A Sustainable City Planning Methodology for 21st Century (Concept of Food Green City)

By
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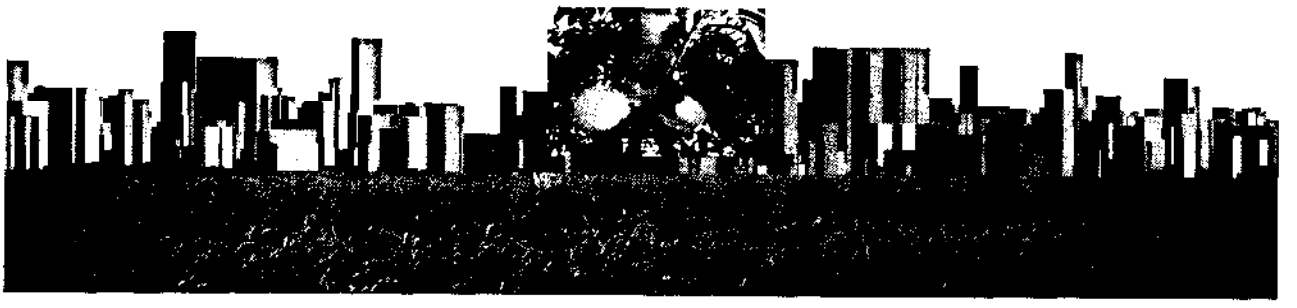
Final Dissertation Submitted to the Division of Environmental Development Engineering, Faculty of Engineering, Osaka Sangyo University in partial fulfillment of the requirements for the Doctor Degree Course



Under the Supervision of

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Osaka, Japan

Key words: *Sustainable City, Planning Methodology, Kitakawachi, GIS, Food Green City [1], Urban Agriculture [2], Middle Natural Farming [3], Environmental Design [4], Spatial Equity.*

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Sunil Babu Shrestha
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09 Jan. 2004

ABBREVIATIONS

WCED	:	World Commission on Environment and Development.
AEZ	:	Agro-Ecological Zone
BAR	:	Building Area Ratio
BSE	:	Bovine Spongiform Encephalopathy
BUGS	:	Bridging Urban Gardening Society
CAD	:	Computer Aided Design
CASE	:	Cities as Sustainable Ecosystems
CBA	:	Community Based Agriculture
CCA	:	Comparative City Assessment
CDI	:	City Development Index
CSA	:	Community Supported Agriculture
CUPUM	:	Conference on Computers in Urban Planning and Urban Management
EF	:	Ecological Footprint
ESRI	:	Environmental Systems Research Institute
FAO	:	The Food and Agriculture Organization of the United Nations
FG	:	Food Green
FGC	:	Food Green City
FGS	:	Food Green Space
FHC	:	Food Holding Certificate
GDP	:	Gross Domestic Product
GIDS	:	Geographic Information Database System
GIS	:	Geographic Information System
GPS	:	Global Positioning System
HIA	:	Holistic and Integrated Approach
HDI	:	Human Development Index
ICLEI	:	International Council for Local Environmental Initiatives
IUCN	:	The World Conservation Union
MDGs	:	Millennium Development Goals
OSU	:	Osaka Sangyo University
PPP	:	Purchasing Power Parity
SEA	:	Self Ethical Assessment
SI	:	Skeleton- Infill
SWOT	:	Strengths, Weakness, Opportunities and Treats
UA	:	Urban Agriculture
UDSS	:	Urban Design Support System
UGS	:	Urban Green Space
UN	:	United Nations
UNDP	:	United Nations Development Programme
UNEP	:	United Nations Environment Programme.
UNIC	:	United Nations Information for the Nordic Countries
UNU	:	United Nations University
WHO	:	World Health Organization
WSSD	:	The World Summit on Sustainable Development
3D	:	Three Dimensional

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Chapter Six

A Sustainable City Planning Methodology for 21st Century (Concept of Food Green City)

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ABSTRACT

The world is rapidly urbanizing. The 21st century is becoming for the first time in the history the urban entity living more than half the population in the urban areas. The cities have developed as centers for the secondary and tertiary activities. And generally rated the development based on those parameters. But the rapid conversion of fertile agriculture lands into residential buildings, commercial complexes, industrial blocks and spaces for urban infrastructures has greatly influencing open spaces, decreasing sharply food self sufficiency rate of city and affecting badly to the urban ecosystem. Today's cities have difficulty in finding sufficient open spaces for healthy breathing and emergency spaces during disaster like earthquakes and fires. Air quality and living environments are greatly polluted, impacting negatively on quality of life. The way of life styles and resource consumption of city dwellers resulting in many cities of the world to exceed it's Ecological Footprint by several folds. Such process of urbanization and industrialization has recently drawn the attention of policy makers, planners, engineers, designers and architects to recognize the cities not only as an engine of development but also as a great challenge for the sustainable development. In such context, this research is motivated to search for the appropriate city planning methods in the 21st century to direct cities for the future.

This dissertation goal is thus aimed at proposing a sustainable city planning methodology appropriate for the 21st century. For this, Japan an industrialized and highly urbanized country but sharply loosing food self-sufficiency rate in recent years is taken as study area after over viewing its situation. The Kitakawachi Region in Osaka Prefecture of Japan was chosen as a case study area, which consists of seven cities with different level of urbanization. These cities have long historical background and are close to the Osaka city, the economic center of western Japan. The research is carried out in the cities to analyze the existing scenario of land uses pattern, demographic characteristics, assess the development status based on CDI and evaluates the spatial distribution of cultural environments & their relationships with city dwellers. GIS was used as analysis, planning, designing and visualizing tools in the research and presenting the results.

Based on the case studies and literature reviews the integration of urban agriculture with land use planning as a strategy for increasing urban food self sufficiency, environmental management and poverty alleviation, is realized. Considering the context of Agenda 21 recognized by The United Nations Conference on Environment and Development at Rio de Janeiro in 1992 for balanced and integrated approach to environment and development; the issues of reducing the human impacts on the earth and decreasing the City's Footprint as pointed by Our Ecological Footprint (Wackernagel, M. and Rees, W.E 1996), WHO Healthy Cities Project to explore the opportunities and mechanism for developing collaborative action in cities to achieve "Health for all"; UN Millennium Development Goals (MDGs) with world's common agenda for reducing poverty and improving lives (UN Millennium Summit Sept. 2000) and The UN-Habitat strategic Vision: sustainable urban development, adequate shelter for all, improvement in the lives of slum dwellers, this study

forwarded the Food Green Concept (Green 21), a new way of looking green for urban sustainability. On this foundation, Food Green City Concept (FGC) was proposed as a new form of Garden city concept forwarded by Howard (1898) with appropriate characteristics suitable of the cities of 21st century.

This dissertation therefore presents a new concept of FGC for converting the Carbon dioxide city to Carbohydrate city with coexistence of Man in natural system. It forwards the vision of sustainability interlinking Nature, Culture & Future, and helping to control the unhealthy growth of cities in 21st century. The F-G City integrates the urban agriculture with urban land use planning & urban management system adopting the Middle Natural Farming and Vermiculture techniques suitable for urban areas; advocating green for functional as well as ornamental purposes. It explores the optimal possibilities of utilizing the resources for providing food, pleasant living environments, economical opportunities, social intercourse and cultural vibrancy in the city. The study has discussed about the Urban Agriculture in the light of its various benefits and answered for How to do?, Where to do? & Who will do? It has also realized the need of promotion of urban agriculture for the cities of Japan in bringing New Urban Green Revolution to pave the way for sustainability and creating cities for all.

A city is regarded as a greatest human achievement. The role of land uses is vital for creating sound and healthy city. The better the land uses of a city, the healthier the state of the city. This study has emphasized on the mixed land uses for the sustainable development and focused on the role of agriculture in the cities. The holistic approach taken for the study has also carried out the study of spatial distribution of Wayside shrines in Kawachinagano city and in cities of Kitakawachi. It is revealed from the study that such cultural elements are meaningfully distributed in the city spaces. Therefore, in the proposed city planning methodology Wayside shrines have also considered in the land uses planning to provide the city dwellers spiritual & religious satisfaction and also try to manage the urban problems through the cultural basis rather than enforcing the legal acts.

Finally, the concept of Food Green City was applied in the cities of Kitakawachi over the 63% estimated developable lands with 250m radius area as "Model Food Green City Neighborhood unit". It is visualized in 3D environment using GIS. The conceptual application result from the application of model demonstrates how efficient FGC to balance Carbon dioxide and Oxygen in the ecosystem. From the analysis, it has investigated that FGC can achieve 47% food self sufficiency state with maintaining plenty of multi-purposes green spaces (68%) at reasonable population density in the cities considering the population of Kitakawachi in 2050. It is also investigated that the food self-sufficiency rate and green spaces could be raised if FGC is designed for lower population density like in the case of population of Kitakawachi in 2100. These satisfactory results for improvement of Green Spaces, Food Self-Sufficiency Rate and Ecological Foot prints supported to recommend this proposed concept and methodology as an appropriate city planning methodology for the cities of 21st century.

In brief, the concept of Food Green City is a process of "restructuring the cities" and its ultimate goal is to establish spatial equity and perfection in urban ecosystem for the sustainable development with coexistence of man in natural system. Thus, this study shows how *"sustainable development"* can be achieved and *"spatial equity"* can be realized with new concept. It exhibits the vision for "Micro action but Macro achieve" for creating urban dominated sustainable world in 21st century. It thus has significance implications towards sustainable development theory and real practices for policy makers, planners, designers and advocators of sustainable development.

CHAPTER ONE: INTRODUCTION

"Cities have failed because we have had no way to see or study them as a functional entity. We are now on the verge of a break through."

(John Ormsbee Simonds, FASLA: Garden city 21, P.204)

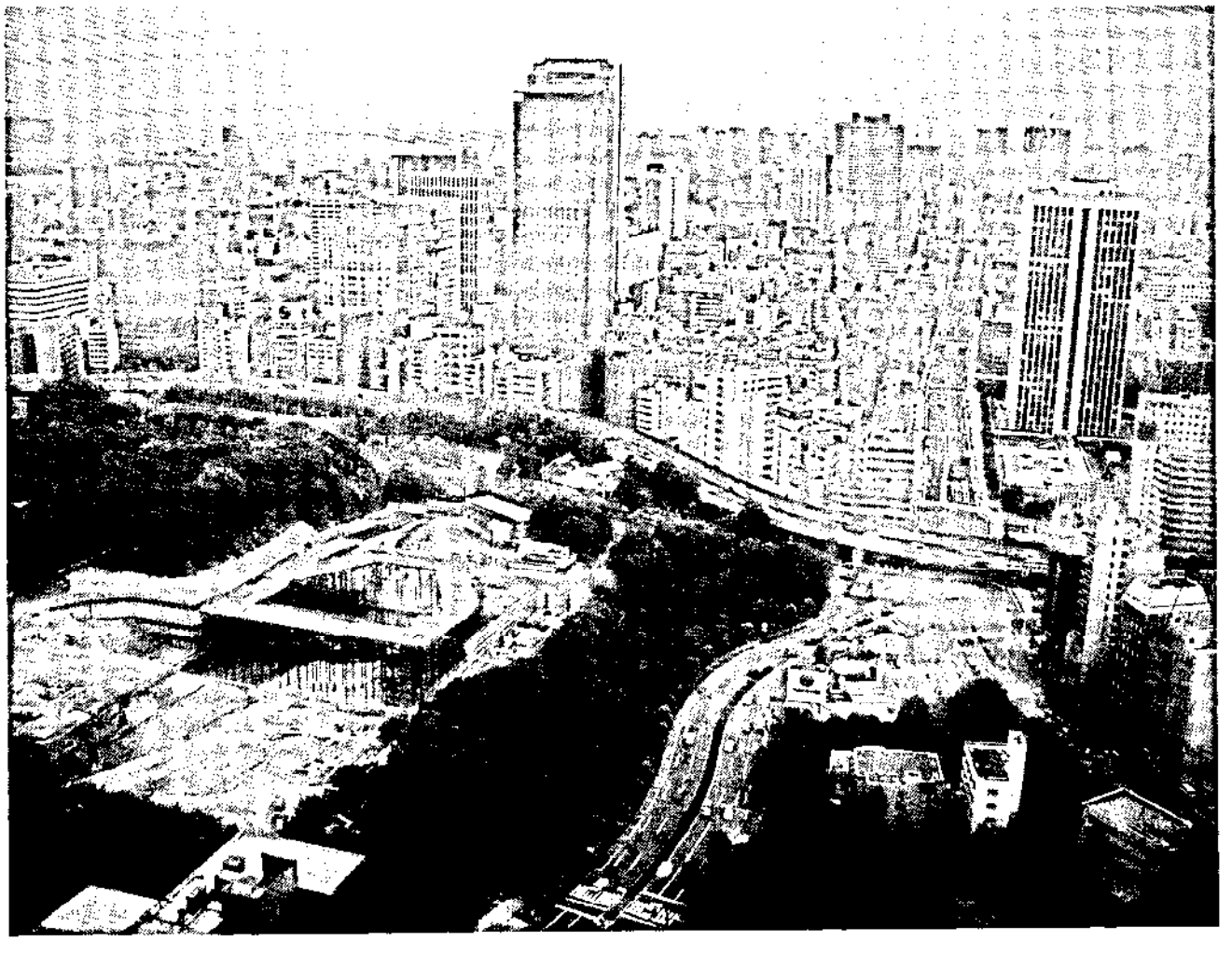


Photo 1: Glimpse of Tokyo City from Tokyo Tower.

CHAPTER ONE: INTRODUCTION

"A sustainable community is a place that seeks to contain the extent of the urban "footprint" and strives to keep to a minimum the conversion of natural and open lands to urban and developed uses."

(Timothy Beatley and Kristy Manning, The Ecology of Place, USA, 1997; P.28)

1.0 Introduction

This chapter introduces the general background of the study and overviews the situation of Japan, which is taken as a study area. It summarizes the Literature review, clarifies the goal & significance of the study and proposes the hypothesis of the study.

1.1 Background[5]

1.1.1 Urbanization Trend

Urbanization is the process of increasing number of people living in urban areas or cities. It is global phenomena. "The world's urban population reached 2.9 billion in 2000 and is expected rise to 5 billion by the year 2030"[51]. The 21st century is becoming for the first time in the history the urban entity living more than half the urban population in the urban areas. Rapid urbanization in the twentieth century has raised serious environmental problems creating the imbalanced urban ecosystem. "The world's cities take up just 2% of the Earth's surface, yet account for roughly 78 percent of the carbon emissions from human activities, 76 percent of industrial wood use, and 60 percent of the water tapped for use by people."[49]

1.1.2 Urban Problems

The cities have developed as centers for the secondary and tertiary economic activities without proper care for primary economic activities and ecosystem. The rapid conversion of fertile agriculture land into residential buildings, commercial complexes, industrial blocks and many urban infrastructures has greatly influencing built-up and open space ratio affecting badly to the urban ecosystem. Today's cities have difficulty in finding open spaces for healthy breathing and emergency spaces during disaster like earthquakes and fires. Air quality and living environments are greatly polluted, impacting negatively on quality of life. Most of the surfaces of urban areas are generally covered with concrete and asphalt. This process of surface sealing greatly influencing the ground water table and have serious consequences in long run. The natural recycling process of nutrients of urban soil has not been working properly. The nutrients which have to be used by plants for food production are flowing unproductively towards sea.

1.1.3 Urban Food Self Sufficiency

Food is the most essential part of the human life. Urban population sustained themselves in food is as important as transportation development in the city. The sharp decrease of food sufficiency rate of the city year by year has made increasing rate of importing foods. The exporting and importing activities of cities from other parts of country or by a nation from other parts of the world have some limits and demerits, as it involved large energy consumption. The high energy involved in importing food for the city dwellers from far will consequently increase the cost and has also

becoming the emerging issue of affordability particularly to the urban poor. Generally cities import the resources and export the pollutions. For example: importing the food items from the rural areas and exporting the garbage to landfill sites out of the city. This became the serious issue of imbalanced rural-urban linkage.

1.1.4 City's Footprint

An Ecological Footprint [52], a way of measuring a population's resource consumption or energy flows in terms of corresponding productive land area, of many cities of the world exceeds by more than several folds. "London, for example, now requires roughly 58 times its land area just to supply its residents with food and timber. Meeting the needs of everyone in the world in the same way that the needs of Londoners are met would require at least three more Earths."[49] "A typical North American (4-5ha) represents three times his/her fair share of the Earth's bounty. Indeed, if everyone on earth lived like the average Canadian or American, we would need at least three such planets to live sustainably."[52] This is not possible, so we must change our lifestyles of consumption to decrease our ecological footprints to be within the presently available 1.5 hectares [52] of such land for each person. After number of trials of calculations of Ecological Footprint per person, calculated based on food, mobility, shelter, goods and services in Ecological Footprint Quiz[9], it noticed that Food Footprint has prominent share in the total Ecological Footprint and it can be significantly reduced if proper cares are taken for the resources consumption and waste generation in relation with food.

1.1.5 Solution

Photo2: Homeless Problem in Osaka City.

To answer these issues and provide solutions need of an integrated vision and holistic paradigm is realized which can track the urbanization trend of 21st century in a sustainable way. Photo2 shows the plastic homes of urban poor, around which there are, a lot of green trees but do not carry any meaning to them, who are struggling for food and decent living environments. How valuable the trees will be if trees give the fruits like orange and persimmon? Hence, this study was carried out to propose a sustainable city planning methodology for making the city a functional entity, supporting its population within their carrying capacities and particularly caring its poorest citizens.

1.2 Overview of Japan[5]

1.2.1 Introduction

Japan is an East Asian island country (Fig. 1) with about 70%[33] of nation's entire surface area covered with forests. It consists of more than 6800[30] islands with major four islands Hokkaido, Honshu, Shikoku and Kyushu. The area of Japan is 377880[30] km^2 and population has reached to 127 million in 2001. Japan has become the ninth largest populated country of the world in 2000 and has ranked in fourth place among the 10 million or more populated countries with its population density 340 persons per square kilometer.[31] This highly urbanized and industrialized country's more than three forth populations have already been living in the cities.

Fig.1: Japan and its major four islands& three cities

1.2.2 Demography

1.2.2.1 Growth of Population

Japan is becoming the aging society with decreasing trend of total population. In 2000, population more than 65 years has reached more than 17.3%[31] and trend is increasing. The growth trend of population at the interval of 50 years is shown in the Table 1.

Table 1: Growth of Population

Year	Population (1,000)	Composition of Population (%)			Average annual rate of increase (%)	Population density(per km^2)
		<14 years	15-64	>65		
1900	43847	33.9	60.7	5.4	0.83	115
1950	84115	35.4	59.6	4.9	-	226
2000	126926	14.6	67.9	17.3	0.19	340
2050*	100593	10.8	53.6	35.7	-0.83	270

* Projection as of Jan. 2002
Source[31]: Statistics Bureau, Ministry of Public Management, Home Affairs, Posts and Telecommunications; Ministry of Health, Labor and Welfare.

From the Table1, it is clear that the population growth of Japan is moving backwards with new demographic characteristics: decreasing trend of child population and increasing trend of old age population. Due to this, even the population density has reached more than double by 2000 within 100 years; total population will be more or less similar to the 1967 in 2050. But in 2050, the child and old age population's share in total will follow the opposite composition as compare to 1967.

1.2.2.2 Household size

Fig.2 indicates more than 50% households have increased and shrunken the household size from 3.41 to 2.67 within the 30 years period. This pointed out the fragmented household characteristics of Japanese society recently. Out of the 46.78 million households in 2000, 58.4%[31] were nuclear family households and 27.6%[31] were one person households also verify the same. This means that without any growth of population, new housing units are required and additional energy is consumed.

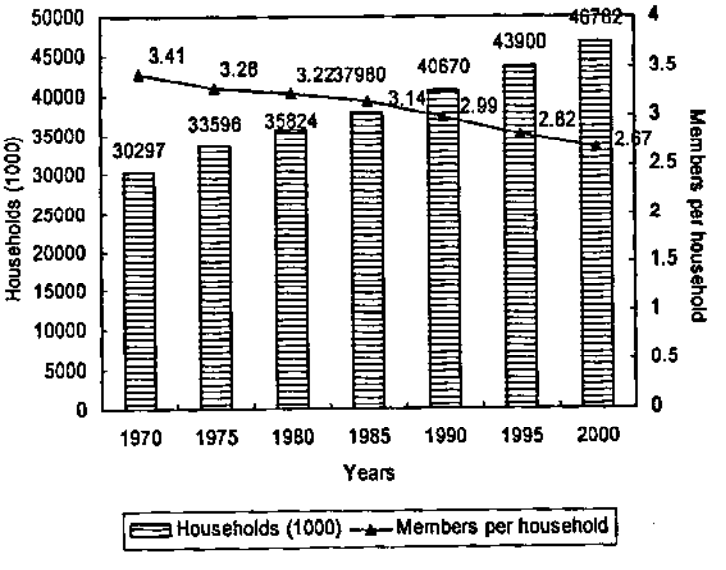


Fig. 2: Households and Household Members

Data Source[31]: Statistics Bureau, Ministry of Public Management, Home Affairs, Posts and Telecommunications; Ministry of Health, Labor and Welfare (2002).

1.2.3 Urbanization Pattern of Japan

Photo 3: Tokyo – Capital City of Japan: Concrete Jungle city model?

"In 2000, 12 cities in Japan had permanent resident populations of 1 million or more. Together their populations topped 26 million, a figure equivalent to 21 percent of national total. The largest single city was the 23 wards (ku) of central Tokyo (Photo3), with 8.135 million citizens. It was followed in decreasing scale by Yokohama (3.427 million), Osaka (2.599million) and Nagoya (2.172 million)".[31)]

About half of the whole population of nation has been living in those three metropolitan areas, the total area of which is less than 7% of the nation (Fig.3). This clearly shows how high population distribution in those metropolitan cities of Japan. Now it is not difficult to guess that Ecological Footprint of those metropolitan cities of Japan exceed by significant multiplying figures. For instance total footprints of city dwellers living in three metropolitan areas of Japan exceeds 114 times than the areas covered by those three metropolitan areas. The change of population in three largest metropolitan areas from 1965 to 1995 is 42.6%[8)] while nation wise is just 27.8%[8)] verifying those metropolitan areas as population magnets for pulling the people from different parts of the country.

Fig. 4 shows that the urban population has reached from 18% in 1920 to 78.7% in 2000 while urban [5] area covered has increased just from 0.4% to 28.1% during the same period. The comparatively higher slope of trend line in percentage of urban area population than in percentage of urban area verifies that the increased urban populations have distributed in the existing urban

areas of the country without increasing the urban area at compatible increasing rate of urban population.

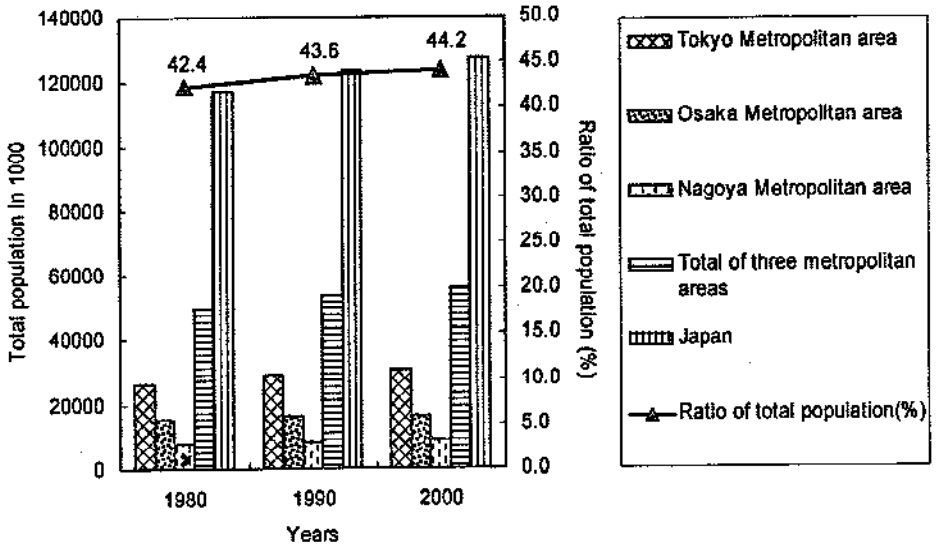


Fig. 3: Population of Three Major Metropolitan areas*

* As of 1 October. Areas within 50 kilometers radius from each municipal office.
Data source[31]: Statistics Bureau, Ministry of Public Management, Home Affairs, Post and Telecommunications (2002).

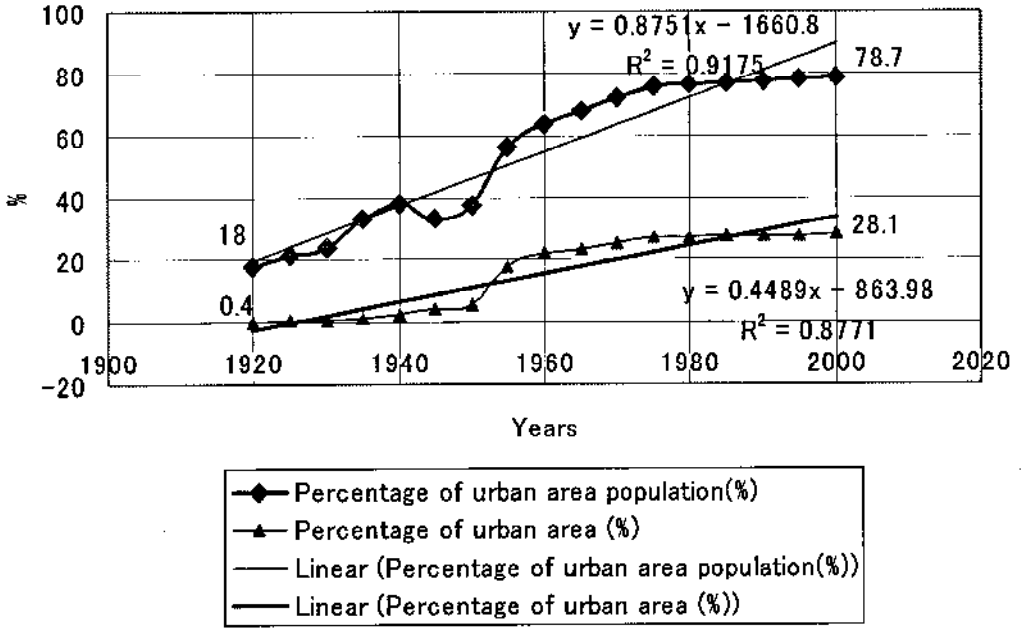


Fig. 4: Growth trend of population and area in Urban Japan.
Data Source[36]: Population Census of Japan.

1.2.4 Land use

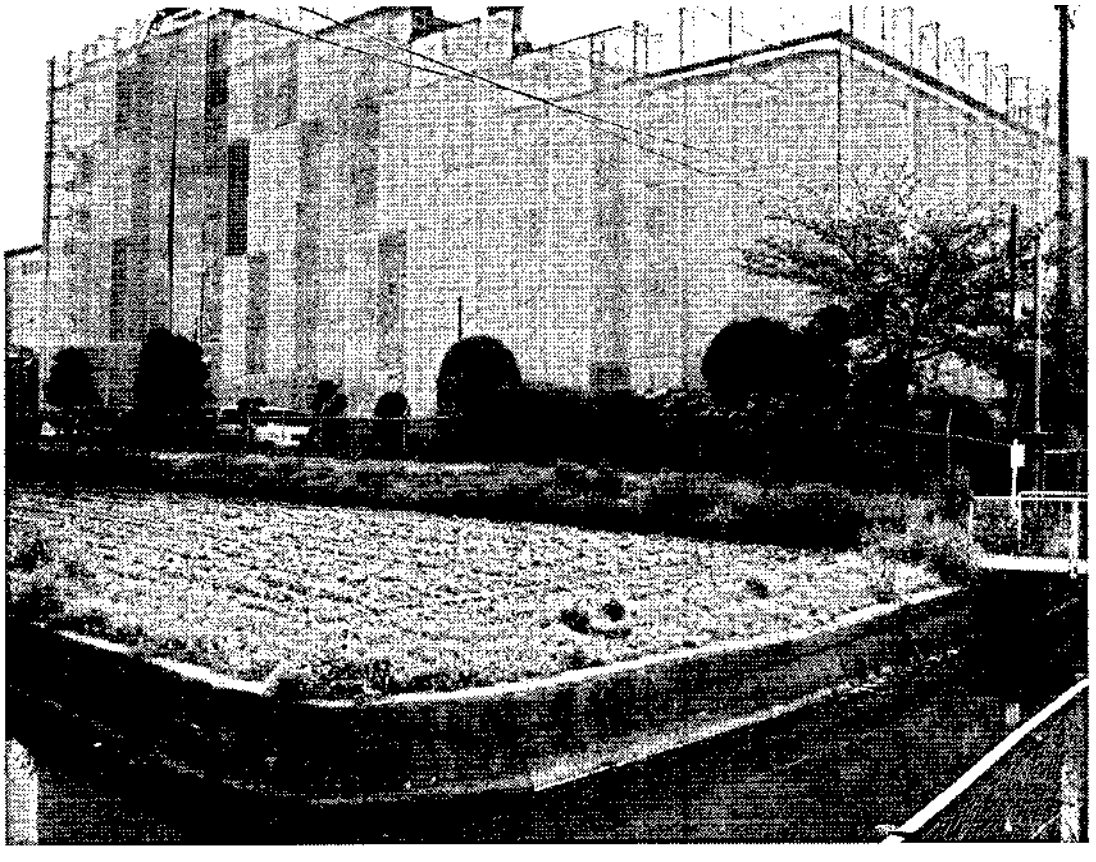


Photo 4: Encroachment of agriculture land by built up area in Daito city

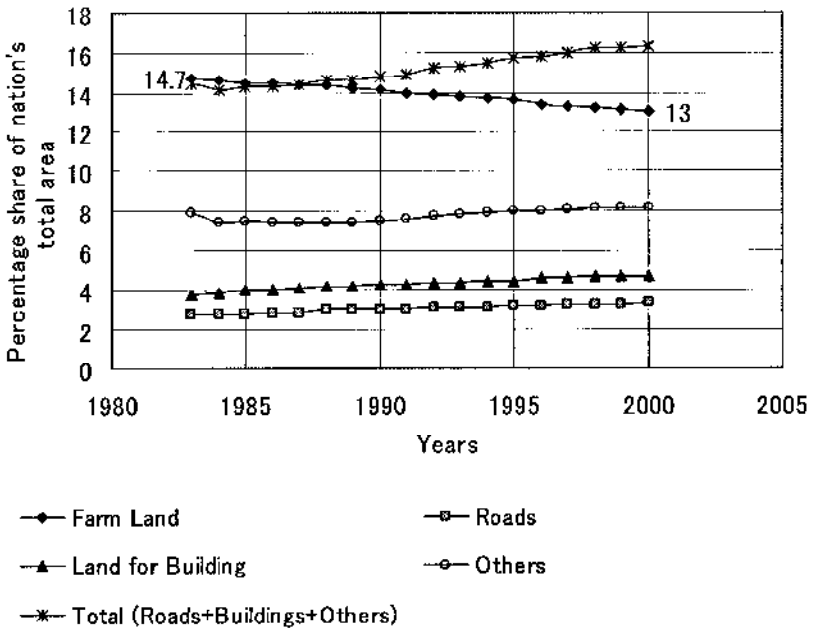


Fig. 5: Land uses trend of Japan.

Data Source[19]: White Paper on National Land Ministry of Land, Infranstructure and Transport (January, 2002) Internet Source:http://jin.jcic.or.jp/stat/stats/01CEN11.html

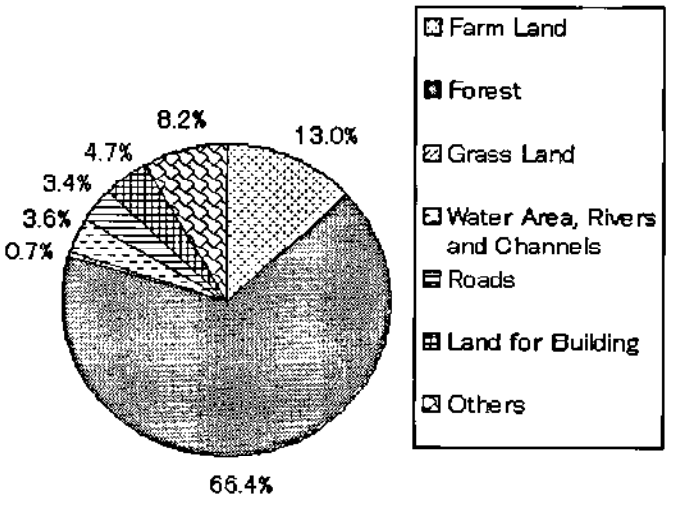


Fig.6: Land Utilization 2000

Data Source[19]: White Paper on National Land Ministry of Land, Infranstructure and Transport (January, 2002)

The land uses trend line of Japan during the period of 1983 to 2000 shown in Fig. 5. Farm land is decreasing at a rate more or less equal to the increasing rate of combined land of roads, buildings and others. Photo 4 illustrates an example. As seen in the figure, the rate of decrease of farmland is 0.1% per year. If this rate continues, then 13% farm land of 2000 (Fig.6) will need about 130 years for completely disappear and there will be no farm land in Japan after few decades of 22nd Century.

1.2.5 Economy and Employment

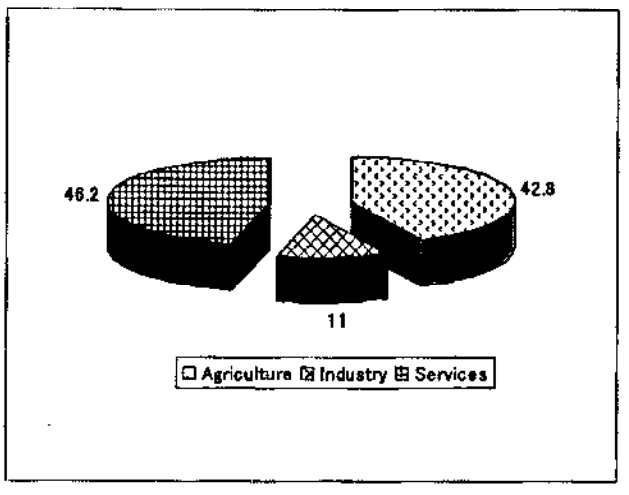


Fig. 7A: GDP Contribution in 1885

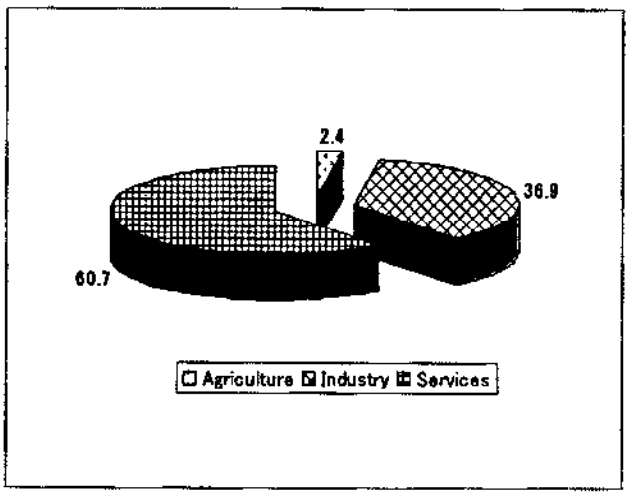


Fig. 7B: GDP Contribution in 1990

Fig. 7: Difference in about 100 years for GDP Contribution

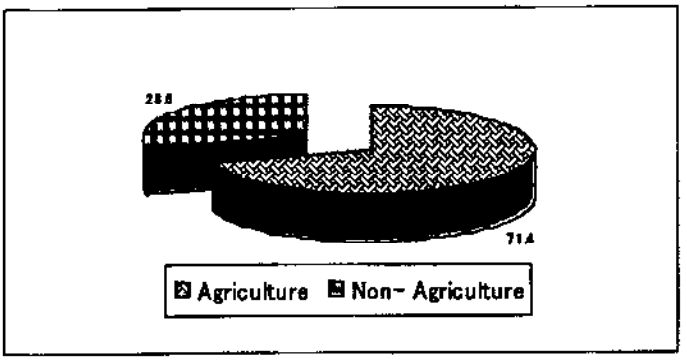


Fig. 8A: Employment Contribution in 1885

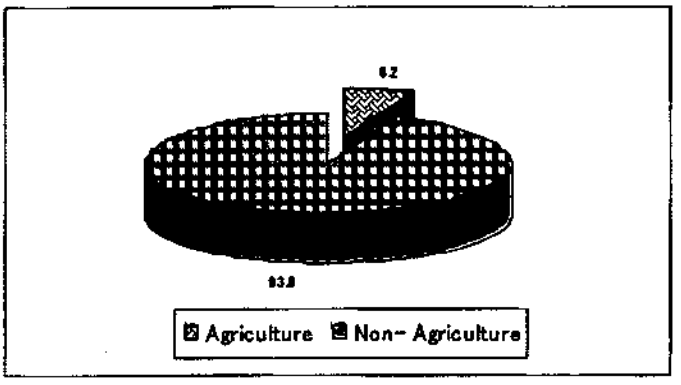


Fig. 8B: Employment Contribution in 1990

Fig. 8: Difference in about 100 years for Employment Contribution
Data Sources [14]: Agriculture and Economic Development in East Asia, p. 37

Japan has advanced as highly industrialized country in the 20th Century. The economic activities mainly focused towards the secondary and tertiary economics. The two examples have demonstrated in Fig. 7 and Fig. 8.

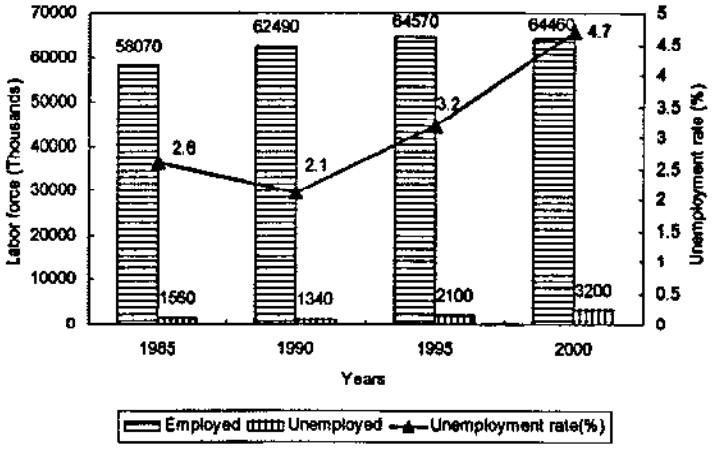


Fig. 9: Labor force status.

Data Source[32]: Statistics Bureau, Ministry of Public Management, Home Affairs, Posts and Telecommunication (2002)

In 2000, there were 67.66 million[32] people in Japan's labor force with 270,000[32] fewer than in 1998, the starting year for declining the labor force. Both employed and unemployed workers are composed in labor force. The unemployed labor forces are in increasing trend. As seen in Fig.9, the unemployment rate has reached almost double from 2.6% in 1985 to 4.7% in 2000 within the period of 15 years.

1.2.6 Household Consumption

1.2.6.1 Energy Consumption

Japan, which is as ranked within the highly industrialized countries, has high per capita energy consumption. Japan's dependency on imports of primary energy is highest among those countries as illustrated by Fig. 10.

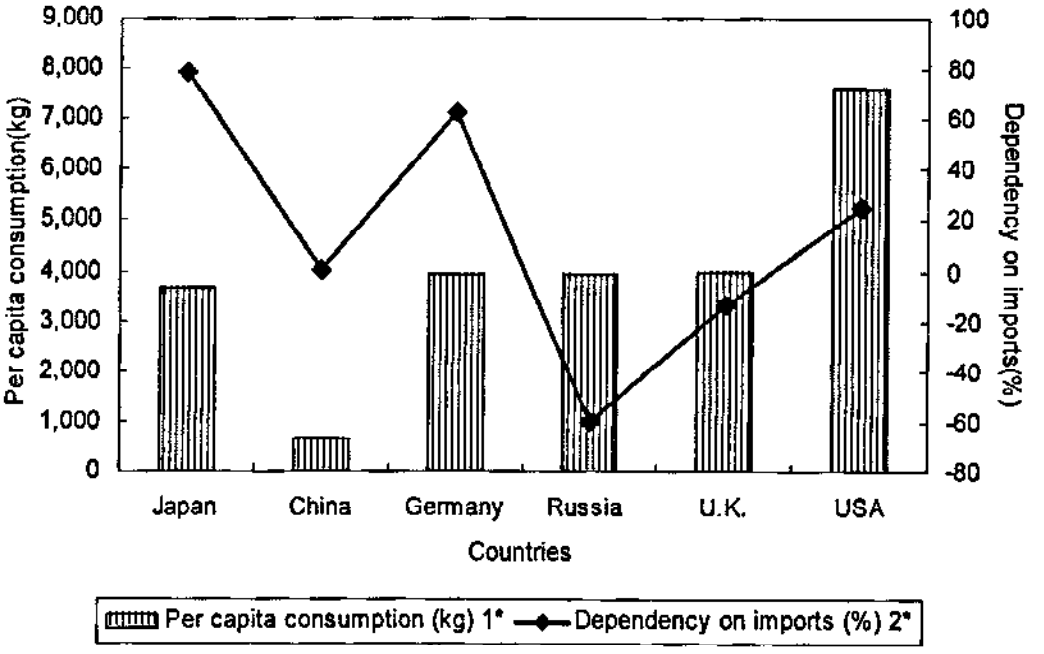


Fig. 10: Per Capita Consumption and Dependency on Imports of Primary Energy (1998)
Data Source [29]: United Nations. 1* Petroleum equivalent.
2* Dependency on imports =(Imports-Exports)/ (Imports-Exports + Domestic production)x100

1.2.6.2 Energy Intake characteristics

The food habits of Japanese people have been changing recently. The energy intake from nutrients per capita per day is slightly decreased from 1960 to 1999. Energy intake composition has the decreasing trend of carbohydrate percentage while the increasing trend of protein and fats as demonstrated in Fig. 11.

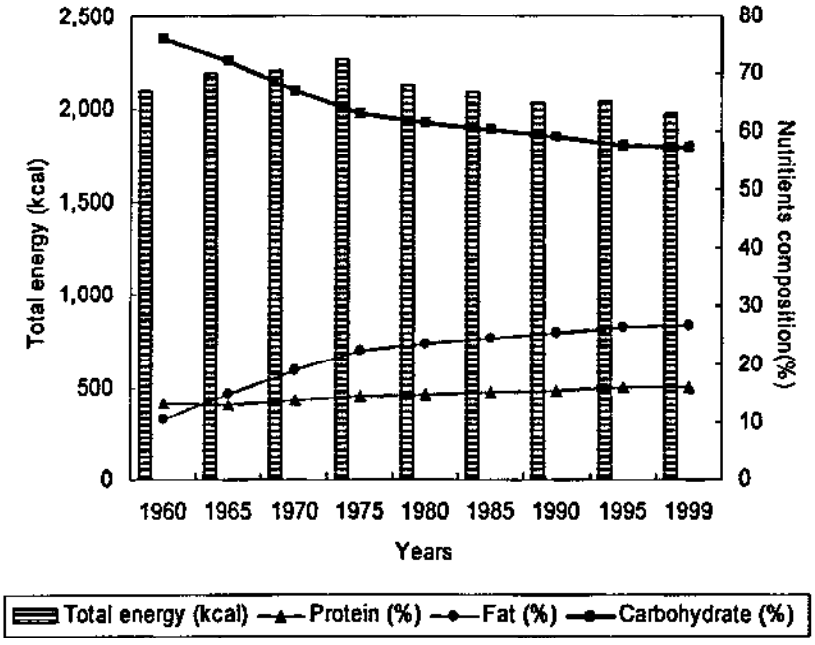


Fig. 11: Energy intake from nutrients (per capita per day)

Data source[21]: National Nutrition Survey conducted by the Ministry of Health, Labor and Welfare

1.2.6.3 Household Expenditure

As illustrated in Fig. 12, the food exhibits the largest share of household expenditure among the individual expenditure items. About one fourth of total expenditure will be in food items.

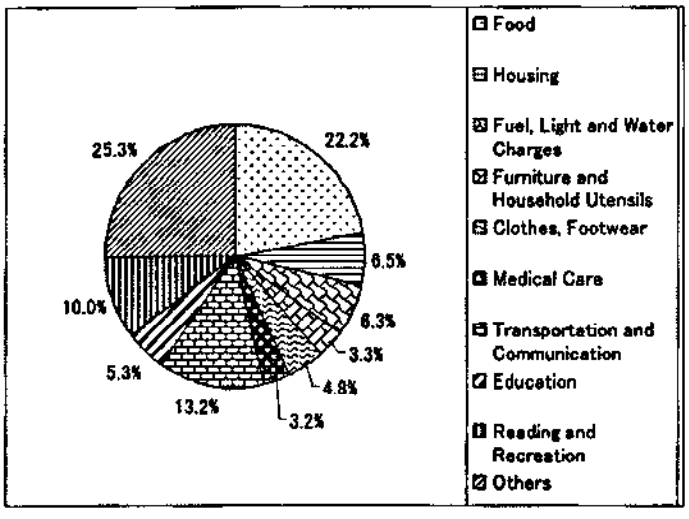


Fig.12: House hold expenditure 2002

Data Source[20]: Annual Report on the Family Income and Expenditure Survey Ministry of Public Manegement, Home Affairs, Posts and Telecommunications (Feb. 7, 2003)

1.2.7 Agriculture

1.2.7.1 Trends in Farm labors

"The number of farm households in Japan has declined since 1960, the starting time of nation's rapid economic growth. In 2001, Japan had about 3.07 million farm households, roughly half the corresponding number for 1960(6.06 million)". [33)]

1.2.7.2 Decrease of Farm land and Agriculture activities

"Japan had about 6.09 million hectares of farmland in cultivation in 1961. By 2001, that total had declined 20 percent, to about 4.79 million hectares." [33)]

1.2.7.3 Senior Citizen involvement

"In 2001, Japan's agricultural labor force (commercial farmers) stood at about 3.82 million individuals, down 1.8 percent from the year before. Moreover, senior citizens accounted for over half this total, in that 54.1 percent of all agricultural workers were aged 65 years and over."[33)]

1.2.7.4 Food Safety

In September 2001, Japan confirmed its first outbreak of BSE (Bovine spongiform encephalopathy), which creates a fearful situation in the food market. Citizens had under the doubtful condition about beef for couple of months. This demanded the safety food production and locally grown food.

1.2.8 National Food Self Sufficiency

From Fig. 13, it is seen that the national self sufficiency of total food is sharply decreasing from almost self sufficient state (98% self sufficient) in 1960 to 67% in 1990 decreasing at the rate of on an average 1% per year. If same trend will continue then from the beginning of later half of 21st century, Japan will totally dependent upon the other countries for food.

Japanese food self sufficiency rate in terms of supply of calories is much worst. "Self sufficiency in terms of supply of calories dropped from 73% in fiscal year 1965 to 40% in fiscal year 2000, where as self-sufficiency in cereal grains fell sharply, from 62% to 28%, over the same period. Japan today has the lowest food self-sufficiency level of any advanced industrial nation."[32)] "Japan is the world's largest food importer. Japan's net food import amounted to approximately 36 billion dollars in 1997."[24)] The major reasons behind the decrease of self sufficiency is decrease of agriculture land and agriculture employment, change of food habits less consumption of rice and high consumption of livestock products as well as oils and fats and increased imports of such products.

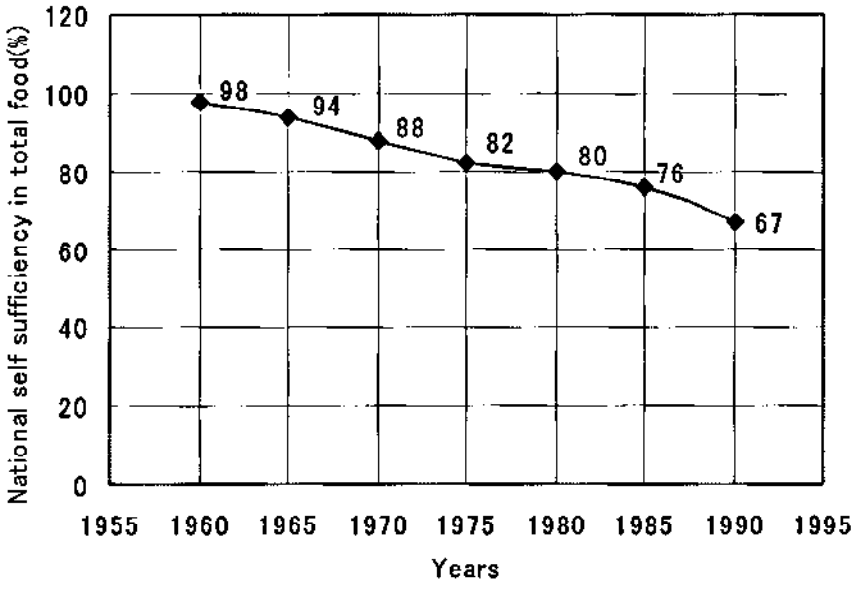


Fig. 13: National sufficiency in total food*
*(domestic production as proportion of domestic consumption %)
Source of Data [14]: Nihon no Tokei 1996:115

1.2.9 Relation between HDI, Urban Population and Energy consumption

Fig. 14 illustrates increase of HDI with the increase of urban population. The mild slope of lines for urban population % and HDI*100 has indicated low rate of increase while the sharp slope of line for energy consumption per capita has pointed out a high growth rate of per capita energy consumption during the same period.

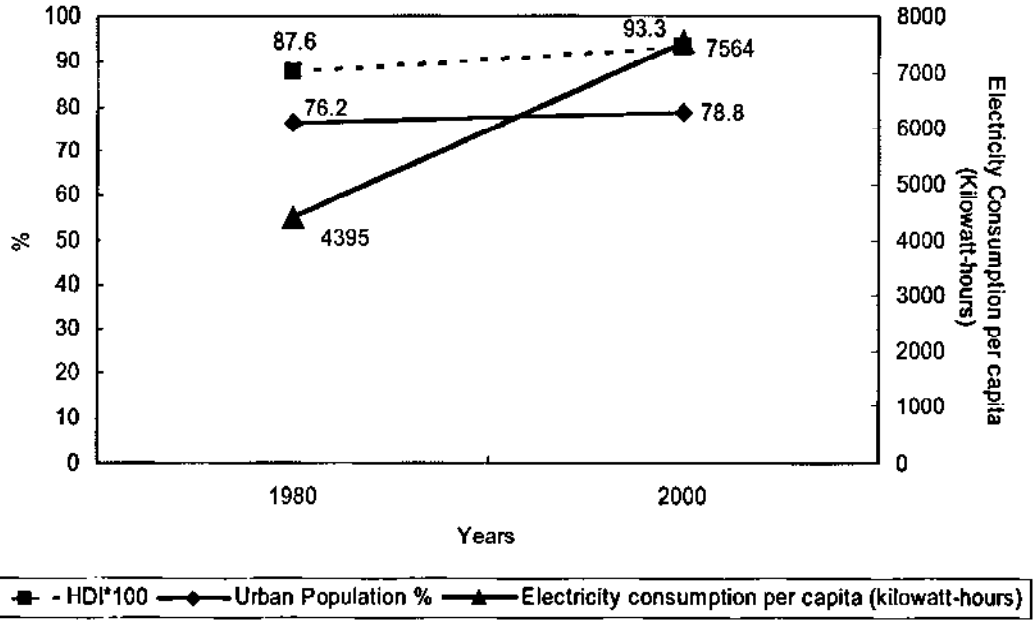


Fig. 14: Trend of HDI [6], Urban Population and Energy consumption in Japan
Data Source: Human Development Report 2002 [48] and Population Census of Japan[36]

1.2.10 Findings

The findings from the overview of Japan are as follows:

1. Japan is small island country of which 70% of total surface area is covered with forests. The country is highly dense and urbanized with mainly agglomerating the population in the three main metropolitan areas.

2. The demographic characteristic is of special type with rapid growth of old age population and decrease of child population. The Japanese society is thus becoming the aging society. The decreasing trend of population will make the total population similar to the population of 1967 in 2050. The rapid trend of nuclear family has been increasing the household numbers and decreasing the size.

3. More than 3/4th population have been living in urban areas with mainly agglomerating in the major urban centers. The urban economic activities are mainly concentrated in industries and services. Farm lands and open spaces are sharply decreasing. Cities are facing many environmental problems like air pollution, water pollution and solid wastes. Lack of sufficient open spaces, the situation is extremely severe at the time of disaster like earthquake and fire.

4. The populations in the cities are increasing without compatible rate of increase of area. This is creating the cities beyond the carrying capacity. The drastic change of consumption characteristic has increased the footprint of city. People's food habit and lifestyles are becoming more and more inefficient. The increasing trend of energy consumption per capita shows the movement towards unsustainable way of lifestyle.

5. Rapid conversion of farm lands into buildings and others have seriously questioned about food self sufficiency rate. Japan has the lowest food self sufficiency ratio and major food importer nation among all industrial nations. The extremely low food sufficiency rate and decreasing trend data has warned the serious consequences in near future. Japan will be farm less country by the year 2130 and totally will have to depend on imported food by the year 2057 if the same trend will continue.

The above findings aware every citizen to realize the present scenario and begins a new way of sustainable lifestyle. The new paradigm of City Planning is therefore required for addressing the issue how to improve the quality of urban lives by providing the energy efficient, fresh and safety food to the city dwellers within the city limits.

1.3 Literature Review

Journals, books, reports and materials available in the internet are reviewed for refinement of the study. Some of the relevant reviewed books are discussed here.

1.3.1 Our Ecological Foot Print[52], Reducing Human Impact on the Earth

"The present Ecological Foot Print of a typical North American (4-5 ha) represents three times his/her fair share of the Earth's bounty. Indeed, if everyone on Earth lived like the average Canadian or American, we would need at least three such planets to live sustainably."

(Mathis Wackernagel and William Rees, Our Ecological Foot Print 1996, p.13)

Our Ecological Foot Print, Reducing Human Impact on the Earth (Mathis Wackernagel and William Rees, 1996) presents an interesting and powerful tool for the measuring and visualizing human impacts on earth. It has successfully talked about the sustainability issues from local to global level including our households, communities, regions and nations. The concept of sustainability and carrying capacity in the light of resource consumption and its assimilation has converted by this book into the numerical form expressed as unit of lands areas (ha) that everyone can understand easily. But this book remains behind in proposing a clear sustainable path on which people walk for local to global level development. This proposed study thus seeks to find the methodology for sustainable city.

1.3.2 Garden cities 21[11], Creating a Livable Urban Environment

"Planning is the bringing together of diverse and multitudinous elements into harmonious relationships. Planning is an art and science that embraces and applies the principles of architecture, engineering, and landscape architecture. Planning brings into play the contributions of such disciplines as law, sociology, economics, and political science. Planning deals with health, safety, sustenance, employment, finance, education, and recreation."

(John Ormsbee Simonds, FASLA: Garden city 21, 1994, p.203)

In Garden cities 21, John Ormsbee Simonds, FASLA points out the urban problems and discusses from urban dwelling to urban metropolis on more livable neighborhoods and unified communities, coordinated system of transportations, close recreational areas, protection of farmland, natural environments and historic landmarks in the cities. This book emphasizes planning for future not based only on physical planning principle but also an understanding of politics, economics, demography, sociology and skill of converting vision into reality. The final chapter on Garden City 21 focuses on The Expressive city, The Functional City, The convenient City, The Rational City, The Complete City with describing about the Howard's famous ideas of Garden City. Finally, it has shown the some diagrammatic models and conceptual plan as the concept of Garden City 21 model in consistent with the thinking of Howard making consistent with the modern urban planning to create tomorrow's cities more livable. The concept of Food Green city model proposed here presents a new form of Howard's Garden city consistent with urbanization process of our time for the vision of sustainable development.

1.3.3 The Natural Way of Farming[15], The theory and Practice of Green Philosophy

"Scientist envisions domed cities of the future in which enormous heaters, air conditioners and ventilators will provide comfortable living conditions throughout the year. They dream of building underground cities and colonies on the seafloor. But the city dweller is dying; he has forgotten the bright rays of the sun, the green fields, the plants and animals and the sensation of a gentle breeze on the skin. Man can live a true life only with nature."

(Masanobu Fukuoka, The Natural Farming Way of Farming 1985, p.22)

Fukuoka, the Japan's most amazing natural farmer and author of this book has explained here his unique method of "do nothing" farming technique on the basis of his devotion on more than fifty years in farming. This method of "do-nothing" farming is based on four major principles: No cultivation, No fertilizer, No weeding, No pesticides. The practical results of yields of food production by this method experienced by him are also encouraging, which has open up a sustainable farming method reducing many costs of farming. This book has also argued the many advantages of this method over the modern farming technique. I recognized this method as an appropriate method for urban agriculture.

1.3.4 Eco-cities[42]: building cities in balance with nature

"With cities, the natural order of things starts with land uses. The analogy that compares constructing houses and constructing cities is so simple, logical and even conspicuous in everyday life that it may, in its own right, ultimately lead to addressing "the bid issues." How could we imagine restructuring society for a healthy Earth without a reasonable approach to rebuilding the largest things we build, our cities and towns?"

(Richard Register, Eco-cities, 2002, p.173)

This book is a comprehensive coverage of various aspects of cities with the full of arguments for sustainable communities and cities. It has explained the quality of life depends largely on how we build our cities. He focused on the higher density city and less motorized transportation for less impact on nature. The restructuring strategies for cities include changing some motor city roads into the pedestrian roads and protect the areas for agriculture.

1.3.5 UN Habitat Strategic Vision[50]

"The United Nations Millennium Declaration recognizes the dire circumstances of the world's urban poor, articulating member states' commitment to improve the lives of at least 100 million slum dwellers by the year 2020. As large as 100 million may seem, however, it is only ten percent of the present worldwide slum population, which, left unchecked, will multiply three fold to 3 billion by the year 2050.

UN Habitat Strategic Vision (The United Nations Human Settlements Programme Nairobi, Kenya, May 2003) Source: Internet: http://www.unhabitat.org/documents/HabVision030505Public.pdf Access date: 18 Nov.2003

The United Nations Millennium Summit in Sept.2000 adopted the Millennium Declaration as common goal for the international society in the 21st century. One year later UN general assembly set the Millennium Development Goals (MDGs) are the common agenda for reducing poverty and improving lives. The UN Habitat strategic vision has refined giving more attention to knowledge management, financing of housing and human settlements. It is forward looking and pragmatic with advocacy norms for sustainable urbanization and urban poverty reduction carried forward through two global campaigns and a number of global programmes.

1.3.6 Agenda 21[1]

"Humanity stands at a defining moment in history. We are confronted with a perpetuation of disparities between and within nations, a worsening of poverty, hunger, ill health and illiteracy, and the continuing deterioration of the ecosystems on which we depend for our well-being."

(Source: http://www.un.org/esa/sustdev/documents/agenda21/index.htm Access date 18th Nov.2003)

The World Summit on Sustainable Development (WSSD) held in Johannesburg, South Africa from 26 August to 4 September 2002 an formulated Agenda 21, a comprehensive plan of action to be taken globally, nationally and locally by organizations of the United Nations System, Governments, and Major Groups in every area in which human impacts on the environment. In chapter seven on PROMOTING SUSTAINABLE HUMAN SETTLEMENT DEVELOPMENT, it is mentioned that in industrialized countries, the consumption patterns of cities are severely stressing the global ecosystem, while settlements in the developing world need more raw material, energy, and economic development simply to overcome basic economic and social problems. The overall

human settlement objective is considered as to improve the social, economic and environmental quality of human settlements and living and working environments of all people, in particular the urban and rural poor. Thus, the programme areas have included Improving human settlement management and Promoting sustainable land-use planning and management.

(Source: http://www.un.org/esa/sustdev/documents/agenda21/index.htm Access date 18th Nov.2003)

1.3.7 City Planning for health and Sustainable development[53)]

"The growth of the world population and the development of consumption patterns that cannot be sustained ecologically and socially severely stressing the life-supporting capacity of the planet and the ability of many countries to prosper and support the wellbeing of their inhabitants."

("City Planning for health and Sustainable development" European Sustainable Development and Health Series: 2, p.8)

Based on Agenda 21 "World Health Organization (WHO) has established WHO Healthy Cities Project. "City Planning for health and Sustainable development" is the report as European Sustainable Development and Health Series: 2 have mainly focused on creating healthy cities to achieve "Health for all" within the frame work of Agenda 21. The healthy city has identified its quality as safe physical environment, sustainable ecosystem, mutual supportive & non-exploitive community and meeting the basic needs (food, water, shelter, income, safety and work) for all city dwellers.

1.3.8 The image of the city[27)]

"The creation of the environmental image is a two-way process between observers and observed. What he sees is based on exterior form, but how he interprets and organizes this, and how he directs his attention, in its turn affects what he sees. The human organism is highly adaptable and flexible, and different groups may have widely different images of the same outer reality."

(The image of the city, Kelvin Lynch, 1960: p.131)

Kelvin Lynch at his book "The Image of the city" describes a study analyzing the three American cities: Boston, New Jersey and Los Angeles that looked at how people build mental representation of a city they live in. Lynch identified five distinct elements of the mutual representation of the city, which he called the "environmental image". These elements of environmental image are paths, edges, districts, nodes and landmarks. He has answered what a city planner can do to make city's image more vivid and memorable to the city dweller. But it has not explained, how is the setting of a city's form that particular city has from the functional perspectives? In that context, the proposed FGC has tried to present city as functional entity.

1.3.9 An Introduction to Ecological Economics[7)]

"Improvement in human welfare can come about by pushing more matter-energy through the economy, or by squeezing more human want satisfaction out of each unit of matter-energy that passes through. These two processes are so different in their effect on the environment that we must stop conflating them."

(An Introduction to Ecological Economics by Robert Costanza and et.al, 1997:p.102)

An Introduction to Ecological Economics provides an excellent overview of ecological economics, the most vital discipline in the new millennium. It has covered from the historical development Economics and Ecology to the problems and principles of Ecological Economics.

1.3.10 The Ecology of Place[2].

"Sustainability is fundamentally about adopting a new ethic of living on the planet. This ethic expands substantially the "moral community" to which respect and duties are owed."

(Timothy Beatley and Kristy Manning, The Ecology of Place, Planning for Environment, Economy and Community, 1997, p.34)

This book covers a lot of ways and vision of how to make cities green, efficient and attractive place. It has considered many things for understanding how to create more sustainable and livable communities.

1.3.11 The Culture of Cities[26]

"Cities are emblems of that settled life which began with permanent agriculture: a life conducted with the aid of permanent shelters, permanent utilities like orchards, vineyards and irrigation works, and permanent buildings for protection and storage".

(Lewis Mumford, The Culture of Cities, 1938, p.3)

This wonderful book gives a clear understanding about the city in many aspects. It has attempted to explore in unified approach of many fields to set the basic principles upon which the manmade environments can be reshaped.

1.3.12 Ethics and Urban Design [17]

"Environmental design starts with the very small scale of housing units and ranges to the larger scale of cities and their regions. It is the systematically planned environment through the physical design for the option of its users with minimum amount of harm to the natural environment."

(Ethics and Urban Design by Gideon S. Golany, 1995)

In this book Golany has defined "Environmental Design is the science of shaping the environment surrounding us for the benefit of humankind. God as creator of this world can be looked as an environmental designer. Man as a dynamic intruder in this world, is also an environmental designer for better or worse." And has suggested to urban designers, planners, architects for conceiving the environmental design as having two basic elements: natural environment and manmade environment. Thus, according to this book, Environmental design is concerned with achieving a balance between human-made physical creativity and the reciprocal influence of natural forces. To this what I want to add is: the environmental design field is the study of the complex relationship within these two environments with primary role of people as actors. Hence, a designer's responsibility is to shape the new environment with showing skillful art for establishing a synthesis between people, natural and human-made environments to protect health and well being of the environment and community.

1.3.13 Design with Nature[28)]

"The world is a glorious bounty. There is more food than can be eaten if we would limit our numbers to those who can be cherished, there are more beautiful girls than can be dreamed of, more children than we can love, more laughter than can be endured, more wisdom than can be absorbed."

(Ian L. McHarg, Design with Nature, 1992, p.1)

This book is the investigation for the design with nature contributing the method by which the environmental data could be incorporated into the planning process.

1.3.14 Genius Loci: Towards a Phenomenology of Architecture[43)]

" When a town pleases us because of its distinct character, it is usually because a majority of its buildings are related to the earth and the sky in the same way; they seem to express a common form of life, a common way of being on the earth. Thus they constitute genius loci which allows for human identification."

(Christian Norberg-Schulz, Genius Loci, Towards a Phenomenology of Architecture, 1980, p.63, 65)

This book describes the psychic implication of architecture. It has explained the architecture means to visualize the genius loci or "spirit of place" where as a place is defined here as space with distinct character. And task of architect is mentioned as to create meaningful places, whereby he helps people to dwell.

1.3.15 Modeling the ecological footprint of green travel plans using GIS and network analysis: from metaphor to management tool? [54)]

(Graham Wood, Environment and Planning B: Panning and Design 2003, Vol 30, pages 523-540)

This paper has explored the use of ecological footprint analysis for evaluating and communicating the environmental implications of transport alternatives within a company travel plan. It has applied the GIS and network analysis to model the impacts of commuting activity prior to and after implementation of the company's 'green travel plan'.

1.4 Hypothesis of the Study

The hypotheses of the study are:

1. Existing cities could be transferred to the sustainable city with sufficient food self sufficiency rate and plenty of urban green spaces.

2. GIS is an effecting planning tool for integration of urban agriculture into land use planning and spatial urban design.

1.5 Goal of the Study

The major goal of the study is to develop a sustainable city planning methodology appropriate for the 21st century. The specific goals of the study are:

1. To review the urban problems, sustainable development issues, planning principles and practical implication of planning process.

2. To overview the existing scenario of Japan from the stand point of sustainability.

3. To carry out the Comparative City Assessment (CCA) and Land use analysis, demographic study using GIS in the seven cities of Kitakawachi region as a case study.

4. To carry out the study of distribution of Wayside Shrines in Kawachinagano City and apply the results in the study area.

5. To study the Urban Agriculture and Natural farming for the integration of urban planning.

6. To forward the concept of Food Green City (FGC) after study in holistic and integrated way that is appropriate for 21st century.

7. To apply the concept and evaluate the results in terms of Urban Green Space (UGS), Food Green Space (FGS) and Ecological Footprint (EF). And finally visualize the FGC model for Kitakawachi using GIS.

1.6 The Logics and Significance of the Study

With falling resources but increasing population, cities are facing environmental problems, urban poverty and slums as a great challenge in the 21st century. The total impacts of human loads can only be decreased in the cities either decreasing the human loads or adopting the ways of minimizing the impacts for balanced urban ecosystem as analogous to the lever balance principle as seen in Fig.15. Let us consider Force (F1) as Natural Resource that can be applied, Force (F2) as Human Loads (due to Population) and Fulcrum at the positions A, B, C of the rod (as city). The force arm AC and load arm BC are here compared with effectiveness of force (F1) and load (F2) respectively. The rod (City) will be balance when:

Force1 x Force1 Arm = Force2 x Force2 Arm

Analogous Interpretation is:

Natural Resources x effectiveness of Natural Resource = Human Loads x effectiveness of Human Loads

This means city could be balance in three ways as follows:

1. Fulcrum at center i.e. AC= BC and obviously F1=F2. This is the most wanted balancing process. But since human loads are increasing, this seems not realistic in the existing city.

2. Fulcrum close to A i.e. AC< BC and F1>F2. This is not feasible balance process as natural resources are limited in the world.

3. Fulcrum close to B i.e. AC> BC and F1<F2. This is the most appropriate means of balancing the city ecosystem as less natural resources could lift large human impacts if suitable methods are adopted in the planning process for increasing the effectiveness of the natural resources and reducing the effectiveness of the human loads. In brief, this is the method of reducing the human impacts.

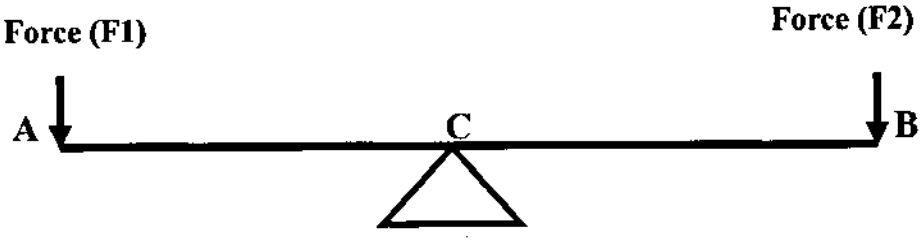


Fig. 15: Balancing Principle

This study follows this logic for minimizing the human impacts with balancing the three human activities primary activities, secondary activities and tertiary activities in the city, balanced participation of 3P (People, Private and Public sectors) and balanced development physically, socially & ecologically. It thus purposes city planning methodology for controlling unhealthy growth of cities in the 21st century with a vision of sustainability interlinking Nature, Culture and Future. For this Food Green City was forwarded with advocating green for functional as well as ornamental purposes. It recognizes for the necessity of integrating the Urban Agriculture and Urban Planning in creating the balanced urban ecosystem, feeding the citizens and reducing city's foot print in clean green and healthy urban environments. Many associated and interlinked aspects of Food Green City converts the Carbon dioxide city to Carbohydrate city, solve the many urban problems with coexistence of Man in natural system. The encouraging application results of this model, establishes a sustainable city planning methodology appropriate for the 21st century. This study explores a way of using GIS for analysis, planning and spatial urban design and shows a way how an existing city could be converted into sustainable city in step by step process.

1.7 Study Area [7]

Japan is an East Asian island country with about 70% [44] of nation's entire surface area covered with forests. The area under study is located in the northeast part of Osaka Prefecture of Japan (Fig.16). It has the area of 177.37 km^2 and consists of seven cities (Fig.17) namely: Moriguchi city, Hirakata city, Neyagawa city, Daito city, Kadoma city, Shijonawate city and Katano city in the order of city designation by year. Moriguchi city was 1st city of this region designated as 11th city in 1946 of the Osaka prefecture and Katano city was the last in recognizing as city of the region. In early days, the construction works of Yamato River at the beginning of 18th century had a great impetus for the cultivation in the farm villages of this area and economy of this region was developed. After World War II, with the beginning of rapid economic growth in Japan; the cities of this region had undergone a rapid rate of urbanization with the advantage being close to the big cities like Osaka city and Kyoto city. Fig.18 shows that all cities had experienced the sharp rise in population density from 1960 to 1970. The rates of change of population density in the region experienced by most of the cities during that period were more than the Osaka city. These sharp slopes of population density in the decade also hint the remarkable changes of land uses in those cities during that period.

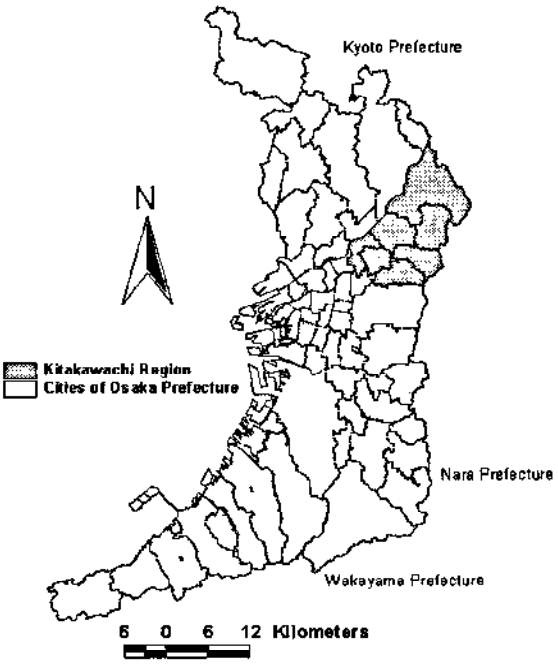


Fig.16: Kitakawachi in Osaka Prefecture.

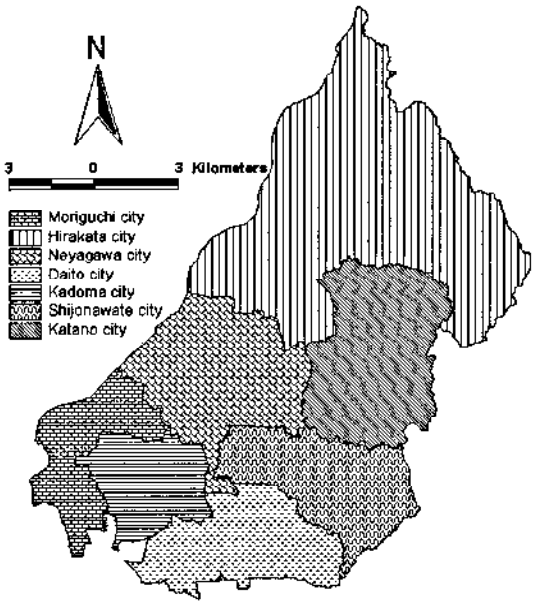


Fig.17: Cities of Kitakawachi.

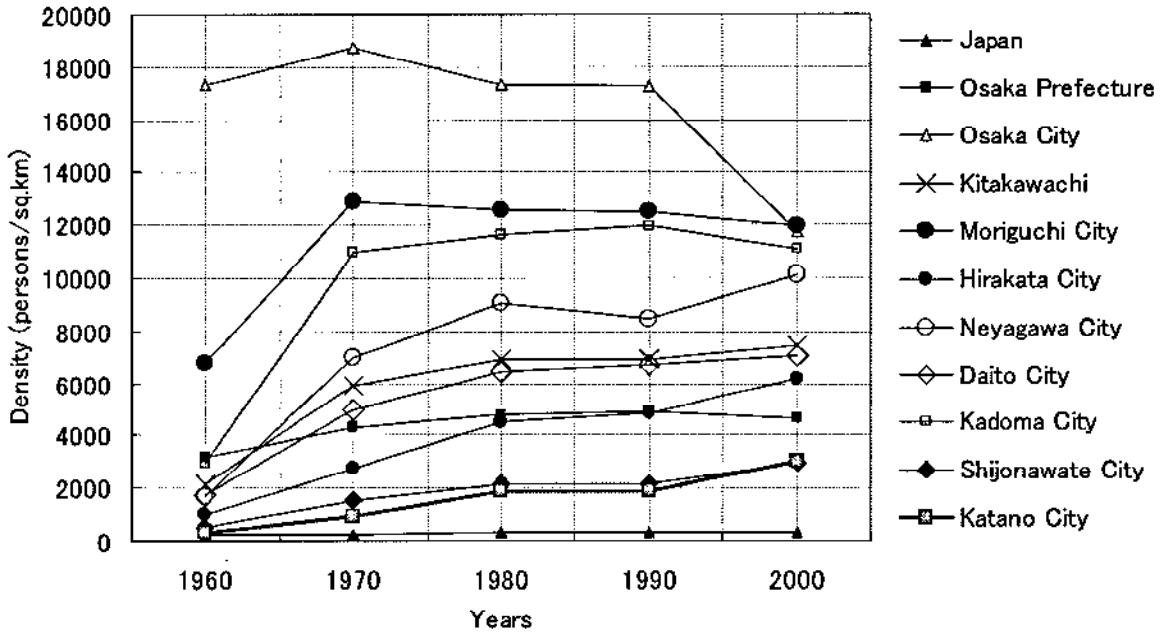


Fig.18: Population densities with time.
Data Source: Osakafu no Zinkoudoukou (1993)[38] and Zinkou no doukou (Nihon to Sekai), 2000.[36]

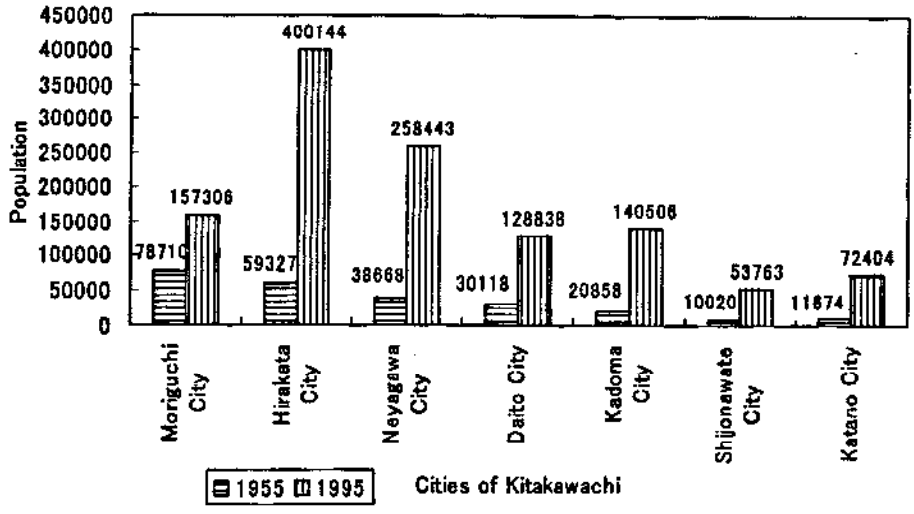


Fig.19: Population dynamics.
Data source: Osakafu no Zinkoudoukou (1993)[38] and Moriguchi shi no Tokeisho (2000).[33]

After 1970, there was no remarkable increase in population density till 1990 for Moriguchi city and Kadoma city. These two cities have started decreasing in population density from 1990 but remaining cities are continuous undergoing the process of urbanization with increase in population. As seen in Fig.19, in 1955, Moriguchi city is the largest populated city where as after 40 years Hirakata city has established as primate city of this region with increase of population nearly seven times. The population of second largest city is less by more than 1.5 times than Hirakata city. Kadoma city, Moriguchi city and Neyagawa city are highly urbanized cities of the region where as Hirakata city and Diato city are medium urbanized cities in terms of percentage of area covered by urban districts as shown in Fig.20. Shijonawate and Katano cities are less urbanized cities. Therefore, the cities of this region can be put under three categories with respect to urbanization process and urban district area. It is also clear from Fig.20 that all cities except Shijonawate city, the per capita park is less than average per capita park of Japanese cities (5.6 m^2/ person). Even the Japan is experiencing depopulation and economic recession; most of the cities of this region are still growing. Although, the cities like Moriguchi city and Kadoma city are experiencing decrease in population density, the figures are not very significant like Osaka city (Fig.18).

In the context of agriculture activities, Moriguchi city which is highly urbanized city of Kitakawachi has experienced the loss of 68.5% agriculture lands within 15 years from 0.62 km^2[33] in 1985 to 0.19 km^2[33] in 2000. Similarly, Katano city, the least urbanized city of the region but has been under going continuous urbanization, has also experienced the loss of 44.87% agriculture lands within 26 years from 7.8km^2[22] in 1973 to 4.3km^2[22] in 1999. In one hand, the decreasing rate is seriously alarming the loss of food self sufficiency state and open spaces of the cities while in other hand; it is creating the imbalanced situation among the three activities in the cities.

Hence, in the context of continuing potentiality of urbanization but loss of agriculture lands (obviously loss of food self sufficiency rate) and deficit of green spaces in the cities of the region, this study is carried out to find the answer how to track the urbanization in right way for sustainable development of the region.

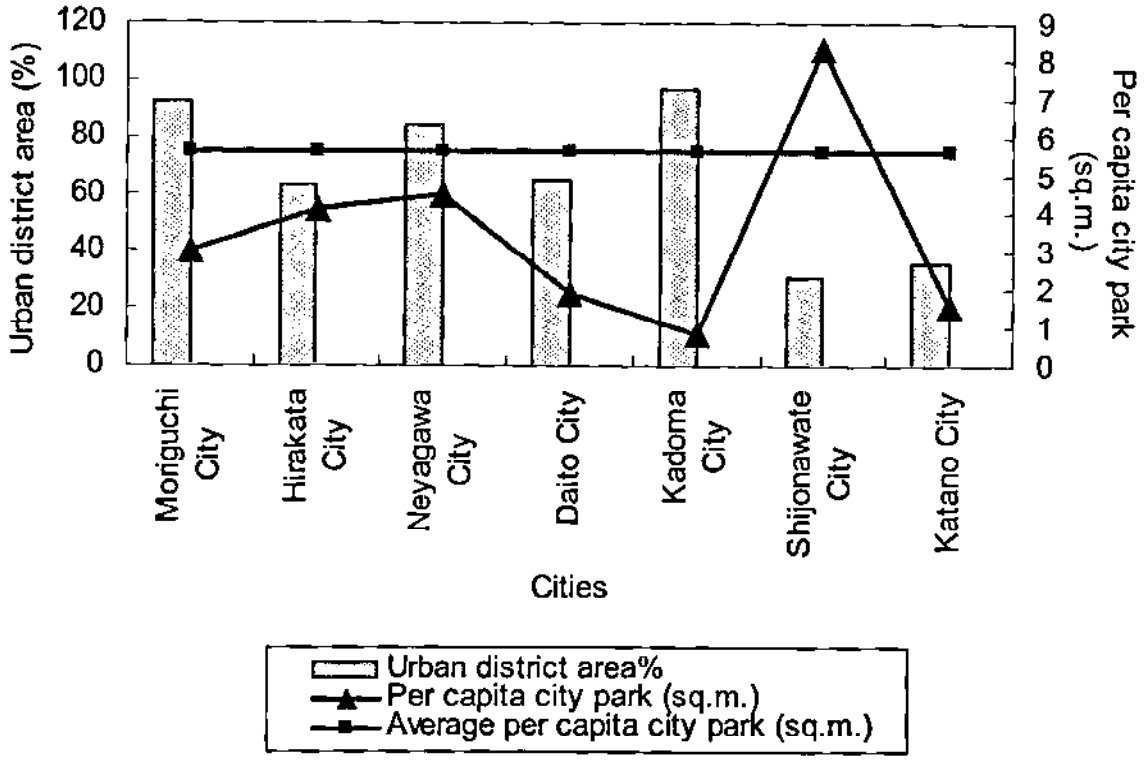


Fig.20: Urban district area vs. per capita city parks.
Data Source: Osakafu Shinchoushon Handbook (2001).[39]

1.8 Limitation of the Study

1 This study is mainly based on the secondary information provided in the books, web sites, reports, maps, Journal papers and digital maps.

2 The proposed Food Green City Concept although conceptualized in an holistic and integrated way based on literature reviews, interactions and many points of city analysis, the details setting of the city elements still remain unexplained in the study which can be carried out in the further research.

1.9 Organization of Dissertation

This dissertation consists of seven chapters.

CHAPTER ONE: INTRODUCTION, gives the background information of the urbanization trends, problems, issues and possible solution and overviews the existing situation of Japan, which is taken as study area for this dissertation. Followed by the literature reviews, this starting chapter introduces goal of the study, the significance of the study, case study area, hypothesis of the study, limitation of the study and organization of dissertation.

CHAPTER TWO: RESEARCH DESIGN AND METHODOLOGY, attempt to explain outlines of the Research Design and study methodology adopted for the study..

CHAPTER THREE: THE CONCEPT OF SUSTAINABLE DEVELOPMENT, makes the analysis of the philosophical foundation of sustainable development along with the description of recent values of sustainable development. This chapter also deals with the criticism of the present planning system, urban development trend and explains the need of integrating of environmental design and planning for the evolution of sustainable society, city, regions and nations.

CHAPTER FOUR: DEVELOPMENT OF SUSTAINABLE CITY PLANNING METHODOLOGY, describes about the appropriate city planning methodology. It includes Integration of Urban Agriculture in Land Use Planning and socio-cultural consideration as an holistic and integrated way of planning. Finally, it proposes the Concept of Food Green City in the crystallized form.

CHAPTER FIVE: ANALYSIS OF CASE STUDY AREA, analyzes the existing scenario of the seven cities of the Kitakawachi on land uses, demographic characteristics, development status, planning approaches. Finally, it evaluates the cities of the region with comments from sustainability perspective.

CHAPTER SIX: APPLICATION OF CONCEPT IN THE CASE STUDY AREA, evaluates the results of the application of proposed city planning methodology based on Food Green City concept.

CHAPTER SEVEN: SUMMARY AND CONCLUSION, summarizes the study and provides the major findings of the study. This concluding chapter also gives some recommendations, describes about theoretical and practical implication of the study and finally shows some opportunities for further research.

CHAPTER TWO: RESEARCH DESIGN AND METHODOLOGY

"Before researchers become researchers they should become philosophers. They should consider what the human goal is, what it is that humanity should create. Doctor should first determine at the fundamental level what it is that human beings depend on for life."

(Masanobu Fukuoka., One straw Revolution,1978)

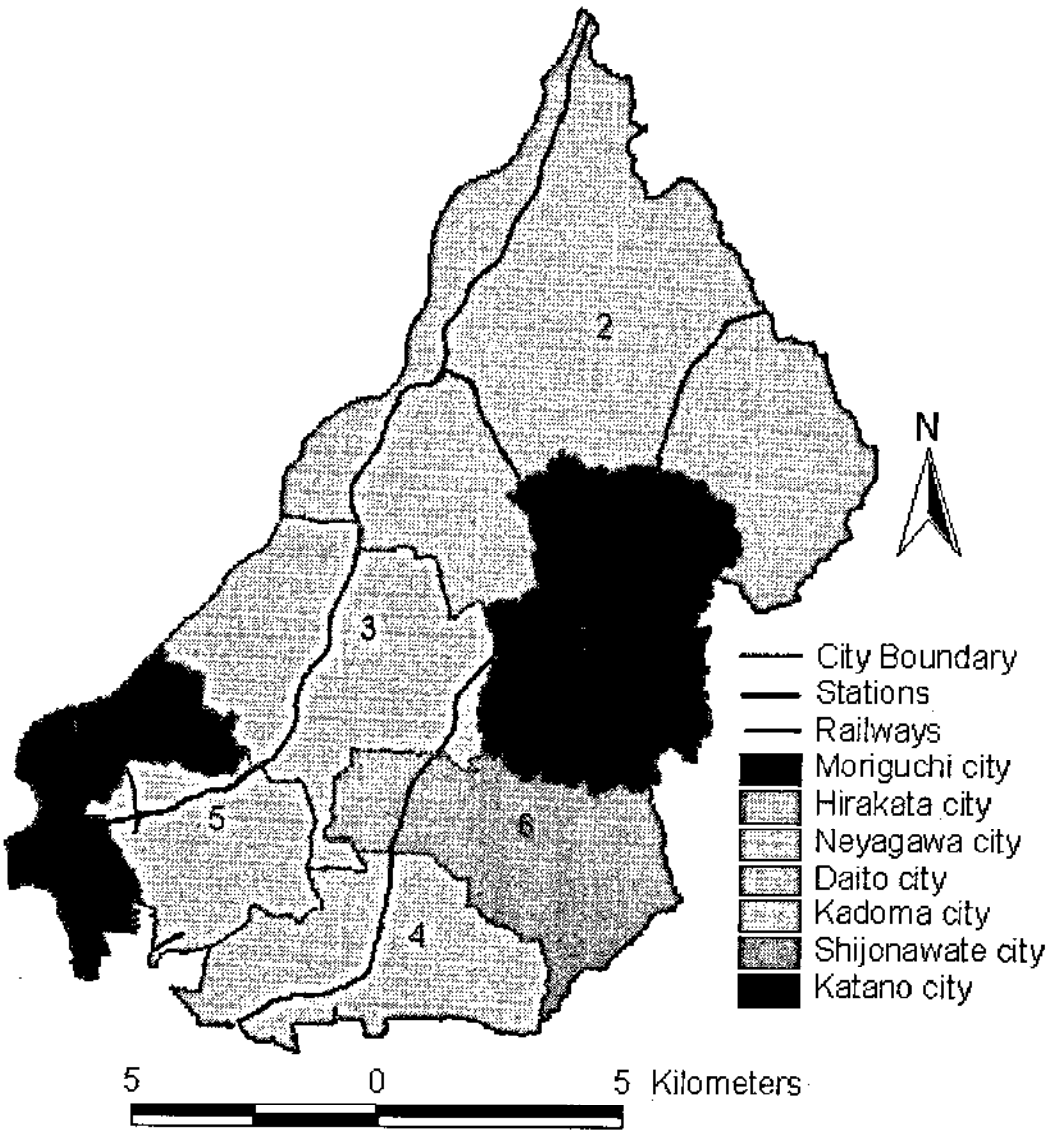


Fig.21: GIS Map for Seven Cities of Kitakawachi

CHAPTER TWO:
RESEARCH DESIGN AND METHODOLOGY

"GISs are simultaneously the telescope, the microscope, the computer, and the Xerox machine of regional analysis and synthesis of spatial data."

(Ron Abler, 1988 ; Source: Keith C. Clarke, 1999, "Getting Started with Geographic Information Systems, Prentice Hall, Inc. New Jersey; p.1)

2.0 Introduction

This chapter describes about the research design and methodology of the study. The research was designed based on the principle that "Whole is always greater than sum of the parts", therefore the study is carried out from global to local i.e. overview global & national scenario and concentrates in details locally as a case study area. The developed concept from output of the holistic and integrated way of study is considered to evaluate at the local level following the saying "Think Globally, Act Locally".

2.1 Research Design

Planning is a purposeful process for future activities that brings together logical analysis and technical knowledge to improve quality of human life with a minimum impact on the natural environments. Planning ranges from small scale of housing units to the larger scale of cities and their regions. This research is belonging to the development of sustainable city planning methodology that is appropriate for the 21st century with a case study of seven cities of the Kitakawachi region.

City developed elapsing longer time; therefore it can be regarded as the longest and complex human project consisting with interconnected and complicated human, manmade and natural environments. To plan an existing city is rather difficult than making a new city. Converting the existing city to the sustainable city suitable in the 21st century needs a logical planning process. For this, a comprehensive study of urbanization trend, urban issues, planning approaches carrying out is essentially required looking through global perspective in additional to the logical city analysis of the study area. As the doctor can give the medicine to the patient only after the real diagnosis of the disease, planner can also give a plan only after the situational analysis of the cities. What are the strengths, weakness, opportunities and treats (SWOT) are first necessary to find before planning the city. To enhance their analytical, problem solving and decision-making capability, planners have always sought different tools. From the late 1950's planners started to develop and use computerized models, planning information systems and decision support systems to improve performance. Adaptation of geographic information system (GIS) has been becoming a popular planning tool recently. This research is carried out by applying the GIS arc view software in many aspects of planning process such as: data collection and storage, data analysis and presentations. The results are interpreted and plans & proposals are visualized in study model area of Kitakawachi based on the concept of Food Green City as sustainable city for all. In short, this research is designed to find a sustainable city planning methodology for proper harmonization of Nature, Culture, Humanity, Peace, Environment and Development, so that healthy cities can be handed over

to the future generation. The following research questions are asked here to find the answers to give a new dimension in the sustainable planning method for the Kitakawachi region.

1. What are the present urban issues, Land uses pattern, demographic characteristics and planning approaches and their positive and negative impact on our future well-beings?

2. What we can do to control, divert, or improve upon the influencing forces in order to suit our existing and future needs in harmony with Nature?

3. By which ethics and norms should we conduct our vision and philosophy in the development of future human settlements?

4. How can cities be planned in a holistic and integrated way?

5. What method should we pursue in order to design a better future for ourselves and the generations to come?

2.2 Methodological Framework for the Research

This research is carried out adopting both qualitative and quantitative methodology. Generally, the research is governed by two epistemological systems: Positivism and Phenomenology. In the methodological context, as mentioned by Sang W. Hwang, 1998 "Phenomenology concentrates on subjectivity and reliability in the foreground and emphasizes objectivity, causality and validity in the background. Therefore, understanding the context to interpret the meaning of the subject from the stand point of Phenomenological philosophy carried out in the qualitative research can generate theories and concept with exploring the hidden dimensions of the societies and realities. Whereas Positivism philosophical approach considered as accompany in the quantitative method, concentrates on objectivity, causality and validity." Survey method is seen as preferred way in positivistic framework, followed by data analysis. Realizing the necessity of the both the philosophical approaches for deeper understanding of the city sustainable planning methodology and perception of the reality of the existing cities both the qualitative and quantitative methods are followed based on the combined philosophical ground of both Positivism and Phenomenology as New Positivism (Positivism 21). Under this methodological frame work following the specific methods are adopted in conducting the research.

2.2.1 Holistic and Integrated Approach (HIA)

The study is conducted not concentrating on one specific sector. It explored the various factors that play role behind the sustainability of the city. This follows the Comparative City Assessment (CCA) and Ecological Footprint Analysis of the cities of the study area. And it searched a method how to improve the quality of city dwellers, how to decrease the City's Footprint and how to create a sustainable city. Based on the comprehensive study of literature reviews, visual analysis of various cities of Japan, qualitative & quantitative data analysis, following the HIA for looking the problems and finding the solution; finally directs to propose the concept of FGC as a sustainable city planning methodology.

2.2.2 Spatial Analysis and Presentation using GIS

GIS has a capability for assembling, storing, manipulating, and displaying geographically referenced information. It can play a valuable role for a wide range of predicting outcomes, and

planning strategies. Therefore, for special analysis of distribution of man-made elements, natural elements, land use patterns, demographic study of the study area GIS Arc View 3.2 is applied successfully. GIS has utilized for the applying developed concept for planning and designing in the study area and evaluating the FGS. This research has included GIS as a planning& designing tool based on its capability to analyze the things in a holistic manner. It can visualize and analyze the spatial elements from whole to parts and parts to whole, which is recognized here as an essential mechanism for planning in HIA.

2.2.3 Interactive Feedbacks

An important method adopted in this study is "Interaction for study approaches & results" with the relevant persons in conferences. For this, the parts of the study output are published and presented in the Journals and International Conferences to seek the feedbacks for the further improvement of the research and evaluating the study works. Some valuable suggestions are also incorporated in the study works.

2.3 Data Source and Analysis Soft ware

As this study follows the qualitative and quantitative methods in a comprehensive and integrated way, this research uses primary data as well as secondary data. It collects the secondary data available in the books, Internet, Pasco Ortho Photo, Pasco Digital Map 2000 and Pasco Fresh Map 2500.

For the analysis of the distribution of Wayside Shrines (cultural element), the data are collected with primary survey visiting each wayside shrine and completing all the information designed for the research.

Finally, the collected primary and secondary data are analyzed utilizing the capabilities of Arc View 3.2 software with extensions Spatial Analyst, and 3D Analyst.

2.4 Work Schedule

This research work was started from April 2001 in the Taniguchi Research Laboratory, Department of Environmental Design, Division of Environmental Development Engineering, Osaka Sangyo University. The study comprised three stages in three years. The first stage included literature review, conceptual development for the study, site visits, data collection and input with the use of GIS technology. In the second year, the preparation of maps and analyses were conducted with the use of GIS. Then the proposed planning concept was refined. In this second stage of study, part of the research works were also started to publish and present for interactive feedbacks to the study. Finally, in the third stages, the analysis was completed, and results were visualized. The research works were published and presented in international conference. The draft report was prepared and refined to final shape by revising in accordance with the comments from supervisors. It is then finally presented the dissertation, following an open discussion. The summary of the work schedule is mentioned below in Table 2.

Table 2: Summary of Work Schedule

Activities	April 2001 To March 2002	April 2002 To March 2003	April 2003 To March 2004
1. Literature Review	●	●	●
2. Maps and Data collection	●		
3. Site Visits and Verification	●	●	●
4. Preliminary Presentation	●		
5. Data Input using GIS	●		
6. Reporting	●	●	●
7. Data Analysis & Preparation of Maps	●	●	
8. Concept Formation and its refinement	●	●	
9. Mid Term Presentation		●	
10. Publication and Presentations at International Conferences		●	●
11. Finding out the Results		●	●
12. Discussions	●	●	●
13. Prepare Plans & Proposals			●
14. Draft Report Presentation			●
15. Final Report Preparation			●
16. Final Presentation			●

2.5 Conclusion

Planning has been regarded as the solution to the problems. It helps in making the decision the future. In other hand, GIS technology is the recent application in the city planning field but ning popularity with its invaluable assistance to planning. Map preparation and spatial analysis bilities of the computer based GIS become a powerful tool as a database system as well as on support system. In other words, the application of GIS has made planning easy, efficient re accurate. Hence, this research is designed to apply ESRI GIS software Arc View 3.2, for al analysis and presentation of the results to provide the solution to the existing urban with the new concept of FGC, a sustainable planning methodology appropriate for the 21st h excellent harmony of Nature, Culture, Humanity and Development.

CHAPTER THREE:
THE CONCEPT OF SUSTAINABLE DEVELOPMENT

"...It took Britain half the resources of the planet to achieve its prosperity; how many planets will a country like India require...?"

(Mahatma Gandhi, when asked if, after independence, India would attain British standards of living. Source: Robert Costanza and et.al, An Introduction to Ecological Economics, 1997 p.1)

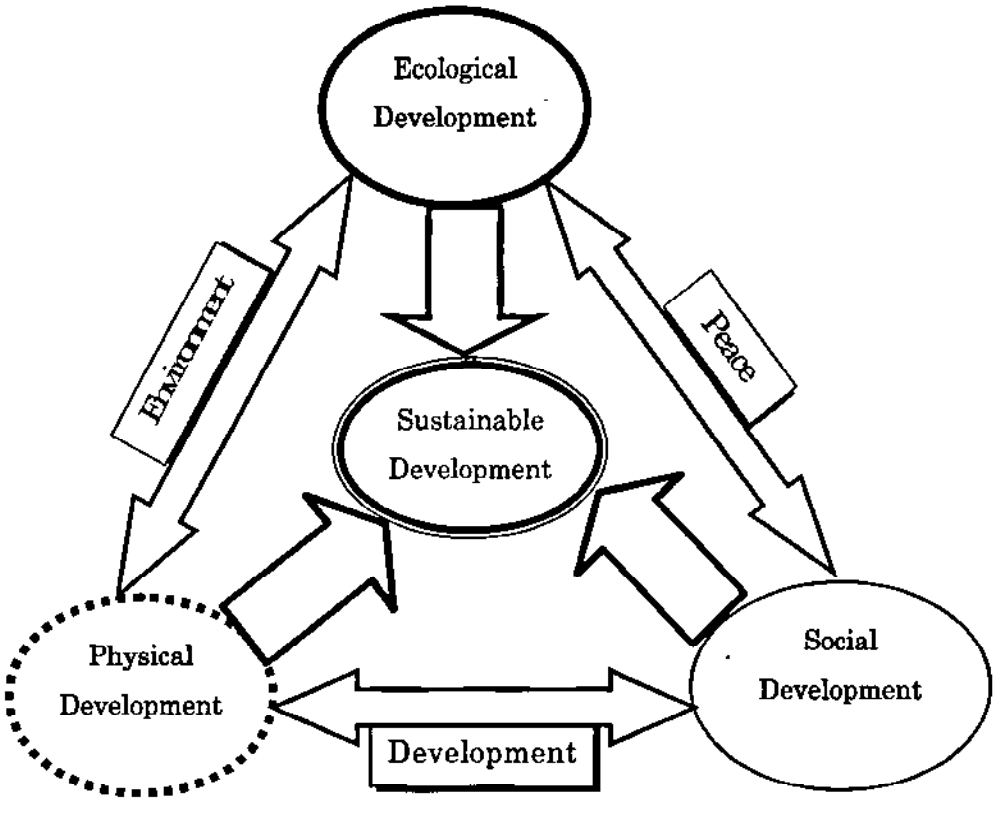


Fig.22: Diagrammatic model for Sustainable Development

CHAPTER THREE:
THE CONCEPT OF SUSTAINABLE DEVELOPMENT

"There is plenty for everyone's need, but not enough for everyone's greed."

(Mahatma Gandhi, Source: John J.W. Rogers and P. Geoffrey Feiss, People and Land, 1998, p.33.)

3.0 Introduction

This chapter describes the emerging definitions of sustainable development and concept of sustainable urban development in the background of Physical, Social and Ecological Paradigms. It consists of analysis of the present city planning methodology from the view point of sustainability and explains the shortfalls of the existing planning. It then follows the evolution of new planning methodology for driving the cities towards sustainability. Thus, it has described the outlines of new planning methodology in the solid background of Environmental Design Principle.

3.1 Concept of Sustainable Development

Sustainable Development has several definitions such as:

- "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (the Brundtland Report WCED, 1987)[3)]
- "Improving the quality of human life while living within the carrying capacity of supporting ecosystems" (Caring for the Earth, IUCN/UNEP, 1991)[3)]
- "Development that delivers basic environmental, social and economic services to all the residences of a community without threatening the viability of natural, built and social systems upon which the delivery of those systems depends."(International Council for Local Environmental Initiatives, ICLEI,1996)[3)]

Accordingly Sustainable urban development is thus defined here as:

"Development which improves the quality of urban life physically, socially and ecologically without compromising the supporting ecosystems of future generations" Sustainable Land uses are foundation for the balanced Physical, Social and Ecological development that can help in attaining sustainable development. Therefore, Fig.23 indicates Physical, Social and Ecological developments as three pillars raised on sustainable land uses as a foundation whereby sustainable development as a roof.

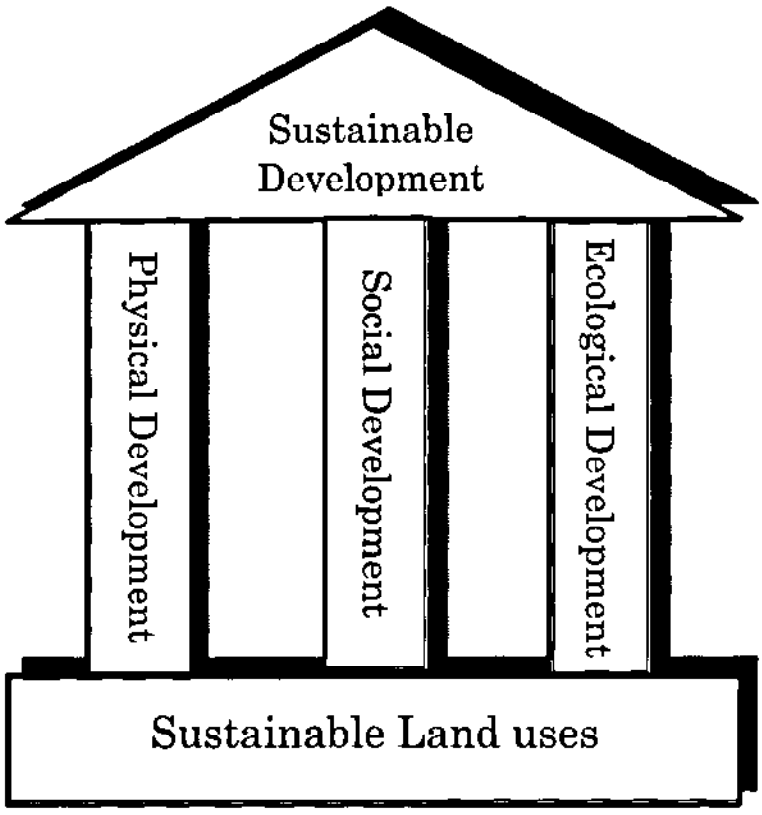


Fig.23: The Three Pillars of Sustainable Development

Balancing between these three Pillars of Sustainable Development is must for developing a sustainable society. The three schematic paradigms for the balancing them are described below.

3.1.1 Layers Paradigm

Fig.24 shows the recognition of three layers for a sustainable development. The better combination of consecutive two layers among the three can give three important indicators of sustainability i) Peace ii) Development and iii) Environment as demonstrated in Fig. 25. Needless to say, all three layers if maintained at equilibrium, the sustainable city could be realized.

Now the question may arise what are the Physical, Social and Ecological layers?

In the case of city, Physical layers are belonging to Physical infrastructures like Road networks, houses and human physical products etc. Social layers are concerned with culture, equity, security and economy etc of the society. Ecological layers cover the ecosystem including forests, rivers, water quality, air quality and wastes etc. This paradigm thus urge the necessity of balancing all above mentioned aspects categorized into three layers to realize the sustainable development. Balancing means without creating disadvantage to any one of these layers within the carrying capacity of the total system. Thus, this requires land uses in harmony of those layers to achieve the goal of sustainable development.

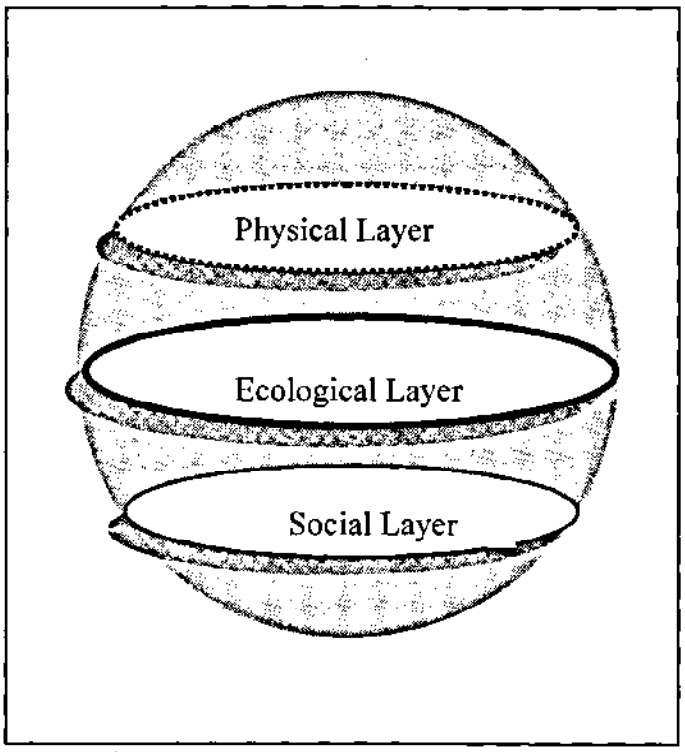


Fig. 24: Sustainability Globe

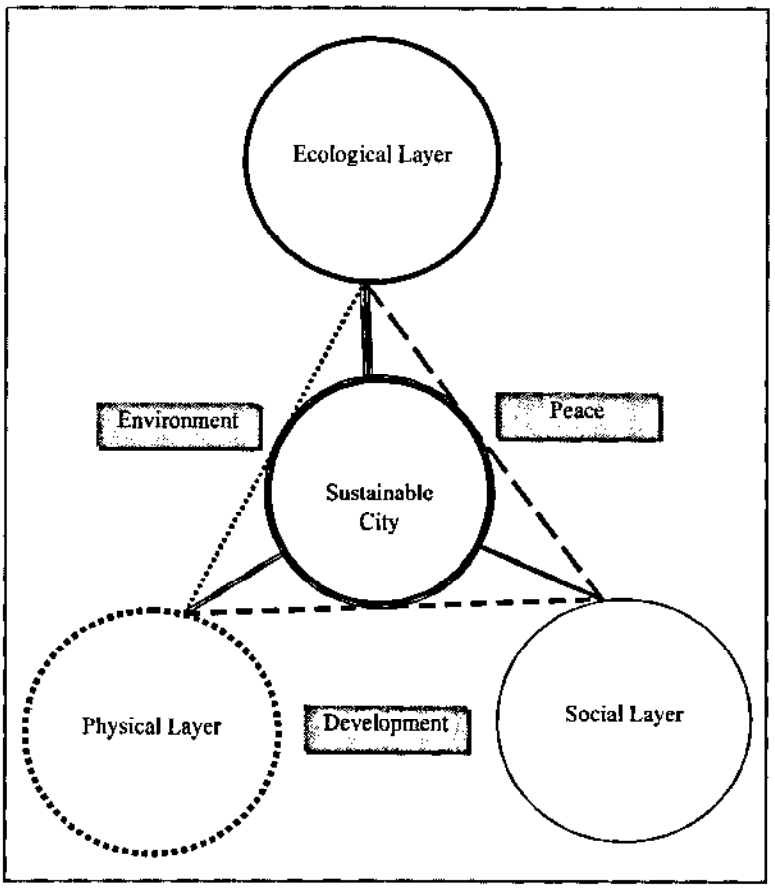


Fig.25: Sustainability: From the view point of three layers.

3.1.2 Actors Paradigm

As illustrated in Fig.26, from the view point of actors, the sustainability can be realized only if all the actors of city development process could be balanced. Unlike this, the present city has been mainly influenced of private sectors.

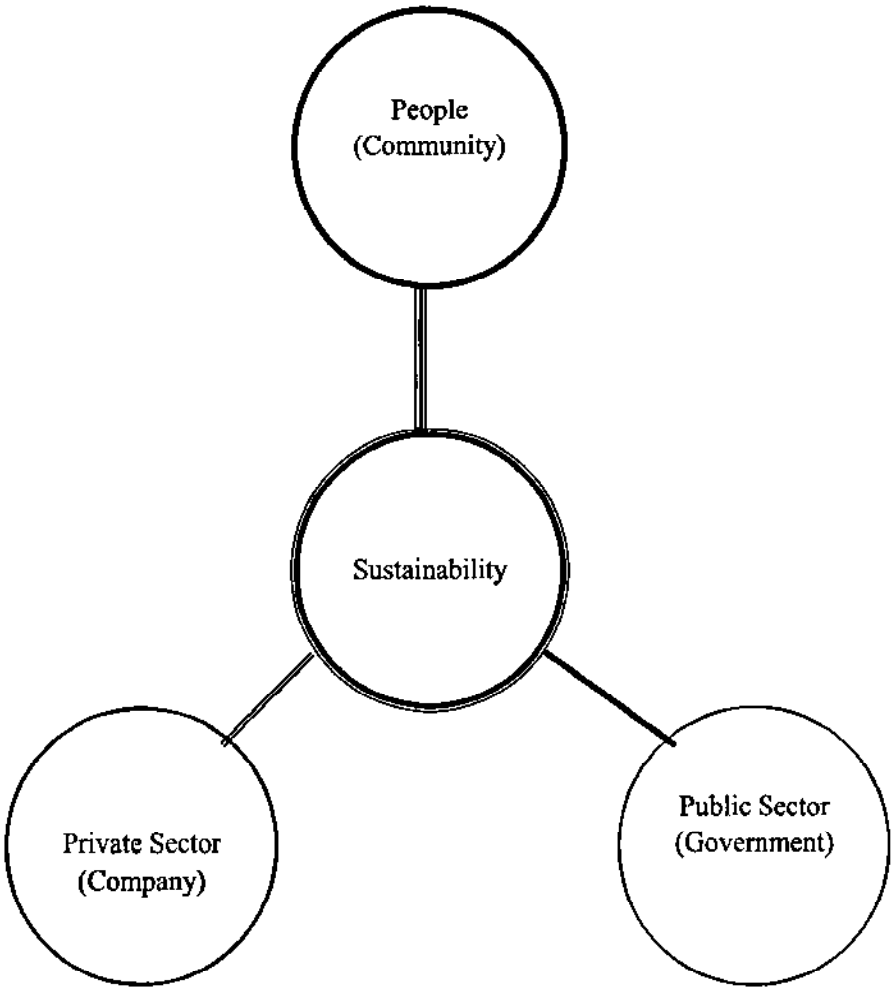


Fig.26: Sustainability: From the view point of actors

With the influence of globalization and privatization, most of the sectors are covered by the private sectors or with direct implementation of the Government bodies. This has created a system of cash flow and promoted therefore the consumption of the materials. Majority of people are just becoming the users and not concerned with the responsibilities of society. The society and activities are therefore based on the monetary values without the feeling of "OURS". In other words, it is making a consumptive society and machine world without protecting the human values, cultures and sense of community. For the achievement of sustainable development, therefore the participation of the people, private and public sector in balanced way is urgent. The collaborative efforts of all three parties could produce a responsible society that keeps the environment and development in harmony.

3.1.3 Activities Paradigm

From the view point of activities, sustainability is the balance of all three economic activities as shown in Fig. 27.

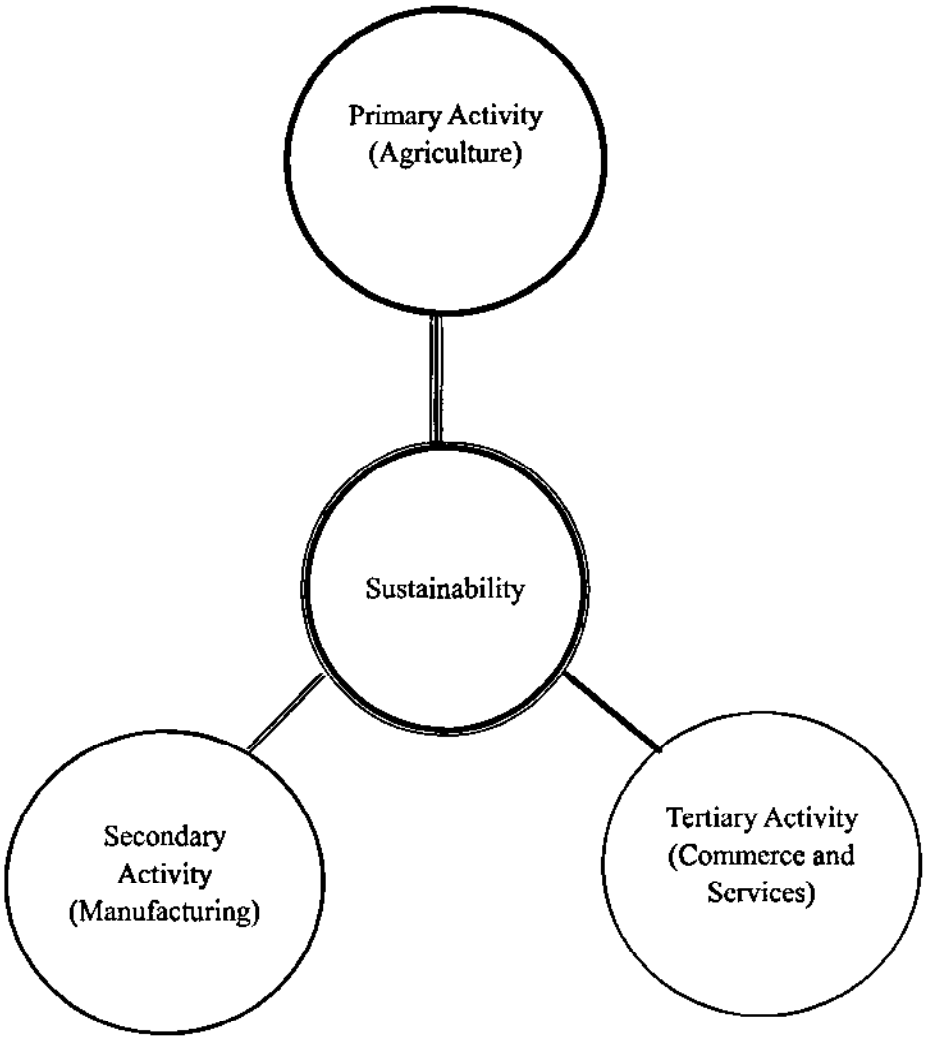


Fig.27: Sustainability: From the view point of three activities.

The three human economic activities are Primary activities like farming, fishing and forestry; Secondary activities related with Manufacturing and Industries whereas Tertiary activities include all the commerce and service orientated activities. Generally, cities are dense place of population with major activities related with secondary and tertiary activities. There are many problems emerging in the cities as a result of excessive such activities. Many environmental problems are becoming hot issues of many cities of the world these days. Therefore, even the cities are engines of economic development but it must be thought from sustainable development perspective, which needs the balancing all three activities. The promotion of the primary activities like agriculture in city is also essentially required for creating a sustainable city.

3.2 Criticism of Existing Planning Methodology and Enlighten for New

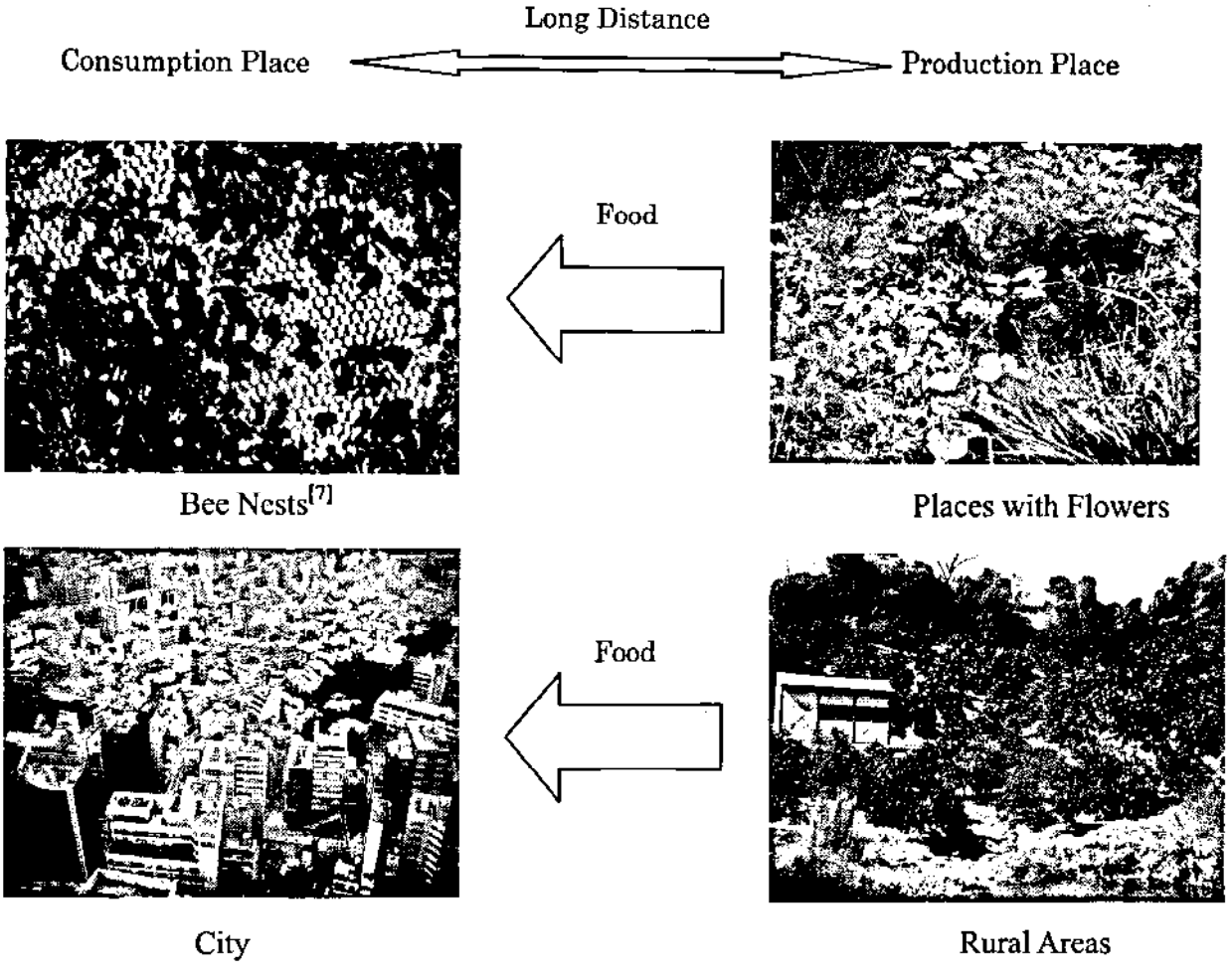


Photo 5: Compact City: Analogy to Beehives

In the recent years, compact city has been a popular planning model in order to achieve a sustainable urban form. Against the backdrop of 'urban sprawl', it is supposed of having many benefits like less automobile dependency, reduced energy consumption and minimum service costs in compact cities. The benefits of compact cities are good but it must be thought that how well it represents a sustainable city in holistic way. As mentioned in Fig.24, Sustainability globe has three layers physical, social and ecological layers and the proper overlay of all three layers can only create a sustainable city. Unfortunately, the present compact city if dissected in depth can not necessarily lead to city sustainability in totality. For instance: Tokyo (23 wards) city has the population density more than 13000[29] per km^2 and can be regarded as highly compact city but how can we say this city as a sustainable city which has to depend on feeding its city dwellers bringing the food that produced far way in rural areas and other countries as demonstrated in Photo 5. City life is highly dependent on rural areas or other countries for food; analogy to Bees' dependent on flowers far way from their Bee Nests as illustrated in Photo 5. The more critical issue that has to thought is that Bees use their food energy for collecting their food but food for city dwellers are produced and transported to cities from outsides 1000's km far away consuming a lot of non renewal energy. This inefficient way of our food supply system leading us unsustainable way of our life styles.

The loss of greenery, farmlands and open spaces with increase of urban density has serious

impacts on urban environments. In feeding the large population of city dwellers, food is brought from outside, which has been consuming the large amount of energy. The amount of total energy consumption depends on length of food supply system. The length of urban food chain as demonstrated in Fig.28 will show how inefficient our urban food supply and distribution system.

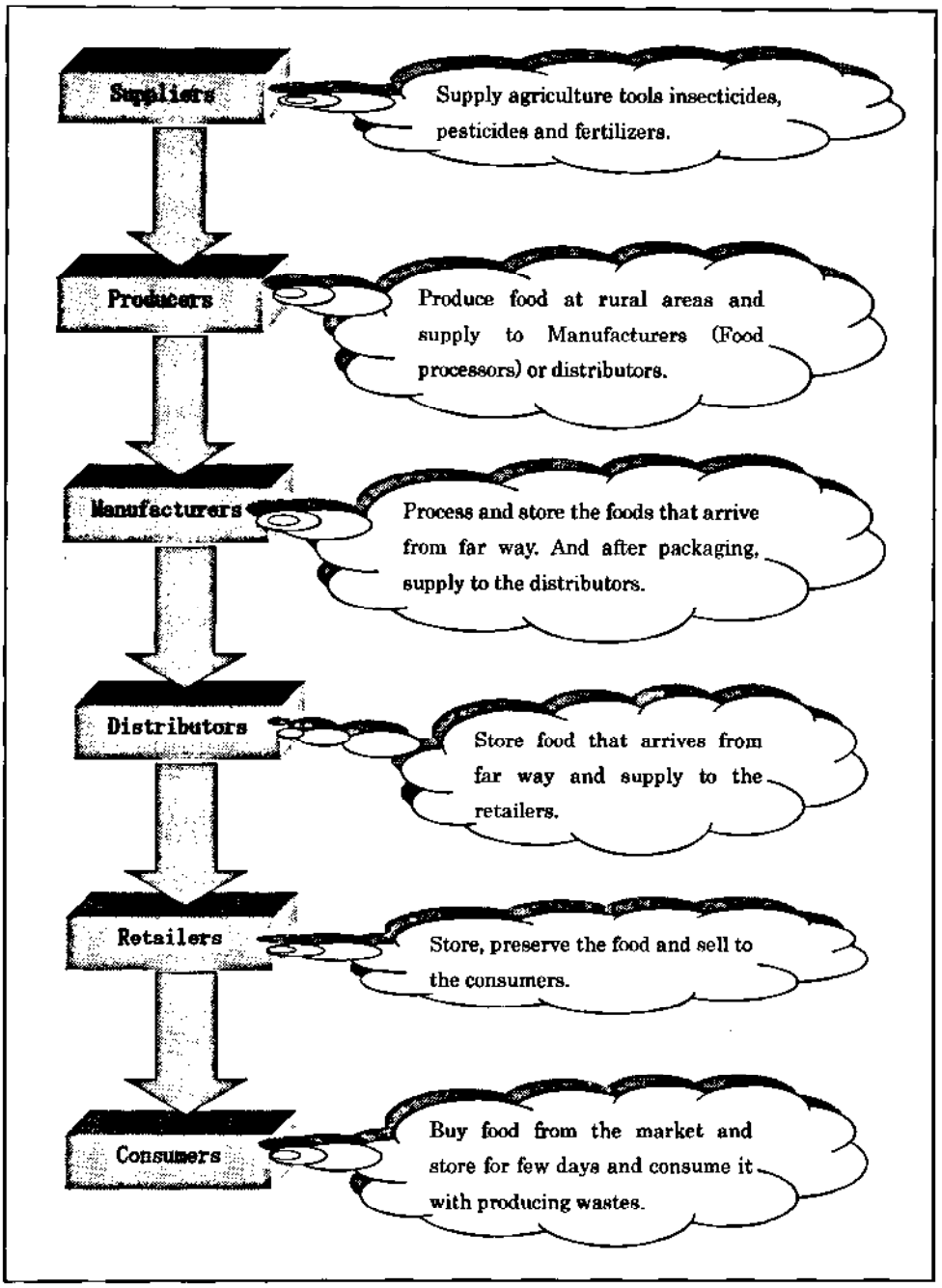


Fig. 28: Existing Urban Food Production and Distribution System

Such an energy consuming Urban Food Production and Distribution System of "so called compact city" cannot be called a sustainable city. Reform in such compact city must be required to change it into sustainable city with better arrangement of the land uses. Actually, the present planning method is responsible for creating the demarcation line between rural and urban areas by planning urban areas for secondary and tertiary activities and rural areas for primary activities. Why

such inequalities for spatial planning? Cannot we create a planning system that disappear the demarcating line between rural and urban areas? In fact, there will be no urban and rural areas in future in the process of civilization, therefore new planning method must seek to marry all three activities to bring a new hope, a new life and a new civilization in the cities.

3.3 Discussion on New City Planning Methodology

Based on the above enlightened "New City Vision" of promoting all the three activities for creating sustainable cities, following discussion on "how to create a sustainable city?" has been carried out.

3.3.1 Logics of New Planning Methodology

The above described issues have argued for "how present compact city model can reduce energy consumption in totality and pave the path towards the sustainability?" In other words, the compact city model is essential, but not sufficient for sustainability. The present compact city model has to be improved to achieve the goal of real compact city. This study thus argue that each smallest division of city called the neighborhood should be compact in real sense and it must be sufficiently self contained division with various land uses like Living (A), Manufacturing, Public service, Recreational (B), Service (C), Agriculture (D). This will actually form sustainable city showing each neighborhood as sustainable city unit like sustainability magnet. The difference between the prevailing compact city model and new city planning model is illustrated in Fig. 29. The layout of two models demonstrates the existing planning model, which even exhibits homogenous arrangement of urban components in parts but it is random in holistic view ("Locally homogenous but Totally random") while the new planning model, even exhibits the urban components arranged randomly, it is homogenous in totality ("Locally random but Totally homogenous") . As an example representation of local or part land use is shown by red colour while total or whole is shown in blue colour for comparing Fig.29A and Fig.29 B. Thus, the new city planning methodology proposed here is the arrangement for randomness contrary to the arrangement for homogenous, the concept forwarded by existing planning methodology. Planning means the arrangement of something and Randomness is the product of efficient way. The combination of two is the logic of new planning methodology "arrangement for randomness", which will form the energy efficient and sustainable to the 21st century cities.

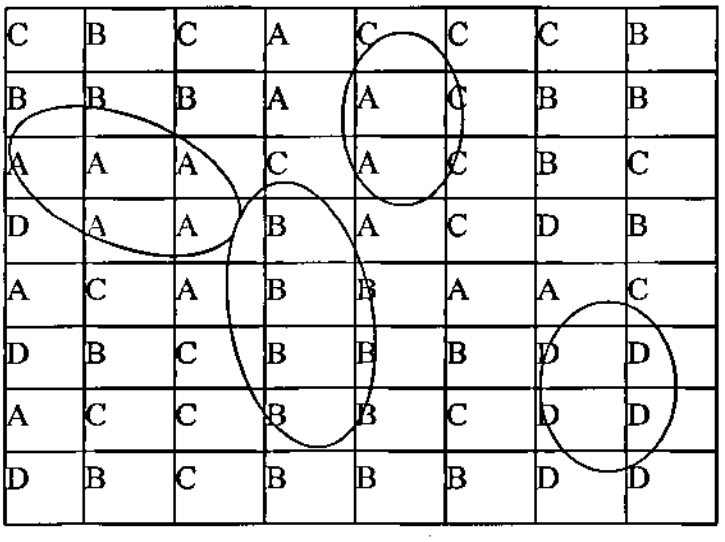


Fig. 29A: Layout of Existing Dense Cities: Compact City Model?

C	A	C	A	C	A	C	A
D	B	D	B	D	B	D	B
A	C	A	C	A	C	A	C
D	B	D	B	D	B	D	B
A	C	A	C	A	C	A	C
D	B	D	B	D	B	D	B
A	C	A	C	A	C	A	C
D	B	D	B	D	B	D	B

Fig. 29B: Layout of New City Planning Model

Fig. 29: Differences between Existing and Proposed City Planning Model
A-Living; B-Working; C- Service and D- Agriculture

3.3.2 Reducing Ecological Footprint

The sustainable food production and distribution system can help remarkably in decreasing the City's Footprint as noticed after number of trials for calculation of Footprint with manipulating number of times food related factors. For instance: I calculated my Ecological Footprint as a resident of Osaka City answering the Footprint Quiz[8] and investigated that my Food Footprint is 1.7 Global hectares out of my total Footprint 3.8 global hectares where as average ecological foot print of Japan is 4.8 global hectares per person. If everyone lived like me, there needs 2.1 planets since worldwide, there exist 1.8 biologically productive global hectares per person. This is not feasible option so I must change my way of living styles. So, I hypothetically change my way of living styles and again calculated my Foodprint reduced to 1 global hectares when I suppose to change my food habit from daily use of meat to occasionally (no meat or occasional mean, but eggs/diary almost daily) and change my living styles for using only one quarter of the food I eat is processed, packaged and imported from most of the food I eat is processed and from far away. Hence, it can be said that Exergy [9] efficiency of total food system (production and supply) of city is an important factor for the sustainability of the city, as food shared a key factor in City's Footprint.

3.3.3 Energy Consumption cuts and Community Empowerment

If the planning system directs Food Production and Distribution in a way that community can produce their food in their own community and consume among themselves, it creates the sense of sustainable and energy efficient community. In other hands, the shorter the food production and distribution chain, the lesser the consumption of energy for transportation, preservation and packaging is. A schematic diagram in Fig.30 shows such an energy efficient and sustainable food production & distribution system that can reduce the supply and distribution chain length significantly. It is also a good method of empowering the community. This type of community based food supply and distribution system will provide the affordable, fresh and energy efficient

food to the consumers of the city and help in creating sustainable society with social equity.

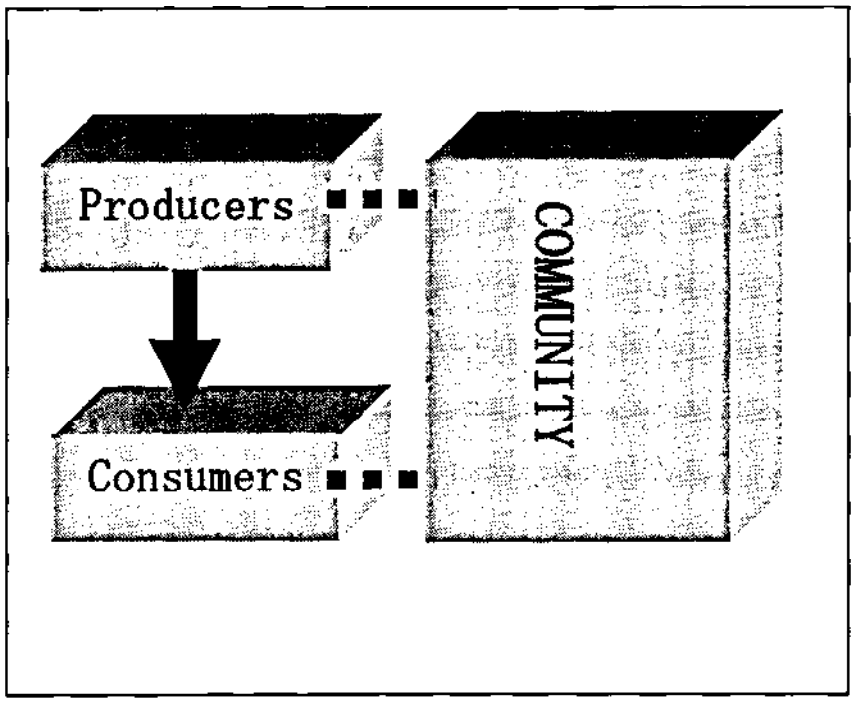


Fig.30: Energy Efficient Food supply system of FGC.

3.4 Conclusion

Urban Sustainability sounds good but due to the complexity of urban way of life, it is very hard to grip in practice. The effective planning and management of urban land has a fundamental role in achieving this difficult goal. The necessity for promoting the agriculture activities in cities is understood from the above discussion for creating a sustainable city by balancing the three economic activities in the city. But the important 3 big questions are: Where to do it? How to it? and Who will do it? Mean while, to increase green spaces in the city is becoming one of the important planning objectives of many cities. There is no doubt; "Urban Green" helps for improving the quality of urban life. But it is important to think from the stand point of sustainability. Do we have sufficient spaces for green just for ornamental purposes? Is our present land uses pattern within the fair global share of our resources? Keeping in mind those questions- city dwellers must try to practice the lifestyles that are compatible to the carrying capacity of city. It is the responsibility of all the urban dwellers to think ethically, whether it is right to enjoy the present materialistic way of lifestyles or not. Before the problem is more severe, it is wise to follow the sustainable path exploring the functional possibilities of each of our available resources.

CHAPTER FOUR: DEVELOPMENT OF SUATAINABLE CITY PLANNING METHODOLOGY

"Creating sustainable places is very much a process of thinking about and visualizing the future. It is as much a process as an outcome. It is about soliciting the input and participation, ideally, of all individuals and groups in the community."

(Timothy Beatley and et.al, The Ecology of Place, 1997: p.205)

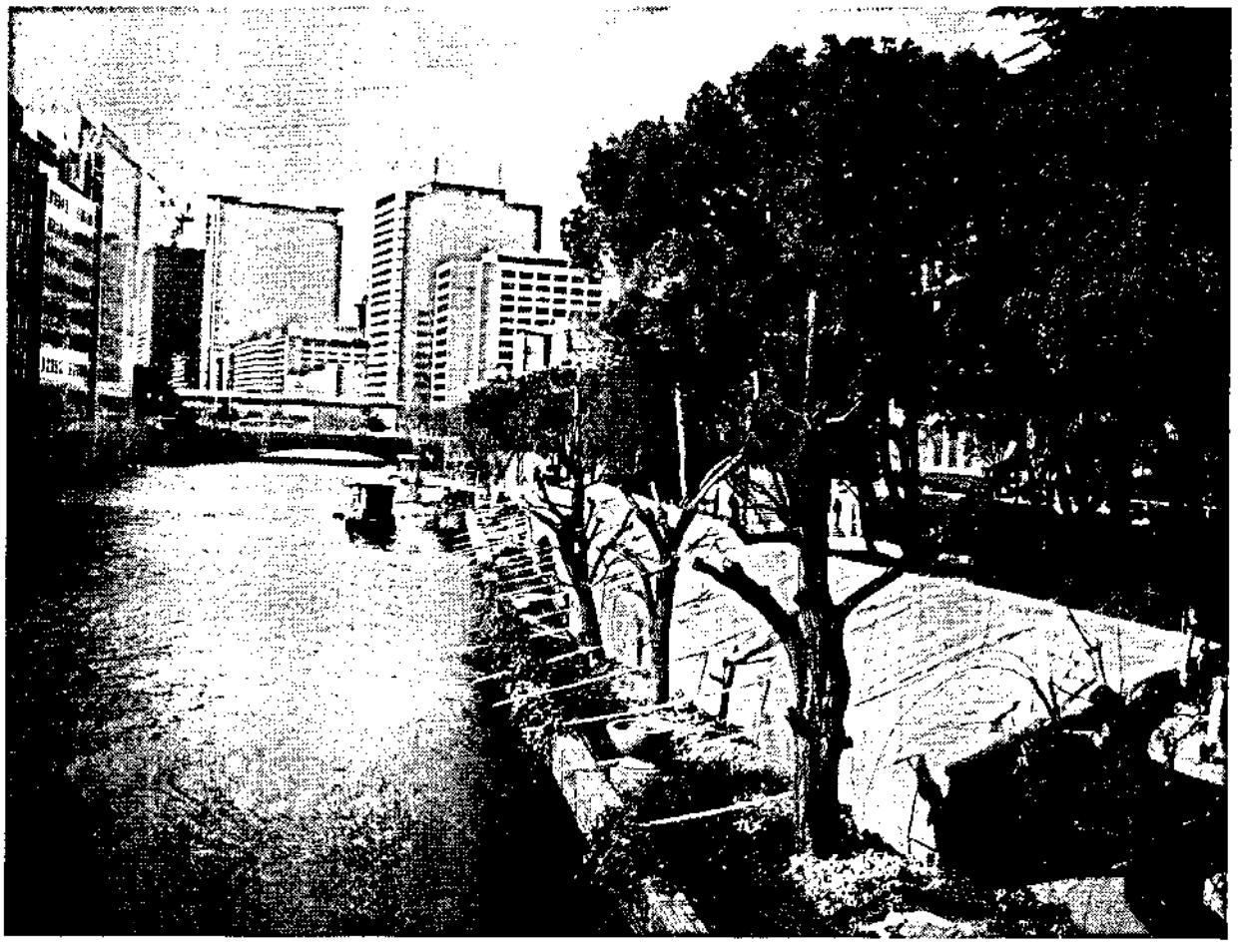


Photo6: Homeless Settlement in Osaka City

CHAPTER FOUR: DEVELOPMENT OF SUSTAINABLE CITY PLANNING METHODOLOGY

"It is not a choice of either the city or the countryside: both are essential, but today it is nature, beleaguered in the county, too scarce in the city which has become precious."

(Ilan L. Macharg, Design with Nature, 1992)

4.0 Introduction

This chapter describes about the philosophical foundation of the sustainable city planning methodology proposed in this dissertation. It proposes the concept of "Green 21 "or "Food Green Concept", based on which FGC are explained here.

4.1 Philosophical Foundation of Sustainable City Planning Methodology

Heidegger concept of dwelling implies something more than shelter. Dwelling used for indicating as man-place relation. "When man dwells, he is simultaneously located in space and exposed to a certain environmental character. It therefore implies that the spaces where life occurs are places. And a place is a space of which has a distinct character whereby Schulz divided concept of "existential space" into complementary terms "space "and "characters" in accordance with the basic psychic functions "Orientation" and "Identification".

Like Schulz idea to conceive Phenomenology as "return to things" and necessity of phenomenology of architecture, today's city are following the way to "Lost Place" and Phenomenology of city planning is essentially urgent to "dwell" the city dwellers in proper sense. Lynch concept of imageability, the environmental qualities that protects the observer in the city to be lost, constitutes the five elements: path, edge, node, district and landmarks. According to him these elements provide the observer to orientate him self with the surrounding environment and feel the sense of security. To be lost means, one who cannot orientate himself with the environment and that increases the insecurity. Analogously, here I tried to define the sustainability as "To be on Security" and un-sustainability as "To be on Lost".

The Philosophy of Heidegger followed by Christian Norberg-Schulz the concept of "Dwelling" and concept of "Existential space" made me to think for the "Existential City". Accordingly, I define "Sustainable Development as "Dwelling man in his environments within its carrying capacity" and "Sustainable city as a city that dwells the citizens within its carrying capacity." i.e. Sustainable city encloses the city space with character, which gives the identification and orientation. In other words, a sustainable city must make the city dwellers secured unlike the present city life with lack of security physically, socio-economically and environmentally and must be able to orientate with the surrounding environments towards secured future. The increasing trend of urban poverty, environmental problems depicts the insecure image of current city that is represented here as a "Lost Place" and aware to "return to things" as a sustainable city.

Hence, the proposed Sustainable City Planning Methodology seeks the methods for dwelling the citizens within the carrying capacity such that citizens feel the "sense of security", which includes from security of basic needs to socio-economic aspects of all urban dwellers. This methodology realizes the need of country side characteristics also in the city and tries to blend them in city's environment in harmony. In fact, it is the method to disappear the boundary between rural and urban areas and "Spatial Equity" establishing method. Based on this philosophical foundation the word "Food Green" has derived as an "existential green", that means green with environmental character of giving food. The concept of the Food Green city (FGC) is forwarded here therefore, as a concept for Sustainable City Planning Methodology for approaching close to the natural system as "return to things" through creating a self sustained city.

4.1.1 Concept of Food Green or Green 21

The earth cannot accommodate increasing urbanized society, which continuously drawing the resources at increasing rate and uses the rural lands, oceans as waste sinks. We must therefore see the ways to live in more sustainable way in the 21st century. In such context of limited resources, this study has advocated green for functional as well as ornamental purposes and designated it as Food Green (Green 21) Concept. This concept recognize the limited lands available in the city and purposes a new way of looking the green spaces and advocates for converting it to productive green spaces so that that green spaces could have multi-functions such as providing green environments in the city and producing food to the city dwellers.

4.1.2 Definition of Food Green City

Food Green City is proposed here as a sustainable city planning methodology based on the "Food Green Concept" or "Green 21 Concept" for providing food for all and improving the living environments of the city. This adopts the policy for integrating the Urban Agriculture with Urban Planning and designed to implement urban agriculture through the method of Middle Natural Farming, advocates for multifunctional purposes of agricultural activities in urban lands to pave the sustainability way.

Food Green City is a process of "returning to nature" and preservation of cultures in good harmony of man-environment relationship with the active participation of community to construct a sustainable society. The concept of Food Green City is visualized with the recognition of the 1902 thoughts of Sir Ebenezer Howard's "Garden City". But it is distinguished from his Garden City model and modified in the view point of the changed context of the world situation (Urbanization and Major challenge of 21st century for feeding the city dwellers). The applicability of Food Green City model is relevant to both new and existing cities. Thus, one of the difference between Food Green City Model from Garden City is that the former is the model especially for the existing city (with applicability possibility for creation of new city as well) while the later one is generally applied for creation of new city. The main thrust of the Food Green City is to revitalize the city as functional city with the new definition of green through the Community Based Agriculture Networking [10] (Fig.31). This concept integrates the urban agriculture with urban land use planning and urban management system exploring the resources in sustainable manner with providing food, healthy and pleasant living environments, economical opportunities, gainful employment, social intercourse and cultural vibrancy in the city. One can realize importance and difference of Green Spaces in existing city and Food Green City from the example illustrated in Photo 7 and Photo 8.

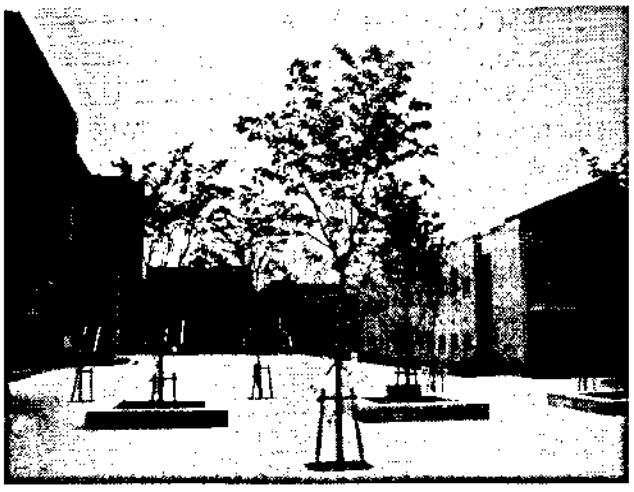


Photo7: Green Space in Existing cities

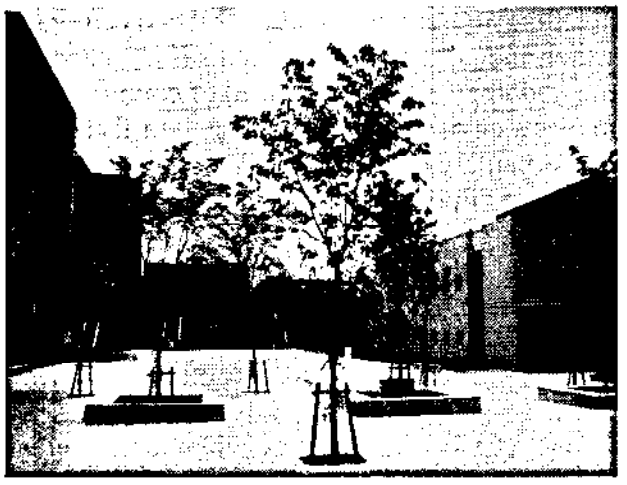


Photo8: Green Space in Food Green City
(Multi-functional purpose for green)

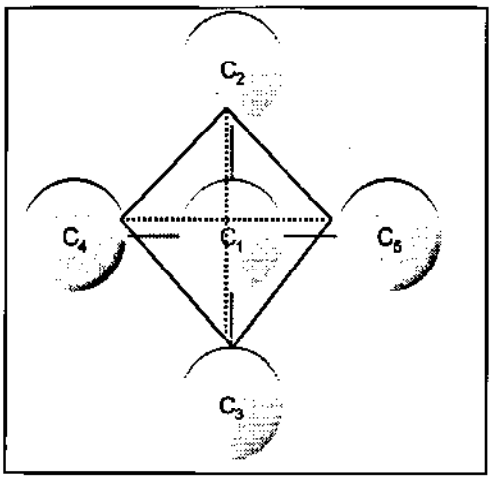


Fig.31: Community Based Agriculture Networking (CBA Networking)
C_1, C_2, C_3..... Represent the communities of the city.
— — ..... Various levels of connections

4.1.3 Logics of Food Green City

Cities are something like ships carrying about half the population of the world. It can travel the safe journey if it follows the right track. The logic behind the Food Green City concept for sustainability is gaining "Something from Nothing. Because this is the concept of harnessing solar energy available from sun for nothing and produces food utilizing the plants maintaining green in the cities. This approach of converting solar energy into food energy as represented by below equation, is the easiest way of eco-technology for harnessing the energy, better than any other technology created by the science of this so called advanced world.

$$\text{Carbon dioxide} + \text{Water} + \text{Light Energy} \xrightarrow{\text{Chlorophyll}} \text{Glucose} + \text{Oxygen}$$

The chemical equation is:

$$6CO_2 + 6H_2O + \text{Light Energy} \xrightarrow{\text{Chlorophyll}} C_6H_{12}O_6 + 6O2$$

(Carbon dioxide) (Carbohydrate)

4.1.4 Principles of Food Green City

According to the Gideon S. Golany in his book "Ethics and Urban Design" "Environmental design is the systematically planned intervention of humankind to improve and enhance the environment through physical design for the optimum benefit of its users with a minimum amount of harm to the natural environment and is concerned with achieving a balance between human-made physical creativity and the reciprocal influence of natural forces." And defined environmental design as "the art of establishing a synthesis between natural and human made environments" with mentioning "the designer's responsibility is to shape the newly combined environment."

I agree with Golany. In my view Environmental Design means design according to the environments and it does not mean design of environments. It is therefore art and science of shaping new elements according to the surrounding environments (natural, manmade and cultural environments) for the benefit of humankind with balancing the human needs within carrying capacity of the surrounding environments. It provides the environmental solutions to the environmental problems that are produced from the human activities as mentioned in the Fig.32. It designs elements according to the environment and maintain the balance to pave the path to sustainability.

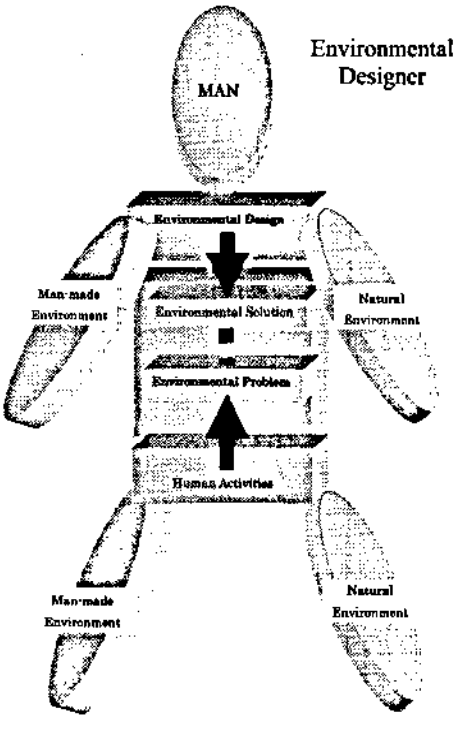


Fig. 32: Role of Environmental Design and Designer (Environmental Robot System)

Therefore, to solve the present problems of the city and make a sustainable city following principles of Food Green City are set from Environmental Design perspectives. They are as follows:

1. **Provide Sense of Community.** Involving community members in many activities of neighborhood for the mutual benefits.
2. **Energy cuts for Transportation.** Energy cuts for transportation using Boot, Bike and Bus (3B's System).
3. **Minimize the resources use.** Sharing of resources for housing, food, transportation, working and leisure.
4. **Balanced activities.** Promoting the Urban agriculture using Middle Natural Farming in the city for balancing three human activities in contrary to the present trend of less care for agriculture in cities.

5. **Fresh Food and Healthy cities.** Converting Carbon dioxide to Carbohydrate for creating healthy cities with clean air and sufficient "*Food to All*".

6. **Cities for all.** Create a livable city for all from male to female, child to old and poor to rich by promoting appropriate balanced activities in holistic and integrated way.

7. **Enrich the cultures.** Revitalizing the culture to live within the natural law rather than human made law.

8. **Establish a sustainable society.** To create the real sense of sustainable society through Self Ethical Approach (SEA) [11].

9. **Adopt 3P' Collaboration.** Collaborative efforts for the sustainable development with the participation of People, Private and Public organizations.

10. **Zero Waste Emission.** To minimize the wastes production and reduce the wastes at source.

11. **Multi functional Land Uses.** Allow the multi-functional land uses like Food Green spaces for functional and recreational purposes.

The basic Components of Food Green City are shown in Fig.33.

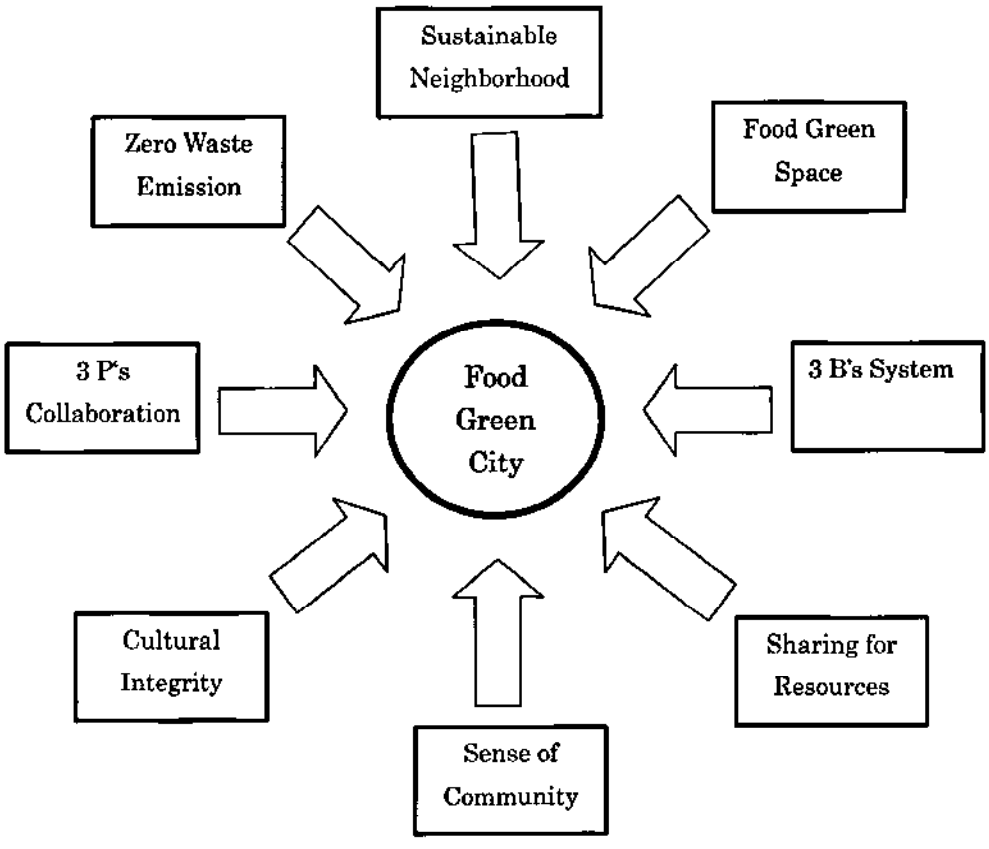


Fig.33: Food Green City Components.

4.2 Integration of Urban Agriculture with Land use planning

4.2.1 Definition of Urban Agriculture

UNDP (1996) defines urban agriculture as follows: "Urban Agriculture (UA) is an activity that produces, processes and markets food and other products, on land and water in urban and peri-urban areas, applying intensive production methods, and (re) using natural resources and urban wastes, to yield a diversity of crops and livestock".[22)]

"The term Urban Farming includes any Primary activity like growing crops or doing some forms of livestock or fishing in urban or periphery of urban areas and food is marketed for local consumption, either by producers themselves or by others. Urban Farming in urban areas refers to small areas(e.g. vacant plots, gardens, verges, balconies, containers) within the city for growing crops and raising small livestock or milk cows for own-consumption or sale in neighborhood markets." [12)]

"Urban Agriculture is the food production occurring within the confines of cities. This production takes place in backyards, roof tops, community vegetable and fruit gardens and unused or public spaces. It includes commercial operations producing food in green houses and other spaces, but is more often small-scale and scattered around the city." [38)]

Urban agriculture as defined above has just emphasized the agriculture activities for producing food in the urban areas. But agriculture is the cultivation of soil, in addition to which it gives food. Thus, the Urban Agriculture in the Food Green City is any primary activity that is for the cultivation of proper land uses to the urban ecosystem. In addition to which it also gives the production of locally grown safe and affordable food to the city dwellers. It thus has multifunctional advantages for the urban environment. Such agriculture activities scale is generally small but collectively large ranging from private to city scale with the optimal utilization of urban spaces through the participation of residents and collaboration of communities. Thus, the hidden goal and role of urban agriculture is to bring the perfection in the urban land uses and urban dwellers close to the natural system.

The role of Urban Agriculture in Food Green Cities is as follows: It

- Remakes the balanced land uses in the city.
- Reinforces the relation between Man and Nature.
- Rebuilds city with providing food and greenery to the city dwellers.
- Regenerates employment opportunities by providing jobs to old and unskilled people.
- Rehabilitates physical, social and ecological condition of the city and improve the quality of urban life.
- Revitalizes the culture and community.

4.2.2 Benefits of Urban Agriculture and its integration with Land use planning

Urban Agriculture plays an important role for physical, social and ecological wellbeing of the urban dwellers. It is the method of giving secure feeling of food security and a nice way of saving energy within the food production and distribution system using techniques of small-scale food production. Ideally, this is the method how a city person just giving his/ her little time and planting vegetables and fruits seeds, can improve his environment and food sufficiency. This also helps for enjoying leisure time with nature and improves the health physically as work is outside in

the sun and fresh air. It has many benefits which are described in Table 3. Urban Agriculture is not new phenomenon. It has been practicing since many years in difference scales. For instance, a small scale Urban Agriculture is practicing in Daito city with utilizing the unused lands as seen in Photo9. In early days, Urban Agriculture served as means of existence for the urban dwellers, when the transportation and communication was poor. Nowadays, it has become the job mainly for old age people and urban poor. For few others, it is just for freshness and aesthetic enjoyment.

But there are still many examples of existing cities where Urban Agriculture supplied food to the urban dwellers. Food production takes place in backyards, rooftops, community spaces, and unused or public spaces as well as green houses. The scale of agriculture is often small-scale and in scattered form around the city as illustrated in Photo 9 and Photo10

"The evidence is scattered but surveys have shown that urban farming provides for 30% of vegetable consumption in Katmandu (Wade,1987), 45% in Hong Kong (Wade, 1982), 50% in Karachi (Yeung,1988) and 85% in Shanghai (Skinner,1981).Overall estimate for Asia is grater than 50 percent of households' farm, for North America the estimate is 25 percent. On the other hand, Guttmann reported that gardening for home consumption is much higher in North America than in South America. The figures vary widely in African cities (from 25 % to 85% depending on the city), who are said to produce from 20% to 80% of their household food consumption." (Cases in IDRC, 1994)[38].

Existing land use planning hardly give the importance for agriculture lands and generally not consider in official plans or zoning, therefore the rapid trend of converting the agriculture lands into residential, commercial and other purposes for providing living and service spaces to meet the increasing demand of city population. Many cities have severely lost the self food sufficiency due to loss of agriculture lands. Not only this, it has resulted recently the many environmental problems in the cities. Even the urbanization is normally rated with non agriculture activities, but from the stand point of sustainability and improving quality of the urban environment, the integration of urban agriculture in urban planning is must. Otherwise how it can be ensured that the few remaining urban agriculture lands as seen in Photo11 will continue its agriculture activities for supplying the food to the urban residents without converting into built-up areas.

Table3: Benefits of Urban Agriculture

Benefits of Urban Agriculture
1. Physical Benefits ① Utilizes the unused land and unsuitable lands for other uses. ② Provides green and aesthetic urban environments. ③ Increases open spaces and try to maintain balance between built up and open space ratio. ④ Prevents the surface sealing problem and maintain underground natural system. ⑤ Maintains the clean atmosphere. ⑥ Allows for emergency spaces during fire and earthquake disaster.
2. Social Benefits ① Provides an opportunity as a part-time job to many who can combine food production activity with their main jobs. ② Increases household food security especially for urban poor. ③ Improves the supply foodstuffs qualitatively and quantitatively in the city at affordable prices. ④ Contributes significantly in social interaction among the neighbors. ⑤ Conserves and promotes many festivals, culture and tradition that are closely associated with farming. ⑥ Provides food in city at energy efficient manner.
3. Ecological Benefits ① Improves the microclimate and reduces the CO_2 accumulation. ② Helps to decrease air pollution, maintain ground water table and keep bio-diversity. ③ Supports for Waste management and soil nutrient recycling.

To make the good balance between three types of activities farming (Primary activity), Manufacturing (Secondary activity) and Commerce & services (Tertiary activity) unlike the existing trend of imbalanced weight towards secondary and tertiary activities only, it is very important to integrate the urban agriculture in urban planning. Thus, in this new planning methodology this policy has been proposed, which ensure long lasting spaces for the urban agriculture with planning guidelines and zoning. The integration of Urban Agriculture into land use planning ensures that the few remaining Urban Agriculture lands as seen in Photo 12, will continue its agriculture activities without converting into built-up areas and supply food to the urban residents. For making the city better place to live with improved food self sustainability, it is important to find the answer where to do the agriculture activities in the urban areas. "Where to do?" is therefore must be answered first to integrate the Urban Agriculture in land use planning.

Photo9: Urban Agriculture practicing in Daito city.

Photo10: Urban Agriculture can provide green environment any time even though the trees planted for green are not green.

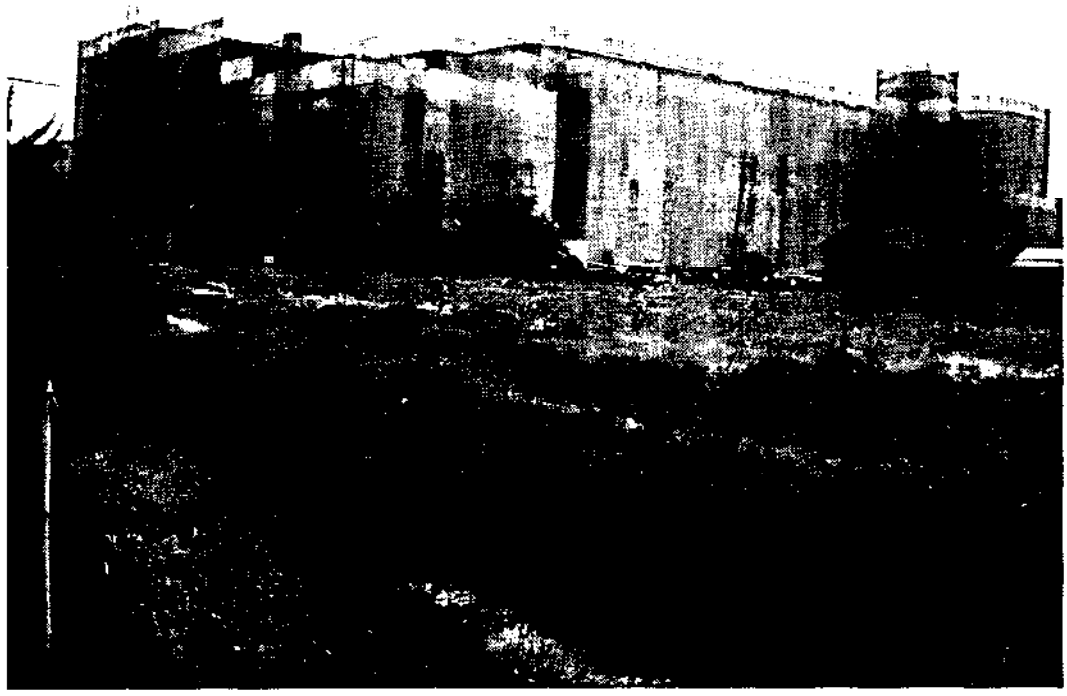


Photo11: Built up area approaching towards Urban Agriculture land in Daito City.

Photo12: Built up area approaching towards Urban Agriculture land in Kawachinagano City

4.3 Middle Natural Farming Method

Many methods have developed in different time with different level of closeness to Nature as shown in Fig. 34. Even the production has increased by the newly developed farming method as the product of this scientific world, but those have many demerits. The extensive use of fertilizers and pesticides has created serious problems to the environment and has negative impact to the global ecosystem. The selection of method of agriculture is vital in doing the agriculture activities in the cities, where residing population density is very high. Therefore, urban agriculture is strongly opposed by the environmentalist, city planners and policy makers due to the shortage of resources (land, water, human) and environmental reasons. In this context, Middle Natural Farming method is proposed here, which is based on the philosophy of Natural farming[15] forwarded by Mr. Masanobu Fukuoka, who is the master of the farming method. Microbiologist Mr. Fukuoka specialized in plant diseases, worked many years in his own field applying his own philosophy instead of using modern scientific knowledge of farming he has learnt and finally developed a unique method of "do nothing method" named as Natural Farming and encouraged to be a quarter acre farmer for an ideal live in Japan as mentioned in Box 1.The four principles[16] of natural farming are:

1. No Cultivation: This means, no plowing or turning the soil. The earth cultivates itself naturally.
2. No chemical fertilizer or prepared compost: These practices drain the soil of its natural nutrients and increase human interference in the natural cycle.
3. No weeding by tillage or herbicides: Weeds are an important part of building soil fertility and in balancing the biological community. As a fundamental principle weeds should be controlled, not eliminated.
4. No dependence on chemicals. Weak plants develop from such unnatural practices which increases their vulnerability to disease and insects.

Box 1: The Road Back to Farming

No "method" is needed for loving nature. The only road to nature is non action; the only method is no method at all. All one must do is to do nothing. The means will become clear of itself and the goal absurdly easy to attain.

This is what I mean by doubting the degree of resolution in those who profess a wish to return to nature. Are they really drawn to farming? Do they really love nature? If you have a genuine love for nature and wish to return to farming, the way will open with great ease before you. But if your love for nature is superficial and what you do amounts simply to making use of farming for your own purposes, the road will be closed off to you; returning to nature will be impossibly difficult.

The first obstacle that blocks the movement back to the land is people, it lies within your self. The second obstacle blocking the return of people to the land is the availability of farmland. With 120 million people squeezed together in a small island nation and land prices soaring out of sight, purchasing farmland would appear to be next to impossible. I have chosen nevertheless to call my program "Farming for All".

Japan has about 15 million acres of farming land, which works out to about a quarter-acre per adult. If Japan's land were divided evenly among 20 million households, this would give each household three quarters of an acre of farmland plus two and a half acres of mountain and meadow land. With total reliance on natural farming, all it takes to support a household of several people is a quarter of acre. On this amount of land, one could build a small house, grow grains and vegetables, raise a goat and even keep several chickens and a hive of bees. If everyone were capable of being content with the life of a quarter-acre farmer, then this would not be impossible to achieve. More to the point, everyone has a right and a duty to live their lives within narrow bounds. This is the basic condition for achieving an ideal of life.

Source: *Masanobu Fukuoka, The Natural Way of Farming, 1985: p.259-260*

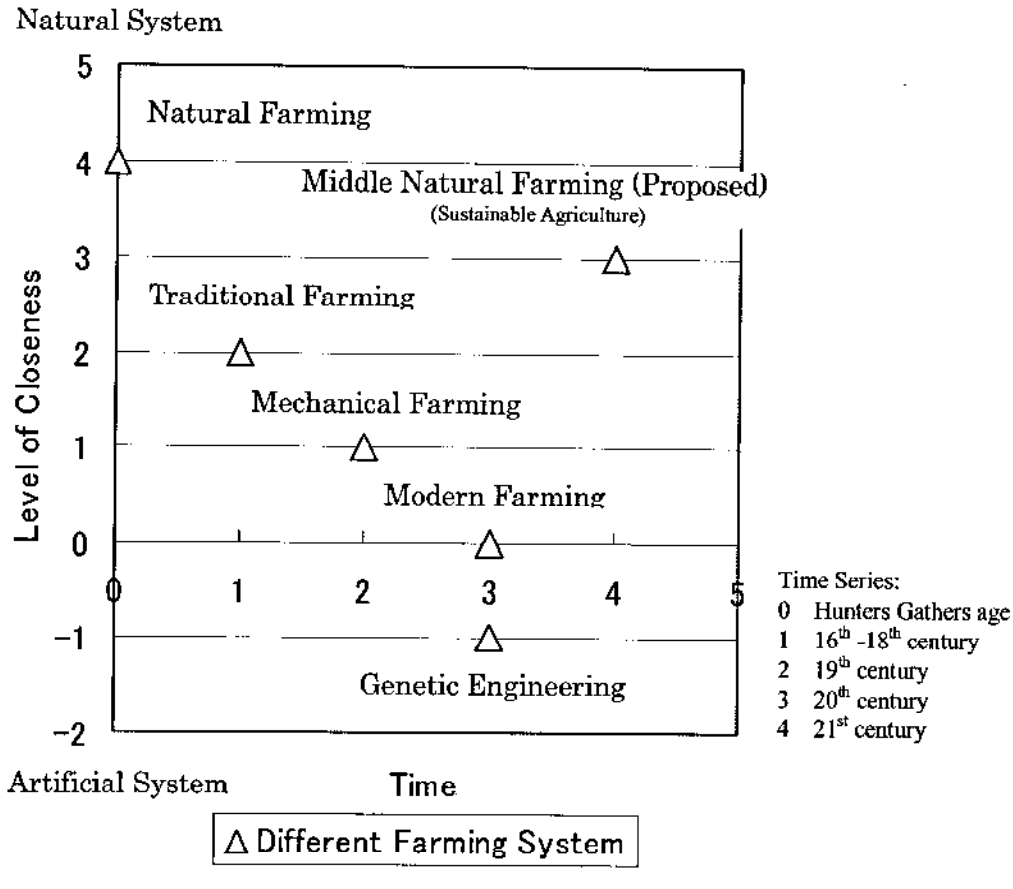


Fig. 34: Evolvement of different Farming systems

This method of agriculture in urban areas is most suitable method, which can reduce most of the cost of urban agriculture and increase the economic productivity of urban lands. Agriculture activities in urban society has multi-functional use and no reason to object it if it is followed with the use of Natural Farming method. Thus, Middle Natural Farming method has proposed to conduct the agriculture activities in cities with little modified the Natural Farming method in compatible with urban areas without major changes of its principles.

4.4 Realization of Urban Agriculture

Looking at the benefits of urban agriculture, it is recognized as one of the best ways by which cities can be better places to live in harmony with agriculture and urban living as seen in Photo 13. City dwellers can improve quality of life in sustainable manner. But there are many obstacles to realize urban agriculture due to various reasons like lack of resources and urban way of life styles. The following sections will discuss about how the urban agriculture could be realized in urban environments.

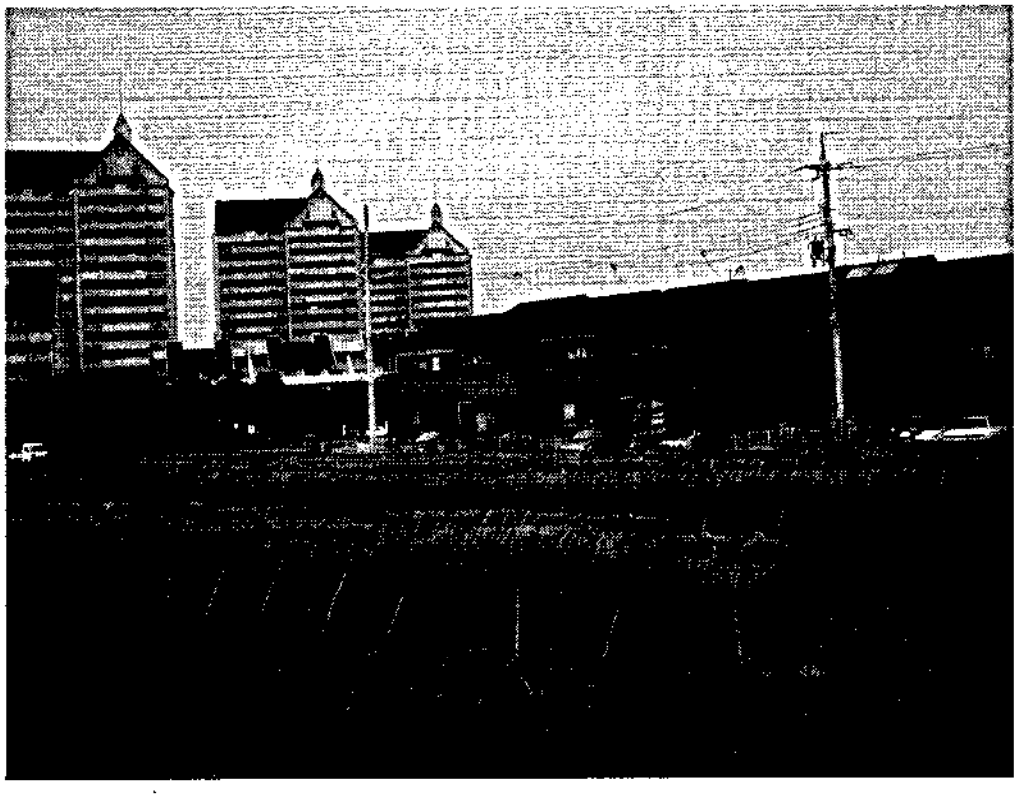


Photo13: Need of agriculture land for maintaining open space.

4.4.1 How to do?

- **Integrate the urban agriculture with urban planning**

This protects the agriculture lands and promotes the agriculture activities in the cities. It explores the possible lands that could be viable for agriculture activities and guides for the promotion of urban agriculture in the city with encouraging the citizens through subsidy policy and initiative programs.

- **Adopt Middle Natural Farming Method**

This method will ensure the urban environment free from the risk of use of pesticides and chemical fertilizers. As this method is closely associated with Natural Farming method- do nothing farming method, need not to do plowing and weeding, it is feasible in doing as part time job for busy urban society in small scale.

- **Practice the 3R's Policy**

  - Reduce significantly energy consumption.
  - Reuse the waste water for irrigation, seeds of used food for growing plants.
  - Recycle the wastes to resources converting into manure through vermi-culture
    A story how earthworm can help for city waste management is explained in Box 2.

Box 2: Earthworms offer key to waste management, infertility

For skeptics, here is something to listen to and consider - "I have been collecting biodegradable waste from my neighbors to feed my earthworms. I am also selling hundreds of worms at Rs. 2 each," said Dr. Ananda Shobha Tamrakar, a scientist affiliated with Tribhuvan University's Central Zoological Department. Tamrakar, who has trained 600 community workers, farmers and housewives on vermiculture (earthworm rearing) and has been raising thousands of red earthworms in her back garden, said that this simple technology is low cost and ecology friendly. She has selected four species of worms that serve the best in waste management. "When other people are impatiently waiting for the municipality tractor to come for collection, I am in short of waste to feed my worms," said the woman scientist. She has been collecting waste from the Kalimati vegetable stock market.

The worms have not only removed the problem of household waste management, but have delivered a fine product - the compost manure. Tamrakar has been selling per kilogram of the black manure for Rs. 25. At a time when chemical fertilizers are posing threats to the ecology and its shortage is troubling the farmers, my manure is selling like hot cakes among the farmers of Kathmandu, she said. "My brothers who trade on gold ornaments tell me to stop playing with waste and join them. I reply them that I am working with black gold." As our farmers are not aware, careless use of chemical fertilizers is killing soil fertility. In absence of proper balance of different chemical components, the soil PH (harmony of acid and base) is being disturbed. This in the long run that harms soil quality. To minimize these adverse effects, a switch to the use of organic manure is the environment-friendly answer, said Tamrakar.

Though the feasibility of this waste management technique still remains to be experimented on large scale, Tamrakar said that it might be applied right away at the community and household levels. When the waste management problem is solved at domestic and community levels, the municipality authorities will have nothing to worry about, she added. She wondered why Kathmandu Metropolitan City is getting embroiled forever in garbage dumping issue, overlooking these practical solutions. An illustrative instance of the applicability of this model can be seen on the bank of the soiled bank of the sacred Bishnumati River where over 100 buffaloes are slaughtered every day. The unsystematic animal slaughtering here generates heaps of garbage that engulfed the area in foul smell. "We established an earthworm based compost plant here. Not only the filth was managed, we generated compost manure and sold it to the farmers," said Tamrakar. When the butchers saw that the animal waste could generate money, they got interested in the plant. "Since our aim was to encourage maximum community participation in the venture, we invited the butchers to manage the plants themselves," said Tamrakar. The Central Zoo in Jawalakhel is also using this model to productively manage the animal waste. Besides converting garbage into fine agricultural input product, earthworms may also be used as an ingredient in fish feed, according to Tamrakar. Nepal has been spending to import dried shrimps to prepare feed for Snow Trout fish culture. "When we start large scale vermiculture, dried earthworms can provide alternative to the imported shrimps as they are equally nutritious," she added. Tamrakar is also experimenting on the medicinal use of the red earthworms. One of the remarkable properties of earthworms is the ability to spark fertility. Earthworm medication is being tried on a few infertile couples. "Earthworms are potent aphrodisiac. They are the indigenous Viagra," said Tamrakar.

Source: *Bhimsen Thapaliya, The Rising Nepal, Feb 2 2003; http://www.nepalnews.com.np/contents/englishdaily/trn/2003/feb/feb02/ Access date: 2003 Nov.23*

- **Small scale farming at three levels**

a) Private: This level of urban agriculture is done by the city dwellers at their own private lands of their house or its surrounding to meet their daily food demands.

b) Neighborhood: This level of urban agriculture is CBA, done with the partnership of community people in the neighborhood lands buying the lands with shares or leasing the public lands for producing the food to meet their neighborhood demand. Such community based agriculture has been practicing in many cities of the world. One of the Community Gardening program to revitalize the neighborhoods with the participation of low income youth and family as an example is described in the Box 3.

Box 3 : Community Gardening

The community Gardening Program organized by Bridging Urban Gardens Society (BUGS) is a set of projects designed to build community through growing food. In the program low-income youth and families participated in developing the means to revitalize their own neighborhoods, feed themselves through their own efforts, grain some income and learn about nutrition, gardening and urban ecology.

The Salishan Family Garden near the Salishan Housing Development has nearly 50 families representing 5-7 different cultures gardening year round on this one –acre community garden. Parties are held to celebrate community and garden produce. The garden has attracted the development of a community art gathering space and children's park.

Source: *http://www.pierce.wsu.edu/tfs/communi.htm*

c) City Level: This level of urban agriculture is relatively larger and supposed to do in organized and commercialized way to meet the food demands of the city dwellers. The large plot of land needed for it can be owned or leased the public land. The agriculture activities and marketing activities will be then executed by the mutual understanding and collaboration of communities through the CBA Networking. Following sentences support the successful existence of community based agriculture in Japan.

"Community Supported Agriculture (CSA) is not new in Japan. In 1965, mothers in Japan concerned about the rise of imported food and the loss of arable land started the first CSA projects, called Teikei in Japanese. Japan has more than 600 producer-consumer groups that supply food to more than 11 million people. The largest cooperative network in Japan is called the Seikatsu Club. Local chapters of this club can involve thousands of people and support up to 15 farms."[4] The more detail is explained in Box.4 about how CSA works in empowering community and developing the sense of community for creating sustainable and symbiotic society.

Box 4: Community Supported Agriculture (CSA) Roots in Japan

The CSA movement is inspired by Japan's *teikei* concept, which is embodied in the dynamic Seikatsu Club. The 30-year-old Seikatsu Club in Kanagawa Prefecture has 50,000 members organized into 11 blocks. Members buy their food directly from the farmers in the region at a cost of 34,000 yen ($40) per month per family. (See IC #36 for more on the Seikatsu Club.) The average member gets 60 percent of their food from the Seikatsu Club. Each block is governed by its own board and steering committee.

Building on this foundation, club members are now doing educational and political work. They have elected women to 34 positions on various council bodies in the prefecture. Success at a local level has prompted them to begin planning a new national community political party.

The Seikatsu Clubs, which can be found all over Japan and involve millions of people, are the successors of traditional consumer cooperatives that try to improve on, but not fundamentally challenge, the market principle.

Parallel with the transition from traditional co-ops to Seikatsu Clubs, was the development of the modern organic agriculture movement, which soon adopted the clubs' guiding concept of *teikei.*

The Japan Organic Agriculture Association (JOAA) has made it a priority to establish the *teikei* system between producers and consumers. *Teikei* is an idea to create an alternative distribution system, independent of the conventional market. Though the forms of *teikei* vary, it is basically a direct distribution system. To carry it out, producers and consumers work to deepen their mutual understanding: both provide labor and capital to support their own growing, processing, and delivery system. They recognize that with the conventional market, where producers and consumers are completely separate, the sustainability of organic agriculture management is uncertain. JOAA summarizes its approach:(1) chemical hazards are not merely a matter of techniques, but a symbol of the total malfunction of distribution systems, consumption structures, and agricultural policies;2) the swollen commercialistic market and food industry intercept the communication between producers and consumers, eventually misleading both of them; (3) therefore consumers are also responsible for this vicious cycle, even if they are unaware of it; (4) in order to correct it, producers and consumers should build an organically combined relationship between themselves and be involved in understanding and helping each other. This is what we have always emphasized in directing our movement.

Source: Brewster Kneen, *http://www.context.org/ICLIB/IC42/VanEn.htm*, Access date: 2003 Nov.31

- **Green as Green + Food**

In Food Green Concept, Green is viewed as Green + Food and has multi-functional purposes. This concept can have a significance role in the greenery plan of the cities. For instance: Osaka city has prepared Basic Greenery Plan in accordance with Comprehensive Plan 21. It has vision for creating green city. The city has set the target by the mid 21 century to achieve per capita park area of 7m^2 (in 1998, 3.9 ^{2}/person).[41] Green 21 concept advocates even if 25 % of increased park areas (3.1 m^2/ person) can be developed into park areas with suitable trees for food, this can support food supply in the city significantly. For instance, this can provide the food to the population more than 10000 if assumed one quarter land is enough to feed one family (200m^2 per person [12]) by natural

farming method [13] as said by Mr. Masanobu Fukuoka on the basis of his practical experience of more than 40 years. The number is more or less similar to the homeless people of Osaka, thus if this is targeted for homeless people there will be no homeless people struggling for food in Osaka by the mid of 21st Century.

The root problem of the homeless can be eradicated if policies are directed for empowering them with providing self-sustaining jobs. The way to distribute food and temporary house can never solve the problem, rather it make the problem complicated as a interesting story mentioned in Box 5.

Box 5: In Osaka, kindness is its own punishment

"Give a man a fish, and you feed him for a day," begins a famous saying. Cynics have revised the second part to read, "Teach a man to fish...and you feed him for a lifetime."

Is Osaka successfully dealing with its homeless problem? Well, shrugs the "Rejection Tray" column in Shukan Shincho (Aug. 15-22), it depends on how you define success.

The city currently hosts Japan's largest number of homeless. According to a survey taken in 1998, Osaka's homeless population stood at 8,660, compared with about 5,600 in Tokyo's 23 wards.

Stunned by this blow to its civic pride, and determined to provide assistance to those down on their luck, the denizens of Osaka rolled up their collective sleeves and transformed Nagai and Nishinari parks into shelters, with the same type of prefabricated housing used to house earthquake and other disaster victims. Each day, counselors are dispatched to these areas to meet the inhabitants, listen to their problems and encourage them to get back on their feet and find work.

At Osaka Castle Park, where the largest collection of homeless reside, seven shifts of city workers, with four people per each shift, have been assigned to interview each homeless person, inquiring about his (or her) health, provide information about where to find day-jobs.

Truly, no one can make the assertion that Osaka is an uncaring town. There's just one problem; these efforts may have paid off in helping to pull quite a few individuals out of the gutter; but they have had no impact whatsoever on the total number of homeless that reside in the city. If anything, word has gotten around among the lumped proletariat in other parts of west Japan that "Osaka's the place where they'll take good care of you." As a result, even more have been head for the city, adding to the JY 2.1 billion annual burdens already being shouldered by aggravated taxpayers.

Well, it was Jesus of Nazareth who said, "The poor you will have with you always." Modern times have certainly proved him right.

Source: *Japan today, August 8, 2002, http://japantoday.com*

4.4.2 Where to do?

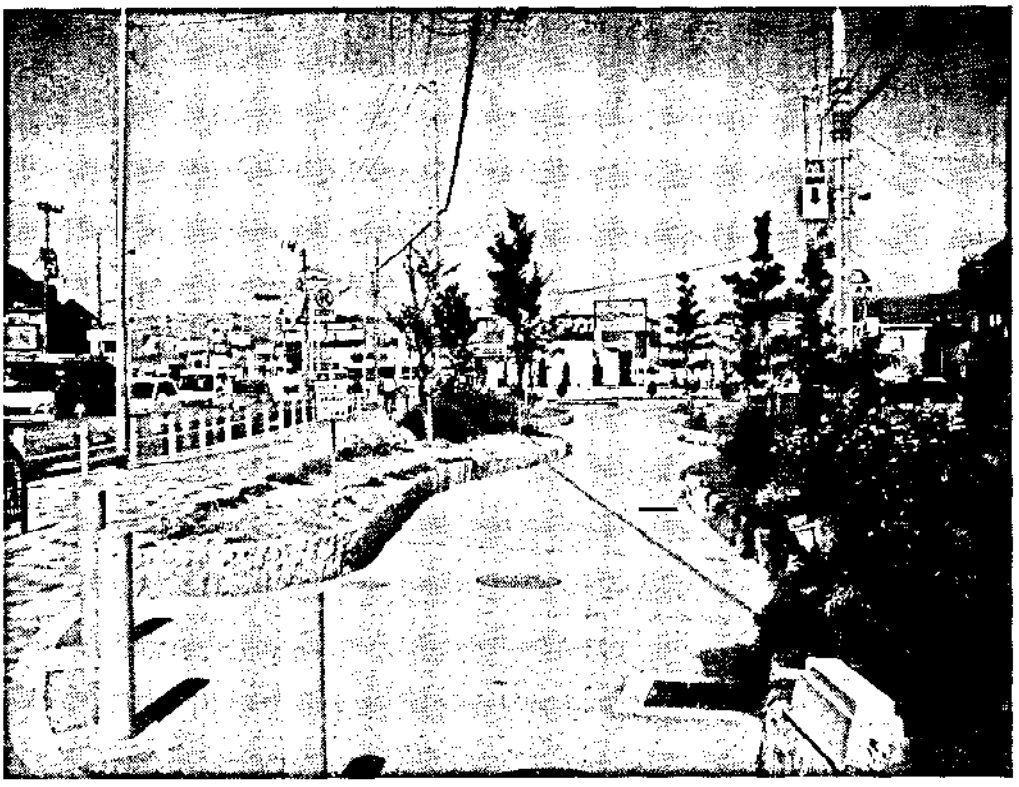


Photo14: Small Parks- Possible areas for Food Green Parks in City.

There is scarcity of land in urban areas but still it is possible to do the urban agriculture if the urban lands are explored and few innovative ideas are utilized. Limited resources available must be realized and actions must be taken accordingly.

1) Despite of lack of farmlands in cities, there are plenty of potential unused lands for agriculture. Right of way of roads, railways & power lines; river banks and unused public lands. These lands can be utilized for agriculture in harmony with urban environment.

2) Part of greenery places and parks of cities as seen in Photo 14, can be utilized for growing suitable fruits in compatible way of urban aesthetic and its function.

3) There are also significant spaces at residential house or public buildings as Building Area Ratio (BAR) is generally 40% to 80%. Therefore, 20% to 60% land is generally vacant around the houses. Some percentage from such vacant lands can be utilized; which is also large plots of land for agriculture in total. The planning policy like Food Holding Certificate(FGC)[14] can be initiated to utilize such vacant lands and for promoting the local food production with many ways such as subsidizing and enforcing of planning and building laws.

4) Roof tops of buildings have been utilizing for aesthetic purposes. Roof tops, front wards, back wards as well as city concrete walls as seen in the Photo 15 can be converted into food green walls that give food as well as ornamental values to the building with some suitable design in urban landscape. This policy of vertical integration of urban agriculture actually solves the problem of scarcity of urban lands for doing agriculture activities.

Photo15: Concrete Walls of Riversides can be designed as Food Green Walls.

4.4.3 Who will do?

Who will do the urban agriculture is the interesting question. Following paragraphs have answers to this question.

1. House wives and old age people can do the agriculture activities caring with their children, house and utilizing some of their free time. Increasing rate of aging society and majority of agricultural workers of aged more than 65 years (refer 1.2.2.1 and 1.2.7.3) has visualized the great possibility of attraction of senior citizen's involvement in this activities.

2. Salary man as a part-time job and utilizing the leisure time can combine food production activity with their main jobs. This can help them to keep physically healthy, can get fresh food and can save money significantly.

3. Homeless people, low skilled people and unemployed people can join in the urban agriculture. This will be a good opportunity for earning money for them working with nature. For example: this will be a great opportunity to eliminate the problems faced by Japan recently such as increasing rate of unemployment and homeless people. Thus, those people can be the human resources for the urban agriculture.

4.4.4 Discussions

Colin Ward mentioned in his article "Exploring agriculture" [6] that pointed out by Geoff Wilson as : "The inescapable logic is that while rural agriculture can need up to eight fossil fuel energy units to produce one food energy sold in supermarkets, urban agriculture can provide up to eight food energy units for energy one fossil fuel energy unit." "In Chinese cities 90% of vegetables are locally grown." [6] Jac Smit found that "Hong Kong, the densest large city in the world, produces within its boundaries two-third of the poultry, one sixth of the pigs and close to half the vegetables eaten by its citizen and visitors." [6] Then, why Japanese cities cannot practice urban agriculture to make self sufficiency in food and provide the fresh and healthy food to the city dwellers. The characteristics of Japanese consumers support the urban agriculture as they expect the good quality of products, fresh food regardless of reasonable price differences. Japanese consumers do not favor the food that has produced at far places; if the information like "Place of Production, Method of Production and Distance traveled" is put on every food items placed in super markets. The outbreak of BSE in 2001 has sufficiently made to realize the fact that if the city is self-sufficient on food then such kind of problem can be handled easily and can assure the quality food to the citizens. It has also aware that if the food is produced locally, people do not have to worry for long time and can eat the safe food without any kind of doubt, unlike bitter experience during the BSE outbreak time. Hence, these discussed points guided the importance of Food Green City concept in the Japanese cities to create the sustainable and food sufficient city. It is also necessity for serious thinking by government as well as every citizen how wise is it for a country to depend on other countries for the food, the most essential basic need for human life to survive?

Recognizing the realities of present situation of cities like issues of rise of CO_2 in atmosphere, shrinking water table, degradation of soil, rapid conversion of agriculture lands to urban sprawl, unnecessary tremendous mobility, food security & food insufficiency and imbalanced urban ecosystem, urban agriculture incorporation with urban land use planning proposed here as solution for driving 21st century cities into the path of sustainability.

4.5 Consideration of Cultural elements

With the advancement of modernization and urbanization in 20th Century, there has a great alternation of environments and land uses pattern world widely. In other words, it has 'lost the place' if we follow the definition of place as space with characters as mentioned by Schultz, 1984 as described earlier. To bring back the lost place in to right place in the 21st century, it needs to change the paradigm of city planning and urban development. To find the new paradigm and apply in the 21st century, I planned to study of Wayside shrines[↑] , which are manmade elements added by the human in the living environments for religious and spiritual satisfaction. The study is initiated with detail study of Wayside shrines of Kawachinagano City of Osaka Prefecture. Then, the study is carried out for making the distribution maps of the distributed Wayside shrines in seven cities of Kitakawachi with GIS. The study performed of Wayside shrines in triangular relationship with people, manmade and natural environments investigated there is very close relations among three. It is observed that nature and surrounding environments are reflected in the form of man made environments like Wayside shrines with the strong beliefs of the people. For example, Wayside shrines that are found established near the rice fields, roadsides, cemetery places and natural places (ponds, spring, mountains, Stones) have some reasons and beliefs behind it. Such beliefs are found still intact in the urban society. This lesson is one of the approach for establishing a sustainable city planning method as "Chinju no Mori" to develop a sustainable land uses and design the city elements with cultural identities, environmental characters and full of function. The details of the study will be described in Chapter Five.

There is no doubt people believes on 'Food' for the survival of their lives. Actually 20th century' machine revolution and technological advancement is also struggle for food. But the ways of struggling in the past century for food and better quality of life lead the 21st century as the century of crisis. Now it has become a big challenge for the whole humanity. Cities are the most vulnerable areas. The new paradigm of city planning is thus inevitable if it has to exist forever. Here 'Food Green City ' has therefore the key word like Wayside shrines as seen in Photo16 on which we can expect the beliefs of the people and high possibility of its sustainability in the city if we can establish city planning method as "Chinju no Mori" as illustrated in Fig.35.

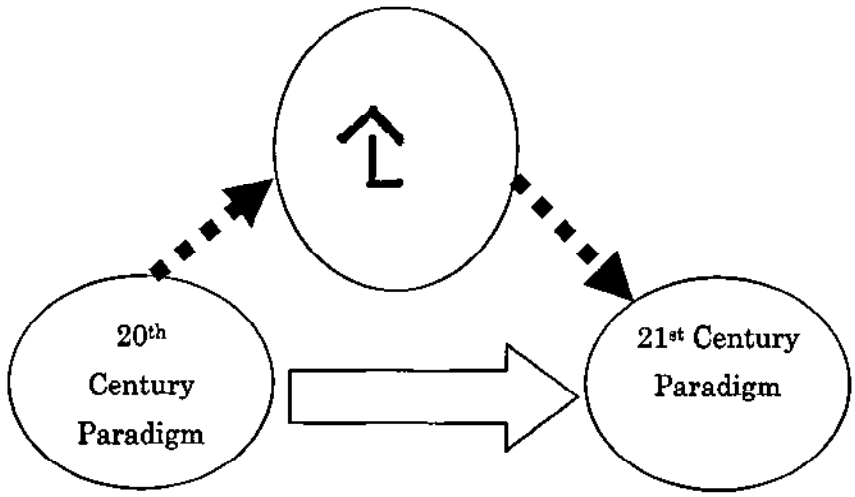


Fig35. Change of Paradigm as "Chinju no Mori"

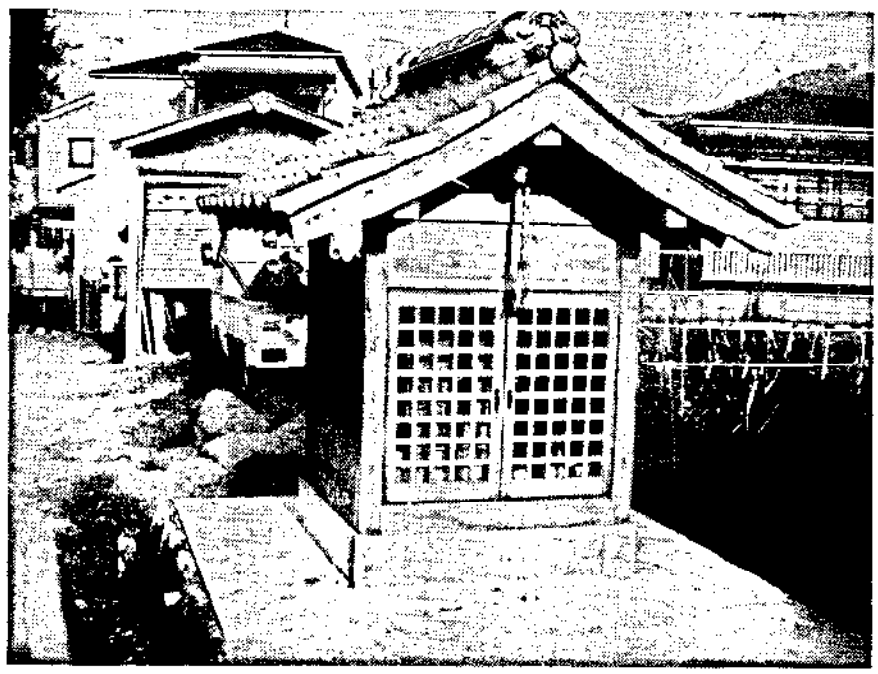


Photo 16. Wayside shrines: Cultural Identities and Believes of People.

4.6 GIS as Analysis, Planning and Design Tools

City is the complicated human project which needs a holistic and integrated approach to keep it run well. City planning and design is therefore very difficult job. The planners need to assess the various manmade and natural elements to finalize the plans and proposals with good analysis. It needs some kind of tools for planners. Similarly, designers must look city in totality in setting the urban elements for the development of urban spaces. It concerns with people, places, movement, urban form, building fabrics and nature. The impact of urban design even in small scale is enough to feel for many urban users. It has therefore a sensitive meaning. Hence, the urban designers need to evaluate their proposal close to the realities before finalizing their proposed conceptual design. Although computer models has been using in urban planning since 1950s the use of GIS in the field of urban design in digital world is a new phenomenon. I have chosen the GIS as a planning and design tool for this study. GIS has the capability to analyze the situation from whole to parts and parts to whole which makes easier to visualize the real situation. It helps to perceive the real world of city that contains many natural and manmade elements. Additional to this being its advantage of fast, easy and accurate data analysis and presentation capabilities GIS is thought as a suitable tool for this study.

I took part as a member of a group in the International Concept Competition for the Northern part of Osaka Station, 2002. In this competition, a "GIS Aided Concept for Northern Osaka Station Area" was proposed. This has demonstrated how the GIS act as powerful tool for UDSS and helps the designer in finalizing their design concept of Northern part of Osaka station. The GIS capabilities in urban design with sketch planning & designing, creating and editing features, simultaneous calculating areas and visualizing in 3D impressively, are utilized for developing the concept of urban development for Northern part of Osaka station based on the Environmental Design Principle as described briefly in Box6 and Box 7. This has thus explored the new horizon of application of GIS for UDSS that made me to choose GIS as an appropriate tool for planning and designing of the Food Green City in Kitakawachi region.

Box 6 : GIS as Analysis, Planning and Design Tool

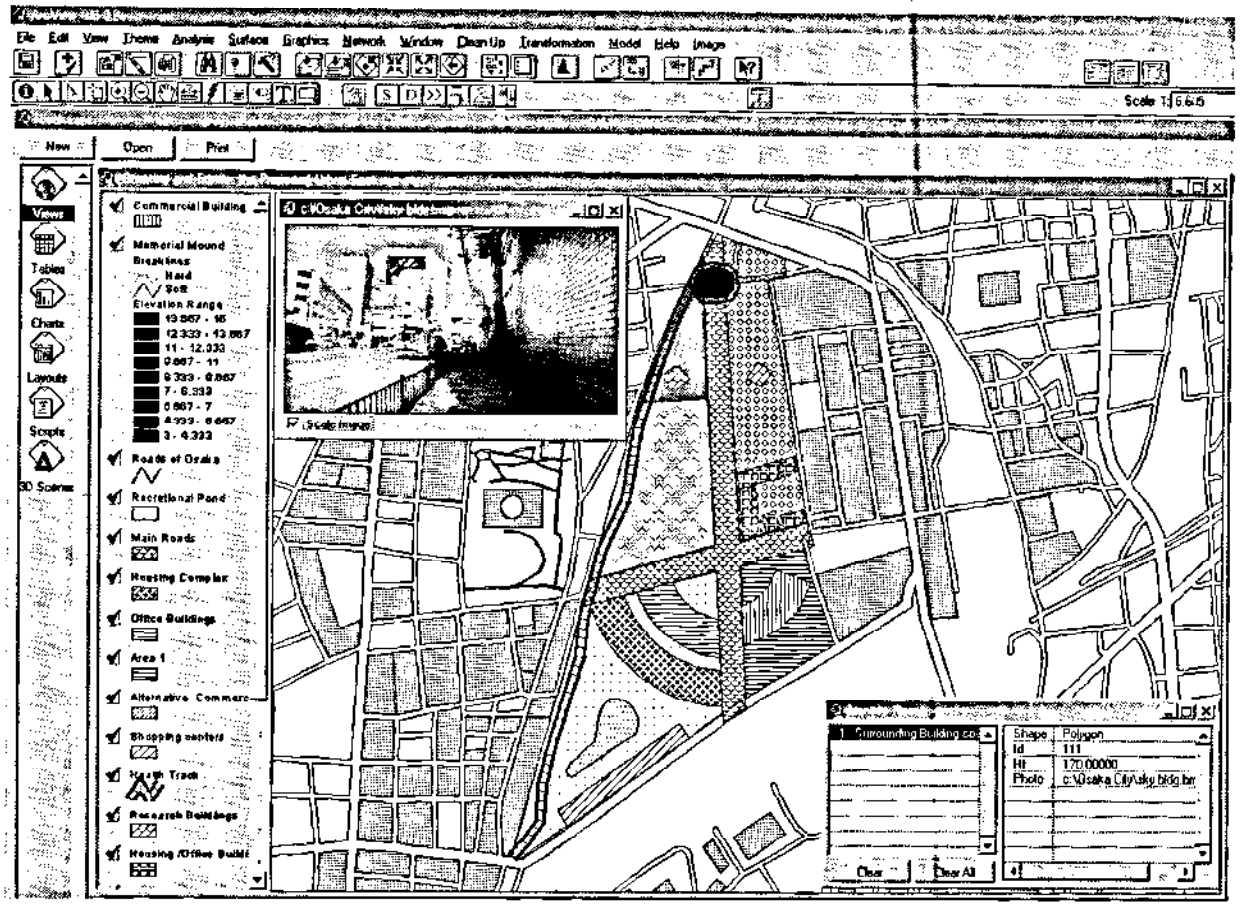


Figure 14. Displaying the hot linked photo and attributes from GIS

GIS provides opportunity to keep the database of all designed features and surrounding features. Photographs can be hot linked and can be displayed in connection with geographically referenced position. Fig.14 demonstrates an example of displaying the hot linked the photograph and attributes of the sky building just clicking the geographically referenced position of the building. This potentiality is very much useful for impressive communication of the design concept to mass public.

Source: Shrestha, S.B and Taniguchi O. **'GIS Aided Concept for the Northern Osaka Station'** *Journal of Osaka Sangyo University Natural Sciences*, No.113 July 2003, p.42.

Box 7: 3D Visualization Using Arc View GIS

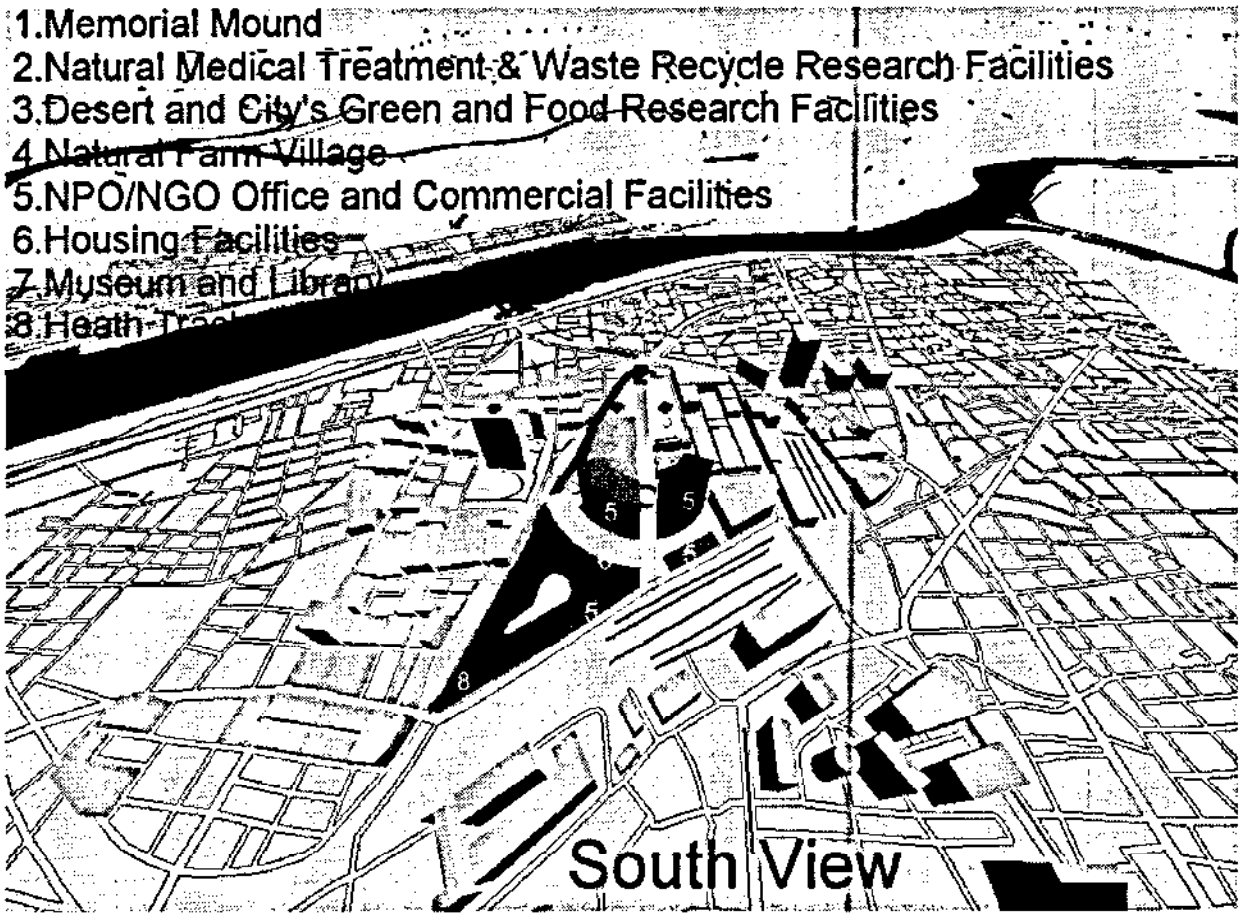


Figure 13. 3D Visualization of Proposed Concept from Arc View GIS (South View)

The ability to quickly visualize design ideas in three dimensions is a vital element in urban design GIS has that 3D Visualization capability as a part of Urban Design support system, which was utilized for the concept design. As shown Figure, the Arc View 3D Analyst is used to create a 3D scene for 3D visualization of the designed elements. The height of designed element is extruded by proposed height just imputing the height in the 3D Properties Dialog Box. For example, the proposed height for the commercial building is 150m. Therefore, 150 are imputed to view the building in 3D. This capability of GIS is utilized for the evaluating many alternatives with different heights by just changing the values of different heights in the Box. This aids to find a suitable height for the proposed building from the urban design point of view to make attractive and good harmony with surrounding environments.

Source: Shrestha, S.B and Taniguchi O. **'GIS Aided Concept for the Northern Osaka Station'** *Journal of Osaka Sangyo University Natural Sciences*, No.113 July 2003, pp.37-38, 42.

Following Holistic and Integrated Approach of study, hereby proposed a Sustainable City Planning Methodology that leads Food Green City as a sustainable city. The schematic diagram of it is shown in Fig.36 below.

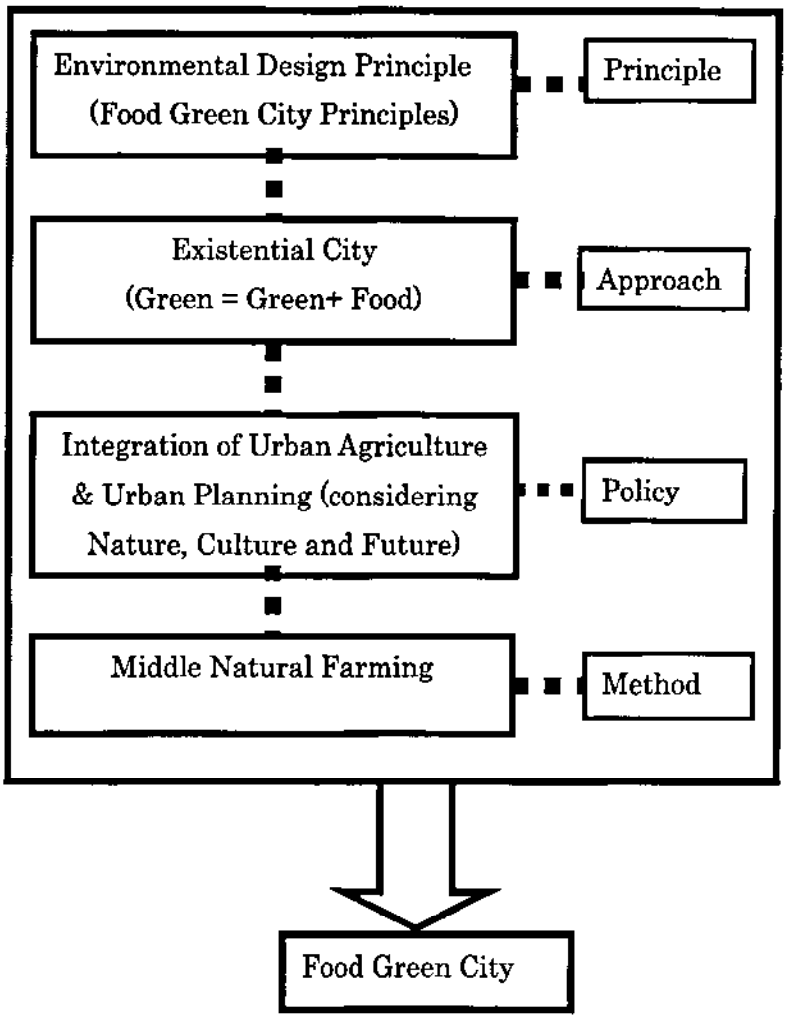


Fig36. Sustainable City Planning Methodology

4.7 Conclusion

The following conclusions can be drawn from this chapter.

1. Food Green City, which follows the new planning methodology layout based on Environmental Design Principle; modeled with concept of Green as Green + Food; adopted the policy for integrating the Urban Agriculture with Urban Planning and designed to implement urban agriculture through the method of Middle Natural Farming, advocates for multifunctional purposes of agricultural activities in urban land to pave the sustainability way.

2. Food has a prominent role in City's Footprint. Food Green City concept thus advocates for decreasing the human impacts on urban environments with shrinking the City's Footprint. It will create a new urban green revolution improving the quality of urban life, convert the carbon dioxide city to carbohydrate city, increase the food self sufficiency rate and balancing physical,

social and ecological structures of cities and direct to follow the path to sustainable life in harmony with nature.

3. Urban Agriculture offers ecological as well as physical and social advantages for urban society. It could be the effective tool for managing the three major problems of city.1) Urban Food (Safety and Self-sufficiency) 2) Urban Poverty 3) Urban Waste and Pollution. The holistic approach which aims at integration of Urban Agriculture with Urban Planning has great potential in contributing for sustainable urban development.

4. Community Based Agriculture Networking (CBA Networking) as an executing mechanism for coordinated agriculture activities in the cities can be an important aspect to build a sense of community and increase the social intercourses and mutual cooperation among the citizens as well as communities.

5. In the context of unequal distribution of population over areas of Japan, alarming rate of decrease of farm lands and primary activities, increasing trend of unemployment rate, occurrence of special demographic phenomenon, increasing food and energy dependency rate on other countries; Food Green City could be a viable solution for the Japanese cities to follow the Green Way toward sustainable cities, food sufficient cities, energy efficient cities and less dependent cities.

6. GIS is a valuable urban planning tool for analysis and urban design support system that helps to evaluate the situation and design accordingly in a holistic manner.

CHAPTER FIVE:
ANALYSIS OF CASE STUDY AREA

"A man-made place, however, is something more than a space with a varying degree of openness..... The character of man-made place is to a high extent determined by its degree of "openness". The solidity or transparency of the boundaries make the space appear isolated or as part of a more comprehensive totality."

(Christian Norberg-Schulz, Genius Loci, Towards a Phenomenology of Architecture, 1980, p.63, 65)

Photo17: A Glimpse of Kitakawachi Region

CHAPTER FIVE:
ANALYSIS OF CASE STUDY AREA

"Nature knows no uniformity, but seeks ever greater variety. Uniformity may therefore be seen as unnatural in the sense that it is an artificial phenomenon."

(N.J. Habraken, SUPPORT: an alternative to mass housing, 1972; pp.21-22)

5.0 Introduction

This chapter explains the existing situation of the seven cities of Kitakawachi based on Comparative City Assessment (CCA) of those cities. The analysis is mainly related with the land uses, demographic characteristic and development indicators. For the analysis GIS has widely used. It also deals with the 3D visualization of existing urban land use model of the Kitakawachi with some constructive comments and highlights the planning vision of Kitakawachi.

5.1 Land uses in Seven Cities of Kitakawachi Region

The GIS Arc View 3.2 software and Pasco Fresh Map 2500 are utilized in the study of the land uses of Kitakawachi region. The land uses study carried out by categorizing the land use of the city in the seven groups. 1. Water bodies (includes ponds, rivers etc) 2. Houses (includes all types of buildings) 3.Green Areas (includes agriculture lands, forests, parks and planted areas) 4. Roads and Railways (includes main roads and railways, tunnel, city roads) 5. Others (includes dam, sandy place, pools, river bank lands and ground) 6.Local circulation roads (local roads inside the residential, commercial and industrial areas) 7. Remaining lands (includes lands that do not fall in other categories). Accordingly, the identified and mapped land uses of those seven cities of the region using GIS are given in the figures (Figs.37-50) below. The aerial photographs are also utilized for land use verification. Photo18 is for instance the aerial photograph of Suminodo station area of Daito city.

The areas of those categorized land uses for all cities are calculated with the help of GIS. Comparative land uses pattern of seven cities have numerically demonstrated by Fig.51. According to the study, the land areas covered by the natural elements like forests and rivers etc. in seven cities can be classified into three groups on the basis of the area coverage as:

1. High area coverage cities (Shijonawate city and Katano city: 40%)
2. Moderate area coverage cities (Hirakata city and Daito city: 10%-20%) and 3. Low area coverage cities (Moriguchi city, Neyagawa city and Kadoma city: less than 5%).

As mentioned in the assumption that there are still a lot of lands that could be able to use for agriculture activities in the cities of Kitakawachi, the lands identified in the category of Remaining Lands are found in consideration percentage as expected. The percentage of Agricultural lands is quite low but there are some residential areas where the practice of agriculture is still going on in small scale as shown in Photo 19.

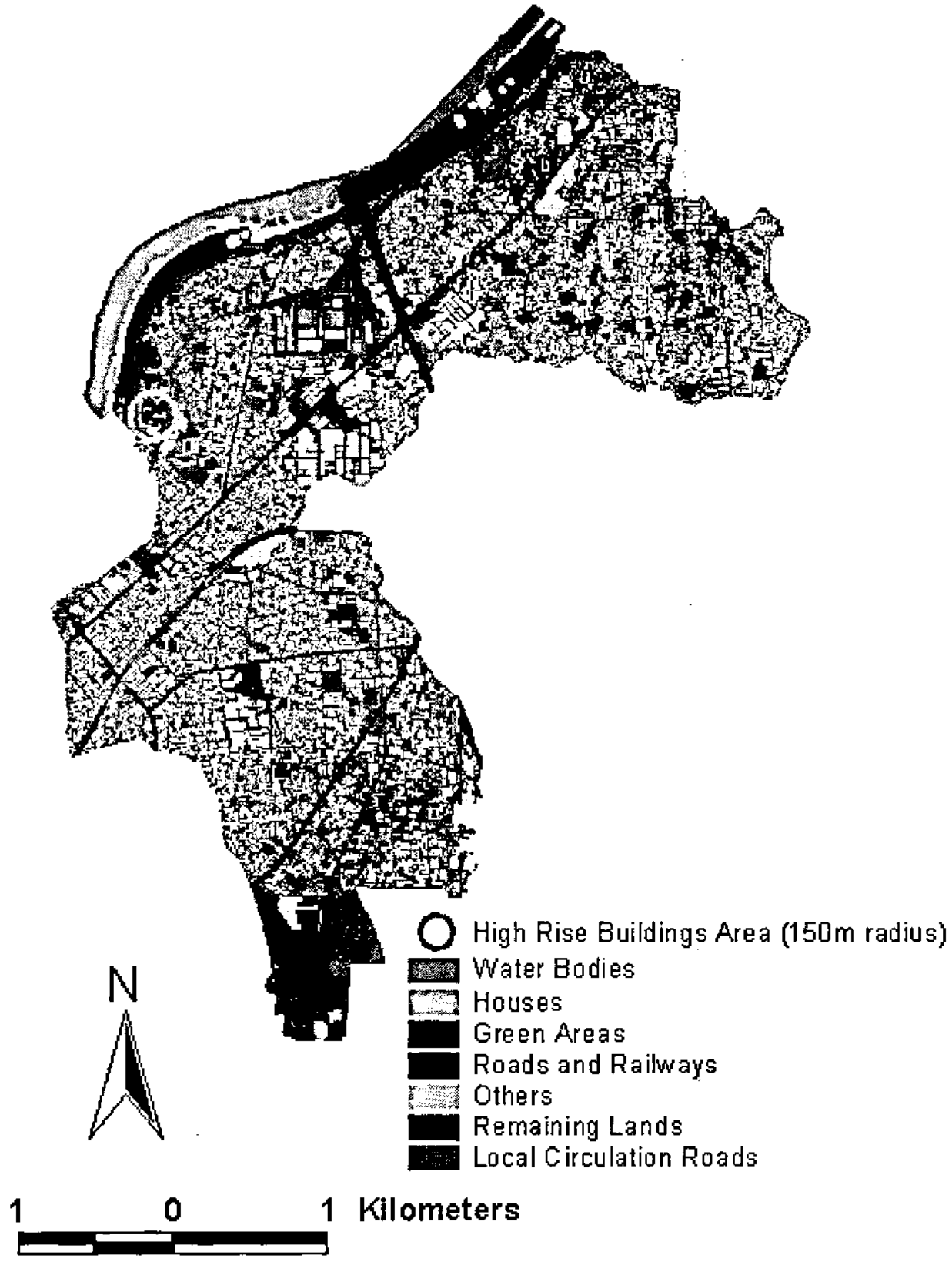


Fig.37: Land uses of Moriguchi City

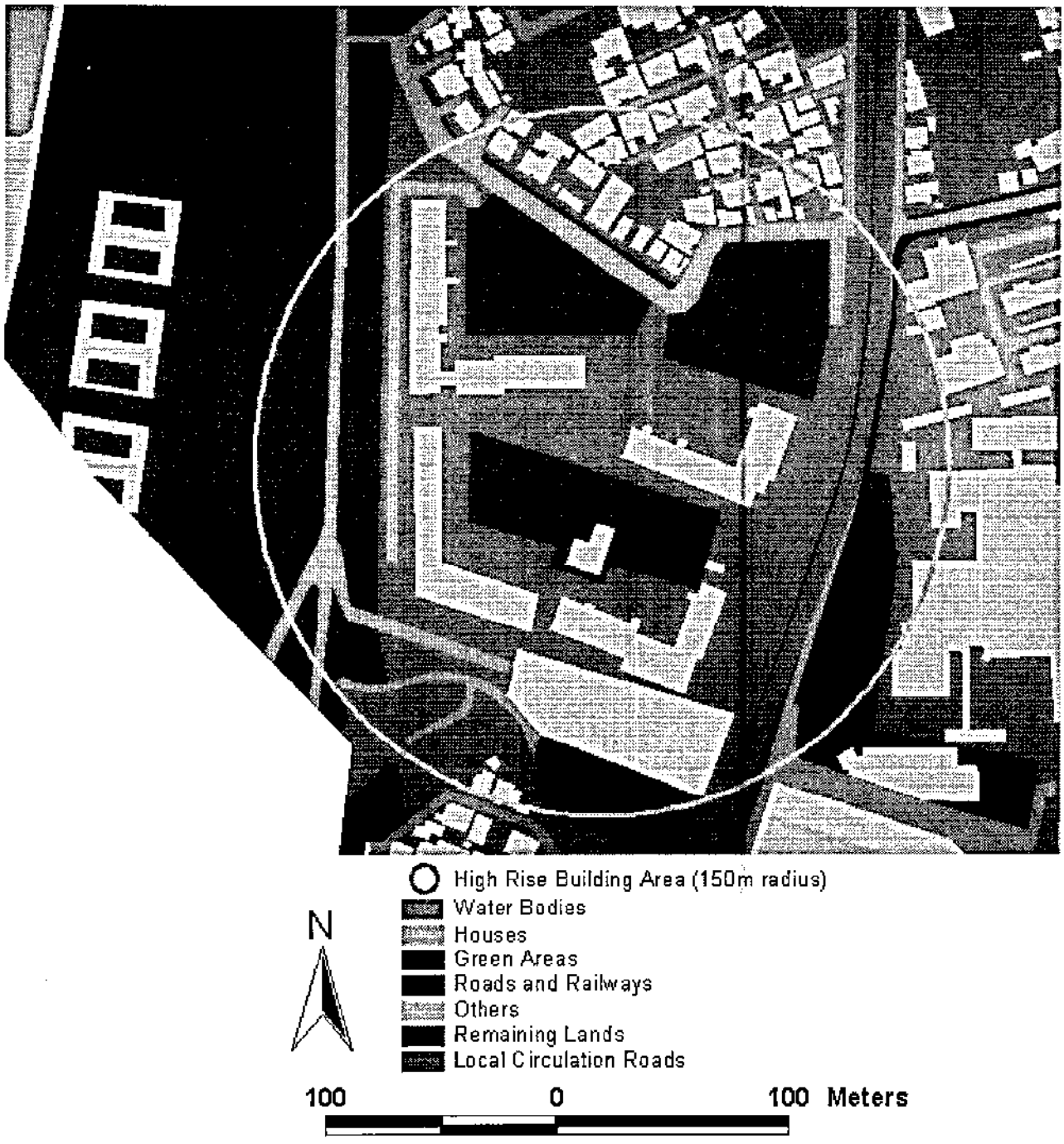


Fig.38: High rise buildings area in Moriguchi City.

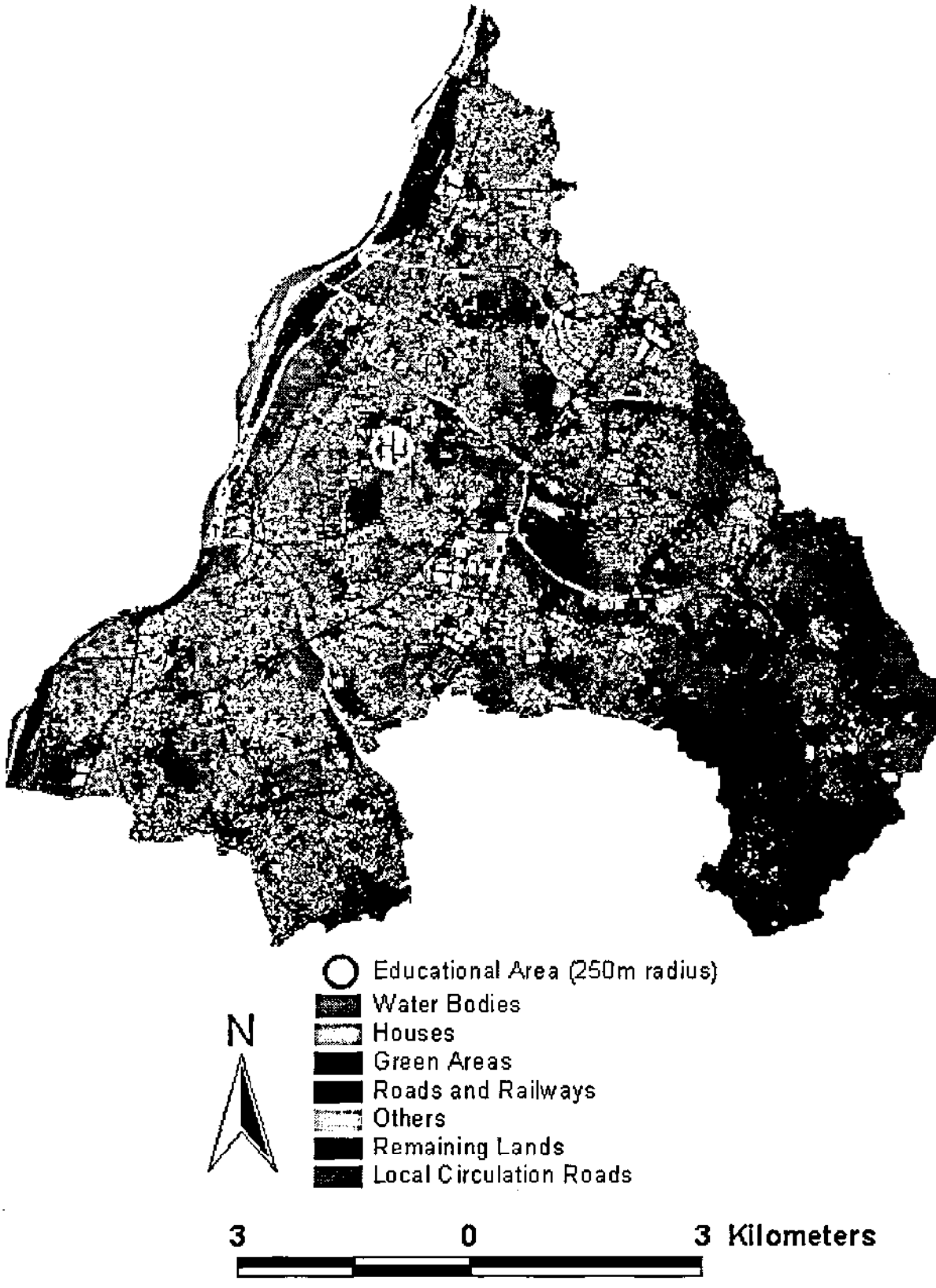


Fig.39: Land uses of Hirakata city

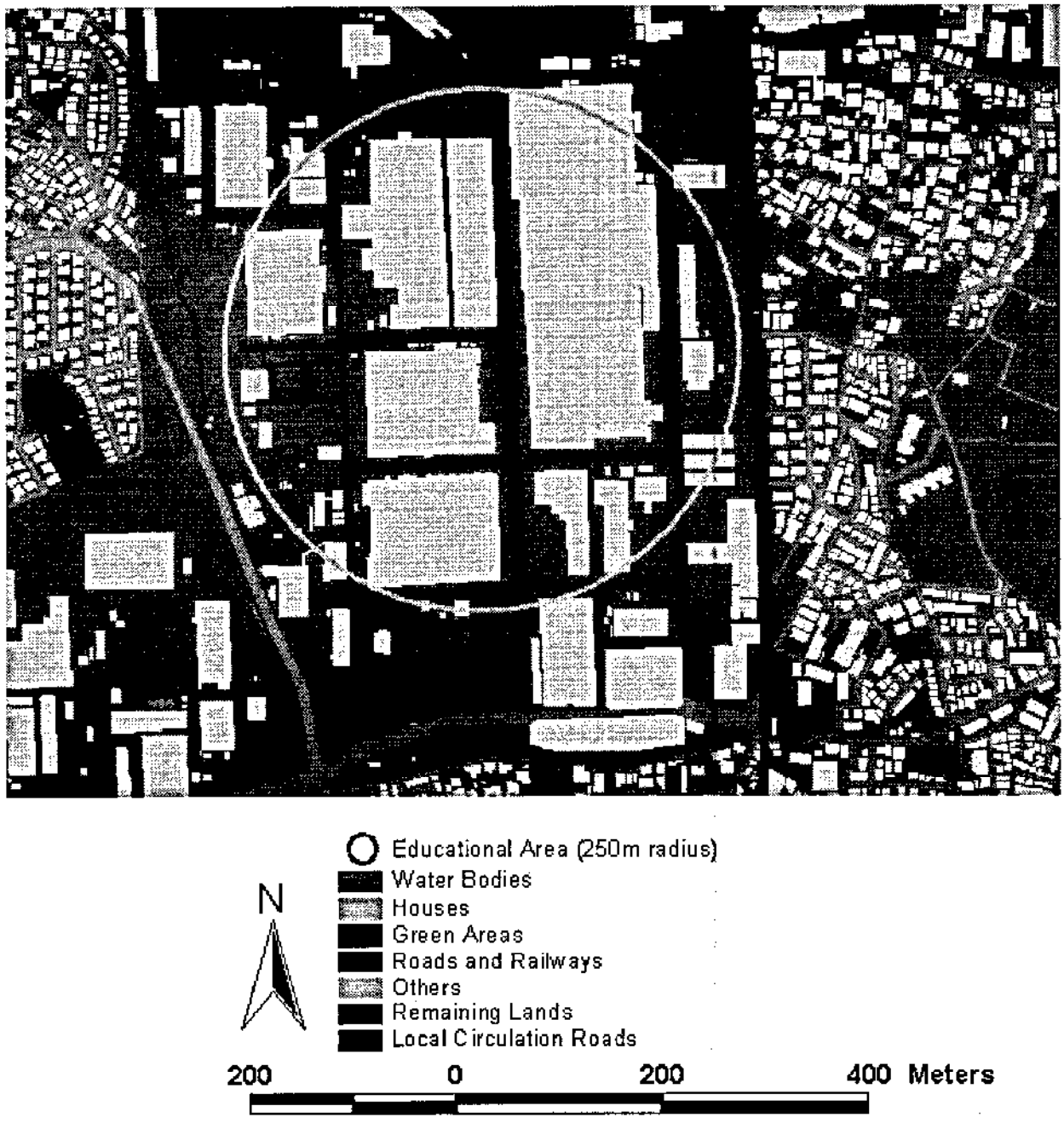


Fig.40: Educational site in Hirakata city

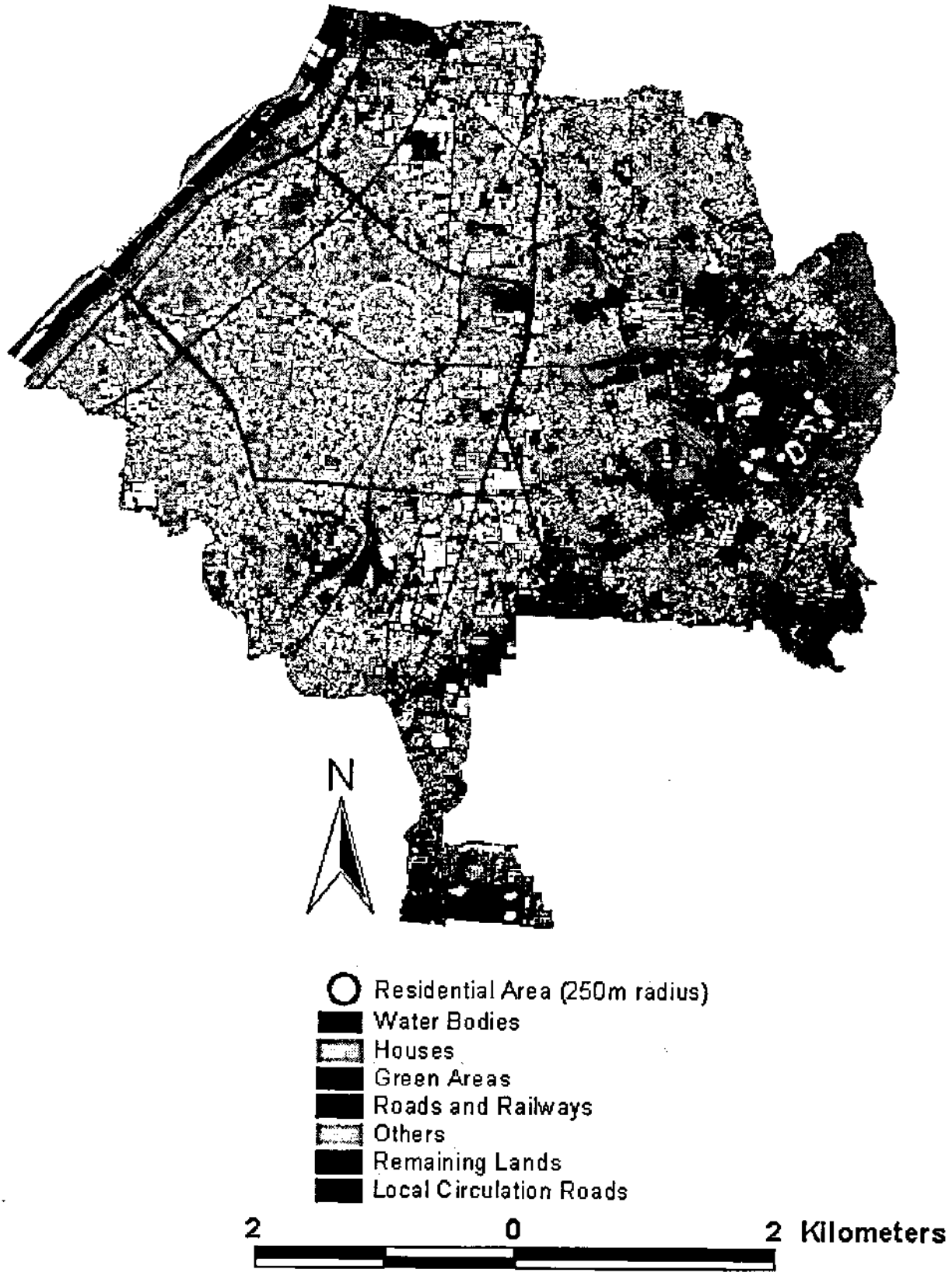


Fig.41: Land uses of Neyagawa city.

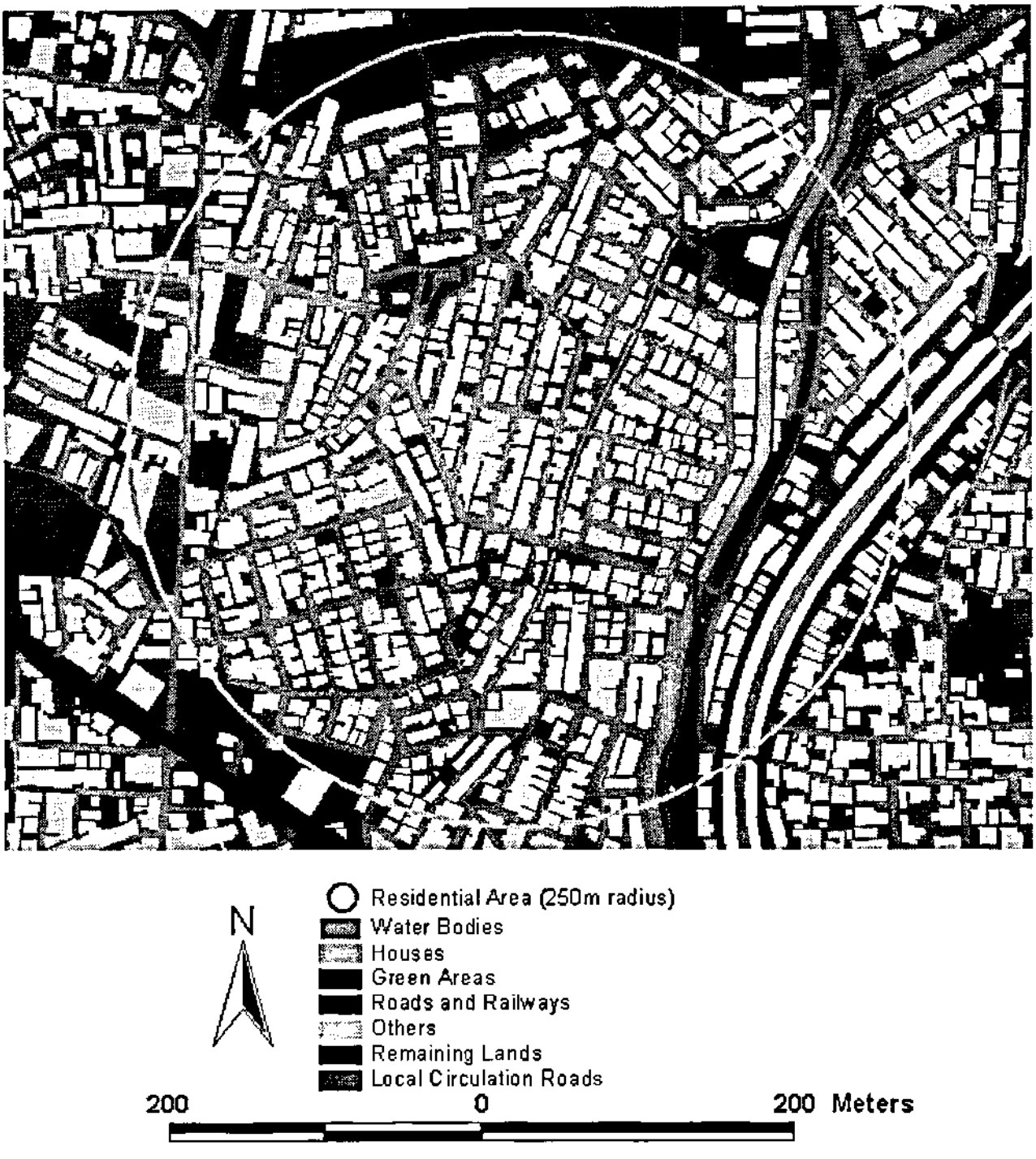


Fig.42: Residential area in Neyagawa city

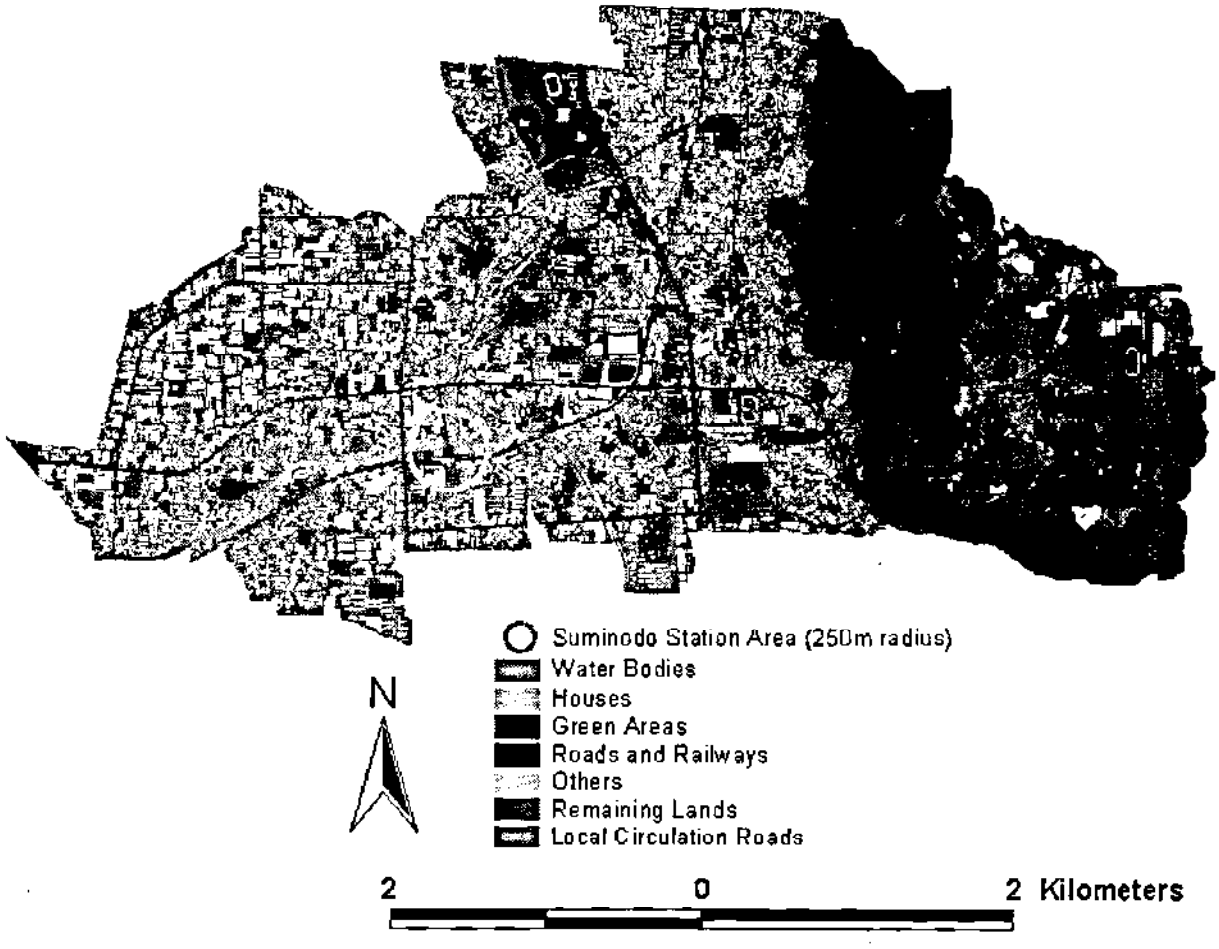


Fig.43: Land uses of Daito city.

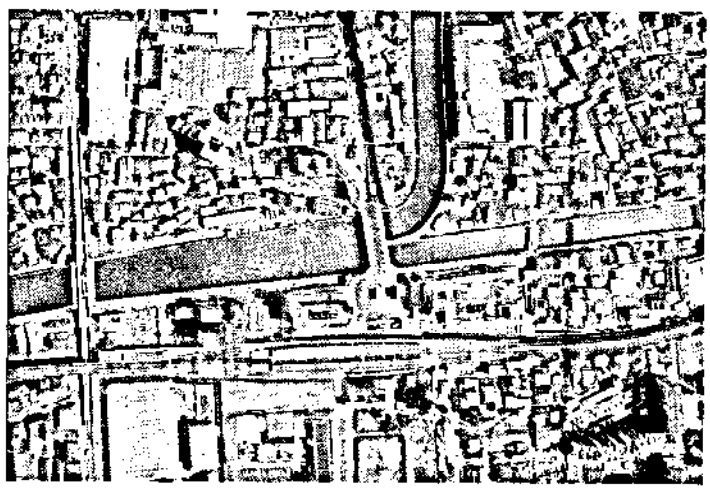


Photo 18: Aerial photograph of Suminodo Station area in Daito City

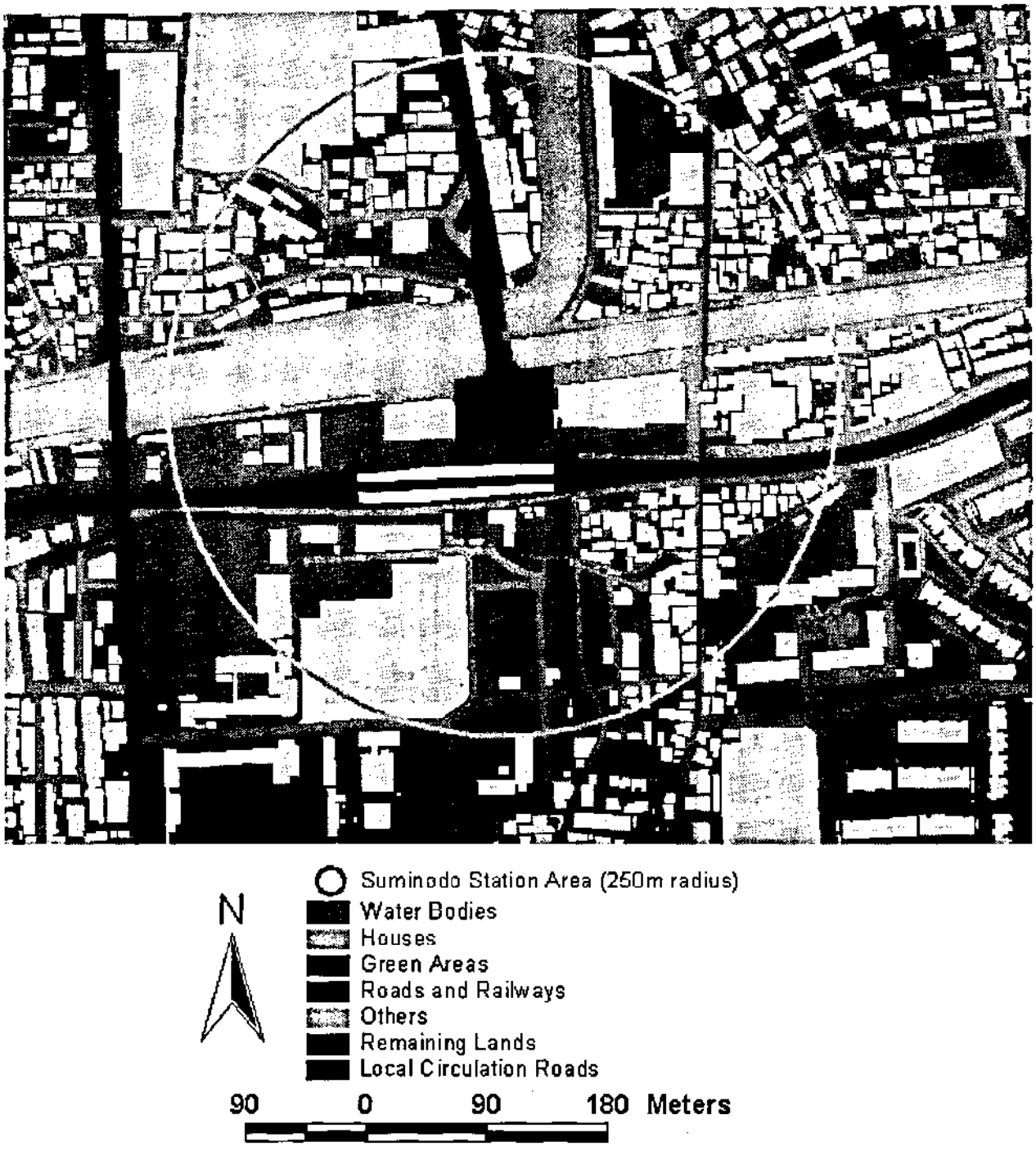


Fig.44: Suminodo Station Area in Daito city.

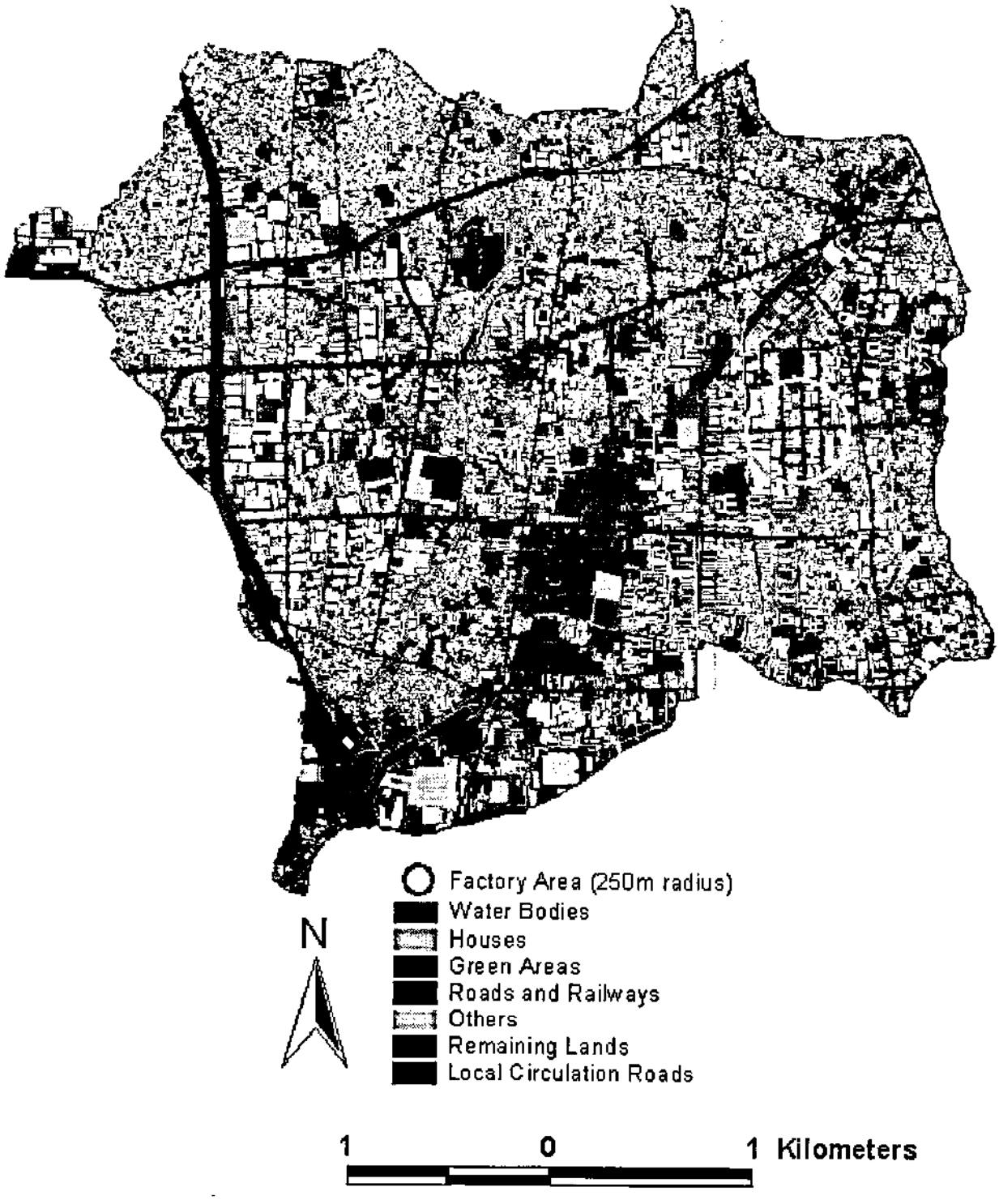


Fig.45: Land uses of Kadoma city.

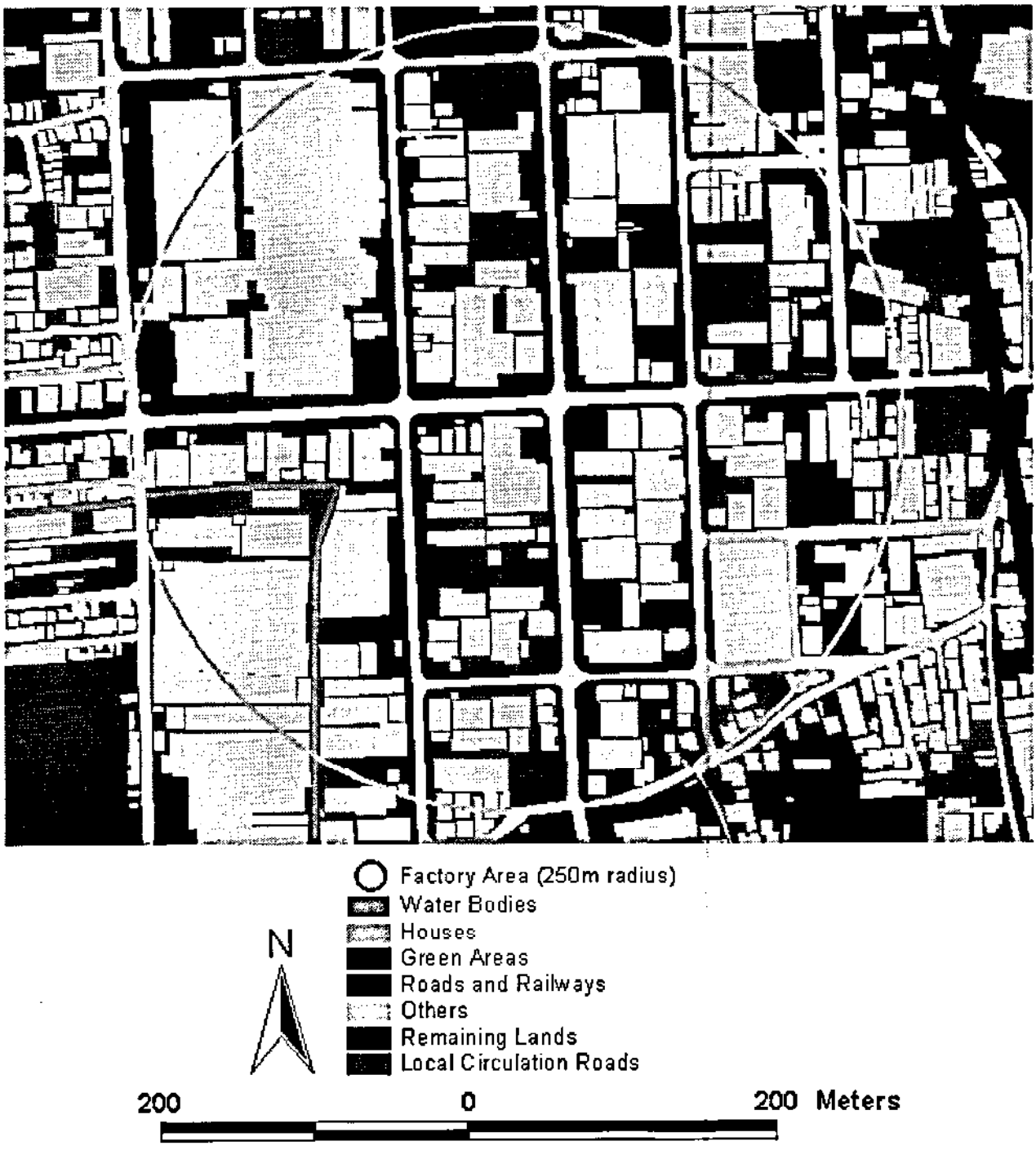


Fig.46: Factory area in Kadoma city.

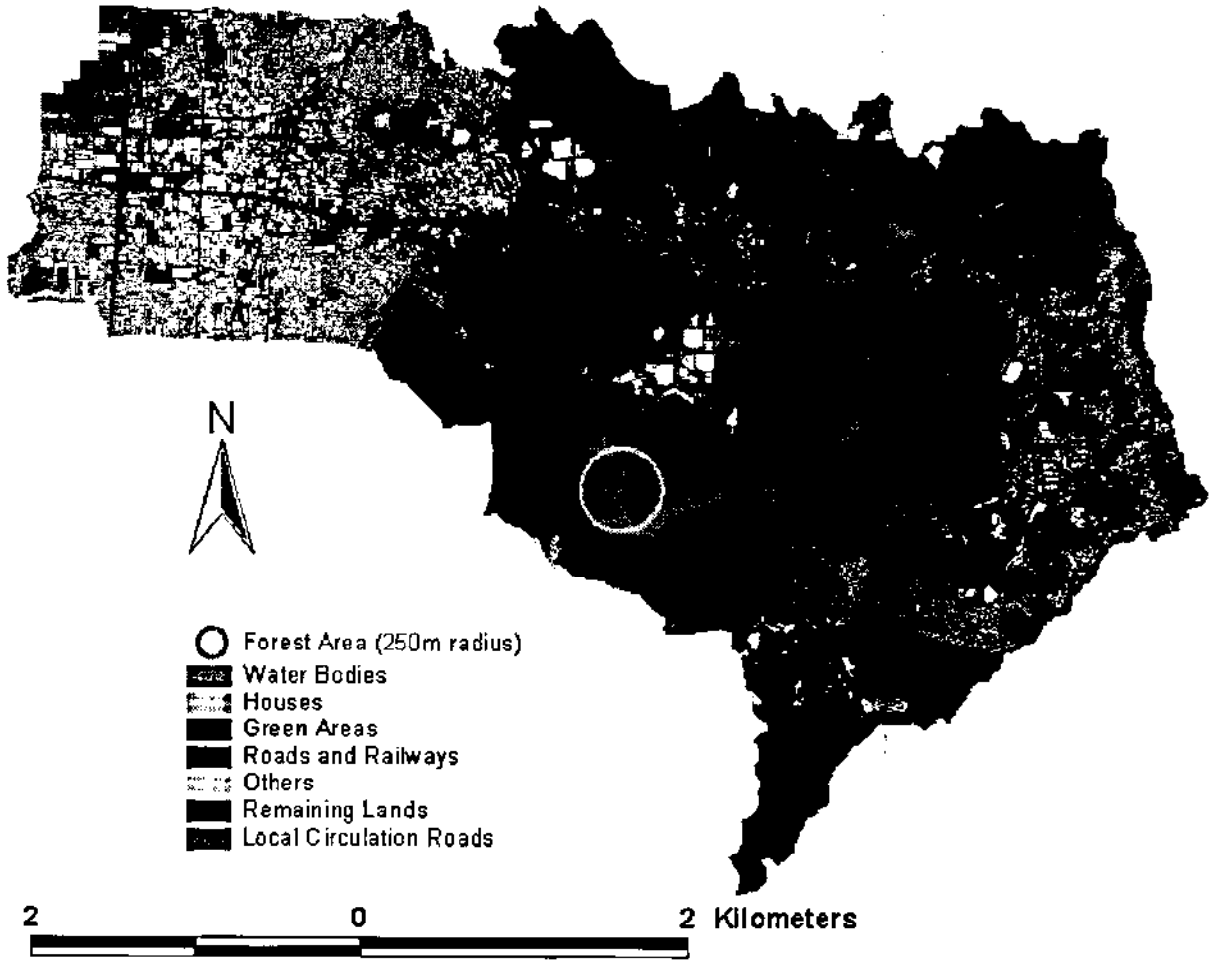


Fig.47: Land uses of Shijonawate city.

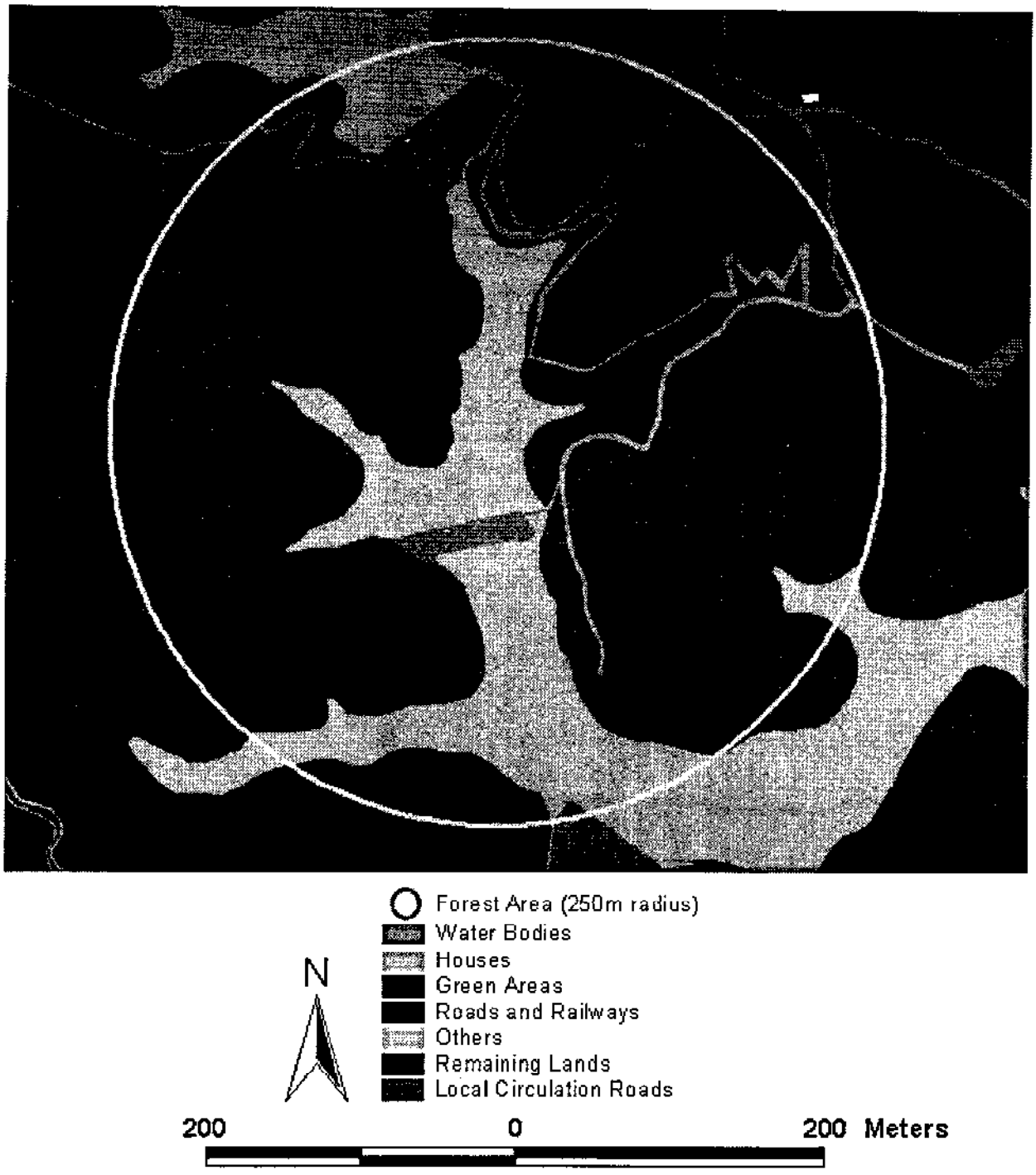


Fig.48: Forest Area in Shijonawate city.

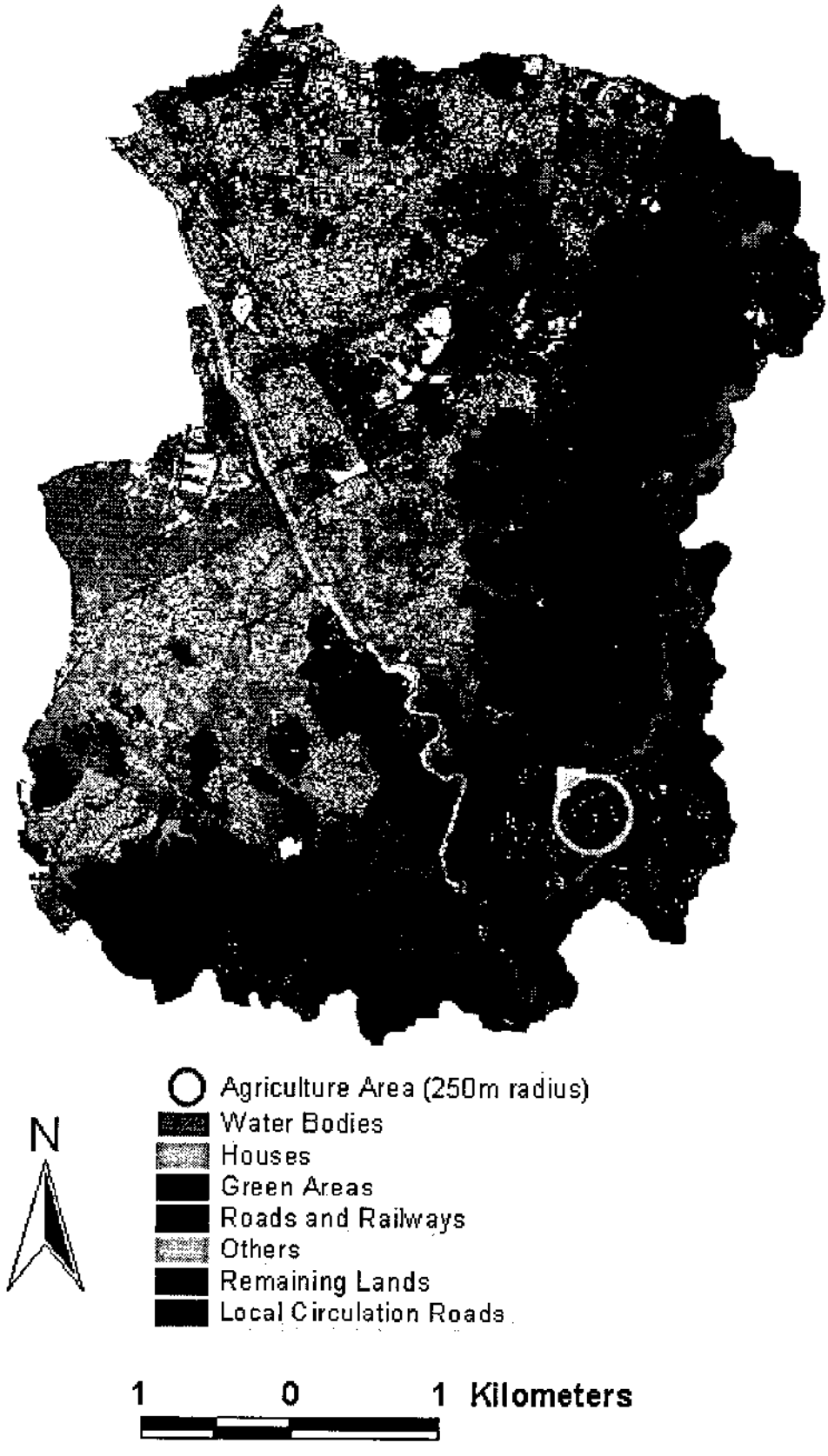


Fig.49: Land uses of Katano city.

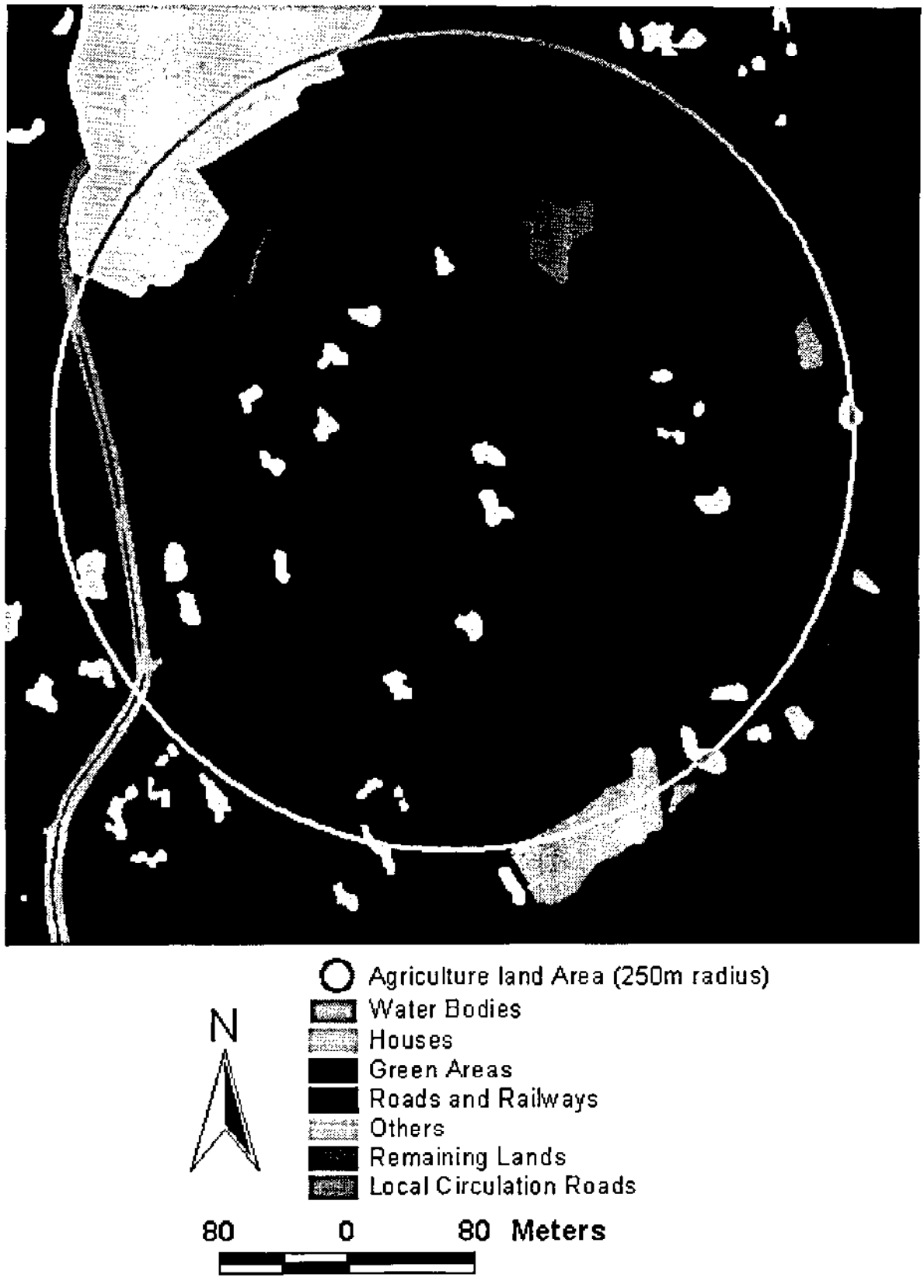


Fig.50: Agriculture area in Katano city.

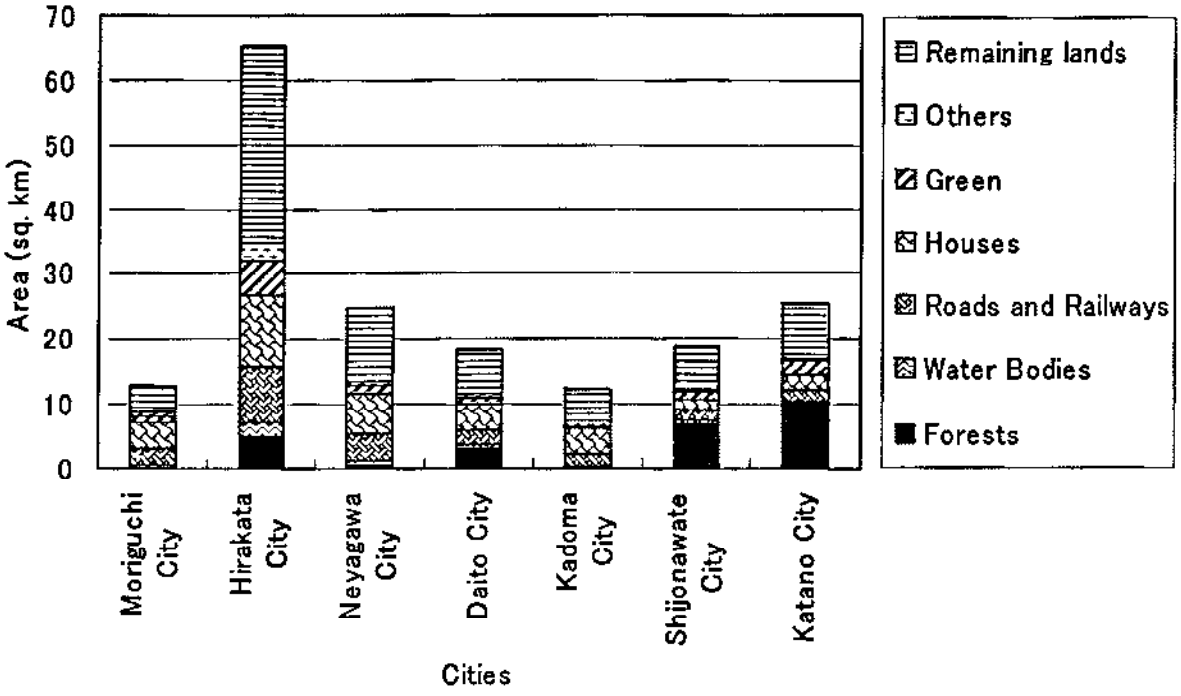


Fig.51: Land uses of seven cities of Kitakawachi.

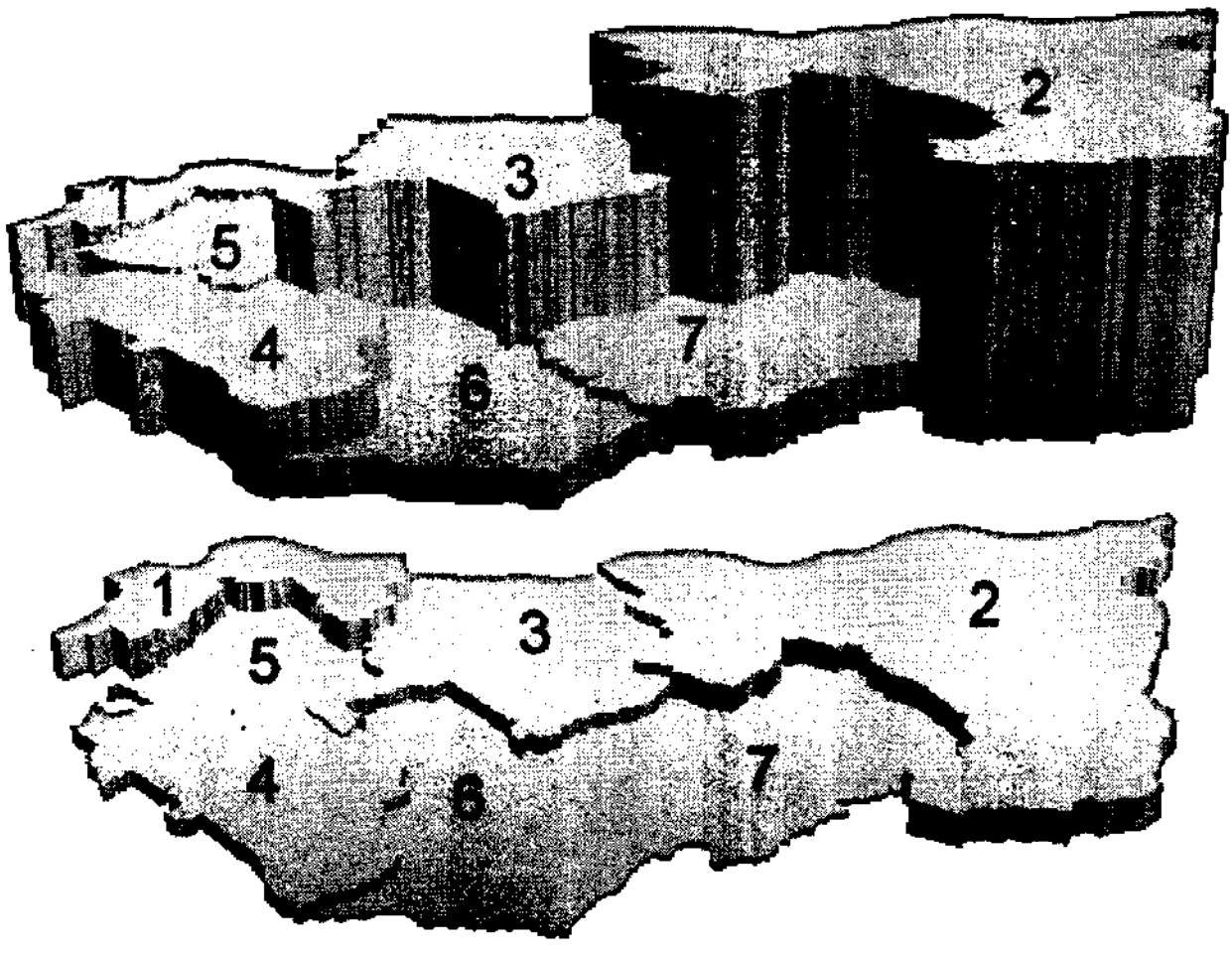
Photo19: Urban Agriculture activities in residential area in Daito city.

5.2 Demographic Characteristics [6]

5.2.1 Introduction

Reliable demographic study of the cities is vital for the land use planning and the provision of facilities & physical infrastructures to the people. This sort of analysis has an important role in planning and designing the city appropriately according to the demographic composition. Therefore, this study has investigated the spatial patterns of distributed population in terms of population density, age structure, sex structure and family structure in Chou (smallest political city boundaries) of seven cities of Kitakawachi region. It has demonstrated how the populations of the cities are distributed with topography and with respect to the train stations. The demographic characteristics of the cities are visualized utilizing Arc View GIS capabilities with new visualizing technique in 3D environment based on data from Pasco Digital Map 2000.

5.2.2 Demographic Visualization and Discussion



1. Moriguchi city 2. Hirakata city 3. Neyagawacity 4. Daito city
5. Kadoma city 6. Shijonawate city 7. Katano city

Population in 1995
Population in 1955

Fig.52: Population dynamics of Kitakawachi region.

5.2.2.1 3D visualization of age structure of seven cities

Fig.52 demonstrates urbanization rate in the Kitakawachi showing the population dynamics within 40 years from 1955 to 1995. Fig.53. exhibits the age structure of the population distributed in seven cities of Kitakawachi in 3D environment by extruding the heights. Age structure of population consists of the ratios of the number of people in three age groups 1) 0-14 years 2) 15-64 years 3) 65 and more years, out of the total population. This has created a new way of visualizing the demographical characteristics with the capability of Arc View 3.2 with extension 3D Analyst. It is observed that there is more or less uniformity in age group composition of total population among the cities of Kitakawachi except slightly higher percentage of old age group in Moriguchi city, being oldest city of the region. The average percentage of 0-14 years, 15-64 years and 65& more years observed in the Kitakawachi are 15.62%, 74.70% and 9.68% respectively. This indicates that working age population is 5% higher and old age population is 5% lower in Kitakawachi in comparison to the national average. Age structure of the population in seven cities is further examined through two indices 1) Dependency ratio and 2) Ageing index. The average dependency ratio (indicator of child population and aging population with respect to working population) and aging index (indicator for the aging population with a lesser number of children) observed in the Kitakawachi region is 33.87 and 61.99 respectively while national average is 43.90 and 91.22. This also indicates comparatively the more working population and less old age population with respect to population under 15 in Kitakawachi than national average of Japan.

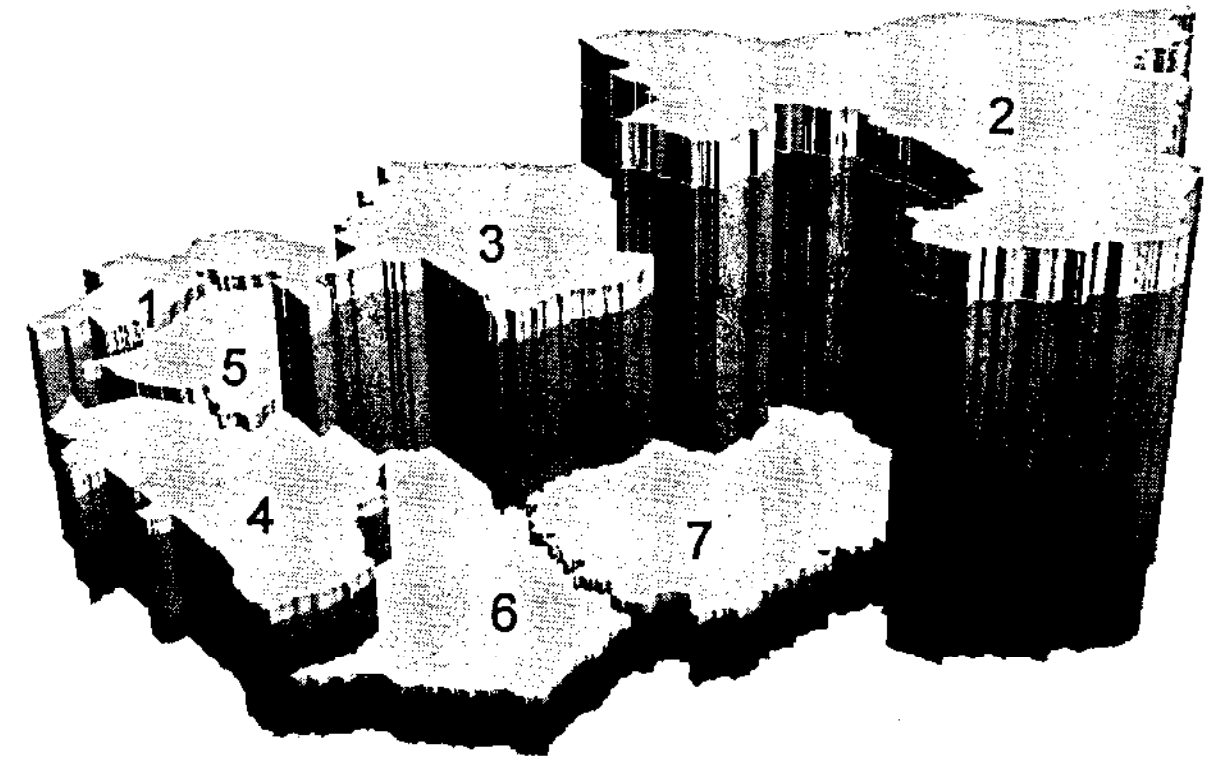


Fig. 53: Visualization of population by age groups

5.2.2.2 Population density by topography

The population density (population/km^2) of Chou in whole Kitakawachi is visualized in Fig.54; distinguishing 3 categories: 1) < 6800 (average population density of Kitakawachi) 2) 6800-10000 3) >10000 (High population density). It is observed that 399, 191 and 528 Chou fall on the respective categories. This means nearly half of the Chou of Kitakawachi has densities more than 10000 population/km^2 (100persons/ha).

In Japan, the lands with more than 300m from sea levels are put in the category of mountain. To investigate population distribution by topography, the study is carried out with the help of contour lines distinguishing into three elevation levels. 1) 0-140m 2) 140m-300m and 3) >300m. It is observed that the land up to 140m from the sea level is more than 80% whereas land which is more than 300m is less than 2% of total area of the Kitakawachi. The elevation in Kitakawachi is observed increasing from west to east, as further illustrated by 140m and 300m contour lines in the Fig.54. The population density in the western part is found high while in the eastern part is low. A typical land use pattern in residential area consisting of private residential houses as well as high rise apartment buildings is as seen in Photo 20.

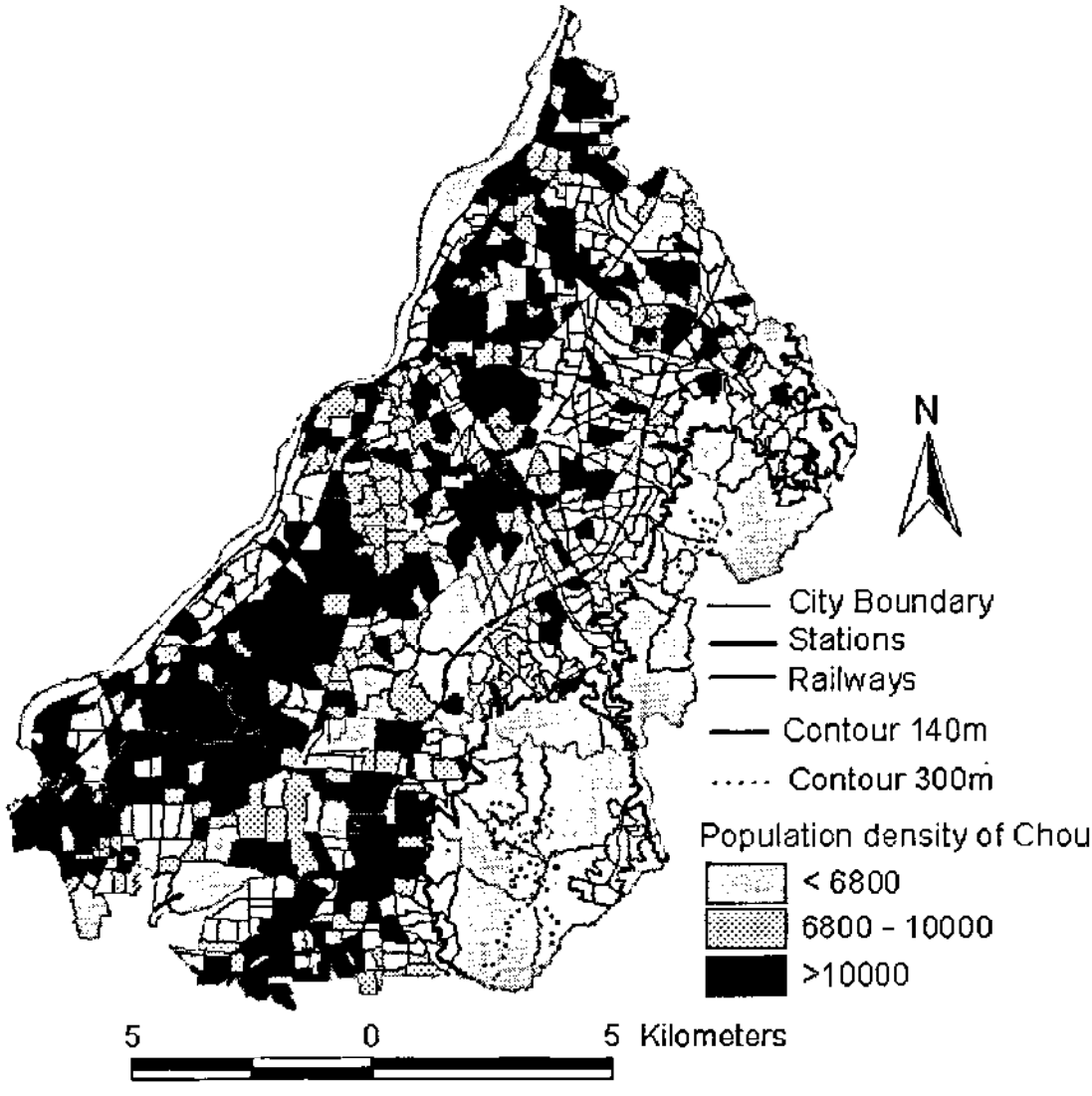


Fig. 54: Population density of Kitakawachi region.

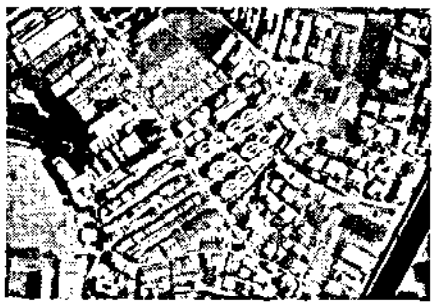


Photo 20: Aerial photograph of residential Area in Daito city.

Photo 21: Glimpse of private residential houses area in Daito city.

Photo 22: Apartment building near to a train station in Daito city.

5.2.2.3 Sex structure and Family structure

For examining the sex structure of Kitakawachi the sex ratio i.e. the ratio of male and female population are calculated. The 1042 Chou of Kitakawachi, which contains data are analyzed for its population sex ratio. The Chou is categorized into three categories depending upon the values of sex ratio as visualized in the Fig.55. The numbers of Chou belongings to the categories 1) <96 2) 96-104 3) >104 are respectively 450, 344 and 248 are observed, indicating imbalanced sex structure in majority of Chou. The average sex ratio of the region is observed as 98.11 while the value in Kadoma city (industrial city and highly urbanized city) is maximum with the value of 101.76 and minimum in Katano city (comparatively less urbanized city) with the value of 95.65.

The family structure is examined by two ways. 1) Average household size 2) Types of households categorized in 5 groups depending upon the number of family members in the households: i) One member family households ii) Two members family households iii) Three members family households iv) Four members family households v) Five or more members family households. Out of total number of households 103214, 99695, 89184, 98561 and 44633 respectively belonging to those categories are investigated as demonstrated in Fig.56. The average household size calculated in the Kitakawachi as 2.76. The increasing popularity of small household size is becoming the reason for additional new housings demands. This has been causing the loss of remaining agricultural lands. A typical example of an approaching residential housing area near to the small remaining agriculture land is shown in Photo 21.

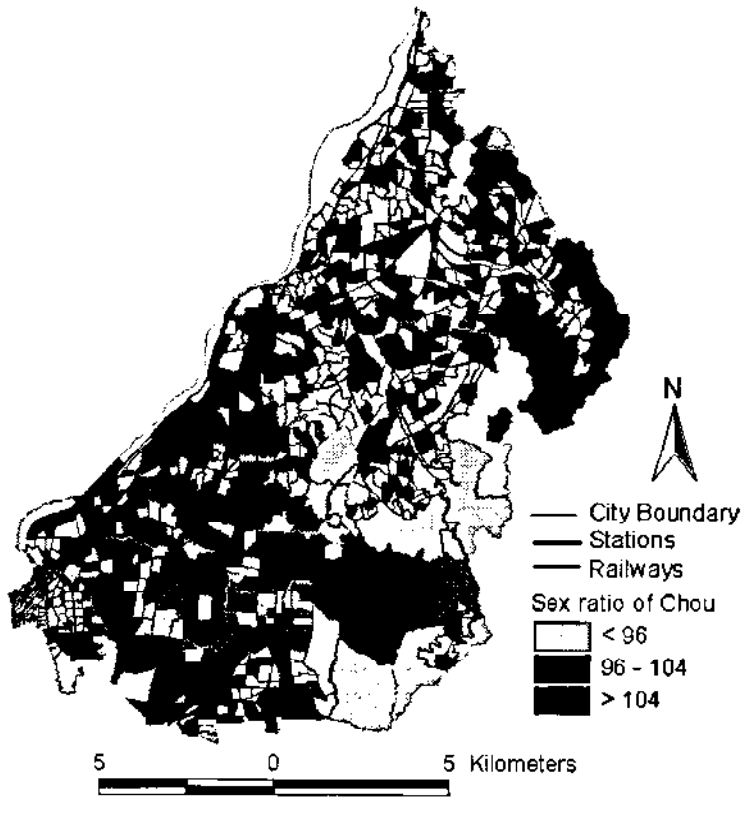


Fig. 55: Sex ratio in Chou of Kitakawachi region.

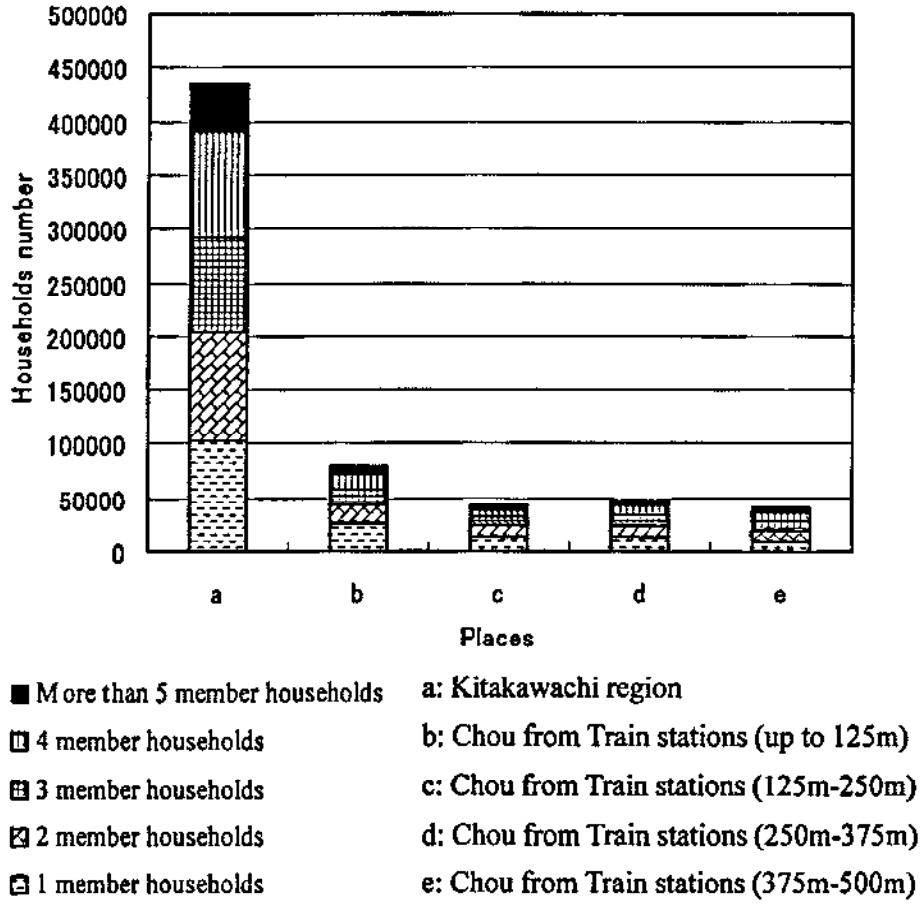


Fig.56: Household size and household number

5.2.2.4 Chou near to the train stations

From the stand point of analyzing, how is the urban demography with respect to train stations? & are there any remarkable differences in demographical characteristics of population living near to the stations and far from the stations?; Chou up to 500m are considered as Chou near to the train stations and these Chou are further classified into four groups: 1) Chou (up to 125m) 2) Chou (125m-250m) 3) Chou (250m-375m) and 4) Chou (375m-500m). There are total 472 Chou identified as near to the total 49 train stations in the region. 181, 101, 100 and 90 Chou are respectively belong to those four classes. Fig.57 illustrates the almost equal level of average population in Kitakawachi region and other groups of Chou near to the train stations but dissimilarity of average population density among them. It points out unequal distribution of population among the Chou and also shows the population density in the Chou near to the stations is higher than average value of the region. Comparatively higher population density noticed in Chou from stations (125m-250m) and Chou from stations (375m-500m).

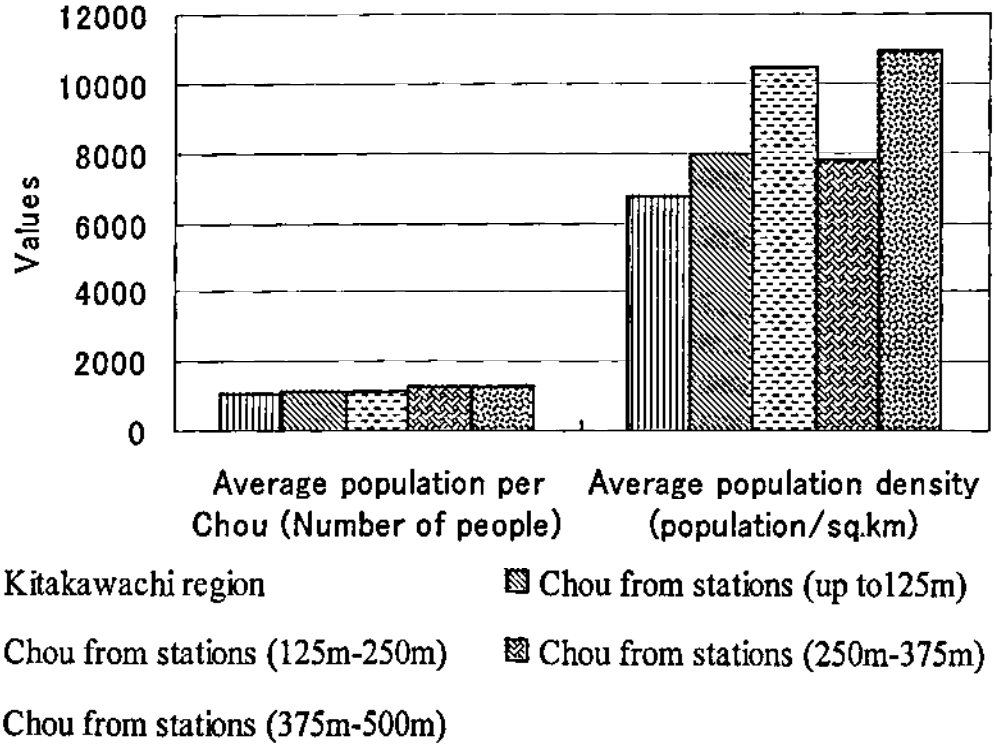


Fig. 57: Comparative population distribution.

Fig.58 shows the comparative demographic characteristics of Japan, Kitakawachi and four classified Chou groups near to the train stations with respect to sex ratio, dependency ratio and aging index. Regarding the sex ratio, there is not any remarkable changes in values, although it seems slightly lower in the Chou from station (up to 125 m) as compare to other groups. The average values for dependency ratio in Kitakawachi and Chou near to the stations are also more or less equal. A notable observation is in the context of aging index in the Chou from the stations (up to 125m) and (125m-250m). The aging index values are observed remarkably high in those Chou, hinting out the larger proportion of the aged population group (65 years old and above) with respect to population under 15 at those Chou. Most of the old age people rarely drive their own vehicles likely to live near the station areas for their traveling conveniences.

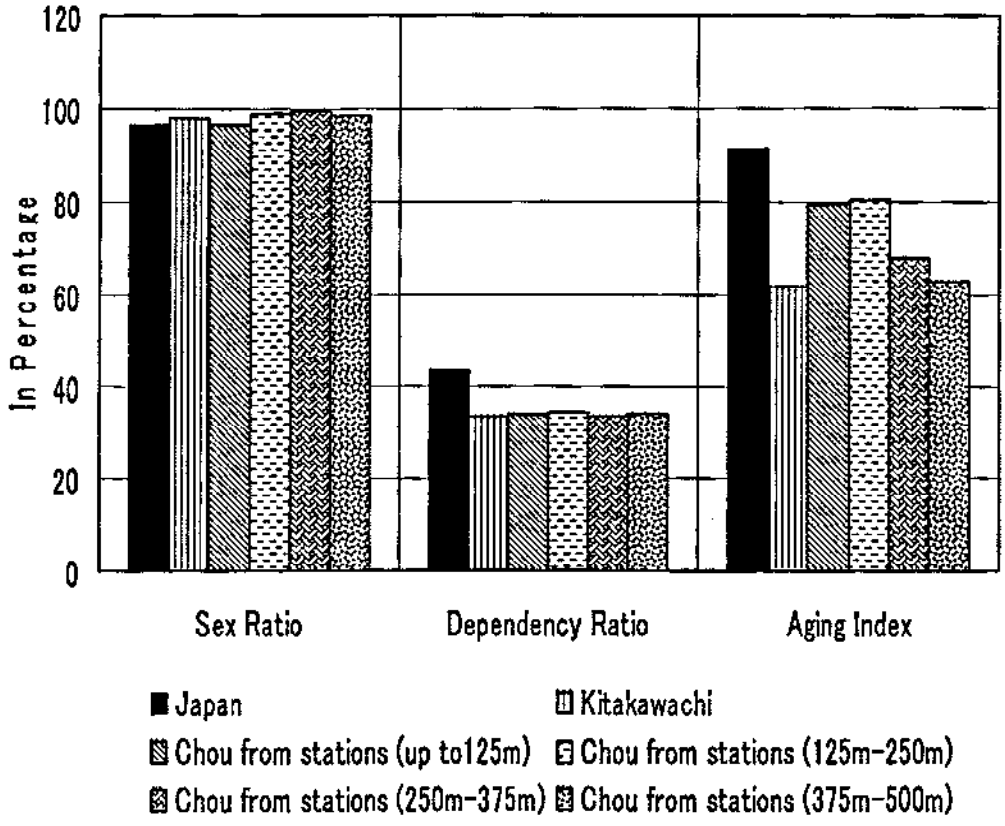


Fig.58: Comparative demographic characteristics.

The large aging index near to the stations has raised the further research curiosity so that old age people's households in Kitakawachi and those classified Chou near to the stations are analyzed, which are tabulated in the Table 4.

Table4: Old age people households

Old age people's Households Category	In total Chou of Kitakawachi	In Chou from stations (up to 125m)	In Chou from stations (125m-250 m)	In Chou from stations (250-375 m)	In Chou from stations (375 m-500m)
Male single	4369	1016	552	603	413
Female single	13781	3358	1845	1823	1266
Total single	18150	4374	2397	2426	1679
Couple	20813	4039	2234	2256	2039

It is noticed that in the Chou near to the stations (up to 125m) and (125m-250m) are found many single households, more by about 7% than the regional average value. Photo 22 shows the newly developed high rise apartment housing near to the train stations as an indicator of demands for housing units near to the stations. The total composition of household sizes in Kitakawachi is presented in the Fig.56.

5.2.3 Conclusions

This study has carried out the investigation of urban demography in Kitakawachi region and visualized in 2D and 3D environment using GIS. It has the following concluding remarks.

1. The demonstration presented in this paper for visualizing the population dynamics of the cities during the period of 40 years and age structure of those cities's population in the 3D environment has opened up the new visualization technique using Arc View 3D Analyst in Demographic analysis.

2. The cities can be grouped into three categories in terms of population density as 1) Highly populated cities (>10000/km^2 or 100/ha e.g. Moriguchi city, Neyagawa city and Kadoma city) 2) Medium populated cities (>5000/km^2 or 50/ha <10000/km^2 or 100/ha e.g. Daito city and Hirakata city) 3) Low populated cities (<5000/km^2 or 50/ha Shijonawate and Katano city) similar as categorized in terms of population trends [46]. But the homogenous demographic characteristics among the cities based on the analysis of sex structure, age structure and family structure observed exhibits demographic similarities among the seven cities of the region as a regional identity.

3. The study has investigated the imbalanced sex structure and population density among the Chou of the region. It has showed the change of population density with topography. The population density of Kitakawachi is found comparatively high with nearly half of the total Chou possessing more than 10000 population/ km^2 or 100/ha. It is observed that old age population is comparatively lower and working age population is higher than average of Japan. The summation of single and two member households constitutes about half of total households number indicates the remarkable existence of fragmented households. This study finds that nearly one fifth of the total one member household belong to the old age people, among them 75% are female, revealing the notable fact of family-less situation for female at their old age as explained in Box 8.

4. The analysis result shows that the concentration of old age (>65 years) people and single family households are found comparatively at higher percentage in those Chou which are near to the train stations. Regarding sex ratio and dependency ratio, more or less homogenous values have been observed at the Chou irrespective to the distance from the train stations.

Box8: Single Female Households in Kitakawachi

It is observed that 9% of the total households and 18% of total single member family households belongs to the old age people. The more interesting investigation is that 75% of total old age people's single member family households belong to female. The percentage of single old age female households out of total single old age people households Chou wisely with three groups: i) □ 50% ii) 51%-75% iii)76%-100% are analyzed. It is noticed that out of 944 Chou containing data, there are 108, 329 and 507 Chou belongings to each group respectively. This shows the majority of Chou possesses remarkably high share of female in single old age people households in Kitakawachi, which is demonstrated in GIS map as Fig.10.

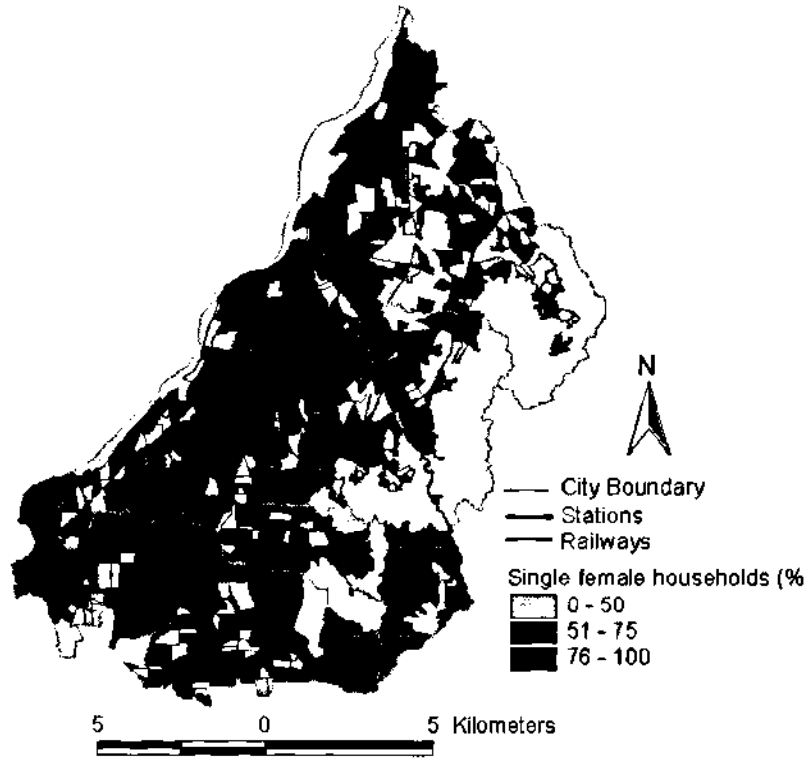


Fig.10. Single female households.

Source: Shrestha, S.B and Taniguchi, O., 2003, "Application of GIS for the Visualization of Urban Demography in Kitakawachi Region, Japan" Proceedings of ACRS 2003 ISRS, Busan, Korea, P.140

5.3 Comparative City Assessment (CCA) based on CDI

There are number of development measurement concepts related to cities. The two most useful urban indices are city product per person giving the economic output of the city and other is City Development index (CDI). The technique used to calculate City Development Index is similar to that used by UNDP for their Human Development Index. The five separate sub-indices for Infrastructure, Waste Management, Health, Education and City Product are combined to form a composite index. Thus, the CDI based on those five sub-indices, which ranges from 0 to 100. It is calculated as according to the formula for the year 1998 in the Table 5 below.

Table 5: Calculating the CDI

Index	Formula
Infrastructure	25xWater connection+25xSewerage+25xElectricity+25xTelephone
Waste	Waste water treatedx50+Formal solid waste disposalx50
Health	(life expectancy-25)x50/60+(32-child mortality)x50/31.92
Education	Literacy x 50+Combined enrolment x 50
Product	(log City product-4.61)x100/5.99
City Development	(Infrastructure index + Waste index + Education index + Health index + City product index)/5

Formula Source: http://www.unhabitat.org/Istanbul+5/116.pdf
Note: In education index formula given in the site is (Literacy x 50+ Combined enrolment x 50) which is corrected as mentioned above.

I have tried to compare the seven cities of Kitakawachi based on assessment of CDI, which is taken as measure of average well being and access to urban facilities by individuals in city level. The City Development Index was developed as a prototype for Habitat II to rank cities according to their level of development. I calculated the approximate CDI values (around 1998 data) based on the available data and try to compare it with the cities of the world as seen in the Fig59. The comparative city development level based on the CDI calculated values shows that the development level of cities is high and can be ranked with world cities having high CDI as shown in Fig.59. On the basis of CDI also these cities can be placed in one group.

Based on the observed CDI values the low urbanized cities of Shijonawate and Katano city of the region are found at comparable status with Singapore and higher level than Seoul. Being the CDI values mainly depends on the infrastructure of the cities and economic growth of the city, it seems not be able to well represent the overall status of the city. Further more it is realized that this indicator can not be useful to measure the sustainable development of the city. Present way of thinking to increase the CDI values can just uplift the development and promotes the urban infrastructures and economic growth. Whereas the proposed Food Green City follows a way to sustainable development within the carrying capacity of supporting ecosystem, rather emphasizing on the big value of CDI. For improving the well beings of the urban lives, it is the approach of sharing the infrastructures and resources unlike increasing the infrastructures and consuming the more resources.

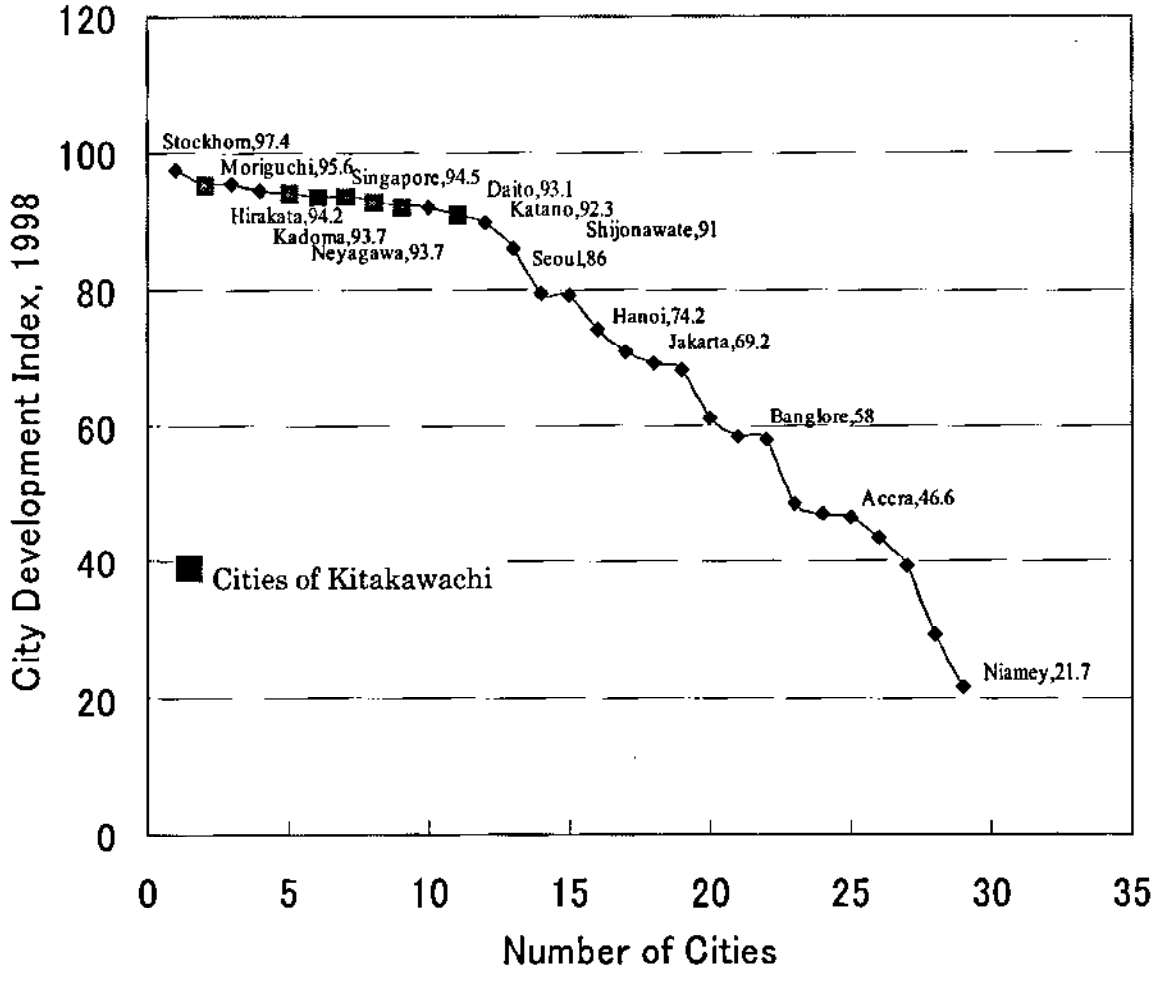


Fig.59: Comparative CDI values cities of Kitakawachi with World other cities

Note: CDI values presented in the graphs for other cities of the world are taken from http://www.unhabitat.org/Istanbul+5/116.pdf

5.4 Study of Wayside Shrines of Cities [4]

5.4.1 Introduction

City is composed of natural and manmade elements. The combination of those elements facilitates the residing people to make happy spiritually and provide comfortable life physically. The growth of those elements may be organic or planned. The Wayside shrines are the human product of many cities of the world to fulfill the spiritual and religious satisfaction of the people. They are covered or uncovered small shrines or stone statues or just pillars to guide the way and found generally connected with Hinduism, Buddhism, Shintoism, Christianism and Confuciasm. A number of researchers have mentioned in their studies about the Wayside shrines found in different cities of Japan e.g. in Osaka city by Murakami (1993)[35], in Kyoto by Takeuchi, et.al (1999)[47] and in seven cities of Kitakawachi by Hamada and Taniguchi (2001)[18].

What are the spatial characters and pattern of distributed Wayside shrines? Are they

functioning well in the present urban society of this secular world? In what ways do they interlink with the human culture and urban development? Answers to these questions are very important bases for urban planning to plan a well socio-culturally function city to facilitate the urban lives. The research was therefore carried out in Kawachinagano city, the southern part of Osaka prefecture using the GIS tool.

5.4.2 Objective

The main objective of this study is to evaluate the characteristics and spatial distribution pattern of Wayside shrines in the urban space using GIS. Thus, it has the following two specific objectives of the study:

1. Building the Geographic Information Database System of Wayside shrines and

2. Conducting attribute, location and pattern analysis of spatially distributed Wayside shrines with environmental design perspective i.e. their triangular relationship with People, Natural Environment and Manmade Environment as demonstrated in Fig.60.

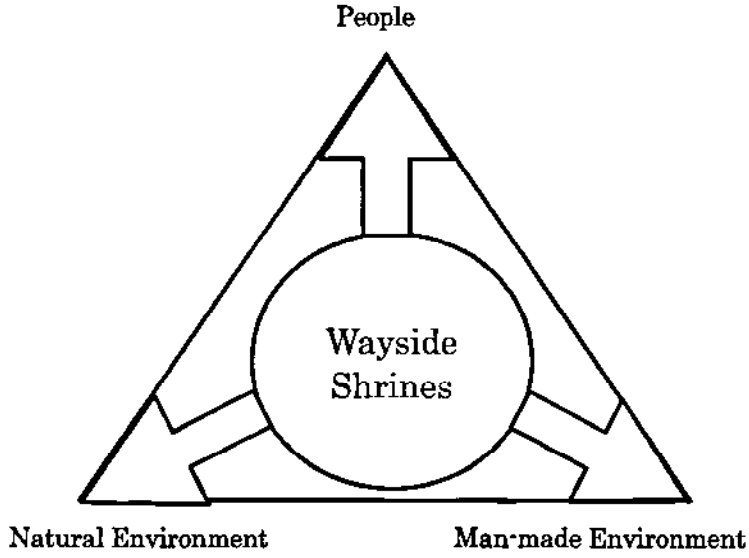


Fig.60: Schematic Diagram of Study

5.4.3 Conclusions of the Study

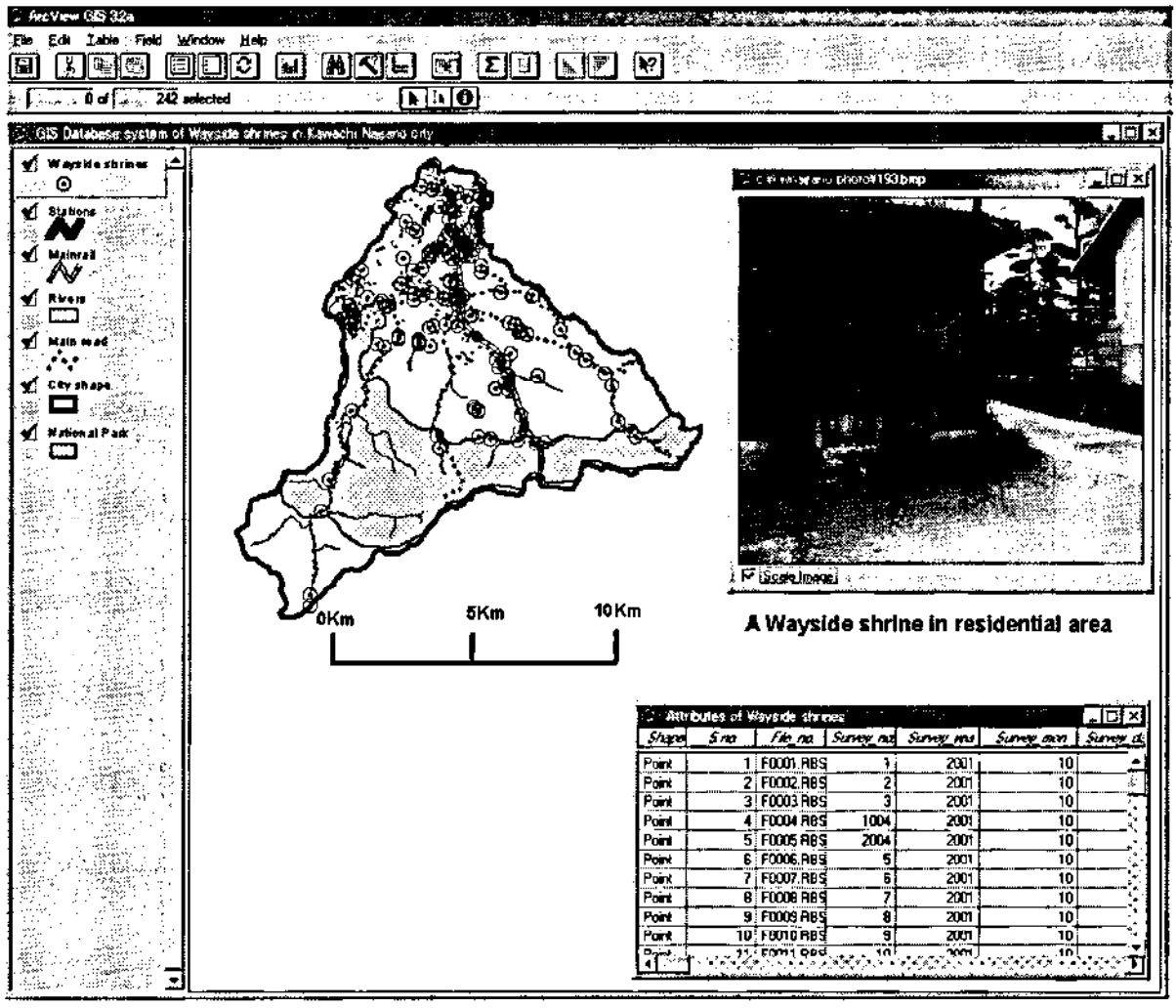


Fig.61: Geographic Information Database System (GIDS) of Wayside shrines

Geographic Information Database System (GIDS) of 242 identified Wayside shrines (photographs of some of which are shown in Photo23, distributed in the city was prepared as shown in Fig.61, using GIS interlinking spatial position with attributes based on the surveyed data and photographs. This study uses then GIS capability and performed the three types of analysis: 1) Attribute analysis 2) Location Analysis and 3) Spatial Analysis. Following are the conclusion of the study:

1. Wayside shrines are found as religious and cultural identity in neighborhood complementary to the major religious places, place of social values, attachments and beliefs as well as spiritual heart of the urban neighborhood. In one hand, some losses of Wayside shrines hints out negative impact of urbanization while in other hand, dedication of flowers and water noticed in most of them demonstrate the people's affections and beliefs towards them even in this modern urban society. The observations of Wayside shrines established at some meaningful locations possessing connection with various activities of people, support some statements of common beliefs of people and prove that they are still alive in this 21st century's secular society.

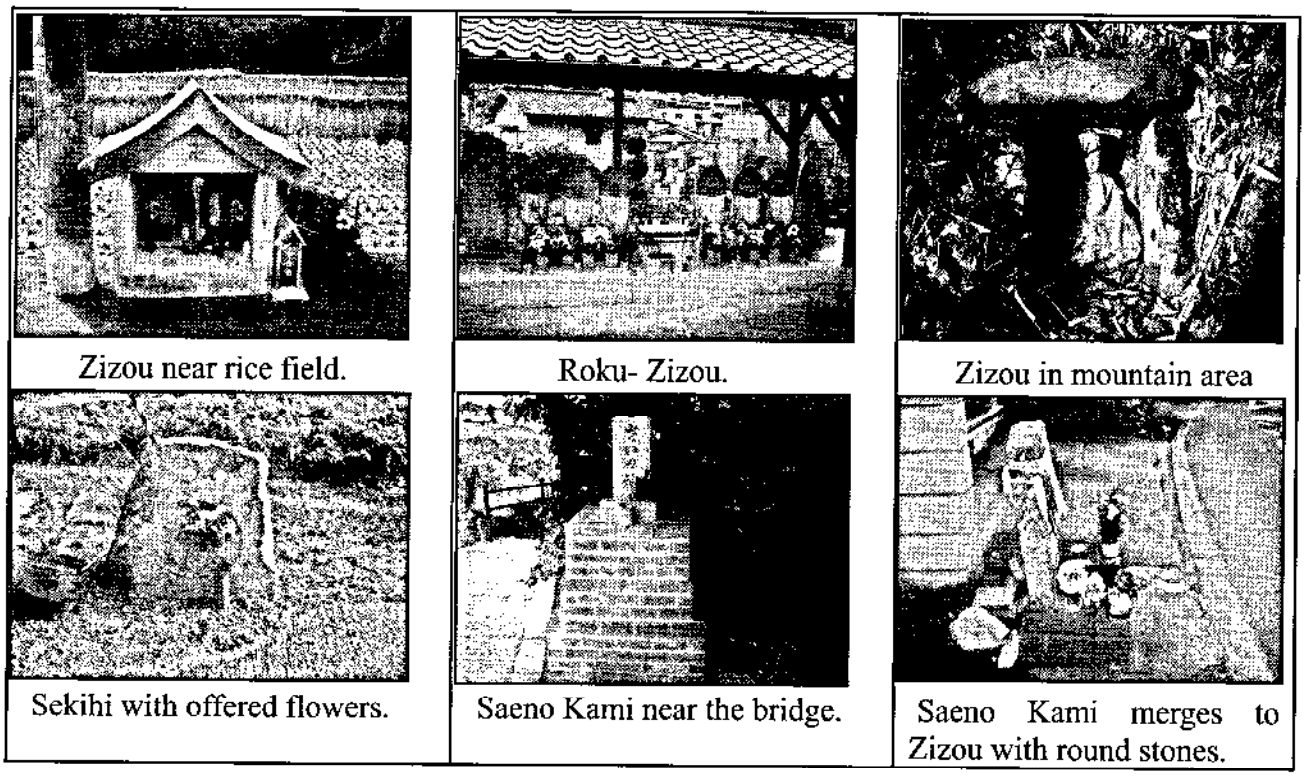


Photo 23: Different types of Wayside shrines

2. Two major currents of religion of Japan, Buddhism and Shintoism are found reflected on Wayside shrines. Attribute analysis reveals that they are connected with those two major religions; following some of their specific characteristics regarding food offerings, building structures, locations, installation situation, internal attached things and external attached things. Thus, they can be classified into three classes as 1) Wayside shrines connected with Shintoism 2) Wayside Shrines connected with Buddhism and 3) Others. The theological perception of people as 'god is everywhere' representing symbolically the god as idols, stones, trees, mirrors are found largely used in such Wayside shrines.

3. The merging practice of Saeno Kami into Ozizou san and presence of comparatively large number of Wayside shrines connected with Buddhism investigated from this research indicates the popularity of Buddhism in the city. The presence of Kami in the temples indicates the religious harmony and also demonstrates a good example of process of transformation of old religious system to new.

4. The distribution of Wayside shrines in the city is not result of random process. The notice of linear agglomeration of Wayside shrines in old settlement areas along old route to important religious places realizes the Wayside shrines as a positive indicator of the old human settlements and explains the growth of old human settlement along the route due to the religious factors.
5. The construction materials used are mainly stone for foundation, wood for body and metal for roof in various building styles, sizes and shapes. In general, the height of body is nearly doubled the height of roof and Ketayuki is slightly greater than Harima. The height of foundation of Kami is comparatively higher than Zizou

6. The average nearest neighbor distance of Wayside shrines is found as 123m which is just the walking distance of 2-3 minutes, thus indicating in average less interacting urban space and smaller

size of neighborhood of the city.

7. The GIDS of Wayside shrines prepared from this study will provide the information about the Wayside shrines of the city and enable city officers to manage, repair and monitor them. Also it helps to city planner, the manipulator of physical environment, for the decision supports in new urban interventions without damaging the existing such important identity of urban neighborhood.

5.4.4 Preparation of Distribution Map of the Wayside shrines in Kitakawachi

The two things are realized from the study of the distributed Wayside shrines in the Kawachinagano city that has great implication in planning. 1) Wayside shrines have the meaningful distribution 2) People still believes on Wayside shrines and they are the means for providing spiritual and religious satisfaction to the people. These two realizations direct to incorporate such Wayside shrines in city planning and design believing that it could make the neighborhood more livable. It is also a good means to develop the cultural society without necessary much legal acts to regulate the society. Thus, distribution map of 459[18] Wayside shrines in Kitakawachi was prepared utilizing the secondary data as shown in Fig.62 and Wayside shrines numerical status is graphed in Fig. 63.

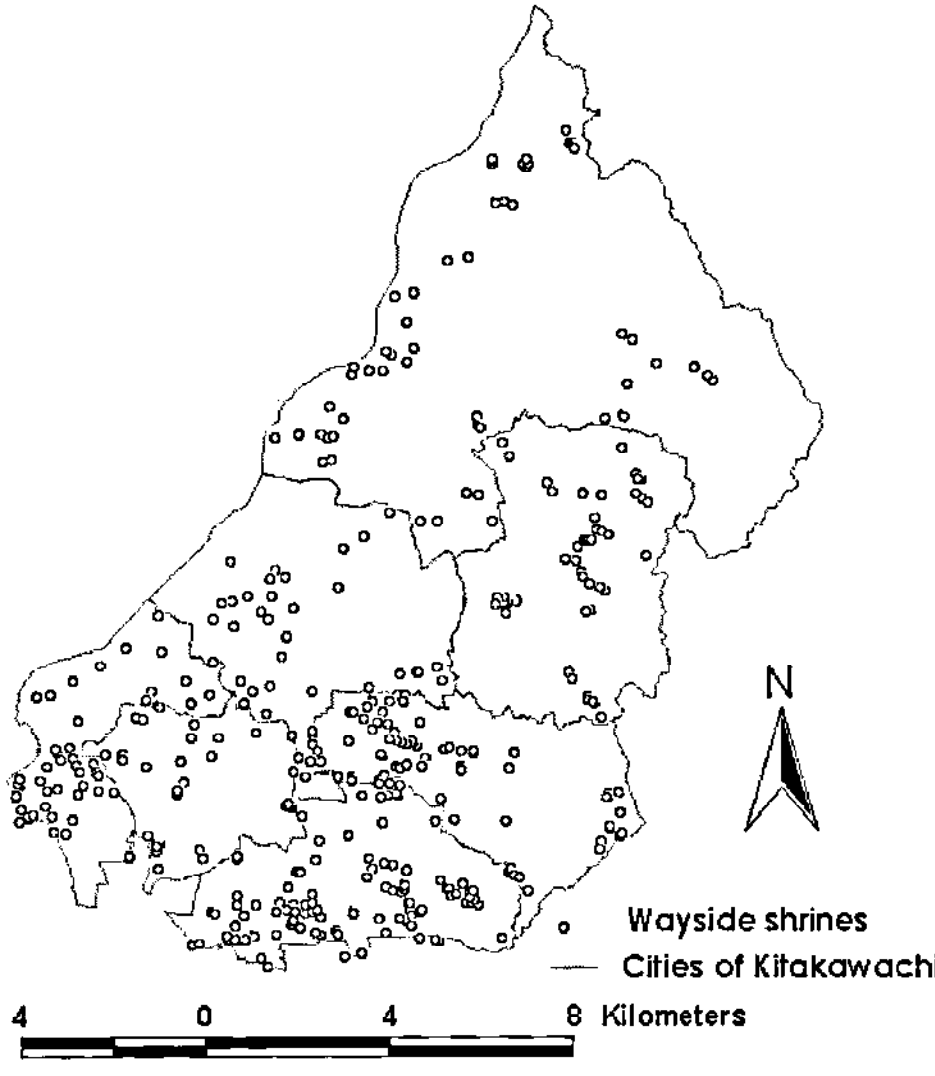


Fig.62: Distribution of Wayside shrines in Kitakawachi

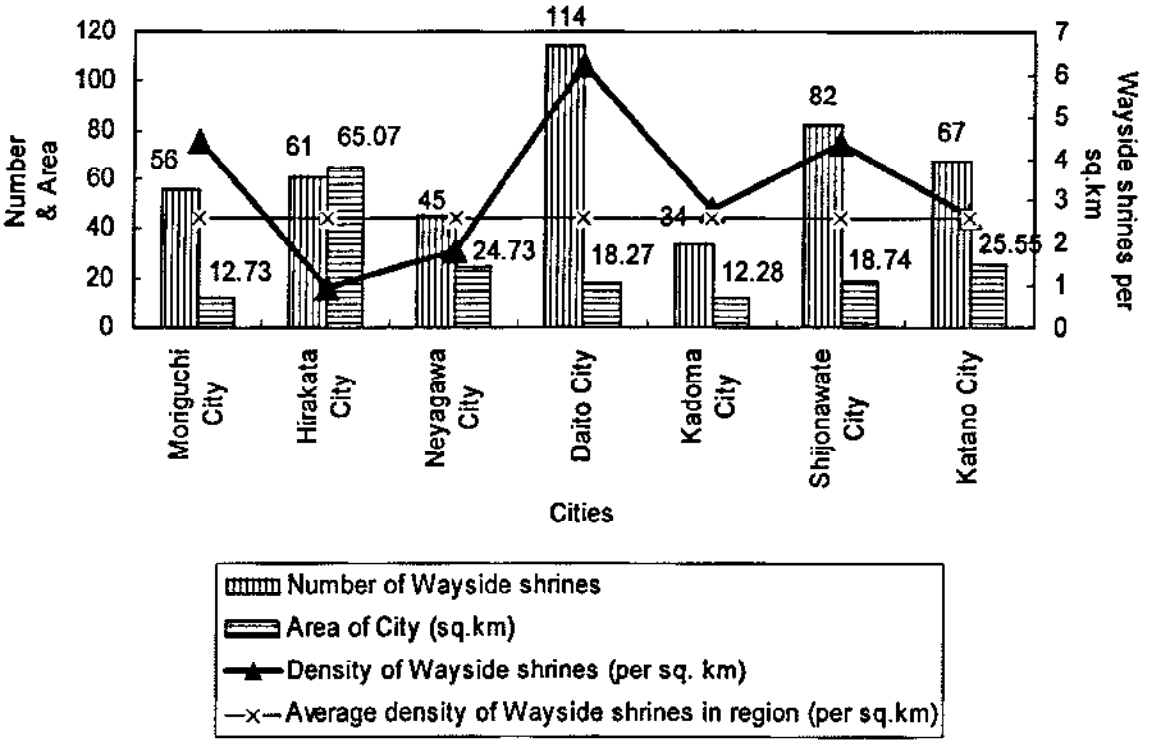


Fig.63: Wayside shrines distribution status in Kitakawachi

Seven cities of the Kitakawachi region have different Wayside shrines density. It is seen that Wayside shrines are found maximum in number and density by area also in Daito city 114 and 6.2 Wayside shrines per sq. km respectively where as minimum by number is observed in Kadoma city and by density in Hirakata city. The number of Wayside shrines in Kadoma city is 34 where as Wayside shrines density of Hirakata city is 0.9 per sq. km. The total population in seven cities of the Kitakawachi region is 1,211,404 in the total area of 177.37 sq. km (1995 data) giving the average population density (population/sq. km.) is 6830 while the average Wayside shrines per sq. km. of area is 2.6. Hence, population for one Wayside shrines on an average in the region is 2639.

5.5Visualization of Housing Coverage Situation of Kitakawachi

For investigating the housing distribution characteristics horizontally and vertically GIS was applied and study was carried out. The research was concentrated on "How much areas covered by houses consisting of different floors?" It is observed that there are remarkably large numbers of detached houses (represented as fl.0) and houses up to 19 floors are identified. The number and total area covered by houses associated with the respective floors are illustrated in the Fig.64. As represented in Fig.65, the share of land coverage by detached houses (represented as fl.0) is considerably high. For finding how the areas of the houses associated with different floors are in the existing situation, mean area coverage by the houses is investigated. The result of which is presented in the Fig.66. The 3D visualization of housing distribution of Moriguchi city in Kitakawachi as an example is demonstrated by 3D Scene 1.

3D Scene 1: Housing Pattern of Moriguchi City in Kitakawachi

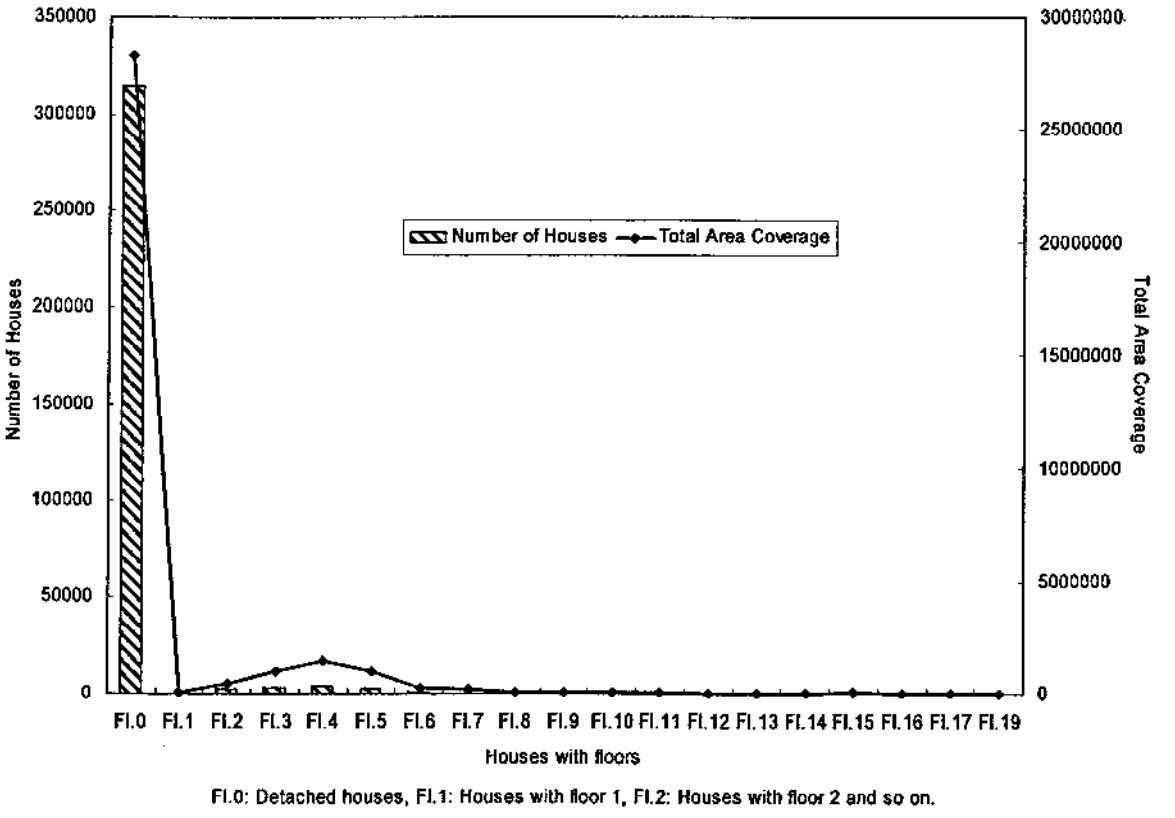


Fig.64: Number and Area coverage by houses in Kitakawachi

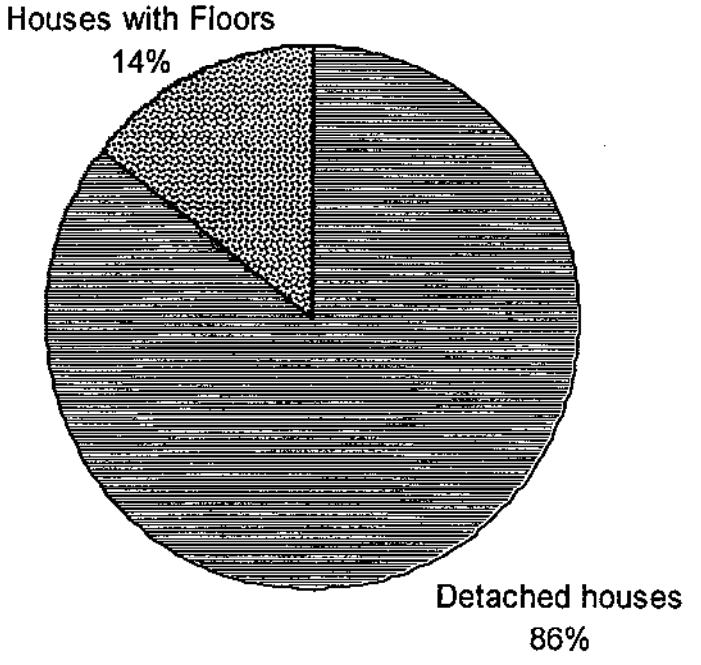
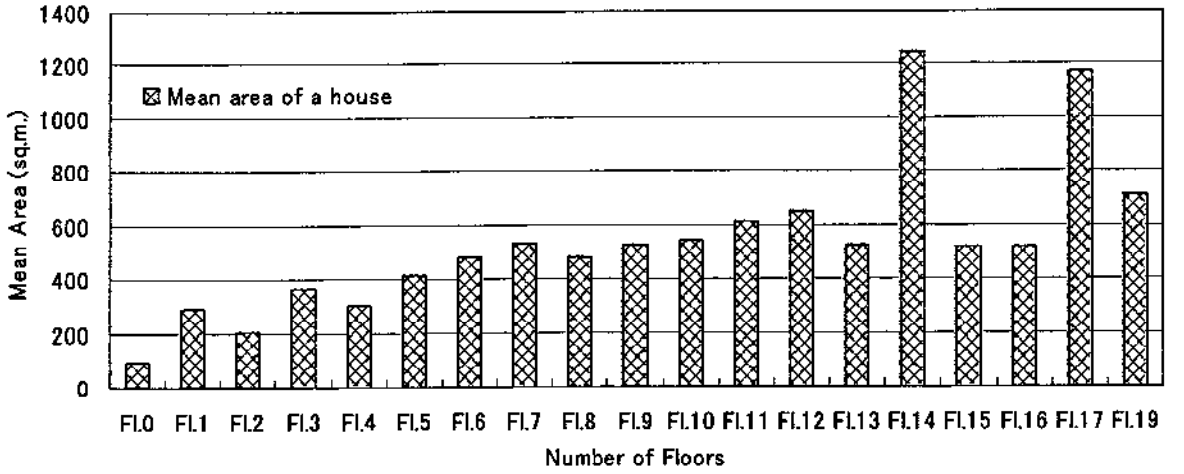


Fig.65: Area coverage share by houses



Fl0: Detached Houses, Fl1: Houses with one floor, fl2: Houses with two floor and so on

Fig.66: Mean area coverage of houses

For detail analysis and visualization of the existing urban land uses, a mixed type of area (approx. 250m radius) close to the Suminodo station area was selected as marked in Ortho photo map as demonstrated in Photo 24.The detail analysis of land uses with the help of the GIS was conducted as presented in Fig.67 and visualized in 3D as shown in Fig.68. The main observations are listed below.

Out line of the study area:
Total Area: 194311 m^2
Land uses pattern
1. Houses: 68121 m^2 (35%)
2. Water Bodies: 1013 m^2 (0.5%)
3. Green Areas: 556 m^2 (0.3%)
4. Roads: 8189 m^2 (4.2%)
5. Others: 11279 m^2 (6%)
6. Remaining lands: 82347 m^2 (42%)
7. Local circulation roads: 22807 m^2 (12%)

This indicates that houses have covered more than 1/3rd of total urban lands and lands falls in the "Remaining lands" have considerably large share of total urban lands.

Photo 24: Study Area in Ortho Photo Map.

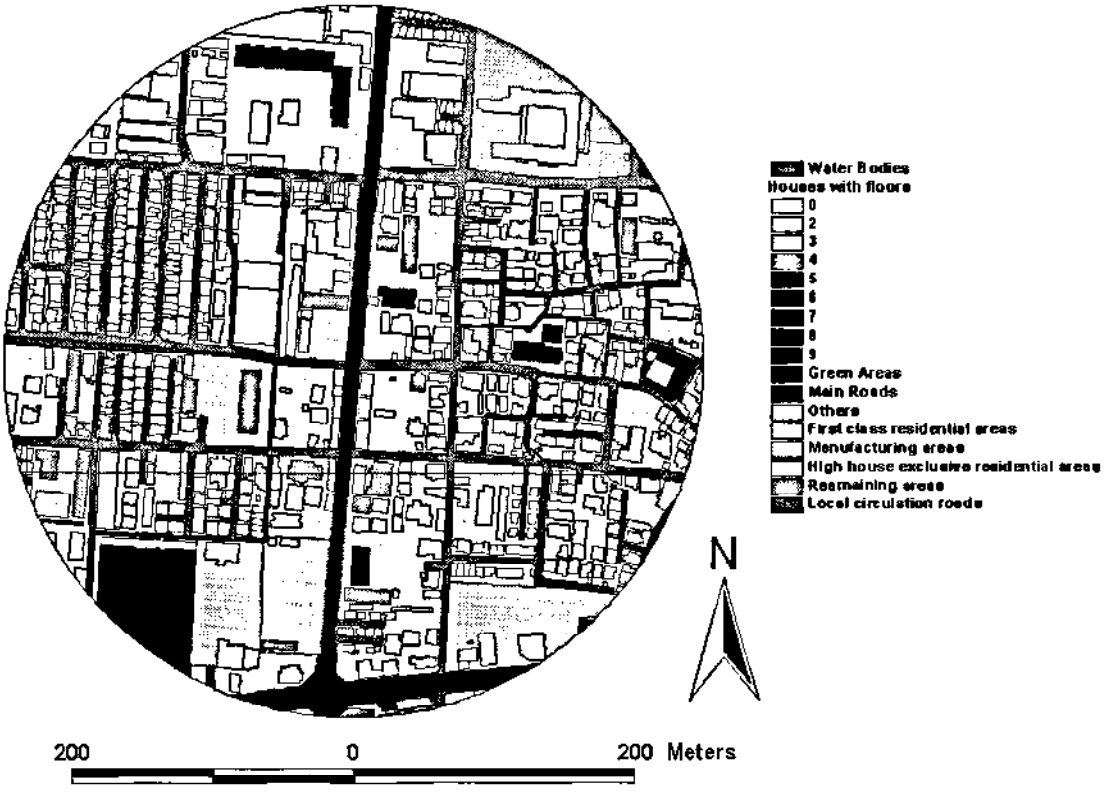


Fig.67: Land uses of selected Study Area

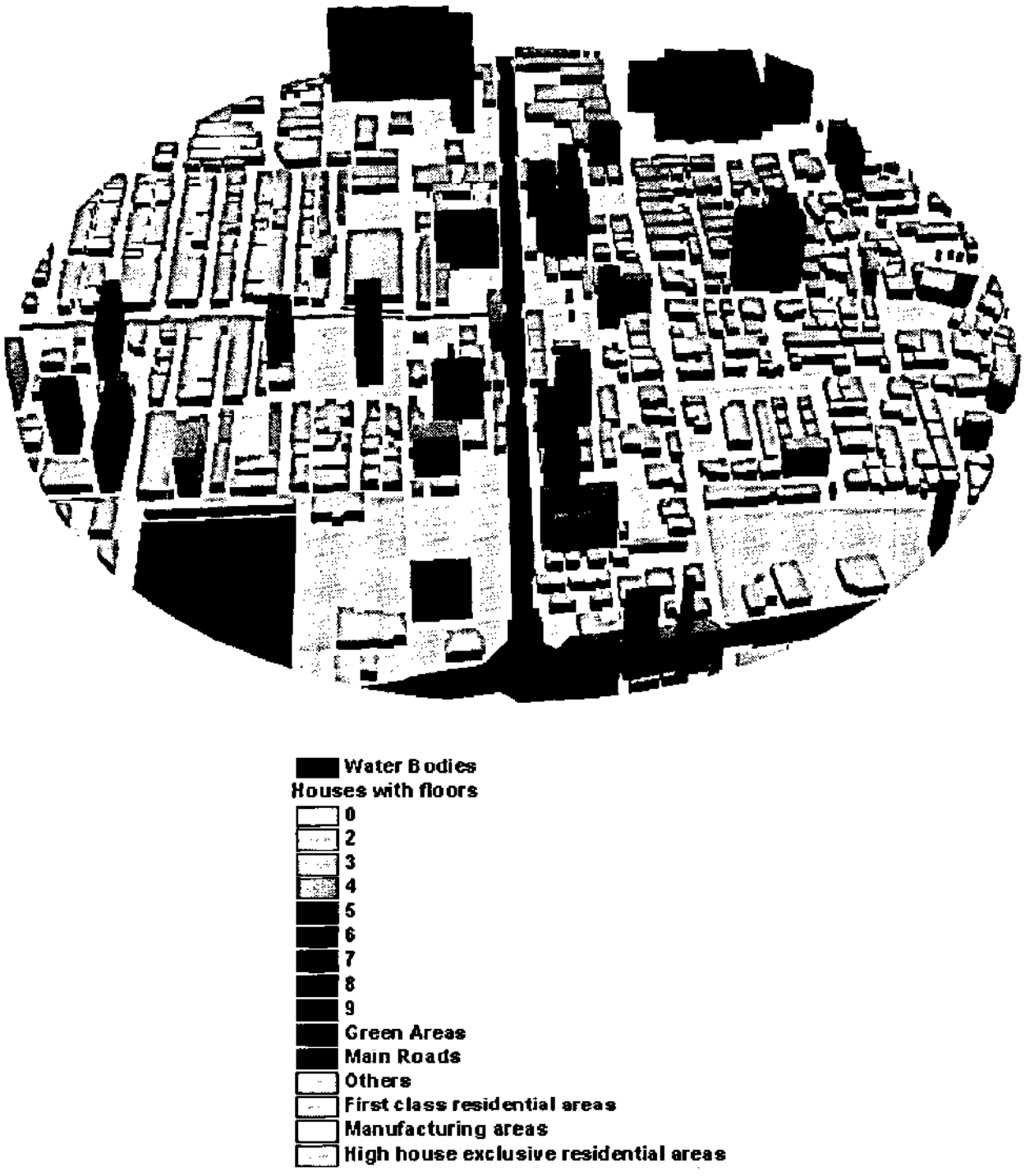


Fig.68: 3D Visualization of land uses of selected Study Area

Note: floor 0 represents detached houses.

5.6 Planning Vision for Kitakawachi

With the merging trend of cities in Japan, it is also becoming the hot issues about merging the cities of Kitakawachi. Many conferences and discussion are going on people and Local government level for merging those cities. Discussions are going on for merging Kadoma city and Moriguchi city in one side, while in other side Hirakata city, Neyagawa city and Katano city are talking about for combining. Meanwhile, I tried to study what are the broad planning vision cities of the Kitakawachi and their focus towards agriculture activities? In this respect following points are noted:

1. Moriguchi city which is the oldest city of this region begins its city history with the majority of the land covered with rice fields at the time of formation and advances towards industrialization with its two major home appliances manufactures Matsushita Company and Sanyo Company. This highly urbanized city focused its basic idea to create it as "Healthy and Welfare cities", "Comfortable environment city" "Cultural vibrant city" and "Safe city". It has mainly focused on land utilization as 1) Residential area 2) Business area 3) Industrial area. It has not focused on Agriculture activities in city and not allocated the land for agriculture.

2. Hirakata city is the largest city by area and population established as 12th city of the Osaka Prefecture in 1947 August. The population started from 40000 now it exceeds 400000. Hirakata is proceeding with its town building to realize "City of Hope" with creating "Environmental safeguarded City". In its Comprehensive Plan, it has focused mainly for developing residential, cultural, scientific research and educational facilities.

3. The third city Neyagawa in between the highly urbanized cities Moriguchi city & Kadoma city and primate city & rapid urbanizing city Hirakata city is aiming towards the formation of the city "Where there is agriculture". Neyagawa city has clear agriculture promotion vision with the basic idea for creating healthy cities in harmony of agriculture and people. For promoting the agriculture it has also designated the city role for the cooperating farmers and supporting the continuous of agriculture activities "where there is agriculture".

4. The fourth city Daito city is the city with less park space per person in the region but large coverage of natural forest of Ikoma in the east has been found directed its policy to investigate industrial field and its promotion. But also emphasized on community role and environmental recreational city.

5. The next city Kadoma is the field for manufacturer particularly electric appliance and plastic production. This highly urbanized and industrialized city has no focus in agricultural activities in the city.

6. The sixth city is Shijonawate is rich with plenty of natural forests covered by 2/3 of its total area by Ikoma Mountain. This city is aiming for "Cultural Welfare City". It has also focuses on the policy for improvement of rural agriculture, promotion of city sub-urban agriculture and introducing recreational agriculture.

7. The last recognized city is the Katano city. This city has the vision of the protecting productive green areas in its comprehensive plan. It has also incorporated the productive green areas in their plan for pollution prevention and integrity of city environments.

5.7 Conclusion

This chapter analyses the cities of Kitakawachi with respect to land uses, demographic characteristics, cities' development status based on CDI, cities' cultural elements (Wayside shrines). It also visualizes land uses along with houses in 3D environment. Finally, planning vision of cities of the region particularly for agriculture activities is described. The main conclusion of this chapter area as follows.

1. The percentage of remaining lands in the Kitakawachi is considerably high and that can be used for useful purposes like urban agriculture.

2. Almost homogenous demographic characteristics are observed among the seven cities of Kitakawachi. This supports the similar type of planning approach applicable to all cities demographically. Demographically, it also supports the merging process and it can be considered as a pre-assessment criterion for merging.

3. The high CDI values of the cities of Kitakawachi shows the well being status of the citizens and well physical facilities situation. CDI has evaluated the economic and physical infrastructure situation of the cities but does not cover the social and ecological situation of the city. The values regarding Katano city and Kadoma city are almost equal but the ecological and social situation between two cities are quite different.

4. Wayside shrines are observed as the elements that are still attached to the heart of the people and they are meaningfully distributed in the cities. So in planning it should be incorporate to make the city more livable and workable.

5. The houses (residential, commercial and industrial) of Kitakawachi have covered a significant share of city space. Most of them are detached housing particularly in the case of residential housing. If detached houses be pooled with vertical integration, a lot of city spaces could be gathered as free spaces. This gathered spaces can be used for urban agriculture.

6. Only few cities of Kitakawachi have directed its policy for promotion of agriculture activities. The lands are limited for agriculture to those cities also. So unless and until the innovative planning concept is not applied, it is difficult to materialize the vision of creating green and sustainable cities as expressed by those cities in their comprehensive plans.

7. The cities of this region can be put under the three groups based on urban district areas and natural elements (forests and rivers etc.) as mentioned below:

   ① High urban districts and low natural elements cities (Moriguchi city, Neyagawa city and Kadoma city)

   ② Medium urban districts and moderate natural elements (Hirakata city and Daito city)

   ③ Low urban districts and high natural elements (Shijonawate city and Katano city)

CHAPTER SIX: APPPLICATION OF CONCEPT IN THE CASE STUDY AREA

"Agriculture creates a balance between wild nature and man's social needs. It restores deliberately what man subtracts from the earth; while the plowed field, the trim orchard, the serried vineyard, the vegetables, the grains, the flowers, are all examples of disciplined purpose, orderly growth, and beautiful form."

(Lewis Mumford, The Culture of Cities, 1938 p. 150)

Photo 25A: Multi-storey Residential Complexes

Photo 25B: Muti-functional Green space

Photo 25C: Integration of Urban Agriculture and Urban Planning

Photo 25D: Integration of Culture and Urban Planning

Photo25: Proposed concept as a product of integration from the environments.

CHAPTER SIX: APPPLICATION OF CONCEPT IN THE CASE STUDY AREA

"In my opinion, if 100% of the people were farming it would be ideal. There is just a quarter- acre of arable land for each person in Japan. If each single person were given one quarter –acre, that is 1¼ acres to a family of five, that would be more than enough land to support the family for the whole year. If the natural farming were practiced, a farmer would also have plenty of time for leisure and social activities within the village community. I think this is the most direct path toward making this country happy, pleasant land."

(Masanobu Fukuoka, One straw Revolution: 1978)

6.0 Introduction

This chapter deals with the application of the proposed concept in the case study area and evaluation of the results. It evaluates how much the Urban Green Spaces (UGS) and Food Green Spaces (FGS) are available in the case study area according to the proposed concept. It has also presented the FGC vision for Kitakawachi and compared conceptually how it reduces the Ecological Footprint of a resident.

6.1 Application of the Concept

6.1.1 Evaluation Urban Green Spaces (UGS) and Food Green Spaces (FGS) [7]

The GIS Arc View 3.2 software and Pasco Fresh Map 2500 are utilized in the identification and mapping of all the potential Food Green Lands of seven cities from the existing land uses of Kitakawachi region. The investigated such lands are demonstrated in the GIS maps as shown in Fig.69 with enlarged 500m radius coverage of Neyagawa city, visualized in Fig.70. Based on Green 21 concept, the identified Food Green Lands include forests, planting area, river bank lands, wetlands, median strips of roads, houses with floors, remaining lands and agriculture lands. The AEZ (Agro-Ecological Zone) assessment [13] reveals the cereal cultivation potential in forest areas. Houses with floors are included in the potential lands as the roof of the houses can be utilized for roof top gardening. The remaining lands includes the spaces between the houses, open spaces and areas without major structures, thus they are also put under the potential Food Green Lands.

From the investigated potential lands, viable Food Green Lands are estimated. It includes 25%[13] forest areas, 50% land coverage of planting areas, river bank lands, wetlands, median strip of roads, houses with floors, remaining lands and 100% agriculture lands. Then, with the consideration of population of cities (2000 census), per capita potential and viable Food Green Lands are calculated and presented in Fig.71. This shows that Shijonawate city and Katano city's per capita potential Food Green Lands exceeds per capita lands required for full self sufficiency in food (200 m^2 per capita) according to the Masanobu Fukuoka if the method followed for agriculture is natural farming. Rest of the cities' per capita Food Green Lands are below that level. Regarding per capita viable lands, all the cities are far below the food self sufficient level. It thus further raises

important question: how to increase the Food Green Lands to achieve the food self sufficient level. The gap can be decreased only if the population is decreased or change in land uses of those cities. It obviously hints out the need for change of land uses of the cities, if the cities want to attend the food self sufficient state. This study investigated that the identified and potential & viable Food Green Lands of Kitakawachi are sufficient to attain multi-functional benefits by providing respectively 49% and 23% food self sufficient state and 66% and 31% green spaces of total area to the region.

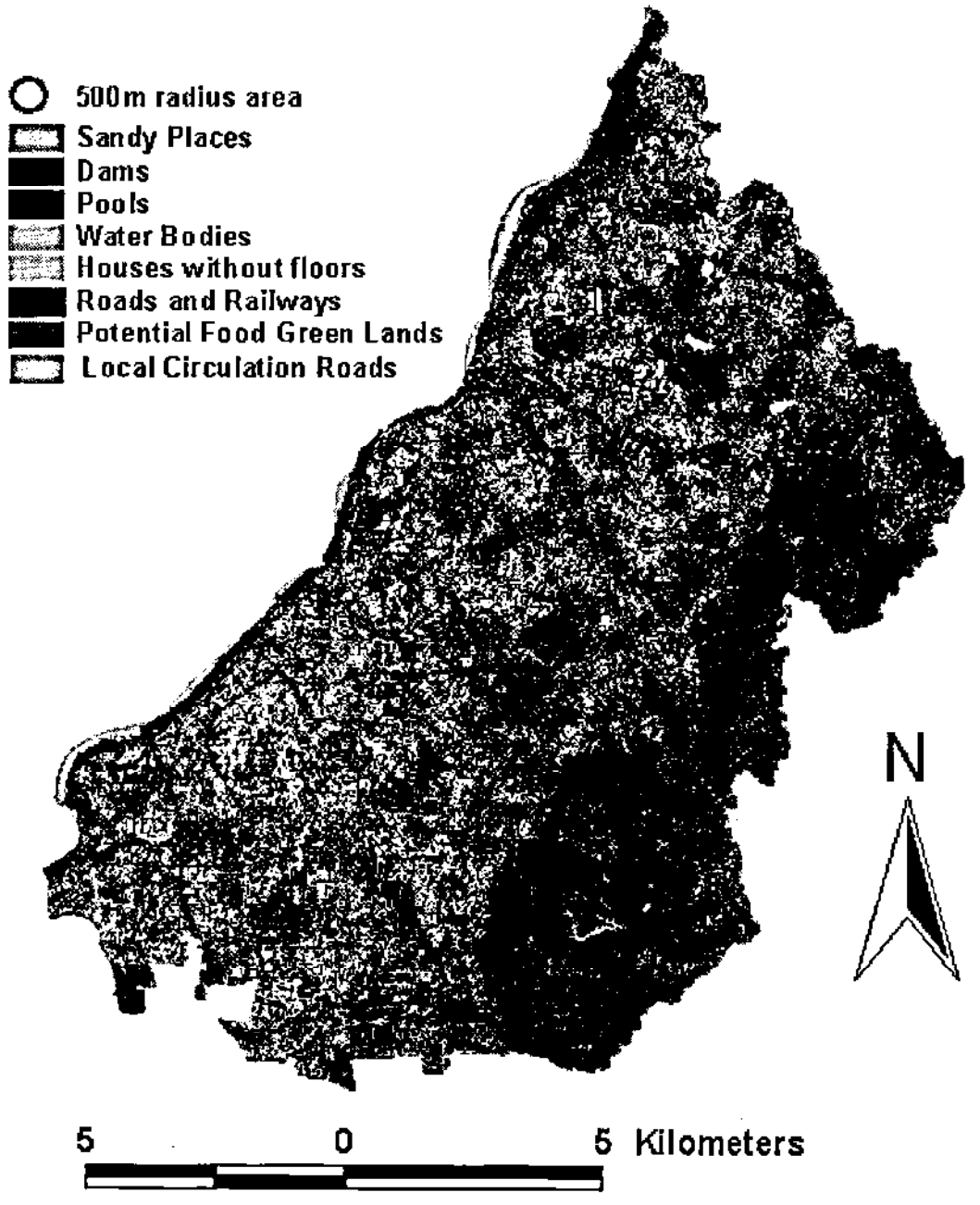


Fig.69: Identified Potential Food Green Lands.

Fig.70: Identified Potential Food Green Lands in Neyagawa city (500m radius)
Legend for Fig.69 and Fig.70 are same.

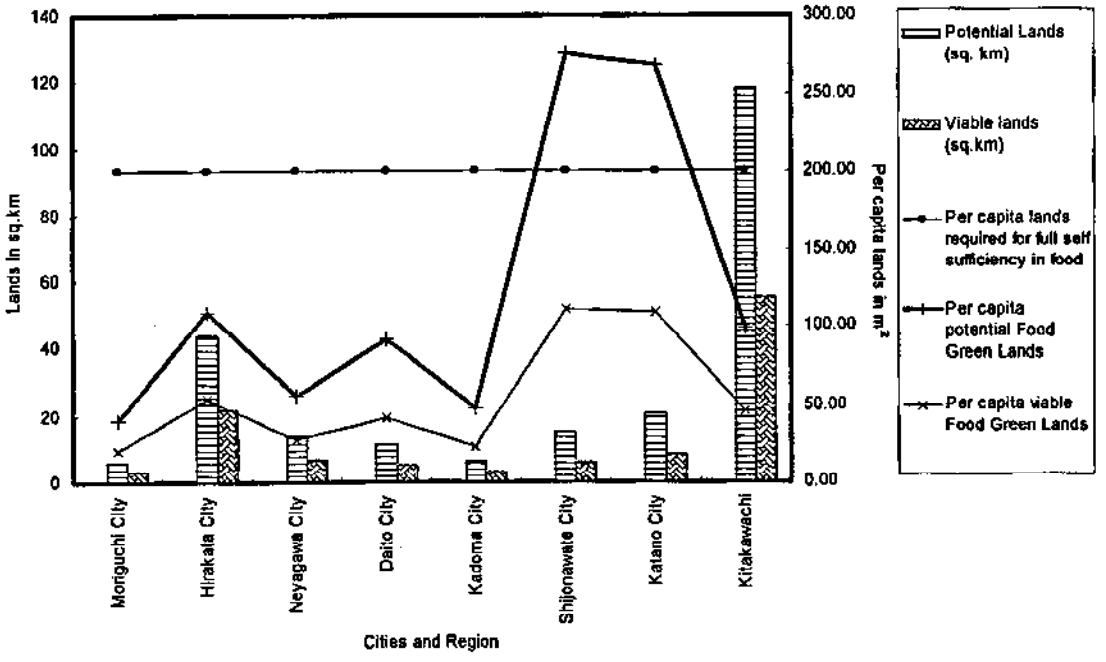


Fig.71: Potential and Viable Food Green Lands.

6.1.2 Proposed Urban Design of Food Green City

The proposed concept of Food Green city is designed with following characteristics.

1. **Changing existing cities.** FGC is the process of converting the existing cities to sustainable cities. It does not mean to convert whole city at once. It advocates transformation with careful planning. Photo 26 presents the repetition of same prevailing development way of space consuming and disintegrated system of housing. It shows a new construction of similar detached houses in the newly developing locality with the destruction of old houses. While FGC advocates for developing a location at an appropriate time (according to the planning for fulfillment of demands) under the FGC principles. It follows the method of vertical integration of spaces constructing Multi-storey residential buildings and designing remaining spaces to use as FGS.

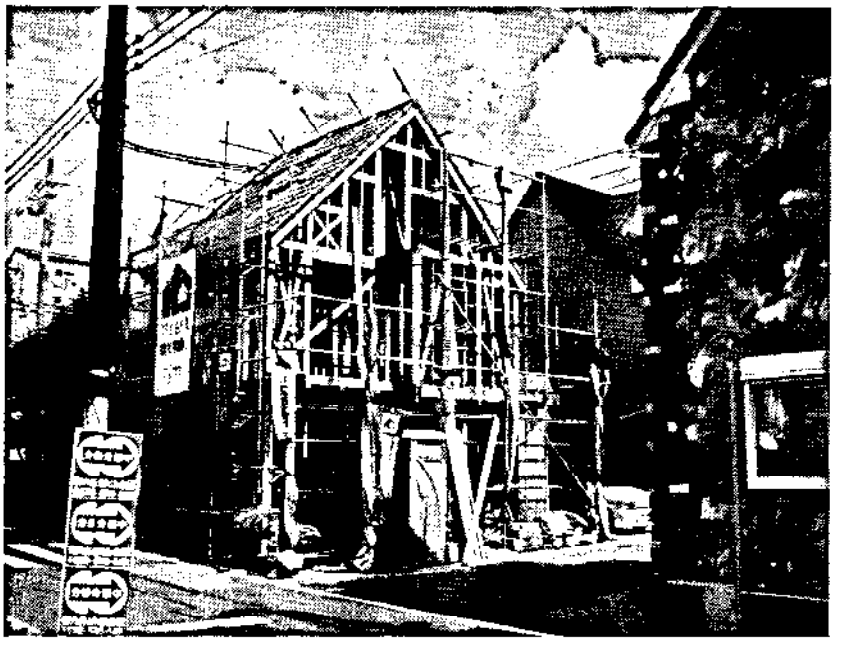


Photo26: Construction of a new detached house.

2. **High-rise buildings.** FGC neighborhood follows the principle of sharing of spaces and integration of space. It advocates the middle high rise residential, commercial and service buildings rather than high numbers low rise houses realizing the limited available lands in the city. It designed therefore 15 floors (45m) residential buildings and neighborhood service centers. The high rise residential building is not unfamiliar in the Kitakawachi. There are already existing middle-high rise apartments in those cities as seen in Photo27. Also high rise residential buildings are coming up in the cities from private sector as explained in Box9.

Photo27: Apartment house at Teragawa in Daito city.

Box9: Outline of the "Kuzuha Tower City" Project

The site for this project is about 500 meters to the east of "Kuzuha Station" on the Keihan Electric Railway, which connects Osaka and Kyoto, and covers about 1.4 hectares, surrounded by roads on three sides. This is a convenient location, only taking around 30 minutes from the city centers of both Osaka and Kyoto.
The layout plan calls for open public areas positioned facing the roads on the south, east and west, as well as open space in the center, according to an overall planning system. The layout of the units is dispersed, both to guarantee privacy and so that they all face south.
The architectural plan consists of four towers: a 41-story tower-shaped super high-rise tower, a plate-shaped 24-story high-rise tower, 13-story and 11-story medium-rise towers, as well as a four-story fitness tower. They are all connected by an underground car park.
Because an overall planning system is being used, and the car park is underground, the external plan calls for lots of open space and plenty of greenery for efficient use of the land and out of consideration to the surrounding environment.
Plans for the residential towers are based on the use of Skeleton-Infill (SI) Housing,* and all the floors and ceilings in the units will be double-layered, maintaining the flexibility to be able to renew equipment or change the plans in the future.

*SI Housing is a system for allowing long-term use of condominium housing, where the skeleton of the building and the infill (living area) can be separated.

Source: http://www.takenaka.co.jp/takenaka_e/news_e/pr0107/m0107_02.htm
Access date: 2003.12.8

3. **Consideration of the cultural elements with the Planning.** The study of spatial distributed Wayside shrines in Kawachinagano city has revealed the fact that these are still alive in the present cities of Japan and their distribution has some meanings attached with their located place. These are found as symbolic and closely associated with people. It has found from the study that these elements have symbolic meaning in land uses e.g. location of 6 Zizou indicates the location of grave yards (Photo 28), Kami are generally distributed in the natural places, ponds etc, Hotoke at the temples and Saeno Kami at the entry point of settlements whereas Zizou are distributed around the settlement areas and in the agriculture fields. Thus, in the designing the FGC neighborhood, Zizou and Kami are designed to place at the residential areas and agriculture areas where as Saeno Kami are placed at the entry point of the neighborhoods. These elements act as cultural identity of neighborhoods, provide spiritual and religious satisfaction to the neighborhood people, revitalize the culture and create the society peace and order through the spiritual believes rather enforcing the legal acts.

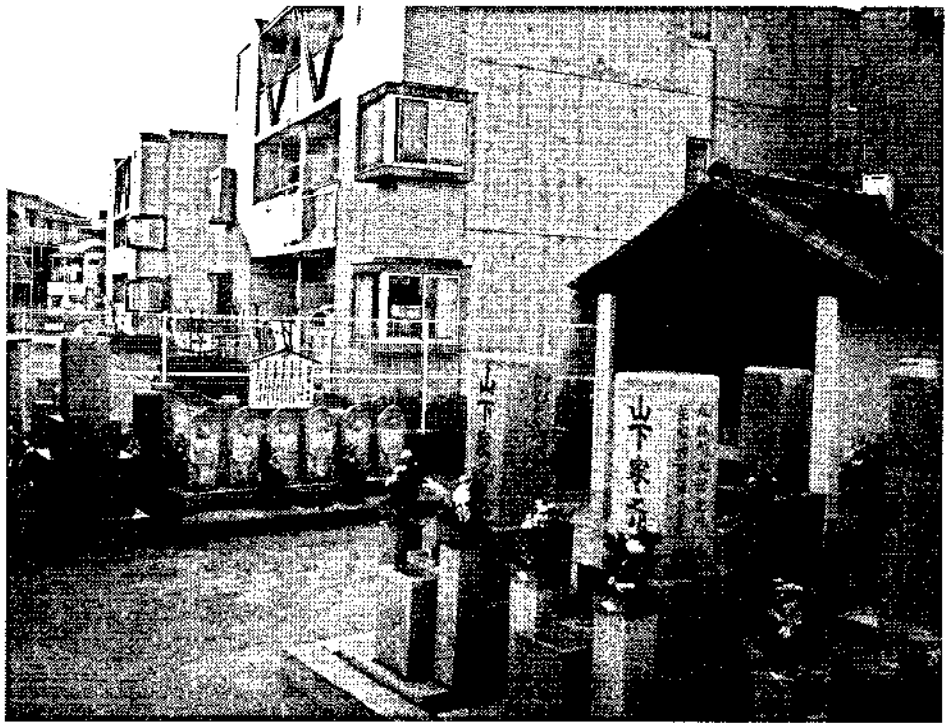


Photo28: Roku zizou near to the grave yard.

4. **Food self sufficiency with healthy urban environments.** The remaining spaces that can be integrated as a result of high rise buildings are designed to utilize for returning the nature with function. It is used for agriculture to achieve the food self sufficiency, to maintain the carbon oxygen balance as described in Box10 and to create the clean and healthy urban environments.

5. **Plenty green space.** FGC promotes the plenty green spaces in the urban environment but utilizes those green spaces for self sustaining purposes.

6. **Reducing wastes.** FGC develops a system of reducing wastes at sources with the use of vermiculture. This not only helps to manage the solid wastes, which is the major problem of many cities but also convert the wastes into resources. It brings back the wastes into primary forms that add it to the natural resources rather than transforming into secondary forms that still do not return to nature as in the process of recycling.

Box10: Carbon dioxide-Oxygen Balance

On a sunny day, the leaves of a full grown maple tree use about 75 cubic feet (9.2 pounds) of carbon dioxide and release an equivalent volume of oxygen. Similarly one acre of lawn uses about 900 cubic feet (111 pounds) of carbon dioxide, releasing the same volume of oxygen. As you can see, you depend upon green plants for life-giving oxygen as well as for nutrition. Yet you and all other chlorophyll- lacking organisms play an important role in the balanced cycle of nature. Each day, in the process of respiration, you convert 20 cubic feet (1.8 pounds) of oxygen to an equal volume of carbon dioxide which is then used in plant photosynthesis. Unfortunately, man in his pursuit of progress, is now using more than his share of oxygen and is contributing excessive amounts of carbon dioxide to the atmosphere. If you live in an industrialized city, you indirectly consume 20 times your basic requirement of oxygen by the burning of fuels such as coal, oil, gas, diesel oil, and gasoline. For example, the combustion of six gallons of oil on a winter day provides heat for four people and in the process, converts 430 cubic feet of oxygen into carbon dioxide. This means that each person requires an additional 107.5 cubic feet of oxygen into carbon dioxide is busy converting 20 cubic feet of oxygen into carbon dioxide through respiration. A 19-acre park produces enough oxygen to balance the respiration requirements of 1000 people during the summer months. But what happens during the winter when many trees shed their leaves and discontinue photosynthesis? During this period we rely upon the oxygen in air and also upon the contributions from plant life many thousands of miles away. For example, prevailing winds over the Atlantic carry inland the oxygen produced by countless numbers of surface phytoplankton in the ocean. Inland cities such as Chicago, Toronto, and Detroit receive over 60% of their available free oxygen from ocean phytoplankton.

By establishing a balance between animal and plant life, nature maintains equilibrium between oxygen-producing and oxygen-consuming activities. What happens when man, in ever-increasing numbers, upsets this balance?

Consider the total oxygen requirement of a community of 1000 people. To balance the oxygen- carbon dioxide cycle during an average year, including the winter months, a park of 440 acre is needed. Whereas 1/4 acre= 1000 m^2. A community of 15000 people covers an average of 1600 acres of land during urban and suburban development; it requires a greenbelt of over 6000 acres to maintain an atmospheric balance. But in this way that North American cities and towns are planned? As growing cities mushroom in all directions, countless thousands of acres of forest, grass land and farmland are buried under buildings and a carpet of pavement.

Man is destroying the equilibrium with no thought for the possible consequences. In recent years, scientists have measured a decrease in the amount of atmospheric oxygen. Correspondingly, the concentration of atmospheric carbon dioxide has risen. Oxygen constitutes a relatively large proportion of the total atmosphere. Presumably we are in no danger of exhausting our supply in the near future. Our greatest problem could well be the increasing concentration of carbon dioxide.

Source: *Environmental Pollution, Editor: William A. Andrews: 1972*

7. **Cutoff mobility.** In designing FGC neighborhood, it has adopted the proposed layout of putting the living, working, leisure together. This reduces mobility which saves the energy.

8. **Sense of community.** It enhances the sense of community and empowers the community. It brings the community as the members of same family as it follows the principle of sharing: e.g. sharing of community service spaces, community farming, sharing of cars etc.

9. **Pedestrian neighborhood.** The neighborhood services are designed to provide within the walking distances that helps in making vehicle free neighborhoods allowing pedestrians and bicycles only. But it has the provision of roads for vehicles at emergency.

10. **Promotion of culture.** As groups of people are living in one building, they are close and have a lot of opportunities for social intercourses. It makes easy for organizing community programs like festivals. This preserves the traditions and cultures. Kitakawachi rooted with many tradition cultures and has many festivals as seen in Photo29 and Photo30. FGC helps in promoting such cultures.

11. **Job opportunities.** FGC provides the opportunity for creating jobs for involving food production and distribution at local level suitable to old age people, women, jobless people and part time job seekers.

Photo29: Danjiri Festival

Photo30: Nozaki Festival

According to the above mentioned characteristics of the FGC model, an example of FGC Neighborhood has shown in Fig.72 and its 3D visualization has illustrated in Fig.73.

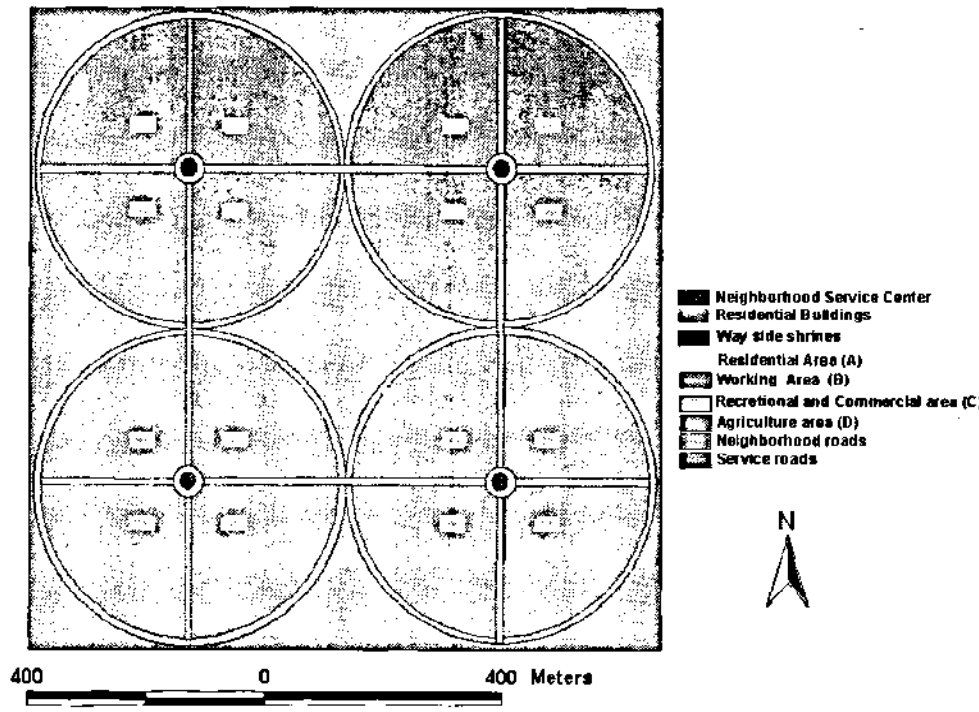


Fig72: Planning layout of FGC Neighborhood

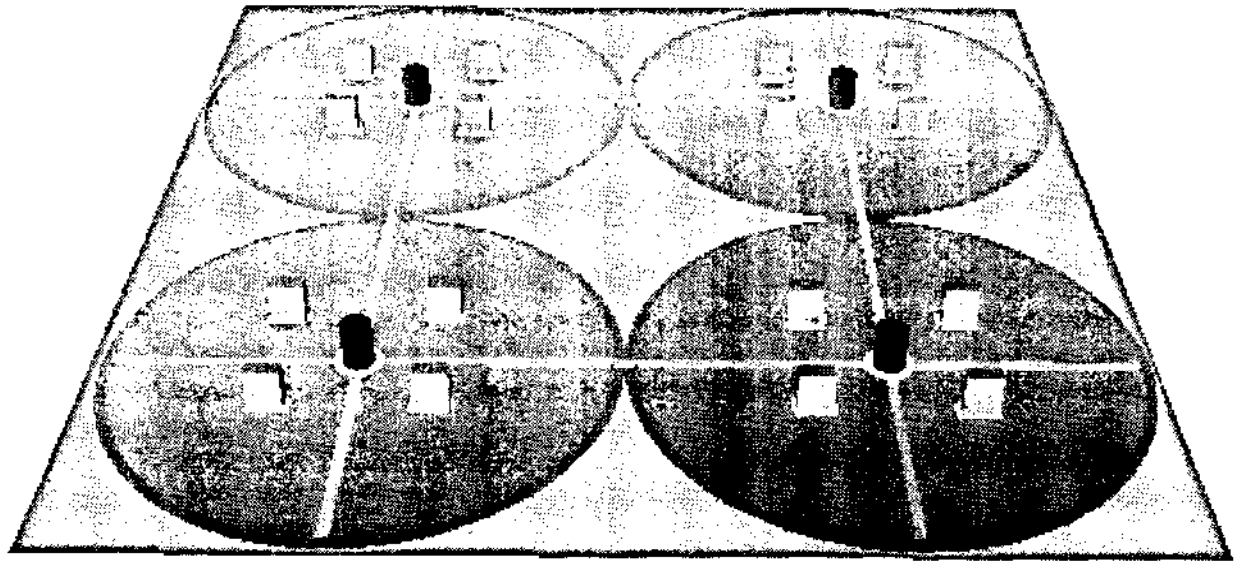


Fig.73:3D Visualization of FGC Neighborhood

The salient features of the proposed 4 FGC Neighborhood units as follows:

1. **Total area:** 1119264 m^2
   (This includes area covered by 4 FGC Neighborhood units (each of 250m radius), neighborhood roads and main roads)

2. **Total proposed population:** 8000
   (The area consists of 4 residential building in each neighborhood unit with dwelling capacity of 500 populations)

3. **Gross population density:** 7148population/ km^2 (71persons/ha)

4. **Residential area (A):** 16128 m^2

5. **Service and recreational area (C):** 7852 m^2

6. **Total residential houses coverage:** 10560 m^2
   (There are four residential high rise houses each covering plinth area 660 m^2 in each unit. Each building proposed of 15 floors (about 45m).At roof it is proposed for sky gardening.

7. **Neighborhood service center buildings:** 3217 m^2
   (There is one round commercial and service center building in one neighborhood unit covering plinth area 804 m^2.These buildings are proposed of height 45m (15 floors).At roof it is proposed for sky gardening.)

8. **Neighborhood roads :** 43200 m^2
   (These are vehicles free neighborhood pedestrian and bicycle roads with fruit trees on both sides)

9. **Sky gardening area:** 13776 m^2

10. **Food Green Space on neighborhood roads:** 10800 m^2

11. **Service roads :** 77207 m^2
    (These are circular Vehicle roads (12m) around the FGC Neighborhood units connecting to manufacturing, working, services etc areas (B)

12. **Manufacturing, Sports, Recreational etc area (B) :** 219582 m^2

13. **Agriculture lands (D):** 734344 m^2

14. **Main roads:** 20960 m^2
    (These are 20m wide main roads connecting the Neighborhood for long distance journey. For calculation purpose the area taken is just the estimated share of the 4 FGC Neighborhood units.)

15. **Total Food Green Space:** 758920 m^2 (68% of total area)

16. **Food self sufficiency rate :** 47%
    (The total food green lands consist in the proposed neighborhood unit is 154 m^2/person. Considering the 200 m^2/person is the100% self sufficient state in natural farming as said by

Mr. Fukuoka, the food self sufficiency rate is calculated for the proposed area)

17. **Oxygen Carbon dioxide Balance state:** Balanced
(Accordingly, mentioned in Box 10, it is calculated about 90 m^2/person green space sufficient to balance the $C0_2$ exhaled during the respiration process. There are 95 m^2/person.green lands in the proposed neighborhood so it is sufficient to balance.

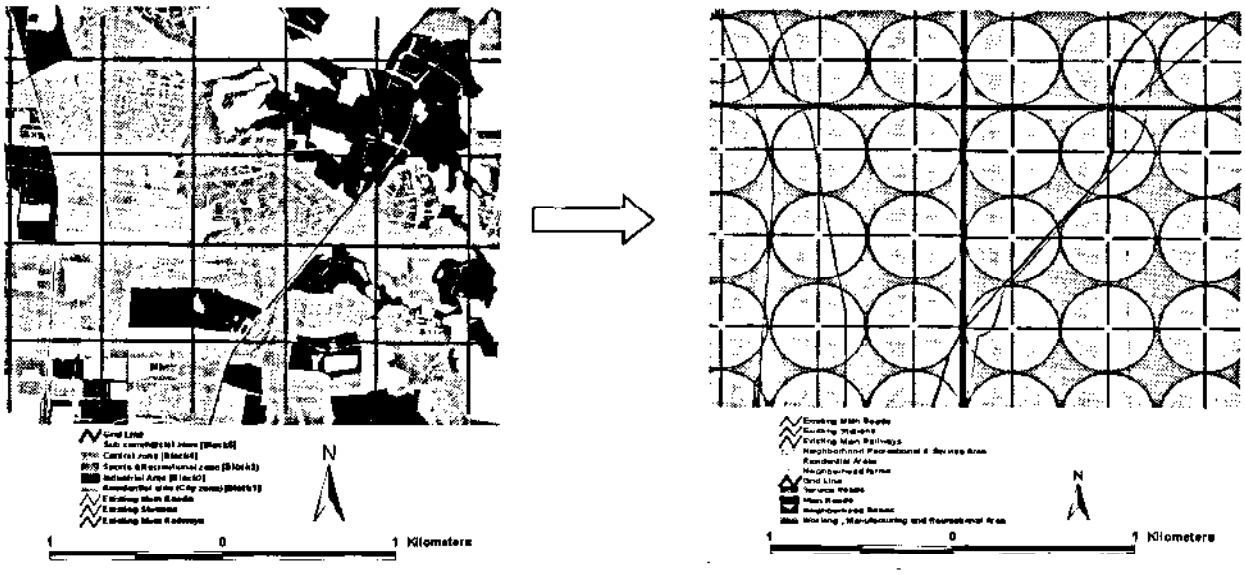


Photo 31A: Existing land use pattern

Photo 31B: Proposed land use pattern

Photo31: Illustration of Differences.

The proposed concept is applied in the seven cities of Kitakawachi according to the proposed planning layout as discussed in Chapter Three (further illustrated by Photo 31). It is found that designed FGC in the area of 63% estimated developable lands in the Kitakawachi targeted to the population of 800000 (Expected population of Kitakawachi in 2050 refer Fig. 74) the food self sufficiency rate is about 47% and Multifunctional green space is 68%. It is also noticed that if it is proposed for less population, food self sufficiency rate will be increased. For example, food self sufficiency will be achieved about 85% for the designed population of 478000. It is estimated that the population of Kitakawachi is less than this in 2100 which shows the

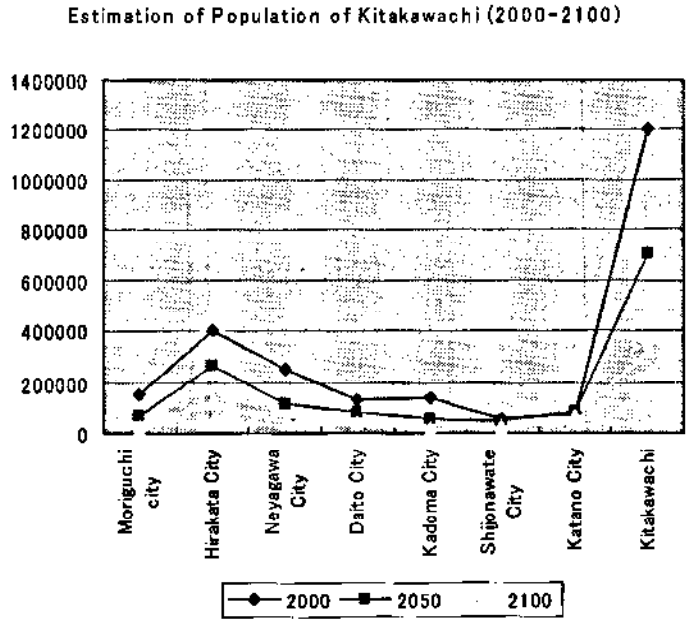


Fig74: Estimation of Population of Kitakawachi
Data Calculation source: http://www.ipss.go.jp

possibility of achieving the 100% food self sufficiency in Kitakawachi with the proposed city planning concept. The proposed Food Green City (FGC) Vision for the Kitakawachi has shown in Fig.75 and 3D visualization of it is illustrated by 3D Scene 2.

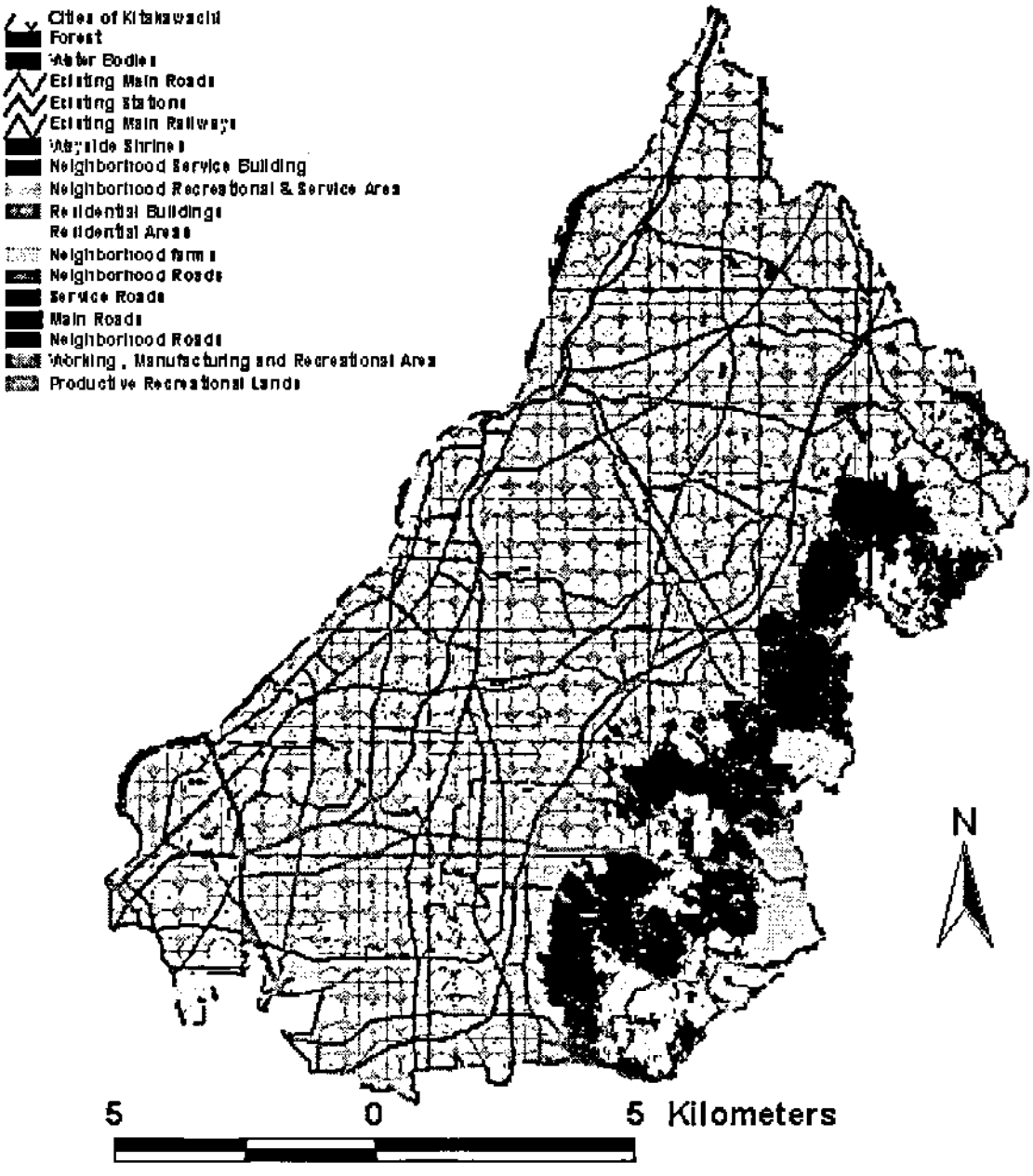
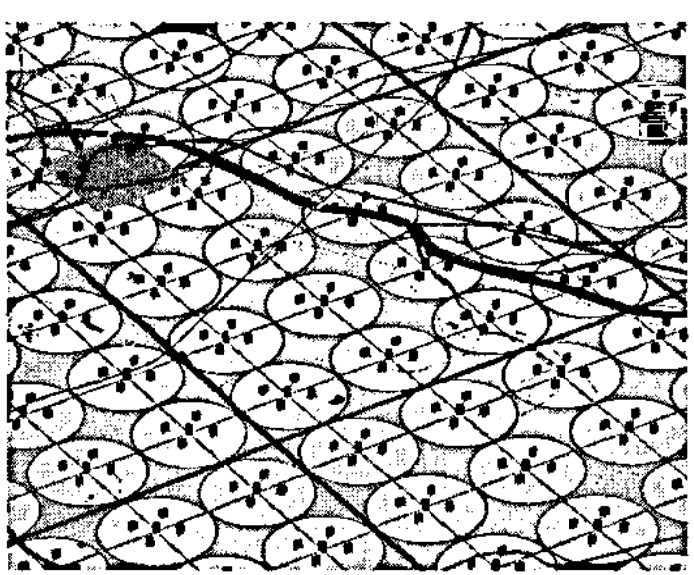
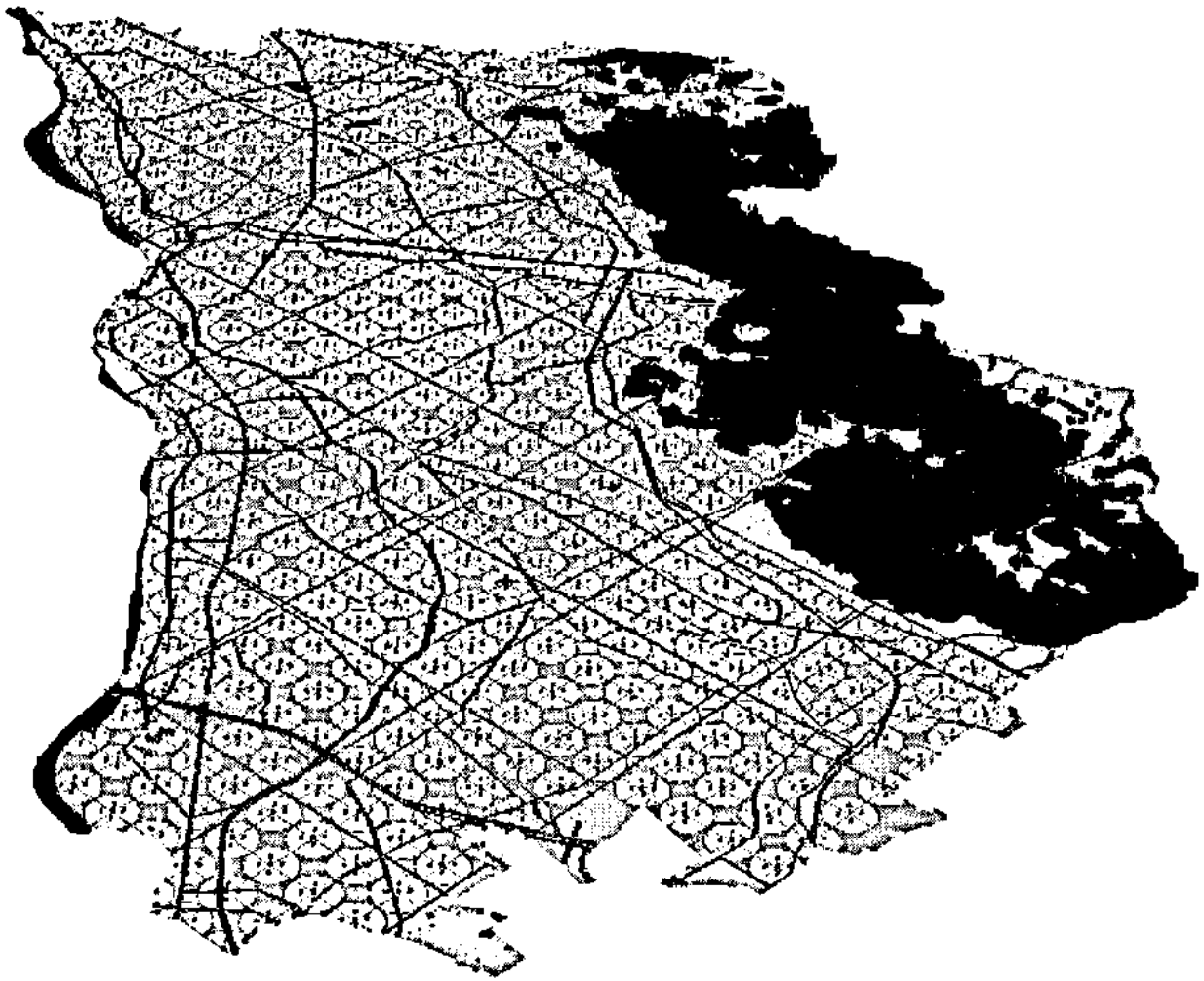


Fig75: Proposed FGC Vision for Kitakawachi





3D Scene 2: Proposed FGC Vision for Kitakawachi

6.1.3 Evaluation of Ecological Footprint (EF)

In this section, I have tentatively evaluated how effective the Food Green City in reducing the Ecological Footprint. This evaluation is based on the Ecological Footprint quiz (Source: http://www.earthday.net/Footprint/quiz.asp). The details of Footprint assessment of me as being the resident of Daito city and assuming of being the resident of proposed Food Green City have been mentioned with the results.

Tentative Evaluation of my Ecological Footprint as being the resident of Daito City:
Let's start
Q: How old are you?
A: 21-35
Q: How big is the city, town, or place where you live?
A: 100,001-1,000,000
Q: What city has the most similar weather to yours?
A: Osaka
Q: Choose on:
A: Male

Food Footprint

1. How often do you eat animal based products? (beef, pork, chicken, fish, eggs, dairy products)
A: Often (meat once or twice a week)

2 How much of the food that you eat is processed, packaged and imported?
A: Most of the food I eat is processed, packaged, and from far away

Goods Footprint

3. Compared to people in your neighborhood, how much waste do you regenerate?
A: Much less

Shelter Footprint

4. How many people live in your household?
A: 1 people
5. What is the size of your home?
A: 30-60 square meters
6. Which housing type best describes your home?
A: Row house or building with 2-4 housing units
7. Do you have electricity in your home?
A: Yes.

Mobility Footprint

8. On average, how far do you travel on public transportation each week (bus, train, subway or ferry)?
A: 100-300km
9. On average, how far do you go by motorbike each week (as a driver or passenger)?
A: 0 km

10. On average, how far do you go by car each week (as driver or passenger)
A: 50-150 km
11. Do you bicycle, walk, or use animal power to get around?
A: Sometimes
12. Approximately how many hours do you spend flying each year?
A: 10 hours
13. How many liters per 100 kilometers does your motorbike consume?
A: Fewer than 3 liters per 100 km
14. How often do you ride your motorbike with someone else, rather than alone?
A: Almost never

Quiz results

Category	Global Hectares
Food	1.5
Mobility	0.6
Shelter	1.0
Goods/Services	1.3
Total Foot print	**4.4**

"In comparison, the average Ecological Footprint in Japan 4.8 Global hectares per person.
World wide, there exists 1.8 biologically productive global hectares per person.
If everyone lived like you, we would need 2.4 planets."

Tentative Evaluation of my Ecological Footprint as being the resident of Food Green City:

Evaluation of my Ecological Foot Print as being the resident of Daito City:
Let's start
Q: How old are you?
A: 21-35
Q: How big is the city, town, or place where you live?
A: 100,001-1,000,000
Q: What city has the most similar weather to yours?
A: Osaka
Q: Choose on:
A: Male

Food Footprint

1. How often do you eat animal based products? (Beef, pork, chicken, fish, eggs, dairy products)
A: Occasionally (no meat or occasional meat, but eggs/dairy almost daily)
2. How much of the food that you eat is processed, packaged and imported?
A: Almost of the food I eat is unprocessed, unpackaged, and locally grown.

Goods Footprint

3. Compared to people in your neighborhood, how much waste do you regenerate?
A: Much less

Shelter Footprint

4. How many people live in your household?
A: 1 people
1. What is the size of your home?
A: 30 square meters or smaller
2. Which housing type best describes your home?
A: Multi-storey apartment building
3. Do you have electricity in your home?
A: Yes.

Mobility Footprint

4. On average, how far do you travel on public transportation each week (bus, train, subway or ferry)?
A: 5-25 km
5. On average, how far do you go by motorbike each week (as a driver or passenger)?
A: 0 km
6. On average, how far do you go by car each week (as driver or passenger)
A: 10-50 km
7. Do you bicycle, walk, or use animal power to get around?
A: Most of the time
8. Approximately how many hours do you spend flying each year?
A: 10 hours
9. How many liters per 100 kilometers does your car consume?
A: Fewer than 3 liters per 100 km
10. How often do you ride your car with someone else, rather than alone?
A: Very often

Quiz results

Category	**Global Hectares**
Food	1.0
Mobility	0.2
Shelter	0.5
Goods/Services	0.6
Total Foot print	**2.3**

"In comparison, the average Ecological Footprint in Japan 4.8 Global hectares per person. World wide, there exists 1.8 biologically productive global hectares per person. If everyone lived like you, we would need 1.3 planets."

This evaluation illustrates a resident of FGC could reduce his Ecological Footprint share to half approximately as compare to existing city and can live in more sustainable manner. As described in Box11, to create a sustainable society change in life styles is must. This helps in running our cities as a closed system without compromising resources of our future generation. Thus, FGC is a means for achieving the goal of sustainable city.

Box-11: Sketching a Vision for a Sustainable Society

The positive effects of more sustainable urban design would be greatly enhanced if people also changed their behavior and lifestyles. For example, EF analysis suggests that we should focus more on living locally than on consuming globally. In many places we could still dwell comfortably on the output of our home regions, supplemented by trade in true ecological surpluses. In the process, we might well rediscover that meeting friends while bicycling home is more fun than spending lonely hours commuting on congested highways.

Cities must simultaneously become more livable while increasing their density and becoming less auto and resource dependent. This requires phasing out the routine provision of physical and institutional infrastructure that imposes a resource –intensive lifestyle on generations to come. (The sprawling, inefficient urban form that accompanied the rise of the automobile in the 1950s and 1960s will be with us for many decades.) Suitable initiatives that are much discussed but less frequently delivered include: planning for high-density, high –amenity downtown restoration; promoting the use of renewal energy in commercial and housing developments; reallocating urban space, particularly road and other auto-orientated areas, to low cost housing and public open space; imposing disincentives on auto use while creating incentives to encourage public transit, walking and bicycling; and using the tax system- rewards and penalties- to encourage urban development, urban land trusts, cooperative housing, dedicated to sustainability principles.

Source: *Wackernagel, M. & Rees, William, Our Ecological Foot Print, 1996:pp.141-142*

6.2 Concluding Results

This study has the following concluding results.

1. The principles associated with FGC are visualized in the neighborhood unit model demonstrate the applicability of sustainability paradigms that explained in the Chapter Three. Active community participation for implementation & management of activities with the support of role of governments as facilitators and private sectors for economic activities & services in the neighborhood is the representation of "Actors Paradigm". Agriculture activities within the city in addition to other economic activities have governed the "Activities Paradigm". Where as overall setting of the FGC based on physical, social and ecological balance supports the "Layers Paradigm". Thus, it is an inspiring model for city planning to create a sustainable city.

2. The conceptual application result from the application of model in Kitakawachi demonstrates how FGC could be able to balance Carbon dioxide & Oxygen in the ecosystem and achieve 47% food self sufficiency state with maintaining plenty of multi-purposes green spaces (68%) at reasonable population density in the cities considering the population of Kitakawachi in 2050. But the food self- sufficiency rate and green spaces could be raised if FGC is designed by lowering the population density in the cities like in the case of population of Kitakawachi in 2100.
3. FGC is an effective means for managing the three major problems of city.1) Urban Food (Safety

and Self-sufficiency) 2) Urban Poverty 3) Urban Waste and Pollution. The integrated approach which aims for integration of Urban Agriculture with Land Use Planning has great potential in contributing the sustainable urban development.

4. This study has identified and mapped the potential & viable Food Green Lands of Kitakawachi that could be used for multi-functional purposes providing green spaces as well as foods to the city dwellers. The study concludes that the potential and viable Food Green Lands identified in Kitakawachi are sufficient to attain multi-functional benefits by providing respectively 49% and 23% food self sufficient state and 66% and 31% green spaces of total area to the region. This proves that it is still possible to move towards the significant percent of self sufficiency state with green urban environment in the region if Food Green Concept is realized in land use planning.

5. The identified potential Food Green Lands using GIS if integrated in land use planning can check the unhealthy urbanization process. This could be a viable solution for the Japanese cities to follow the "Green Way" to achieve the sustainable cities, food sufficient cities, energy efficient cities and less dependent cities. Thus, it directs the land use planners a sustainable option for land use planning to make the cities more livable and sustainable.

6. The tentative evaluation of Ecological Footprint in existing city and Food Green City shows that the Ecological Footprint of a city can be reduced if Food Green City is realized. It is thus represents a way of living in more sustainable manner in harmony with urbanization in the 21st century.

7. It has demonstrated and applied successfully GIS in analysis, planning and designing for FGC. Thus, it has practiced GIS as a useful tool for planning and designing the urban environments and opened up a new GIS application field.

CHAPTER SEVEN: SUMMARY AND CONCLUSIONS

"What transforms the passive agricultural regime of the village into the active institutions of the city? The difference is not merely one of magnitude, density of population, or economic resources. For the active agent is any factor that extends the area of local intercourse, that engenders the need for combination and co-operation, communication and communion; and that so creates a common underlying pattern of conduct, and a common set of physical structures, for the different family and occupational groups that constitute a city."

(Lewis Mumford, The Culture of Cities, 1938, p.6)

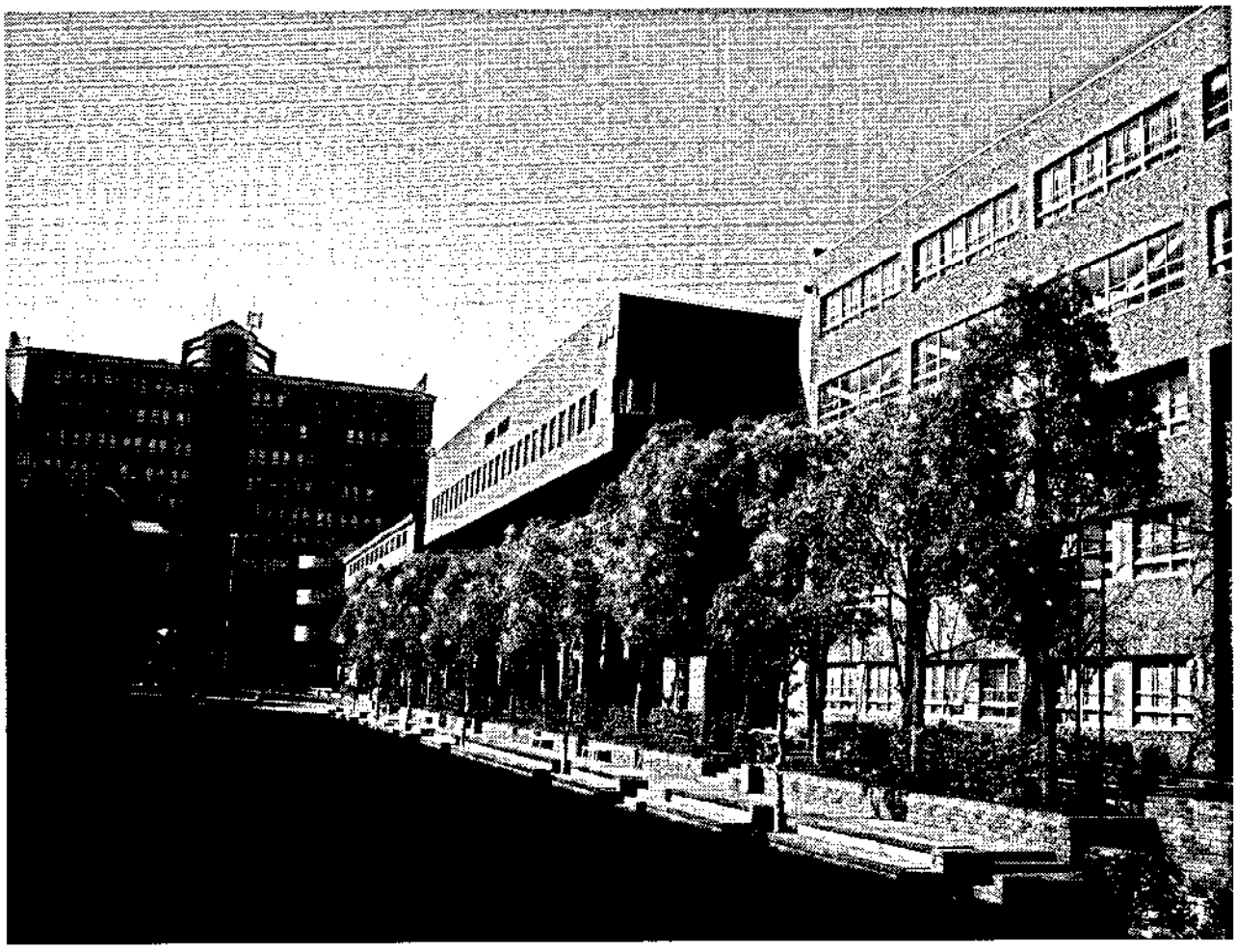


Photo32: A conceptual scene of FGC

CHAPTER SEVEN: SUMMARY AND CONCLUSIONS

"How could we imagine restructuring society for a healthy Earth without a reasonable approach to rebuilding the largest things we build, our cities and towns?"

(Richard Register, Eco-cities, 2002:p.173)

7.0 Introduction

This is the last chapter of the dissertation, which summarizes the study. It has listed the important findings of the study and mentioned some recommendations. Theoretical and Practical implications of this study are also included in this chapter. Research is never ending process. It is something like adding bricks on the foundation already laid by someone in the past. So every research has open up some further opportunities of research. Such opportunities provided by this research are also pointed out in this final chapter.

7.1 Summary

The dissertation started with the study of problems that are facing by the cities from the beginning of 21st century due to rapid urbanization rate. To meet the demands of increasing population in the cities, the farm lands have been rapidly converting. This brings mainly two types of problems i) Decreasing the food self sufficiency rate ii) Environmental problems. To tackle these problems, this study was initiated and aimed for proposing sustainable city planning methodology suitable for the 21st century.

Planning is the future oriented activities to provide the solution for the problems. But it needs a "Holistic and Integrated Approach" to tackle the problems. After over viewing the situation of Japan, one of the urbanized and industrialize country of this world and various literature review, the "Food Green Concept" was proposed that advocates Green as a functional entity. Based on this concept and set of principles Food Green City was proposed in this study as a sustainable city planning methodology. In this study, GIS technology which can provide invaluable assistance to planning is applied. This research is carried out with the application of ESRI GIS software Arc View 3.2 assuming it as a holistic tool which can give the holistic picture of the environments to the planners and designers. It is used in the study as a database system for spatial analysis, map preparation and presentation of results. It is also used for spatial design and planning purposes with impressive visualization in 3D environment. It thus opened up possibilities of GIS application in the field of urban planning & design.

This research is carried out taking seven cities of Kitakawachi region as case study. It performs demographic analysis and land use analysis of those cities. Beginning with the study of Wayside shrines in the city of Kawachinagano city, this study also carried out the spatial distribution of the Wayside shrines in Kitakawachi region using GIS. It is investigated that the potential and viable Food Green Lands identified in Kitakawachi are sufficient to attain multi-functional benefits by providing respectively 49% and 23% food self sufficient state and 66% and 31% green spaces of total area to the region. Finally, it has proposed the Food Green City neighborhood unit model of 250m radius area and applied to the 63% of the region (estimated developable lands in the region). The FGC vision for Kitakawachi is illustrated by Conceptual Plan by Fig.75 and 3D Scene 2. The designed model is visualized in 3D environment using GIS. It shows how it looks like and how it spatially arranges the land uses and built-up environments with

consideration of cultural elements like Wayside shrines. Finally, it has verified with data how much percentage food sufficiency state will be achieved in the model neighborhood unit. The encouraging results direct that if such neighborhood units are set in the proposed planning layout, the existing city could be converted into sustainable cities. Food Green City is thus a process to bring back city in harmony of Nature, Culture, Humanity & Development and a method of converting the carbon dioxide city to carbohydrate city with coexistence of Man in natural system.

This dissertation has put the efforts by proposing "Food Green City Concept" to overcome the urban environmental problems understanding the importance of balance between primary, secondary and tertiary activities. This addresses the issues of declining food self sufficiency rate of Japanese cities, advocates for spatial equity and demonstrates how to combat the situation in sustainable way. Therefore, the major contribution of this dissertation is a proposal of a sustainable city planning methodology suitable for 21st century- the century beginning with the issues of environmental problems and resource crisis.

7.2 Findings

The important findings of this study are as follows:

1. Like the countrywide situation of Japan, the cities of Kitakawachi have the imbalanced of primary, secondary and tertiary activities. The rate of decreasing farm lands and obvious lower food self sufficiency rate is alarming. This is one of the major reasons behind the large ecological footprint share of those cities.

2. From the analysis, the built-up areas percentage in the cities is large due to the detached housing patterns. And it is also investigated that there are a lot of unused lands around the houses and in the cities as seen in the category of "Remaining lands" of land use analysis.

3. Wayside shrines are found as religious and cultural identity in neighborhood complementary to the major religious places, place of social values, attachments and beliefs as well as spiritual heart of the urban neighborhood. The observations of Wayside shrines established at some meaningful locations possessing connection with various activities of people, support some statements of common beliefs of people and prove that they are still alive in this 21st century's secular society.

4. The cities of this region can be put under the three groups based on population density, urban district areas and natural elements (forests and rivers etc.) as mentioned below:

   (i) High population density, High urban districts and low natural elements cities (Moriguchi city, Neyagawa city and Kadoma city)
   (ii) Medium population density, Medium urban districts and moderate natural elements (Hirakata city and Daito city)
   (iii) Low population density, Low urban districts and high natural elements (Shijonawate city and Katano city)

   But the homogenous demographic characteristics among the cities based on the analysis of sex structure, age structure and family structure observed exhibits demographic similarities among the seven cities of the region as a regional identity. Whereby the analysis based on CDI also shows the cities of Kitakawachi have well facilities and can be placed in one group.

5. Based on Green 21 concept looking Green as Green + Food, the identified potential and viable

Food Green Lands of Kitakawachi are sufficient to attain multi-functional benefits by providing respectively 49% and 23% food self sufficient state and 66% and 31% green spaces of total area to the region. This proves that it is still possible to move towards the significant percent of food self sufficiency state with green urban environment in the region if Food Green Concept is realized in land use planning.

6. The proposed Food Green City Model shows that it can be possible to reshape the city with sufficient open space and achieve remarkably high food self sufficient state. The principles associated with it can create the cities as sustainable places with reduced the Ecological Footprint. Following the newly proposed planning layout of city and applying the Foot Green Concept an existing city can be changed to a sustainable city.

7. GIS is the valuable planning and design tool that help in creating database system, analysis, presentation and design of the environments. The presentation capability of GIS in 3D environments can create the easy understanding of the environments.

7.3 Recommendations

This study has following recommendations.

1. In Japan, there is merging trend of two or more cities or two or more villages into a city to form a big city. The uniformity of demographical characteristics among the cities or villages as investigated in the cities of Kitakawachi region could be the pre-assessment criteria for the merging process, so that sustainable development and social equity in the merged city can be achieved under the similar types of planning and development approaches. Therefore, such kinds of study are also recommended to carry out for the pre- assessment of merging process of the city. Based on the study, it supports the merging process from the demographic point of view and recommend for cities of the Kitakawachi to adopt the integrated planning approach in collaboration among the cities.

2. It is observed that seven cities have different patterns of land uses and topographical back ground. Therefore, it is recommended for the cities of Kitakawachi to construct integrated planning vision of the region and follow the plans & activities among the cities accordingly. This helps for better use of potentialities of cities and makes the collaborative support for the sustainable development of the region.

3. Not to have further environmental deterioration of the cities, it is highly recommended the incorporate the vision of productive green areas in the land use planning in the respective cities. Collaborative and supportive plans of action must be carried out for the promotion of urban agriculture in city. FHC, Zoning for agriculture activities, encouragement of local food production are some of the policies that must encouraged by the city administration.

4. Community participation is vital for bringing the effectiveness in urban planning and management. Therefore, in every stage of planning process the role of community participation along with activities of NPO, NGO are highly encouraged.

5. In past people are bounded with culture and faced few environmental and social problems. With advancement of civilization and urbanization number of problems increased. Such problems have been trying to manage with the use of legal basis in present days. But many of urban problems can be tackled still in cultural basis. So, cultural incorporation in the planning process are also suggested.

6. "Reducing the prosperity for sharing the equity" is must to live within the carrying capacity. Sharing of the resources is one of the methods to find trade off between prosperity and carrying capacity. For example: Sharing cars in community, Sharing of space and Traveling in Bus etc.

7. Cities should be the cities for all i.e. from poor to rich, female to male and child to old. To achieve this, the land uses of city must keep balance of three activities (primary, secondary and tertiary) and provide the opportunities for all.

8. Agriculture has important role for providing food and keeping ecological balance in city. It is necessary to teach about it beginning from child. So it is recommended to create school gardening as a practical teaching system about agriculture and ecology to the students.

9. GIS has a recent planning tool for data storing, analysis and results presentation. The application of GIS for practical planning process is recommended for keeping the database system of city environment and land use planning.

10. In brief, Food Green City concept is the product of HIA for creating sustainable city that can transfer the existing city to sustainable form. Therefore, the principles associated with Food Green City are highly recommended.

7.4 Theoretical and Practical Implications

The sustainable city planning methodology proposed in this dissertation has applied for the cities of Kitakawachi following proposed planning layout described in Chapter Three. This dissertation proposes for creating a self sustained place and spatial equity according with the nature. In the context of falling resources, Food Green concept and principle of balance, integration & share of space have been adopted in the proposed methodology for transforming existing cities to sustainable cities to get rid from the existing problems. This dissertation is a deeper understanding of man in nature and our place in the planet unlike present trend of city growing beyond the carrying capacity of the city.

From the theoretical context, this dissertation adopted the Holistic approach for sustainable development invoking the ideals of social justice, community empowerment, equity, people participation based on principle of integration: Integration of actors, Integration of activities, Integration of Space. It has recognized the place as space with character and advocated for self sufficient city (particularly in food) to all. For this it viewed the Green as Green + Food from the stand point of function and directed to integrate urban agriculture in land use from planning perspective. Following the proposed new planning layout, the city could be converted into sustainable city. In long run there will be no more demarcation line between rural areas and urban areas. Thus, this dissertation has forwarded a methodology of *"restructuring for cities"*, which reframe the way for spatial equity and sustainable development in harmony with nature.

From Practical context, this dissertation has offered a simple and practical method of empowering the community and creating a sustainable neighborhood within the carrying capacity of the city. This study particularly advocates bringing back the agriculture activities in the city as a culture and sustainable means for balancing physical, social and ecological state of the city. *"Sharing the Resources"* through *"Community Management"* has mainly targeted for realizing the theory into practice. In the context of decreasing trend of population, this concept has great possibility of its application in the Kitakawachi for restructuring into sustainable region within the

carrying capacity. The cities of Kitakawachi, which are in between two big cities like Osaka and Kyoto, has been acting as resident cities. In the context development vision for resident cities (e.g. Hirakata city), the Food Green city is highly applicable and appropriate.

7.5 Opportunities of Future Research

This dissertation is just a foundation of Food Green City Concept as a sustainable city planning methodology. The application of this methodological perspective in practice has offered many opportunities for further important research. Some of them are listed as follows:

1. Based on the Food Green City concept this dissertation has shown a self sufficient neighborhood unit of radius 250m. It has demonstrated how living working and recreation can be put together for self sufficient purposes. Now, the researchers can go details on creating such self sufficient unit under the principle idea of the concept. For example: community space design, spatial arrangement of buildings, heights of buildings, agriculture land use pattern and roads patterns. It also opens a field of research what should be the size of the Food Green City neighborhood by area and people.

2. Regarding the agriculture activities in an area, researchers can investigates what kinds of plants are suitable and how to plant them in the area keeping in mind for the good living environment. How to manage the agricultures activities in such community based neighborhood is also a good further research topic.

3. Food Green City is the process of creating a sustainable place. It has advocated for transferring the exiting city to sustainable city. It needs planning when, how and which part of the city could be changed into Food Green City. This requires the research on land uses pattern, demographic trends, land uses and Housing patterns of the existing part of the city. Thus, one of the potential research opportunity is to develop the method when, how and which part of the city could be changed to Food Green City.

4. In the real city, there are not always flat lands or developable lands. There may be natural elements like forests, ponds, rivers. So the next research opportunity might be how to interlink the Food Green City neighborhood with those natural elements and design the neighborhoods according with nature and environments.

5. This dissertation has widely used GIS from analysis of city for the application of concept in model design. It has therefore shown the further research areas of using GIS in planning and design for clear, accurate and quick results and visualization purposes.

6. Study of cultural elements of the city has revealed the fact that these elements are distributed in the city meaningfully and closely connected with the people. So researcher could further investigate in such cultural elements to interlink them into planning.

NOTES

[1] Food Green City (FGC) is designated for producing the food for the residents maintaining the green within the city by means of Urban Agriculture incorporating into land use planning of the city. It is based on proposed concept for multi-functional uses of green as: producing food to the residents and creating a green environment in the city to achieve the sustainable development in 21st century.

[2] Urban Agriculture (or some times Urban Farming) includes any primary activities like growing crops or doing some forms of livestock or fishing in urban areas.

[3] This method of Urban Agriculture designated for the Food Green city. The characteristics of which are close to the Natural farming process but not completely follow Natural farming. This is the intermediate type of farming system in between modern farming system and natural farming system considered from the view point of 21st century urban environments.

[4] Environmental Design does not mean design of environments. What it means is design according to the environments. It is therefore art and science of shaping new elements according to the surrounding environments (natural, manmade and cultural environments) for the benefit of humankind with balancing the human needs within carrying capacity of the surrounding environments.

[5] The terms urban indicate the administratively defined "shi" areas.

[6] The Human Development Index (HDI) is a summary measure of human development. It measures the average achievements in a country in three basic dimensions of human development:

- A long and healthy life, as measured by life expectancy at birth.
- Knowledge, as measured by the adult literacy rate (with two-thirds weight) and the combined primary, secondary and tertiary gross enrolment ratio (with one third weight).
- A decent standard of living, as measured by GDP per capita (PPP US$)

(Human Development Report 2003, UNDP) Internet source: http://www.undp.org/hdr2003/pdf/hdr03_backmatter_2.pdf Access date: 15 July 2003

[7] Courtesy of Photo: http://www.beeworks.com/gallery/image4.htm Access date: 2. July 2003.

[8] Earth day Network, "Footprint Quiz"
Internet source: http:// www.earthday.net/Footprint/quiz.asp Access date: 25 July 2003

[9] Exergy defines the maximum amount of work theoretically obtainable from a system as it interacts to equilibrium with the environment. While the energy of 11 liters of water at 80 degree Centigrade and 1kWh of electricity is approximately the same, it should be obvious that 1kWh of electricity enables the production of more useful work than the 11 liters of hot water. Exergy, therefore, is a quality measure for different types and forms of energy. (Source: Eco- restructuring Implications for Sustainable Development, p.176, United Nation University Press, 1998, Japan)

[10] This is the networking among the communities that are doing agriculture activities for exchanging and supplying seeds, agriculture tools, human resources and food produced in collaboration and multilateral agreements for their mutual benefits. This improves a sense of community, promotes the social intercourse and extends the mutual understanding & various social benefits.

[11] Self Ethical Approach (SEA) is the proposed approach to contribute to the society by oneself for creating the sustainable society after doing Self Sustainability Assessment. This approach advocates the ethical support of one's for the reducing the consumption pattern to develop the sustainable society.

[12] Calculated from the data available in the home page about Natural farming. Internet source: http://www.seedballs.com/gmmfpa.html , Access date: August 26, 2003.

[13] This unique method of "do nothing method" [16] and has four principles 1) No Cultivation 2) No fertilizer 3) No weeding 4) No pesticides. This method of agriculture in urban areas is most suitable method, which can reduce most of the cost of Urban Agriculture.

[14] It is proposed policy for controlling over population in the city. This assures that the certificate holder households access the designated percentage of locally produced food in their daily lives. The population growth beyond the city capacity of food production is checked by this policy.

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APPENDICES

APPENDIX- A

Table 6: Households and Household members

Year	Households (1000)	Members per household
1970	30297	3.41
1975	33596	3.28
1980	35824	3.22
1985	37980	3.14
1990	40670	2.99
1995	43900	2.82
2000	46782	2.67

Data Source[31]: Statistics Bureau, Ministry of Public Management, Home Affairs, Posts and Telecommunications; Ministry of Health, Labor and Welfare (2002)
[Ref. Fig. 2: Households and Household Members]

Table 7: Population of Three Major Metropolitan Areas*

Areas	1980	1990	2000
Japan	117060	123611	126926
Tokyo Metropolitan area	26343	29200	30724
Osaka Metropolitan area	15422	16210	16567
Nagoya Metropolitan area	7828	8432	8852
Total of three metropolitan areas	49593	53842	56143
Ratio of total population (%)	42.36545361	43.55761219	44.23286009

* As of 1 October. Areas within 50 kilometers radius from each municipal office
Data source[31]: Statistics Bureau, Ministry of Public Management, Home Affairs, Post and Telecommunications (2002).
[Ref. Fig. 3: Population of Three Major Metropolitan areas*]

Table 8: Population of Urban and Rural Areas

Year	Percentage of urban area population (%)	Percentage of urban area (%)
1920	18	0.4
1925	21.6	0.6
1930	24	0.8
1935	32.7	1.3
1940	37.7	2.3
1945	33.1	4.3
1950	37.3	5.3
1955	56.1	18
1960	63.3	22
1965	67.9	23.5
1970	72.1	25.3
1975	75.9	27.1
1980	76.2	27.2
1985	76.7	27.3
1990	77.4	27.5
1995	78.1	27.8
2000	78.7	28.1

Data Source[36]: Population Census of Japan.
[Ref. Fig. 4: Growth trend of population and area in Urban Japan]

Table 9: Land uses trend of Japan.

(percent)

Years	Farm Land	Forest	Grass Land	Water Areas, Rivers Rivers and Channels	Roads	Land for Building	Others	Total
1983	14.7	66.9	0.8	3.1	2.8	3.8	7.9	100
1984	14.6	67	0.8	3.5	2.8	3.9	7.4	100
1985	14.5	67	0.8	3.4	2.8	4	7.5	100
1986	14.5	66.9	0.8	3.5	2.9	4	7.4	100
1987	14.4	66.9	0.8	3.5	2.9	4.1	7.4	100
1988	14.4	66.9	0.7	3.5	3	4.2	7.4	100
1989	14.2	66.9	0.7	3.5	3	4.2	7.4	100
1990	14.1	66.8	0.7	3.5	3	4.3	7.5	100
1991	14	66.8	0.7	3.5	3	4.3	7.6	100
1992	13.9	66.7	0.7	3.5	3.1	4.4	7.7	100
1993	13.8	66.6	0.7	3.5	3.1	4.4	7.8	100
1994	13.7	66.6	0.7	3.5	3.1	4.5	7.9	100
1995	13.6	66.5	0.7	3.5	3.2	4.5	8	100
1996	13.4	66.5	0.7	3.5	3.2	4.6	8	100
1997	13.3	66.5	0.7	3.5	3.3	4.6	8.1	100
1998	13.2	66.4	0.7	3.5	3.3	4.7	8.2	100
1999	13.1	66.4	0.7	3.5	3.3	4.7	8.2	100
2000	13	66.4	0.7	3.6	3.4	4.7	8.2	100

Data Source[19]: White Paper on National Land Ministry of Land, Infranstructure and Transport (January, 2002) Internet Source:http://jin.jcic.or.jp/stat/stats/01CEN11.html
[Ref. Fig. 5: Land uses trend of Japan]

Table 10: Population by Labor Force status

(Thousands)			Labor force		Not in labor	Unemployment rate (%)
Year	Population aged15 years and over	Total	Employed	Unemployed		
1985	94650	59630	58070	1560	34500	2.6
1990	100890	63840	62490	1340	36570	2.1
1995	105100	66660	64570	2100	38360	3.2
2000	108360	67660	64460	3200	40570	4.7

Data Source[32]: Statistics Bureau, Ministry of Public Management, Home Affairs, Posts and Telecommunication (2002)
[Ref. Fig. 9: Labor force status]

Table 11: Household Expenditure by Category (1988-2002)

Household Expenditure by Category	(percent, 2002)
Total (Living Expenditure)	100
Food	22.2
Housing	6.5
Fuel, Light and Water Charges	6.3
Furniture and Household Utensils	3.3
Clothes, Footwear	4.8
Medical Care	3.2
Transportation and Communication	13.2
Education	5.3
Reading and Recreation	10
Others	25.3

Notes:
Yearly average of monthly disbursements per worker's household.
Worker's Households:
Head of the household works for a company or government agency. Directors and executives are excluded.

Living Expenditure:
Excludes social security and taxes.
Data Source[20]: Annual Report on the Family Income and Expenditure Survey
Ministry of Public Manegement, Home Affairs, Posts and Telecommunications (Feb. 7, 2003)
[Ref. Fig.12: House hold expenditure 2002]

Table 12: National self sufficiency in food

Year	%
1960	98
1965	94
1970	88
1975	82
1980	80
1985	76
1990	67

Source of Data [14]: Nihon no Tokei 1996:115
[Ref. Fig. 13: National sufficiency in total food*]
Notes: (*domestic production as proportion of domestic consumption %)

Table 13 : Trend of HDI [6], Urban Population and Energy consumption in Japan

Year	HDI*100	Urban Population %	Electricity consumption per capita (kilowatt-hours)
1980	87.6	76.2	4395
2000	93.3	78.8	7564

Data Source: Human Development Report 2002 [48] and Population Census of Japan[36]
[Ref. Fig. 14: Trend of HDI [6], Urban Population and Energy consumption in Japan]

Table 14: Per Capita Consumption and Dependency on Imports of Primary Energy, by country:1998

Item	Japan	China	Germany	Russia	U.K.	USA
Per capita consumption (kg) 1*	3659	635	3940	3942	3967	7633
Dependency on imports (%) 2*	78.6	0.8	62.3	-60.2	-13.1	24.7

Data Source [29]: United Nations. Notes: 1* Petroleum equivalent.
2* Dependency on imports = (Imports-Exports)/ (Imports-Exports + Domestic production) x100
[Ref. Fig. 10: Per Capita Consumption and Dependency on Imports of Primary Energy (1998)]

Table 15: Sectoral distribution of GDP and employment (%) for Japan

Year	GDP			Employment	
	Agriculture	Industry	Services	Agriculture	Non- Agriculture
1885	42.8	11	46.2	71.4	28.6
1920	27.3	31.6	41.1	52.1	47.9
1935	17.9	51.1	32	44.6	55.4
1960	13.3	48.8	37.9	30.8	69.2
1970	6.7	51.3	42	16.3	83.7
1990	2.4	36.9	60.7	6.2	93.8

Data Sources [14]: Agriculture and Economic Development in East Asia, p. 37

[Ref. Fig. 7: Difference in about 100 years for GDP Contribution
Fig. 8: Difference in about 100 years for Employment Contribution]

Table 16: Energy intake from nutrients (per capita per day)

Year	Total energy (kcal)	Protein (%)	Fat (%)	Carbohydrate (%)
1960	2,096	13.3	10.6	76.1
1965	2,184	13.1	14.8	72.1
1970	2,210	14	18.9	67.1
1975	2,268	14.6	22.3	63.1
1980	2,119	14.9	23.6	61.5
1985	2,088	15.1	24.5	60.4
1990	2,026	15.5	25.3	59.2
1995	2,042	16	26.4	57.6
1999	1,967	16	26.5	57.5

Data source[21]: National Nutrition Survey conducted by the Ministry of Health, Labor and Welfare
[Ref. Fig. 11: Energy intake from nutrients (per capita per day)]

APPENDIX-B

Table 17: Population densities with time

Density (persons /sq. km)

Year	Japan	Osaka Prefecture	Osaka City	Kitakawachi	Moriguchi City	Hirakata City	Neyagawa City	Daito City	Kadoma City	Shijonawate City	Katano City
1960	252.7	3132.2	17289.4	2158.428571	6775.9	1003.6	1676.8	1774.6	2972.7	541.2	364.2
1970	280.3	4295.4	18747.4	5874.042857	12913.8	2768.5	6995.3	4962.4	10943.9	1566.2	968.2
1980	314.1	4764.2	17305.7	6889.671429	12546.3	4482.2	9050.2	6459	11636.1	2165.8	1888.1
1990	331	4896.8	17245.8	6922.528571	12474.7	4839.1	8424.1	6741.8	11966.5	2155.2	1856.3
2000	339.8	4651.8	11744	7475.785714	11942.8	6187	10143	7061.4	11048	2938.2	3010.1

Data Source: Osakafu no Zinkoudoukou (1993) [38] and Zinkou no doukou (Nihon to Sekai), 2000. [36]
[Ref. Fig.18: Population densities with time]

Table 18: Population dynamics

Cities	1955	1995
Moriguchi City	78710	157306
Hirakata City	59327	400144
Neyagawa City	38668	258443
Daito City	30118	128838
Kadoma City	20858	140506
Shijonawate City	10020	53763
Katano City	11674	72404

Data source: Osakafu no Zinkoudoukou (1993) [38] and Moriguchi shi no Tokeisho (2000). [33]
[Ref. Fig.19: Population dynamics]

Table 19: Urban district area vs. per capita city parks

(2000 Year Data)

Cities	Urban district area %	Per capita City park (sq.m.)	Average per capita City park (sq.m.)
Moriguchi City	92.53	3	5.6
Hirakata City	63.31	4.1	5.6
Neyagawa City	83.94	4.5	5.6
Daito City	64.97	1.9	5.6
Kadoma City	96.58	0.8	5.6
Shijonawate City	31.43	8.3	5.6
Katano City	35.85	1.6	5.6

Data Source: Osakafu Shinchoushon Handbook (2001). [39)]
Fig.20: Urban district area vs. per capita city parks.

APPENDIX-C

Table 20: Land uses of Kitakawachi Region (Area in km^2)

Land use Category	Moriguchi City	Hirakata City	Neyagawa City	Daito City	Kadoma City	Shijonawate City	Katano City
Forests	0	4.99	0.48	3.26	0	7.05	9.73
Water Bodies	0.64	2.21	0.72	0.46	0.19	0.42	0.48
Roads and Railways	2.42	8.56	4.08	2.32	2.02	1.65	2.09
Houses	4.10	11.03	6.32	3.86	4.04	1.55	2.24
Green	1.09	5.20	1.20	1.21	0.21	1.27	2.05
Others	0.45	2.74	0.59	0.44	0.19	0.28	0.36
Remaining lands	4.16	30.41	11.30	6.74	5.63	6.66	8.52

Based on GIS Analysis.
[Ref. Fig.51: Land uses of seven cities of Kitakawachi]

Table 21: Potential and Viable Food Green Lands.

Cities	Potential Lands (km^2)	Viable lands (km^2)	Per capita lands required for full self sufficiency in food (m^2)	Per capita potential Food Green Lands (m^2)	Per capita viable Food Green Lands (m^2)
Moriguchi City	6.090238389	3.217247564	200	40.05892436	21.16164731
Hirakata City	43.8346675	21.74412843	200	108.8827418	54.01113907
Neyagawa City	14.01099513	7.043863231	200	55.85697139	28.08143627
Daito City	11.81226936	5.387289092	200	91.56017209	41.75837015
Kadoma City	6.437885536	3.240499656	200	47.4528856	23.88533605
Shijonawate City	15.17533708	6.079603706	200	275.6045382	110.4137828
Katano City	20.62046877	8.375878839	200	268.1186452	108.9077708
Kitakawachi	117.9818618	55.08851052	200	98.14605361	45.82670442

Based on GIS Analysis.
[Ref. Fig.71: Potential and Viable Food Green Lands]

ABOUT THE CANDIDATE

Sunil Babu Shrestha is a Ph. D. Candidate for the year 2004 in the Division of Environmental Development Engineering of Osaka Sangyo University, Japan. He did Master Degree in Urban Planning from Department of Architecture, Tribhuvan University of Nepal, producing M.Sc. Thesis on "Affordable Housing Strategy for Urban Poor of Nepal" in 1999. He served for about 2½ years working as Engineer and Planner in Nepal. His main research interests are in Sustainable Urban Development, Ecological Economics, Affordable Housing and Application of GIS in planning & design. He can be reached via email at: sunilbabus@yahoo.com

His achievements during three years (2001 March-2004 March) of Doctor Course study is listed below.

Lists of Published Papers:

(1) Shrestha, S.B and Taniguchi O. **"Geographic Information Database System (GIDS) And Analysis of Distribution of Wayside shrines in Kawachi Nagano City"**, *Journal of Osaka Sangyo University Natural Sciences,* No.112, p.p.45-78, March 2003.[34 pages]

(2) Shrestha, S.B and Taniguchi O. **"A Holistic Approach for Providing Affordable Housing to the Urban Poor Of Nepal"**, *Journal of Asian Architecture And Building Engineering*, Vol.2, No.1, pp.153-160, May 2003.[8 pages] **(Reviewed Full Paper)**

(3) Shrestha, S.B and Taniguchi O. **"GIS Aided Concept for the Northern Osaka Station"** *Journal of Osaka Sangyo University Natural Sciences*, No.113, pp.27-46, June 2003. [20 pages]

(4) Shrestha, S.B and Taniguchi O., **"A Study of Spatial Distribution of Wayside shrines in Kawachi Nagano City Using GIS"** *Proceedings of 8th International Conferences on Computers in Urban Planning and Urban Management (CUPUM'03)*, Sendai, Japan May 27-29, 2003. (Abstract published in hardcopy pp.169-170 and full paper published in CD Proceedings/Reviewed Section) [16 pages] **(Reviewed Full Paper and presented in International Conference)**

(5) Shrestha, S.B and Taniguchi O., **"Urban Green" Concept for Sustainable Cities of 21st Century (A Case Study of Japan)"**, *Journal of Osaka Sangyo University Natural Sciences,* No.114, pp. 29-63, Oct. 2003. [35 pages]

(6) Shrestha, S.B and Taniguchi O., **"Application of GIS for the Visualization of Urban Demography in Kitakawachi Region, Japan"**, *Proceedings of The 24th Asian Conference on Remote Sensing & 2003 International Symposium on Remote Sensing*, pp.136-141, 3-7 Nov. 2003, Busan Exhibition and Convention Center (BEXCO), Busan, Korea. [6 pages] **(Accepted for presentation after reviewing Abstract and presented in International Symposium)**

(7) Shrestha, S.B and Taniguchi O., **"GIS Application for Integration of Urban Agriculture into**

Land Use Planning of Kitakawachi", *Proceedings of The 4th International Symposium on City Planning and Environmental Management in Asian Countries*, pp.233-245, Jan 11-14, 2004 at Korea Environment Institute in Seoul, Korea.[13 pages] **(Reviewed Full Paper and Presented in International Symposium)**

(8) Taniguchi O, Shrestha, S.B. and Sakakibara, K., **"Analysis of Wayside Shrines in Kawachinagano City by GIS",** *(In Japanese) City Planning Review of City Planning Institute of Japan.* (Accepted to publish on Apr.2004) [10 pages] **(Reviewed Full Paper)**

Lists of Presentation at International Seminar and Conferences:

1. **"Public Awareness for Environment and Development"** presented in group, *Global Seminar 2nd Kanazawa Session 2002* organized by **United Nation University(UNU), United Nations Institute of Advanced Studies (UNU/IAS), Ishikawa International Cooperation Research Center (IICRC)** with collaboration of various universities of Japan at Ishikawa Youth Training Center in Kanazawa City, Nov 23-26, 2002.

2. **"A Study of Spatial Distribution of Wayside shrines in Kawachi Nagano City Using GIS"** *7th International Conferences on Computers in Urban Planning and Urban Management (CUPUM'03)*, Sendai, Japan May 27-29, 2003

3. **" Will for Change"** presented in group with focusing sustainable cities, *Global Seminar 2nd Tohoku Session 2003'* organized by **United Nation University(UNU),** with collaboration of various universities of Japan at Akita University in Akita City, July 27-30, 2003.

4. **"Application of GIS for the Visualization of Urban Demography in Kitakawachi Region, Japan",** *The 24th Asian Conference on Remote Sensing & 2003 International Symposium on Remote Sensing* 3-7 Nov. 2003, Busan Exhibition and Convention Center(BEXCO) Busan Korea.

5. **"Integration of GIS and GPS for the Study of Wayside Shrines",** *The 24th Asian Conference on Remote Sensing & 2003 International Symposium on Remote Sensing* 3-7 Nov. 2003, Busan Exhibition and Convention Center(BEXCO) Busan, Korea.

6. **"GIS Application for Integration of Urban Agriculture into Land Use Planning of Kitakawachi",** *The 4th International Symposium on City Planning and Environmental Management in Asian Countries*, Jan 11-14, 2004 at Korea Environment Institute in Seoul, Korea.

Participation for International Concept Competition:

1. Participated in group with proposing **"Sustainable Development and Planning Concept with the assistance of GIS"** based on Environmental Design Principle in *International Concept Competition for the Northern Osaka Station Area,* Jan31 2003.