4332 (Rank 8)

This community is located in the city fringe, at some distance from the core area. It belongs to pattern A. One city road passes through the community, separating the east and west parts. The integration for this road is high, but the integration for the other part of the community and the elementary school is poor.

Park 4322 (Rank9)

This park is near the mountain side of the community, as pattern H. Most of the block parks are located in the north part, where accessibility is higher. This community is a mainly residential area with grid-shaped road connections. There is another new residential area south of the park, with a convenient connection to the neighborhood park. However, the connection between this commercial area and other parts of the community is inadequate, which limits the service efficacy of the park.

Park 4187 (Rank 5)

This park is located near the industrial area, but some parts of the community are covered by a semi-commercial area, as pattern F. Fig.9 and Fig.10 indicate that the south part of the community has high global and local integration values; this area has been developed as a residential area with an efficient road system. The integration values are also high in the southeast, which will help the semi-commercial area in this part to become a commercial area. It is a more mature reserve community for the sprawling downtown area.

Characteristics and Inadequacies of Neighborhood Parks and Community in Each Area

The ranking and analysis for each park shows the current situation. It also shows possibilities for future development and revitalization of the communities and open spaces. The points below summarize the findings of the study.

(1) The parks for the communities in the coastal area (4343, 3171 and 3169) have good service efficiency. The communities are developed in the form of urban functional zones, with clear commercial, residential and industrial areas. The accessibility of the road system is better than in other areas, which gives more potential for development of commercial areas and public services. However, there is a lack of open space, perhaps due to the inadequate park area and high population density. The best approach would be to develop the existing parks and make more open space available along the pedestrian system.

(2) The parks for the communities in the downtown area (4588, 3345 and 3047) have good service efficiency. The communities are much closer to the ideal model described in neighborhood unit theory, with a mainly residential area that has a commercial street and public services. The communities and parks have good accessibility. However, the location of the public service and commercial area needs to be adjusted. It would be best to locate the commercial street on the edge and the public services in the center. Also, some of the parks need to be better connected to the pedestrian system.

(3) The parks for the communities in the urban fringe (4332, 4322 and 4187) are in poor condition. In this sprawling downtown area, connections and the pedestrian system should be developed, taking into consideration the geographical features.

CONCLUSIONS

(1) The study researches on the characteristic of parks and their neighborhood communities in different areas of Kitakyushu, evaluating their existing situation from served area aspect. All the parks were categorized into 9 patterns. As the model patterns suggested, the communities in coastal area develop in urban functional zones while communities in downtown area are constituted mainly with residential area and the commercial street near the edge of communities. The communities in city fringe area are in random pattern and the parks are not efficiently designed.

(2) In consideration of the park system in Japan, this study defined the neighborhood communities and suggested evaluation variables for the Neighborhood Park follow the neighborhood theory. The Indexes include the adequate area of open space (park) and elementary school; adequate public service and its location; commercial area and its location; accessibility of open space (use space syntax theory); the constitution of Neighborhood Park and block parks.

(3) Instead of single park evaluation, this study analyzed parks by the comparison study and ranking. As the finding of this research, for the city of Kitakyushu, the parks of communities in downtown area are more efficiently served to residents. The parks of the communities in coastal area have well designed accessibilities but inadequate area, because of the high population and building density.

(4) Beside the park, the research takes the open space, pedestrian connection and the surrounding community as a whole, analyzes and displays out the urban structure by GIS. These can help to realize the existing situation of each park, which is very important for the future development and district revitalization. It suggests that the road system for the parks in urban fringe and some of the parks in coastal area has low accessibilities. In other words, the road system should be adjusted according to the space syntax factor.

The results obtained in this result cannot be generalized to other district. However, the conceptual exploration of the evaluation system of open space has provided a useful indication of community and park. This research adopted space syntax theory, which only analyzes the topological structure of the neighborhood community and park system. In the following studies, questionnaire and survey will be adopted among the residents. Furthermore, the assessment procedure presented in this study is expected to be used to other district.

REFERENCES

Barbosa, O., Tratalos, J.A., Armsworth, P.R., Davies, R.G., Fuller, R.A., Johnson, P. and gaston, K.J. (2007). Who benefits from access to green space? a case study from Sheffield, UK. Lands. Urban Plan., 83: 187-195.

Cohen, D.a., Marsh, T., Williamson, S., Golinelli, D. and McKenzie, T. (2012). Impact and cost-effectiveness of family fitness zones: a natural experiment in urban public parks. Health and Place, 18: 39-45.

Eikichi, B., Yoritaka, T. and Takesi, K. (1999). A study on relation between park utilization by the aged people and spatial condition of urban park. Environmental Inform. Sci. Extra, Papers on Environmental Inform. Sci., November 16, 13: 37-42.

Herzele, A.V. and Wiedemann, T. (2003). A monitoring tool for the provision of accessible and attractive urban green spaces. Lands. Urban Plan., 63(2): 109-126.

Higgs, G., Fry, R. and Langford, M. (2012). Investigating the implications of using alternative gis-based techniques to measure accessibility to green space. Environ. Plan. B-Planning and Design, 39(2): 326-343.

Hiller, B. (1993). The hidden geometry of deformed grids-or, Why space syntax works, when it looks as though it shouldn't. Environ. Plan. B: Planning and Design, March, 26: 169-191.

Hiller, B. and Hanson, J. (1984). The Social Logic of Space. Cambridge: Cambridge University Press: 90-142.

Kato, H. (2008). Town Planning, ISBN 978-4-87071-004-7: 47.

Lotfi, S. and Koohsari, M. J. (2009). Measuring Objective Accessibility to Neighborhood Facilities in the City (A Case Study: Zone 6 in Tehran, Iran). Cities, 26(3): 133-140.

Maki, R. (2010). Maintenance of Green Space by Residents (Our Gardens). JABS, June 20, 125(1605): 40-41.

Makiko, T. and Yoko, S. (2010). The role of group activities and key persons in a community: Research on the neighborhood communication in the mini-housing development in the 1960s. Architect. Inst. of Japan, February, 75(648): 343-351.

Nicholls, S. (2001). Measuring the accessibility and equity of public parks: a case study using GIS. Managing Leisure, 6(4): 201-219.

Nordh, H. and Ostby, K. (2013). Pocket parks for people-a study of park design and use. Urban Forestry and Urban Greening 12: 12-17.

Parra, D.C., Gomez, F.L., Fleischer, N.L. and Pinzon, J.D. (2010). Built environment characteristics and perceived active park use among older adults: Results from a multilevel study in Bogotá. Health and Place, 16(6), November: 1174-1181.

Perry, A.C. (1975). The Neighborhood Unit. Translate Version, ISBN 9784306070585: 27-28.

Saadeldin, E. and Satoshi, H. (2002). Physical characteristics and residents utilization of neighborhood parks: Case study Higashi Ward Fukuoka. Bulletin of the Kyushu University Human Environ. Fac., July 02: 1-10.

Shusaku, F. and Junne, K. (2008): A Study on Kagoshima Park Planning in Former City Planning Act: About the Selection Method of the Plan Ground. Architectural Inst. of Japan Res. Rep., March 01: 293-296.

Talen, E. and Anselin, L. (1998). Assessing spatial equity: an evaluation of measures of accessibility to public playgrounds. Environ. Plan. A, 30(4): 595-613.

Toshifumi, K. and Motofumi, M. (2010). A measurement of the cold air drainage from urban green space on summer nights in Kanazawa. Japan Architect. Academic Lecture, July 20: 979-980.

Weiss, C.C., Purciel, M., Bader, M., Quinn, J.W., Lovasi, G., Neckerman, K.M. and Rundle A.G. (2011). Reconsidering access: Park facilities and neighborhood disamenities in new york city. J. Urban Health-Bull. of the New York Academy of Medicine, 88(2): 297-310.

Witten, K., Hiscock, R., Pearce, J. and Blakely, T. (2008). Neighborhood access to open spaces and the physical activity of residents: a national study. Preventive Medicine, 47(3): 299-303.

Yoshihiro, F., Satoru, S. and Satoru, Y. (2010). Study on the relationship of pedestrian amenity and public open space in urban greening. Lecture Outline Sets, Aij, July 20: 859-860.