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Special Issue on "Clue to Sustainability Development in aspect of region character encouragement, City planning trend and Citizen participation"
Guest Editor: Misato Uehara and Anrong Dang

Content

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Editorial Introduction

Special issue on "Clue to Sustainability Development in aspect of region character encouragement, City planning trend and Citizen participation"

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The key idea of sustainable development in the fields of economics, demographic politics, and regional planning remains a significant issue. The ability to create a new sustainable planning model is essential to all our futures, but it will require sharing experience between different countries and study fields. This was indicated by Professor Qizhi Mao at the 2013 International Conference on Spatial Planning and Sustainable Development (30 Aug. - 1 Sept. 2013, Beijing). Professor Yan Li and Anrong Dang (2014) also emphasized the importance of sharing case studies. Unfortunately, spatial planning studies cannot be conducted under the same conditions as laboratory experiments, which can be tested. In addition, different countries have different situations regarding their economy, religion, and culture. Thus, sustainable development is interpreted differently.

Richard Buckminster Fuller (2008) stated a reason contributing to the failures of sustainable development as the flowing; 'Society operates on the idea that specialization is the best way'. But this principle might lead to big problems. For example, because of a lack of relevant knowledge, site planning of the Fukushima nuclear plant along the seaside for seawater use resulted in the 2011 tsunami disaster and ground water contamination problem. About 1,000 tons of underground water from the mountains flows into the nuclear plant each day, and 400 tons of water seep into the reactor and turbine basements and get contaminated. For this reason, Fuller suggested the planners should have a wider knowledge pool than some other professions.

Fortunately, we have some excellent sustainable development models, even if we are limited to the works of Landscape Planning and Architecture. For instance, the Boston Back Bay Fens by Frederick Law Olmsted, the Woodland in the USA. by Ian McHarg's, and the First Garden City, Letchworth in the U.K. The Boston Back Bay Fens and the Woodland are co-existing models of disaster prevention and attractive open space creation. Also, Olmsted's new town The Riverside influenced Letchworth's First Garden City planning.

Few successful new town developments in Japan are inspired by the idea of Letchworth with a concept of the marriage of the city and the countryside by Takahito Saiki (2002). These old success models seem under-rated. Spirn (1985) indicated that "much more is known about botany, geology,

sociology, and economics than about the links between them". This theory of specialization is the reason why there are few success models.

Our ambition in this issue is to share common solutions and problems across disciplines and inspire new ideas about how to deal with sustainable development.

The case studies are classified into three different categories.

1. Regional characteristics of sustainable design
2. The trend of city planning and its sustainability
3. Citizen participation for sustainable development

The first category is ‘regional characteristics of sustainable design’.

"The Use of Vertical Greening in Urban Rehabilitation to Improve Sustainability of the Environment in Taiwan" (Kuang-Hui Peng, Y. K and H.L, 2014) points out that scarce green space and dense urban areas have caused serious urban heat island effects. The paper proposes to increase the plant cover of the city with vertical greening as well as regulating its maintenance in urban rehabilitation. Through a literature review and field research, the researchers summarized the topics of plants, vertical greening technology systems, and external building environments that are directly related to vertical greening technology. The paper also provides suggestions for vertical greening development in the city.

"Climate-Sensitive Urban Design in Cold Climate Zone: The City of Erzurum, Turkey" (Dogan Dursun and M.Y, 2014) focuses on the inconsistencies between urban planning practices and climate factors in Erzurum as a cold area. Direction, disturbances, vulnerability of the urban ecosystem, construction practices, street orientations, settlement patterns, housing typology, density, average height, hard-surfaces, distances, flora and density of green areas are analysed in this paper. The findings suggest that urban built environments in Erzurum (City centre, Dadaskent and Yildizkent districts) are not consistent with the cold climate conditions. The paper suggests possible solutions that will also be helpful for air pollution and other design based problems. This could be a guide for the new development of a city.

"Challenges and Tasks of Ecobridges in Seoul Based on the Ecobridge-use Behavior Survey: In the Case of Ecobridges in Dongjak-gu and Gwanak-gu Huh" (Hur Yoon-seo, Y.H, Y.S, W.E and S.Y, 2014) discusses landscape ecology networks. From 1994, the Seoul City Government began building ecological corridors to re-establish the ecological network. 25 eco-corridors were built before 2013 in Seoul. This model of Seoul is significantly important. To perform the ecological functions as a route for humans and wildlife, the eco-corridors in urban areas need to be comprehensively considered with respect to both ecological and pedestrian uses. Through user behaviour analysis of four eco-bridges, it is found that the appearance frequency of wild animals along the eco-bridges is very low and species are quite limited. On the other hand, the frequency of human utilization is very high and the purposes of utilization are varied. Based on these results, the paper suggests that eco-bridges in Seoul might have more functions and meaning, not only as a wildlife passage. This paper is organized very carefully to address future planning problems.

The second category is ‘the trend of city planning and its sustainability’.

"Key factors for renewable energy promotion and its sustainability values in rural areas: findings from Japanese and Chinese case studies." (Qianna WANG ,L.P M.M, I.K et al, 2014) examines two parallel cases with

literature, local plans, policy documents, and a questionnaire. Using SWOT analysis, this study presents two pioneer cases: Kuzumakicho in Japan, and Chongming Island in China. Both of the two case studies represent the most advanced renewable energy (RE) technologies in their home country. The paper presents the key factors of developing RE as municipal planning concepts and subsidies from national or regional governments. It concludes with the lessons learned and recommendations for future RE promotion in Japanese and Chinese rural areas.

"Legacy creation strategy in Olympic cities - the path towards sustainable development?" (Yawei Chen 2014) aims to identify the best strategies to improve the post-event usage of the facilities and long-term benefits of the host city. Every Olympic host city is expected to experience some form of short- and long-term impact, the so-called 'legacy', it is however difficult for most of the organisers to think beyond the Games in a systematic way due to the pressures and complexities involved. From the perspective of legacy planning, the paper suggests that it is not only important to consider how to integrate urban visions and existing/planned projects, but more significantly, to have a vision as to how the urban development for the Olympics should be planned in the long-term.

The last category is 'citizen participation for sustainable development'.

The purpose of the paper "Spontaneous Urban Agricultural Lands as Potential Green Open Space" (Min, Kyung-chan, K.J and S.Y 2014) is to categorize the types and problems of agricultural lands in Gwanak-gu through field surveys. "Urban Agriculture" is promoted through consistently building vegetable garden parks and community vegetable gardens and inviting citizens to participate in the new movement.

This paper suggests: 1) the government support on small-scale agricultural lands that can be easily managed; 2) restricting illegal cultivation on vulnerable agriculture land through periodical monitoring; and 3) gradually restoring forests. Analysis of agricultural land use in the city can suggest clues to new urban open space management styles.

"The Perception of Land Rights Impacts due to the Abolition of a Native Title: Evidence from the Bakun Hydroelectric Project and the Kelau Dam Project in Malaysia" (Nor- Hisham, M.S and P.H 2014) is a study of the impacts of the land rights policies on two indigenous groups (namely the Orang Ulu and the Orang Asli) in Malaysia. This research employed a mixed method of investigation, including survey, interview, observation as well as content analyses. This paper hopes to illustrate the indigenous peoples' perceptions on the loss of their land rights as well as to enrich the debates on the credibility of the institution.

"The favorable settlement relocation process after the 2011 earthquake and tsunami disaster in Japan by evaluating site environments and accessibility" (Misato UEHARA, T.I and G.S 2014) analyses a mismatch between people's evaluations and the special planning decisions. In 2012, the researcher conducted a field survey in 16 relocation sites after the Tsunami. Using the Semantic Differential Method, they asked 80 university students to assess the two municipalities' relocated housing projects. They also investigated the sites' accessibility to a new traffic network using layer analysis. The result shows that the importance of holistic planning for natural disasters has not been mentioned so far. Compared to previous research, this comparison offers additional evidence regarding the value of residents' participation and holistic land selection in early planning processes.

In this feature, our aim is to clarify some of the uncertainties of these topics by bringing together people who are testing new methods and taking actions in the field with significant projects.

We would like to express our sincere gratitude to the researchers who joined this conference and submitted their works to our journal.

Special thanks go to the reviewers who gave us their most generous support on reading and commenting on the papers.

REFERENCES

Anne Whiston Spirn (1985). *The Granite Garden: Urban Nature And Human Design*, Basic Books, New York.

Takahito Saiki, Robert Freestone and Maurits van Rooijen (2002). *New Garden City in the 21st Century?*, Kobe Design University, Kobe.

R.Buckminster Fuller (2008). *Operating Manual for Spaceship Earth*, Lars Muller Publishers, Zurich.

Yan Li and Anrong Dang (2014). "Special issue on 'Sustainability Indicators and Analysis'", *International review for spatial planning and sustainable development*, 2(3), 1-3.

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The Use of Vertical Greening in Urban Rehabilitation to Improve Sustainability of the Environment in Taiwan

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Key words: Urban Heat Island, Vertical Greening, Green Building, Urban Rehabilitation, Sustainable Environment

Abstract: Urban heat island effect has caused countries around the world to set a low-carbon and sustainable environment as their goal. It suggests that communities can achieve the goal by planting trees and vegetation which can cool down the temperature and reduce the effect on the environment. The paper aims at exploring how to promote the application of vertical greening that increases green quantity as well as how to regulate maintenance of it in urban rehabilitation. Through the literature review and foresighted design point of view, implications suggest a way of arranging plants in groups, natural irrigation, rainwater recycling systems, encouraging vertical greening, and the need of standards to provide and manage vertical greening. A case of a fiber reinforced plastic vertical greening system has introduced a further understanding of it.

1. INTRODUCTION

The formation of urban heat island effects in recent years has caused countries around the world to set a low-carbon and sustainable environment as their goal. According to the US Environmental Protection Agency (2008), the heat island effect affects micro-scale temperature differences between urban and rural areas: the built-up urban areas are warmer than their surrounding rural areas. The annual mean air temperature of a city can be 1–3°C hotter in urban areas. The difference can be as high as 12°C in the evening. The problems caused by the heat island effect in urban built-areas can be categorized as increasing energy demand, air conditioning costs, air pollution, greenhouse gas emissions, heat-related illness and mortality, and water quality. It suggests that communities can achieve their goals by planting trees and vegetation so shade provided by trees and smaller plants such as shrubs, vines, grasses, and ground cover can help cool and reduce the effect on the environment.

In Taiwan, 97% of the buildings are considered as being part of the built-up environment, and their existence usually does not meet ecological needs. This indicates that urban rehabilitation and environmental planning should

put an emphasis on being ‘green’, ecological city development and placing people at the core of the design process (Architecture and Building Research Institute, 2012). In 2008, Taiwan launched “The Eco-city and Green Building Promotion Program”. Eco-city and green building assessments are included in “The Implementation Regulation of Periodical Overall Review of Urban Planning”. This regulation was amended in 2011 and stated that the process of conducting the overall review of urban planning needed to develop a system of water and green network principles. The Taiwan government has learned that green buildings and networks are important to achieve an ecological city. However, the existing cities are crowded by buildings and artificial facilities. The motivation of this paper is to explore how trees and vegetation can help cool urban climates through shading and evapotranspiration, then focuses on applying vertical greening technology to rehabilitate built-up urban areas for creating a sustainable environment. It aims at exploring how to promote the application of vertical greening that increases green volume and regulates maintenance of it in urban renovation. Through the literature review and foresighted design point of view, this paper first introduces the relationship and development between vertical greening and green building, followed by the vertical green technology which increases green space and creates an urban green network. Analysing and applying urban rehabilitation requires technology and innovation of vertical greening. An example of fiber reinforced plastic (FRP), a vertical greening system produced by the National Taipei University of Technology (NTUT), has introduced a further understanding of it.

2. BENEFITS AND ISSUES OF VERTICAL GREENING

Walls that are covered with vegetation that self-clings or grows on supporting structures are known as vertical greening. Vertical greening, also known as façade greening, green wall, planting wall, vertical garden, living wall, or ecological wall, is essentially a living and self-regenerating cladding system for buildings (Dunnett and Kingsbury, 2008). Self-clinging plants are used without supporting structure since they attach themselves directly to the building surface. On the other hand, a supporting structure greening wall uses wires or trellis which allows plants to “climb”.

Vertical façade engineers need to consider the essential elements - sun shine, water, soil, et cetera - of greening growth conditions in both cases. It turns out to be that by using natural or pipeline watering to sustain plants’ lives, shallow-rooted plants are able to grow in walls of different angles, and stems and leaves of plants will grow whether they are directly or indirectly attached to the building surface. Plants which grow on the surface of a building wall can be artistic, as well as improve the urban landscape, increase green coverage rate, reduce indoor temperature, improve efficacy regarding biodiversity and ecosystems, and improve urban greening.

Due to intensive urban construction and artificial facilities, extensive use of things which absorb or reflect solar radiation, such as dark roofs, walls, floors, uneven buildings, or impermeable pavement, are needed. On the other hand, reducing the use of air-conditioning, heat emissions from automobiles and motorcycles, air pollution, and other human waste heat is another important issue that causes urban heat island effects. In Taiwan, after successive decades of rapid economic development and a high degree of industrialization, energy use increased by approximately 20 times, and the energy consumption rate per unit area is probably one of the highest amongst

the countries that have populations exceeding ten million. Heat island effect may be one of the most significant urban environmental issues in the world.

The global area that is affected by the heat island effect has been consistently increasing. This may also be leading to regional climate change and should be considered an urgent environmental problem (Liu et al, 2003). Based on the fact that tree-crowns can absorb or reflect approximately 80% to 90% of long-wave radiation heat, and transpiration of blades can consume some heat, if the vertical green capacity of cities can be moderately increased, the rehabilitation area will have an effectively reduced urban heat island effect.

Lin (2010) pointed out that green walls are capable of reducing wall surface temperature effectively by 10 to 14°C and indoor temperature by 2.0 to 2.4°C. This leads to reduced use of air-conditioners and improvements in energy saving. If a ton of air-conditioning is operated without being turned off for 24 hours, the power cost is about NT$60. If a room's temperature is increased by 1°C and then air-conditioned, electricity bills can be reduced by about 6%. In terms of office buildings, the electricity saving will be considerable. The Japanese Urban Greening Technology Development Institution's experiments show that the implementation of green walls eases acid rain and UV damage to buildings and waterproof layers and improves the durability of buildings.

The indicators of green buildings are closely related to plant greening; increasing greening volume and biodiversity, and site water indicators are directly correlated with them. In the past, applied green design, was rarely regarded as an architectural element, and the effect of vertical greening from an overall view of the urban landscape was hardly considered. Through the literature review and analysis, the paper sums up the following benefits for urban rehabilitation:

1. Dust-proof, lower temperature, noise-proof, and energy-saving: vertical greening can decorate rooms, improve the indoor microclimate, lower indoor temperature, increase humidity around 20~30%, isolate noise, absorb dust and reduce pollution.
2. Aesthetic and a better three-dimensional vision: green vegetation vertically set in the wall can shape the overall environment artistically, improve creative space effect, and provide social education function. It also gives three-dimensional stereoscopic visual effects from outdoor views by its uniqueness, distinctive kindness and use of advertisement.
3. Positive impact on human mentality: green walls via advanced greening technology may have plants with various colors, forms, and textures. The natural beauty of it positively enhances landscape, improves residents' psychological feelings, and relieves pressure of modern life.
4. Increase green coverage and economize land: vertical greening can create an advantage of creating three-dimensional space of green network and lead to an increase of green coverage.
5. Create environmental bio-diversity: vertical greening supports the growth of dozens of beetles and spiders. In the food chain, beetles and spiders are the best food for birds, and it leads to a positive impact on urban ecological environment.
6. Added value to the real estate market: although cost of vertical greening buildings is slightly higher than cost of normal buildings in general, the added value of the real estate market increases since it raises positive benefits such as saving energy spending and a better long-term quality of living environment.
7. Modifying measures and legal system: through continuous research and practical operation, the benefits from greening are the best references for promoting green building and legalization in vertical green measures and norms.

In order to ensure the integrity of the benefits of green building beyond the current assessment indicators and strengthen the effectiveness of social, humanistic art, and community empowerment, issues related to technical research and innovation or relevant norms for promoting green building reference are summarized:

1. Safety concerns of supporting structure: although vertical greening in existing walls is able to improve the urban landscape and building energy efficiency, is there any issue regarding compatibility or safety caused by traditional urban planning and architectural design regulations? In Taiwan, we are confronted by the typhoon season during summer; thus, there is a need concerning structural safety and having further norms for legalization.
2. Simple calculation of green building rating: a proposal of a grading system which calculates the relationship between effect of carbon reduction and assessment of green building can facilitate vertical greening promotion.
3. Innovative materials and developing different types of units of green modules: the necessary measures to promote vertical greening is directly associated with reducing the costs of development and maintenance. Thus, we need to develop a high strength, durable, weather-proof, and biocompatible green wall system.
4. Community's expectancy and way of localizing vertical greening: in order to strengthen the positive physical and psychological impact given by the green wall on residents, it is necessary to explore how residents are affected by the green wall practically and psychologically. Also, what are their feelings toward the process of plant growth?
5. Reuse of construction fences: how to effectively promote the application of vertical greening to safety fences in construction sites. How to retain fences and make them reusable rather than being dismantled and wasted.
6. Water supply and drainage system: in order to maintain plant health, water supply, drainage system, and stability should be carefully designed, constructed, managed, and maintained. For instance, how to link feed-water systems with storm-water retention systems? How do drainage systems avoid being polluted?
7. Subsequent maintenance: effective management including watering, pest management, plant domestication, changing plants and so on, are closely related to the sustainability of vertical greening. It is not a good idea to rely completely on costly professional factories. Therefore, how to educate people continuously? How to mould maintenance and warranty measures into management?

Aforementioned issues, derivatives of professional responsibility, acceptable quality standards and risk of long-term maintenance commitment issues need to be well catered for by legal systems. Interdisciplinary integration from co-operators and practitioners including from the civil and material science engineering, architecture design, urban design, and law disciplines, is needed so that our legal system to creates and supports better norms to solve these problems.

3. VERTICAL GREENING TECHNOLOGY

Regarding the application of vertical greening technology, the environmental characteristics of green walls and plant selection must be considered. Through literature review and field research, the paper has summarized the items including plants, vertical greening technology systems, and building external environment that are directly related to vertical greening technology in the following table, *Table 1*.

Table 1. Vertical greening of the building: related items with impact factor

Item	Factor	Sub-factor
Plants	category	ground-cover, flowering, leafy, climbing-vine
	growth nature	wind-enduring, drought-enduring, wet-enduring, acid-enduring, cold-enduring, shade-enduring, barren-enduring, high temperature enduring, salt--resistant, dust-resistant
	eco-nature	bird-attracting, butterfly-attracting, bug-attracting
	planting method	once planted, no maintenance; planting in batches, and subsequent periodic maintenance
	maintenance method	clipping, water supply, drainage, fertilization, disease prevention
	growth period	flowering period, fruiting period
	sense	sense of sight (color), sense of smell (fragrance), sense of touch (quality)
Vertical greening technology	climbing	self-clinging to the building surface, the use of climbers' supporting structure
	hanging	drooping from the wall type, drooping from the supporting structure type
	module	overall joining of supporting network, planting module type
Building external environment	building type	traditional courtyard houses (traditional architecture), terrace housing, condominium without elevator, high-rise housing
	greening position	roof, exterior wall, balcony, door, windowsill, fence
	impact factor	space: direction, number of story, effect of surrounding building (smoking hole, reflector, wind-tunnel effect) climate: sunshine, wind power, temperature, humidity, rainfall
	additional substance of facade	air conditioning, grille, canopy, advertising signboard, tube, hanging substance of external wall
	community environment	seashore community, existing plain community, riverside community, hillside community
	material of facade	wood, RC (reinforced concrete), brick, tile, stucco washing finish, cement, SS（steel structure）
	disaster	typhoon, earthquake, fire

The influencing factors mentioned above, especially the wall microclimate in windy environments, need to be carefully handled. It is necessary to find suitable treatments for rising wind, descending wind, whirlpool effects, and prevent vegetation from being stripped by the wind. Additionally, illumination from sunshine is going to be influenced by differing wall directions, the surrounding environment and colours of the wall; therefore, we must choose plants carefully. It is also necessary to pay attention to temperature changes and avoid using materials such as metal, concrete, stone, tile, and other materials that absorb heat or have good conductivity. Regarding plant selection, native plants should be treated as priority, attention should be paid to their firmness, barren-endurance, drought-resistance, and moisture-resistance., they must be able to be properly affixed to walls, the thickness of which has to be applicable, maintainable and plants must be easily replaceable, durability must be maintained, and pests and diseases well managable.

In response to the above, many vertical greening technologies have been developed recently. This paper summarizes them into six types of technologies in accordance with methods and characteristics of vertical greening in the following table, *Table 2*.

Table 2. Technical types of vertical greening classification

Case location	Materials & Mineral Resources Building, NTUT	Park Lane, by CMP, Taichung	Green Gate, NTUT	Hassen Hotpot Restaurant, Taichung	Decathlon Sports and Leisure Goods Center, Taichung
Technique type	self-clinging	soilless culture frame	FRP vertical greening	plant-growing tube	1.continuous planting green wall 2. vine-covered green wall
Construction year	1980	2008	2010	2012	2012
Greening floor	5	16	8	2	3
Usage of building	university building	department store	university building	restaurant	hypermarket
Greening type	self-clinging to the building surface	hanging planting trough on the insert panel of wall	planting in the soil package made of non-woven material, and put in FRP box	planting in plant-growing tube	planting trough by open, continuous cultivation
Container material	none	stainless steel, non-woven felt	FRP, non-woven felt	HDPE connected pipe	zinc-plated iron, coconut fiber mesh blanket
Container size	none	thickness:22cm size: 50x80cm weight: 75kg/㎡ (with light media, planting)	thickness:6cm width:30cm	length:125cm aperture: 9-12cm width:50kg/㎡ (with light media, planting)	size: 220x120cm width: 50kg/㎡
Scale	1,200 ㎡	1,850 ㎡	1,000 ㎡	125 ㎡	2,000 ㎡
Unit price (NTD/㎡)	> 3,000	40,000~4,5000	8,000	16,000~20,000	picture element type:8,000 vine-type:5,000
Irrigating system	irrigating by rainwater	overflow pipe	penetrating pipe irrigating system by rainwater	automatic detached drip irrigation	automatic drip irrigation
Drainage system	natural penetration	horizontal drainage channel with metal	natural penetration	recycled drainage channel	drainage channel
Planting type	*Parthenocissus tricuspidata* (Sieb. & Zucc.) planch, *Ficus pumila* Linn.	*Impatiens walleriana* Hook. F., *Lantana camara* L., *Acalypha wilkesiana*, *Nephrolepis exaltata* Schott., *Duranta repens* etc.	*Parthenocissus tricuspidata* (Sieb. & Zucc.) planch, *Pyrostegia venusta* (ker) Miers, *Antigonon leptopus* Hook. & Arn., *Ficus pumila* Linn.	*Cuphea hyssopifolia* H. B. K., *Nephrolepis auriculata* (L.) trimen, *Codiaeum variegatum* (L.) Blume	*Duranta repens* 'dwarftype', *Nephrolepis exaltata* Schott., *Asparagus densiflorus* (Kunth) Jessop, *Asplenium antiquum* Makino, *Chamaedorea elegans* etc.

Picture					

As introduced above, the natural type of self-clinging to the building surface is planting by traditional creepers which are attached, adhere to, and climb the walls by themselves. They hardly climb once they hit smooth or high temperature wall. Moreover, this heavily relies on natural growth conditions such as the soil layer and are reliant on air moisture created by rainwater; therefore, they grows slowly, approximately one to two meters per year.

Considering the type that uses climber support structures, seedlings can be fixed by humans, like planting droopy ivy so that it climbs through supporting frames. A better heat insulation effect is achieved since air layers form between the supporting frames and wall.

Another type of technology is planting troughs directly on the wall. Whenever troughs and panels are planted completely, greening is completed. If the wall structure is strong enough, we can apply this on higher floors. Although plant selection is less restrictive in this case, it costs more, and facilities for its completion, maintenance, and replacement must be considered.

As for the type of soilless cultivation, in order to provide water and minerals required by plants, non-woven fabric can be used so that plants can meet their needs and grow directly on the fabric. In this case, Plants which can survive without a soil a substrate must be selected. This greening technique suits regions with stable climates.

4. APPLICATION OF PLANTING IN DIFFERENT REGIONS OF TAIWAN

The installation of plants on green walls must take local characteristics into account including rainy, dry, and typhoon seasons. After considering whether planting is applicable in Taiwan's northern, central, southern, and eastern regions of the urban climate, this paper tries to establish the appropriate planting varieties in a database as shown in *Table 3* and *Table 4* below.

Table 3. Environmental characteristics of the northern, central, southern, and eastern regions of Taiwan

Region	**Attributes**				**Environmental Characteristics**
	Sunshine hours	**Temper -ature**	**Rainfall**	**Humidity**	
Northern	1,587hr	22.8℃	3,036mm	77%	Less sunshine hours, low temperature, rainy, high humidity. Applicable for humidity and shade-enduring plants
Central	2,063hr	23.2℃	2,046mm	77%	More sunlight, moderate rainfall. Applicable for warm and moist plants
Southern	2,156hr	24.6℃	2,264mm	76%	Much sunlight, high temperature, moderate rainfall. Applicable for

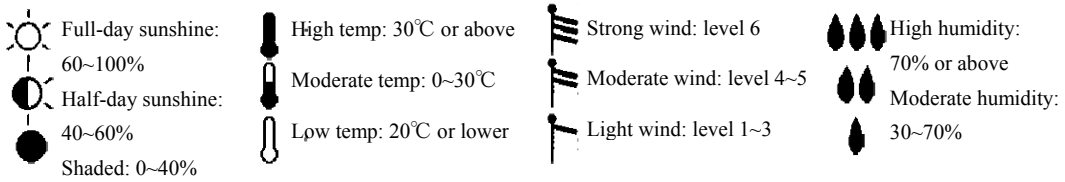
					moist and drought-enduring plants
Eastern	1,670hr	24.2℃	1,939mm	76%	More sunlight, high temperature, less rainfall, close to seashore, high humidity, windy. Applicable for barren-enduring, salt-resistant and wind-resistant plants

Note: Average annual climate analysis in Taiwan during 1998-2008.
Source: Statistics Department of the Ministry of Communication and Transportation (2009)

Table 4. Attribute of building facade and applicable planting

	Height of building facade	Attributes				Environmental Characteristics
		Sunshine	Tempera-ture	Wind	Humidity	
Eastern	**High**					Direct sunshine in the morning, applicable for full-day sunshine, draught-enduring, poor temperature-enduring, light and good clinging plants
	Middle					Direct sunshine in the morning, applicable for full and half day sunshine, wind-resistant plants
	Low					Direct sunshine in the morning, applicable for half-day sunshine, shade-enduring, ornamental plants
Northern	**High**					Applicable for half-day sunshine, poor temperature-enduring, light and good clinging, wind-resistant, barren-enduring plants
	Middle					Non-sunshine, applicable for shade-enduring, wet-enduring, cold-enduring and barren-enduring plants
	Low					Non-sunshine, applicable for shade-enduring, wet-enduring, cold-enduring, barren-enduring, and ornamental plants
Western	**High**					Direct sunshine in afternoon, applicable for full-day sunshine, draught-enduring, light and good clinging, wind-resistant, heat-absorbing plants
	Middle					Direct sunshine in afternoon, applicable for full-day sunshine, draught-enduring, heat-absorbing plants
	Low					Direct sunshine at afternoon, applicable for full and half day sunshine, heat-absorbing and ornamental plants
Southern	**High**					Sunshine all year, applicable for full-day sunshine, poor temperature-enduring, draught-enduring, wind-resistant, light and good clinging plants
	Middle					Sunshine all year, applicable for full-day sunshine, draught-enduring plants
	Low					Applicable for full and half day sunshine, ornamental plants

Note:
1: Referring to building technology regulations, the height of the building is roughly divided into: low: h<15m; middle-low: 15m<h<30m; middle-high: 30m<h<50m; high: 50m <h <75m; super-high: h>75m. The height of buildings for further analysis should be in accordance with the actual situation and the assessment of the regional environment.



Urban environment affects the growth of vegetation on the green wall. The relevant factors are as follows:

1. Near main traffic arteries will be vulnerable because of vehicle emissions and thermal effects, applicable for anti-pollution, anti-dust, and wet-enduring plants.
2. Shadows arising from the buildings. It is suitable for shade-enduring plants.
3. Nearby surroundings, such as whether other light sources affect the light cycle, thereby affecting plant growth and shape of flowers.
4. Close to coastal areas, applicable for wind-resistant and salt-enduring plants.
5. Close to industrial areas, applicable for anti-acid and anti-pollution plants.
6. Conditions of nearby areas such as air conditioners, cooling water towers, and smoking machines which produce heat emissions and are harmful to plants.

The following example of Green Gate uses a fiber reinforced plastic (FRP) vertical greening system in the National Taipei University of Technology (NTUT), which is introduced for a further understanding of how it formed and what it looks like. It aims at exploring how to promote the application of vertical greening to increase green quantity and environmental landscaping.

5. AN EXAMPLE OF GREEN GATE IN NTUT

National Taipei University of Technology is located in the center of Taipei; it is a typical metropolitan campus. Following the opening of the MRT Zhongxiao Xinsheng Station, the entrance between the Design Building and Materials and Mineral Resources Building became a popular accessway to the MRT, and the nearby areas became places for the local public and tourists. In order to reduce the negative impact of crowds and harmonize the urban campus by a friendly, ecological, and green living environment, the university extended the wall from the Materials and Mineral Resources Building to the Design Building and turned the new wall into a green wall which is the so-called Green Gate as shown in *Figure 1* and *Figure 2*.

Figure 1. A proposal to build a new green wall from the existing wall of the Materials and Mineral Resources Building to the Design Building

Figure 2. A linkage proposal of vertical greening between buildings

The Green Gate was quickly completed after approval by the University. The case adopted FRP as the wall greening system (Figure 3). The system of the FRP box and built-in soil package were wrapped by non-woven cloth (Figure 4) which had the ability of resisting the acid etching ingredients released by plant roots and organic compounds. The FRP system is benefited by its light weight, structural strength, and excellent durability; it takes advantage of the amount of body light and strong material combination of the steel structure that links the FRP box (Figure 5) so that plants are solidly located on the building outer wall surface. It performs like an envelope that isolates buildings from sunshine and enriches the urban landscape (Figure 6).

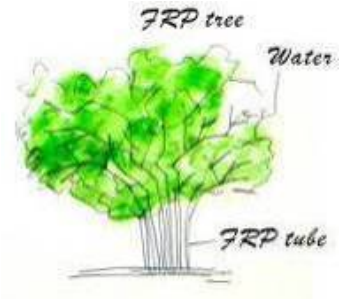


Figure 3. A diagram of FRP wall greening system

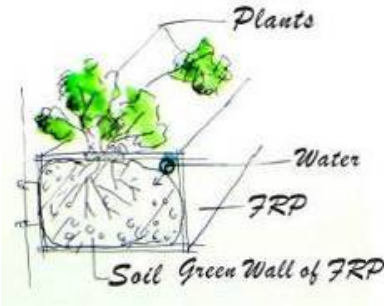


Figure 4. A diagram of FPR box and built-in soil package wrapped by non-woven cloth

Figure 5. FRP greening wall

Figure 6. A completed work of the Green Gate

This technology has been patented and applied to the FRP greening wall system of the National Taipei University of Technology as the paper's foresighted concept design case shows. This innovative system can reduce costs, shorten the construction period, and is easily maintained. The FRP wall greening system has great facilities in fiber composites, reducing the

structural weight and the seismic force, corrosion resistance, structural strength, and durability. Furthermore, the FRP wall greening system enhances the landscape environmentally, has economic efficiency, and the ability to achieve a sustainable environment. Regarding the maintenance plan, since plant roots can grow on the ground, and the internal pipeline automatically stores moisture, plants will be able to grow naturally without manual maintenance so that near-zero maintenance and management is able to be achieved.

6. CONCLUSION

Scarce green space and highly dense urban areas have caused serious urban heat island effects. Vertical greening can increase greening amount, reduce urban heat island effects, improve the quality of outdoor and indoor air, beautify urban landscapes, lower indoor temperatures, increase energy efficiency, protect building structures, and reduce noise. In conclusion, this paper suggests the following points:

1. Different vertical greening systems should exploit advantage from each system, such as doing an experiment of planting troughs into different segments and recording the improvements of natural growth rates.
2. The priority consideration is that the green is naturally watered with a rainwater recycling system which reduces maintenance and management costs.
3. In order to achieve better performance through renovation, the effectiveness of heat insulation and moisture-regulating effects should be reviewed and the best suited should be selected according to the particular environment.
4. Expanding the use of vertical greening is a good way to rehabilitate high-rise congregated house building façades and sustain the green wall system.
5. Encouraging local governments to green construction site fences and strengthen inspection works for periodic maintenance. Aims should be to prevent plants from wilting, which would result in a significant loss of greenery and of the facility to reduce carbon.
7. The competent authority should ascertain amendments through a Green Building Standards Special Chapter or set vertical greening and maintenance regulations so that it can encourage the promotion of vertical greening technology in applied rehabilitation of existing buildings and community, prevent secondary refurbishment of exterior walls and prevent owners from wasting space.

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REFERENCES

Architecture and Building Research Institute. (2012). *2012 Building Energy Efficiency and Improving Green Office Building Grant Program- Information for Applicants*. Taipei.

Architecture and Building Research Institute. (2012). Retrieved from http://www.abri.gov.tw

Blanc, P. (2008). *The Vertical Garden: From Nature to the City*. New York: Norton.

Construction and Planning Agency, Urban and Rural Development Branch. (2012). http://www.tcd.gov.tw

Construction and Planning Agency. (2012). Retrieved from http://recity.cpami.gov.tw

Construction and Planning Agency. (2012). Retrieved from http://www.cpami.gov.tw

Huang, S.M. (2008). *Vertical Greening of the Building and Localized Customary-façade.* Kaohsiung: Graduate Institute of Urban Development and Architecture, Kaohsiung University.

Kingsbury N. & Dunnett, N. (2008). *Planting Green Roofs and Living Walls*. Portland: Timber Press.

Lin, H.T. (2010). *Green Roof and Green Walls.* Retrieved from http://www.risecare.com//

Liu, S.C., Liu, Z.R., Lin, C.Y., Xu, G.Z. and Lin, W.Z. (2003). Taiwan's Western Plains Heat Island Effect. *Watch Taiwan*, Winter, Taipei.

MFO-Park. (2012). retrieved from Wikipedia, the free encyclopedia, http://en.wikipedia.org/wiki/MFO-Park

Peng, K.H. (2010). *A Study on Green Wall Panel Technology to Promote Urban Rehabilitation and Maintenance*. Taipei: National Science Council.（NSC 98-2218-E-027 -012 -）

Peng, K.H. (2012). Vertical Greening of Green Building and Urban Rehabilitation. *Taiwan Environmental and Land Law Journal*, 1(4), Taipei.

Peng, K.H. and Ding, Y.C. (2009). *A Study on Rehabilitation Plan of Public Facilities and Utilities of the Existing Housing Community.* Taipei: Council for Economic Planning and Development.

United States Environmental Protection Agency. (2008). Reducing Urban Heat Islands: Compendium of Strategies. United States Environmental Protection Agency.

Yin, D.C. and Tsai, J.H. (2009). Preliminary Study of Existing Buildings Wall Greening System. *Proceedings of the 2nd of 21st Conference of the Architectural Institute of Taiwan*, Taipei.

Zhou, Z.C., Tsai, Z.X. and Kuo, Z.C. (2009). “Explore the Vertical Green Wall from a Green Building Perspective”. *Proceedings of the 6th Taiwan Architecture Forum: Review and Prospective of the 10th Anniversary of the 921 Earthquake*, Taipei.

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Climate-Sensitive Urban Design in Cold Climate Zone: The City of Erzurum, Turkey

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Key words: Cold Climate, Built Environment, Urban Design, Sustainable Development

Abstract: The main objective of this paper is to explore the contradictory relationship between the climate and physical structure of the built environment in Erzurum as one of the coldest climate cities in Turkey. It mainly questions whether the urban form and geometry (size, density, street orientation and ventilation), height and shape of the buildings and vegetation in selected districts of Erzurum are compatible with the cold climate conditions. In this direction, disturbances, vulnerability of urban ecosystem, construction practices, street orientations, settlement patterns, housing typology, density, average height, hard-surfaces, distances, flora and density of green areas are analyzed. The findings show that the urban built environment in Erzurum (City Centre, Dadaskent and Yildizkent districts) is not consistent with the cold climate conditions. Urban heat island, urban sprawl, ventilation problems and existing air pollution, and high temperature differences in the city are the threatening factors for ecologically sustainable urban development. In the context of this study, it is aimed to formulate urban design guidelines for the city of Erzurum in cold climate zone. Urbanization and urban form of the three different districts, which are the focus areas of this research, must be reconsidered from a climate sensitive perspective, otherwise new development areas will not be energy efficient and resilient against changes, surprises and risks. For ecologically sustainable urban development, climate sensitive urban design guidelines must urgently be prepared and implemented for Erzurum.

1. INTRODUCTION

Due to climate conditions, urban settlements located in cold regions have certain characteristics. Winters are the long seasons affecting the everyday lives of the people. Heavy snow fall, frost, the short day length, icy roads and sidewalks are the main components of living in such urban areas. Cities located in cold climate regions are characterized by this climatic condition because of the challenges and opportunities presented. The impacts of cold climate can be observed in urban life as minimized outdoor activities, more energy consumption, limited recreational activities and types of transportation. Thus, the cold climate conditions force urban planners to deal with different aspects of urbanization, planning and climate conditions. In the literature, there is a growing interest about climate sensitive urban design, but in Turkey there is a limited amount of research related to this issue (Basibuyuk, 2005; Caliskan, 2012; Caliskan & Matzarakis, 2013; Caliskan, Cicek, & Matzarakis, 2011; Ercoskun, 2007; Girginer, 2006; Guclu, 1988; Gulten, 2007; Gulten & Aksoy, 2010; Hisarligil, 2009; Koseoglu, 2012;

Kuscu, 2010; Sahin & Dostoglu, 2007; Simsek & Sengezer, 2012; Soysal, 2008). It is not only the problem of academic research fields, but also of urban planning practices. Although knowledge of the relationships between climate conditions and urbanization is growing, the same scale impact cannot be seen in the application of this knowledge on urban environments. The necessity of taking cold climate factors into urban design consideration has been detailed especially in the Northern country literature (Pressman, 1985; 1995; 2004; Ebrahimabadi, S., Johansson, C., Nilsson, K.L., 2012; Milosovicova, J., 2010) providing a framework for this study focused on the city of Erzurum in Turkey.

Erzurum is a city situated at 1757 meters above sea level in the east of Turkey with a population of 780,000 in 2011. It has a humid continental climate according to the Koppen Climate Classification which is one of the most widely used climate classification systems (Kottek et.al, 2006). As it is stated in this data, a humid continental climate is a climatic region typified by large seasonal temperature differences, with warm to hot (and often humid) summers and cold (sometimes severely cold) winters. Erzurum is one of the coldest cities in Turkey with its very cold winter months averaging a minimum during January of around -16 °C. Temperatures fall below -30 °C each year and the record for the lowest temperature was -37.2 °C in December 2002. Despite all these climatic data, the built environment in the city Erzurum does not show winter city characteristics. As it is observed in the main decisions, cold climate conditions have not been evaluated as an input for the city planning practices. There are some accidental developments in the city consistent with the climate conditions but Erzurum needs a more detailed urban design brief. In this context, three different districts of Erzurum - Kent Merkezi, Yenisehir and Dadaskent - are decided to, in this study, present existing situations of the built environment according to a climate sensitive approach (Figure 2). They are selected, because in terms of the settlement pattern they have different characteristics. While the city centre has highly dense, narrow and deep streets, Yenisehir (a new city) displays more organized characteristics with its middle range density, five-storey housing areas and parks. On the other hand, Dadaskent which is the satellite city of Erzurum is located on the plain having a high ground water level, causing an urban sprawl.

In this context, this study evaluates the compatibility of urbanization practices in Erzurum with cold climate conditions for the sustainability of regions. Within this context, three subject areas are of particular interest: (1) urban geometry, canyons and street orientation (2) settlement patterns and land uses of selected districts (3) density. The main aim is to investigate the characteristics of settlements by addressing cold climate factors in the region. The findings show that land use and urbanization processes in Erzurum are the factors not planned according to the climate conditions. With respect to the research aim, the research questions are as follows:

Main Question:

- What are the inconsistencies between urban planning practices and climate factors in Erzurum?

Sub-questions:

- Are cold climate factors in the city adequately reflected in location choices?
- Are the street geometry and orientation in Erzurum planned according to the changing climatic conditions between winter and snow-free seasons?
- Are there any perceived effects of climate factors on urban form in Erzurum?

Figure 1-2. Location of Erzurum and Case Study Areas: City Centre, Yenisehir, Dadaskent

The study focuses on the relationship between the built environment and cold climate conditions in terms of the urban design practices. First, the literature on the climatic aspects of cities in cold climates is reviewed and the characteristics are described. Second, the study concentrates and evaluates the existing situation of selected districts of the city of Erzurum in the frameworks of design-based factors such as urban geometry, density, building height to street width (H/W) ratio, the sky view factor (SVF), the building volumes, orientation of the streets, ventilation and the particular land use (Milosovicova, J., 2010). Third, the criteria for climate sensitive urban design in cold climate regions are summarized as an exemplar for the other cities in the same climate zone of Turkey. Finally, discussion for the current and future situation of Erzurum is made by considering the recommendations by climatologists and climate-specialized urban designers/planners in the literature.

2. CLIMATE CONSIDERATION AND URBAN PLANNING

For the climate sensitive urban planning, provision of outdoor comfort is the key objective (Ebrahimabadi, S., Johansson, C., Nilsson, K.L., 2012). Although it seems in the literature that there are many studies related to the climatic conditions and urbanization, unfortunately they omit the problem of urbanization in cold climates. In order to develop a theoretical framework, a limited number of cold climate studies are evaluated and summarized in the following part.

As it is stated above, maximization of outdoor comfort for the residents is the major objective of urban planners in the process of climate-sensitive urban design (Ebrahimabadi, S., 2012). There are three categories of outdoor activities: necessary activities, optional activities and social activities (Gehl, 1996; 11-13). Quality of urban space or outdoor comfort does not have an effect on necessary activities but it has a big influence on the other two activities, optional and social ones (Ebrahimabadi, S., 2012). On the meterological side, climate factors such as wind, sun, radiation, temperature, humidity and rain influence outdoor comfort. On the other hand, the feeling of comfort is influenced by the context including design and function, environmental interaction containing lightning and noise, and psychological aspects such as adaptation, experienced and perceived control (Ebrahimabadi, 2012, p.5).

The winter extends over a large part of the year in the north regions by generating deep impacts on the patterns of urban life. As it is stated by

Pressman (2004, p.5), there are some characteristic features in cold regions: temperature normally below freezing; precipitation is often in the form of snow, short daylight and sunshine, and seasonal variation. These conditions restrict the activities of people in urban life by reducing the variation of outdoor activities. Snow and ice on the streets, freezing temperatures, frost and limited sunshine hours create unpleasant situations for the inhabitants. On the other hand, for some people, winter conditions provide a beauty of nature and some recreational and sporting activities can be made under these conditions. The task of urban planners under these circumstances is to incorporate climate conditions into planning practices (Ebrahimabadi, 2012). In this process, reduction of inconvenience, protection from winter based stressors and utilization from the beneficial aspects should be the strategies necessitating highly creative approaches (Pressman, 2004, p.23). A climate sensitive urban design process in a cold climate region requires the clarification of the goals for all city scales. There are three scales of urban place: macroscale (a whole city), mesoscale (district and building group), and microscale (buildings) (Pressman, 2004; Ebrahimabadi, 2012). Urban planning and design is mostly related to the whole city form and districts and building groups. The compact or sprawled forms of the urban environment, placement of buildings, street dimensions and density are the instruments of urban design for a climate sensitive approach. Achieving climate sensitive design necessitates the understanding of climate conditions and the existing structure of urban design elements. Through design, recommendations can be made for the development plan with the aim of reducing the negative impacts of winter conditions on inhabitants.

Within this context, three subject areas: urban geometry, canyons and street orientation; settlement patterns and land uses; and density, are explained in the following part with the aim of clarifying the subjects used in the analyses of Erzurum.

2.1. The Design Based Factors

In this study, design based factors summarized by Milosovicova (2010) will be used by combining and excluding some of the elements such as the size of the city and water in urban areas. Size of the city is excluded due to the discussions about its reliability on the explanation of the correlation between the city size and the urban heat island. Water is the other factor excluded because of the cold weather conditions and inexistence of the natural water surfaces in Erzurum. The other design based factors used in this study have a decisive role in determining urban climate and outdoor comfort by influencing the urban heat island, shading and air circulation.

- Urban geometry: Building height to street width (H/W) ratio, the sky view factor (SVF), orientation of the streets
- Density and compactness
- Settlement patterns and particular land use

2.1.1. Urban Geometry

Urban geometry is one of the most important factors determining the urban climate and outdoor comfort. H/W ratio and sky view factor (SVF) are the geometry related indicators showing the impact of insolation on urban climate. In the H/W ratio, while H shows the height of the buildings, W displays the spacing (width) between them. The value of this ratio demonstrates how much sunlight and radiation reaches the street ground and

heats the air near the ground. On the other hand, the SVF shows the ratio of sky visible from the middle of the street (Milosovicova, 2010).

When the ratio of H/W is equal to "0", there is no building and sunlight and insolation is absorbed and later released towards to the sky. An urban canyon with a ratio below 0.5 is named as a shallow street canyon. In a medium density area which refers to the ratio of H/W around equal to 1, radiation strikes other buildings and the ground and is absorbed near the ground level. It is called a uniform street canyon. In the case of high density areas, the H/W ratio is nearly equal to 4 or more and the radiation cannot reach the ground level. If it has a deep street canyon form, absorption stays high above the ground level. As it can be understood from these different values, the higher the ratio of H/W, the lower the heating of the urban environment. A higher H/W ratio restricts the release of heat into the atmosphere at night and slows down the night cooling of the urban environment (Milosovicova, 2010; Shishegar, 2013).

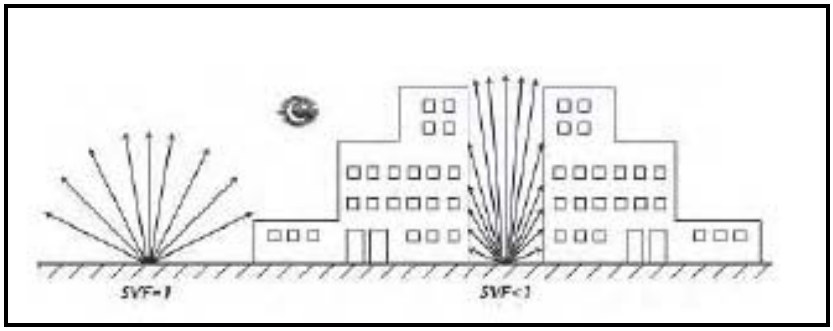


Figure 3. The SVF is equal to 1 if there is no obstruction in the horizontal area; if the street mid-point is surrounded by buildings, it is lower than 1(Milosovicova, 2010, p.24)

Canyon geometry is the other term used for the evaluation of the street geometry as an urban parameter in climate based studies. It is an artefact of an urban environment similar to a natural canyon and basic units of the urban surface can be seen repeatedly throughout urban areas. Horizontal and vertical surfaces and combinations between them produce urban canyons. In order to use the H/W ratio as a value for the mitigation of the negative impacts of urban heat island in our study, we use Emmanuel's (2005, p.39) suggestion for the optimal values of H/W ratio of an urban canyon as 0.4-0.6 to keep minimal heat in summer and enhance it in winter. Although the optimal ratio is suggested, it has some deficits such as the exclusion of different seasonal impacts and factors such as vegetation and anthropogenic heat production. In fact there is no clear answer for the appropriate H/W ratio of urban canyon and there is no right H/W ratio (or sky view factor) generally applicable in all conditions. However, as it is stated by Shishegar (2013, p.56), the H/W ratio affects the quantity of solar energy obtained by street surfaces (facades, roofs and ground) and decreases of the H/W ratio increases solar access in the street. Therefore, case studies should be made for every particular region and planning situation involving the overall density of the area, street orientation and greening measures (Milosovicova, 2010).

For the determination of urban geometry, building volume is the other important factor. If the surfaces of buildings are large, the reflection and absorption of solar radiation will be high and the heat release will be later. Therefore, the volumes of buildings can be considered as a factor having an

impact on the urban climate. In this process, the question of what type of building is the most appropriate one for climate sensitive urban design becomes important. As it is stated by Milosovicova (2010, p.25), the compact multi-unit buildings are the most preferable ones due to their smallest proportion of walls and roofs. Owing to these characteristics, they are most likely to avoid multiple sunlight reflections and solar radiation absorption, as well as the emmitance of heat from buildings through walls.

In the urban environment, different situations emerge according to the streets' orientation. The urban parameters used in these studies are the airflow in an urban area, solar exposure of open areas and buildings, the thermal comfort of people walking on the streets, outdoor and indoor environments of cities, solar access inside and outside the buildings, and urban ventilation as well as the potential for cooling of the urban system (Emmanuel, 2005; Herrmann and Matzarakis, 2010; Milosovicova, 2010; Shishegar, 2013). Therefore, street designs have to be considered in the urban design process with all the complexity of seasonal differences. While the street should provide protection from the sun in summer months, it should also facilitate solar access during winter periods. These issues necessitate compactness and openness to the sky.

Urban airflow as one of the urban parameters has to be considered in climate sensitive urban design. The interaction between wind and the built environment is the decisive factor of the urban airflow pattern. It is essential for human heat, outdoor and indoor thermal comfort, and urban microclimate due to its cooling and mitigating effects on the urban heat island. Thus, design of the built environment or street orientation and geometry has to be considered as one of the key factors for the formation of an urban airflow pattern. In the literature, three airflow regimes are defined on urban surfaces based on the aspect ratio of H/W (Fig.4).

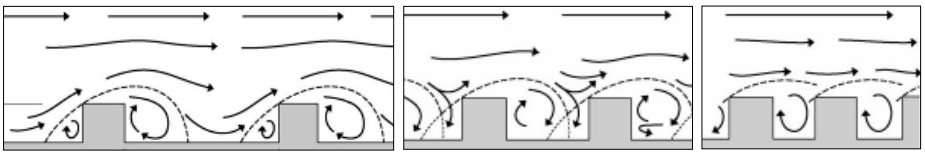


Figure 4. Airflow regimes: (a) the isolated roughness regime; (b) the wake interference regime; and (c) the skimming regime (Shishegar, 2013, p.53)

Shishegar (2013) stated that the isolated roughness regime takes place between well spaced buildings if there is no interaction between windward and leeward flows. When the H/W ratio increases, it produces a wake interference regime by disturbing wakes. As seen in the figure (c), an increase in the H/W ratio isolates the street canyon from the circulating air in the urban layer above the average height of buildings and thus, a circulatory vortex is created in the canyon. It is called a skimming regime and is frequently seen in urban areas. There is a clear relationship between street geometry and the microclimate in urban areas. Narrow and wide street canyons have different effects on wind speed and thus on urban microclimates. Additionally, building heights have big impacts on better ventilation. As stated in the studies of Milosovicova (2010) and Shishegar (2013), strategical placing of a few blocks of high-rise towers improves the velocity in the street canyon if the airflow is parallel or perpendicular to the canyon. The temperature can be increased or decreased in a street canyon according to the placement of high rise buildings. On the other hand, provision of adequate width between streets and courts should be considered

in the urban design process because it improves air exchange within the urban canopy layer. The configuration of streets such as straight and parallel to each other affects the airflow and promotes air movement in urban areas. While straight and parallel streets improve airflow into and within a city, narrow and winding streets make airflow slow and reduce cold or hot winds (Fig.5-6) (Shishegar, 2013, p.54).

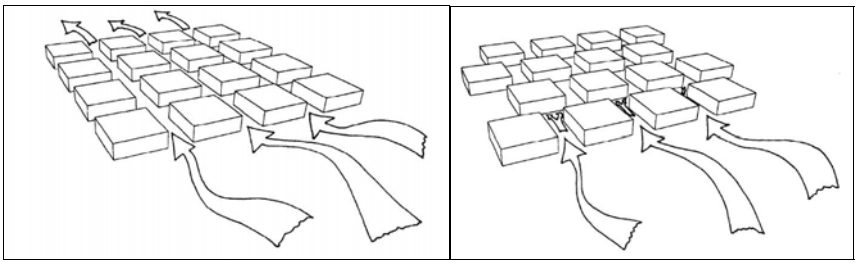


Figure 5-6. Straight and parallel streets and narrow and winding streets (ibid. p.54)

According to the climate conditions, the configuration of the streets must be done in different ways. In cold regions, the south-north orientation of the streets proves the most convenient option by allowing sunlight to reach the streets at ground level. While the south-north oriented street reaches high temperatures, lower temperatures are observed in east-west oriented urban canyons (Herrmann & Matzarakis, 2010, p. 525-526; Milošovičova, 2010). In cold climate regions, street layout should minimize the northern urban winds in winter. As it is summarized by Givoni (1998, p.424), the wider urban arterials should be planned as perpendicular to the wind direction in order to reduce the speed. Bridged buildings crossed over the street are the other strategy proposed for the reduction of wind speed in winter months.

2.1.2. Density and Compactness

Density is the important parameter affecting urban climate and ventilation conditions in the streets. While the density of sealed surfaces increases the temperature, density of green areas decreases the air temperature by influencing the shading and humidity. As stated by Milosovicova (2010), a heating effect is expected to be more significant in low density urban areas due to the inexistence of obstacles to solar radiation. However, in reality, it is more significant in higher density and compact urban areas. A lower presence of vegetation and lower wind speed in high density urban areas naturally produces a higher heat load. The high and dense built-up areas decrease the rate of cooling at night due to the absorbed heat on multistorey building surfaces.

Thus, density as one of the urban parameters should be controlled in urban areas in order to avoid climate based disturbances. Floor area ratios and population densities are the two indicators displaying both the physical structure of the cities and climate related problems. As it is emphasized in Milosovicova's study (2010), high population densities are more than 250 dwellers per hectare and cause high thermal loads in urban areas. There is no exact information about the ideal density for cold climate regions, but it is known that high density in urban areas means paved surfaces, road infrastructure and parking lots producing negative thermal and climatic conditions.

High urban density and compact urban forms in a cold climate have an unarguably positive effect on the climatic comfort of cities owing to the lower ratio of settlement areas and road infrastructure. They decrease transportation problems by reducing walking and driving distances (Givoni, 1998). High density and large multi-family buildings reduce the floor area ratio and the use of energy in cold climates. However, due to the low altitude of the sun above the horizon in high altitude cold regions, the length of the shadow caused by the buildings cast a shadow over the other buildings located in the north part. Therefore, appropriate distances between buildings along the north to south direction must be planned. Otherwise, high density prevents solar access to the buildings especially in residential areas.

The average height of buildings and the distance between them are the principal factors determining the urban density affecting the urban ventilation conditions. The differences in the heights of neighbouring buildings are decisive factors creating and modifying wind flow patterns and speed at the pedestrian level (Givoni 1998, p. 282, 285, 293). The location of the high-rise buildings is an important factor for the effects of wind on the urban fabric.

As Givoni stated (1998, p.425), an urban design solution for cold climates, providing partial solar access and achieving moderate density in cold climate urban areas, is the two-to-three storey houses oriented towards the south. As a building design solution, Givoni (1998) suggests the use of high multistorey buildings in some parts of the city, orienting them toward specific directions in order to determine the winter wind direction. It can be said an ideal design for a higher density urban area should be based on a mixture of high and low buildings. In order to block northern winds and create sheltered areas in the southern part, long buildings in different shapes such as curved convex and V-shaped can be used in urban places. In general, wind velocity and the cooling effect near ground level can be reduced by a high concentration of tall buildings in a dense city center, unless the street canyons between buildings are aligned with the wind direction (Milosovicova, 2010). High-rise buildings in the city centre should be planned with large open spaces in order to provide better ventilation conditions.

2.1.3. Particular land use and Settlement patterns

The characteristics of different land uses and their geometry and design significantly determine the energy balance and climatically positive and negative character of cities. On the city space, there are two types of places: on the one hand, cold-air producing areas such as parks, rivers and lakes; on the other hand, settlement areas such as dense urban cores, industrial areas and closed urban blocks (Milosovicova, 2010). Land use mixing is a strategy used in urban planning practices for all climates, but for the cold climate regions, there is a need for special attention due to the potential problems such as noise. Togetherness of office buildings, houses and stores may create this type of problem. In order to minimize such problems, spatial separation can be made between different uses according to the design based solutions such as vertical and horizontal separation. While vertical separation means floor based separation within the same building, horizontal seperation means the building based separation and interconnection between them with covered passages (Givoni, 1998).

As another settlement pattern, housing area design multidimesionally affects urban climate depending upon the differences in the distribution of spatial elements and different surfaces in building blocks (Sahin and

Dostoglu, 2007). Clustering should be the way of design for housing areas in order to trap warming air in courtyards (Fig.7).

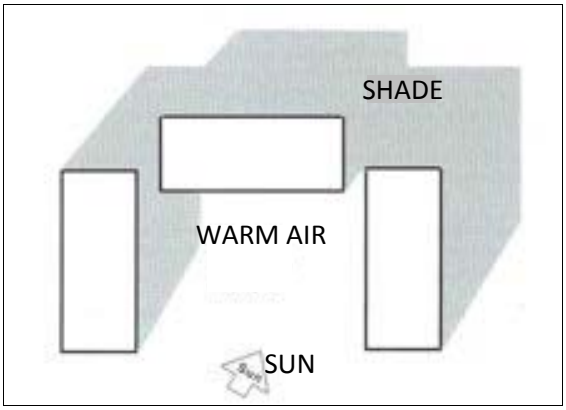


Figure 7. Sample of design for trapping warm air in courtyards

The air circulation is essential for the climatic comfort in urban areas due to the ability of the wind to transfer exhaust gases, odours, sounds, heat and moisture from urban cores to the other parts of the city. Therefore, considerable attention should be given to ventilation aspects in the design process of settlements. Ventilation channels as a design element should enable cooler air flows from the surrounding lower density areas, green areas or water bodies towards the center as well as between the inner city green areas and densely populated areas (Milosovicova, 2010).

It is difficult to suggest the ideal or most efficient urban form for better ventilation and human physical comfort in cold climates. Protection from the north wind, by locating possibly in a south facing position, and locating high-rise buildings where needed, are the strategies for climate sensitive urban planning providing sufficient ventilation, preventing overradiation and heat release, and enhancing climatic comfort (Milosovicova, 2010).

Parks and Green Areas

Parks and green areas are tools in urban design for modifying the micro-climate of urban areas. While they can be used for the protection of buildings from winter winds, they may also be used for opening them to summer winds. Thus, the positioning of them is important for the control of wind direction and speed, and air temperatures around the buildings. While urban parks designed as enclosed shapes with deciduous planting can be a heat source in winter, they also provide shade in summer and are a good source of cooler air. On the other hand, they can be used for the modification of air quality and noise impact with the help of suitable planting (St.Clair, 2010).

As summarized by Milosovicova (2010, p.32), “the climatic effects of green areas in cities are in improving the air quality and urban climate through the retention, absorption and evapotranspiration of rainwater; returning the rainwater in the form of vapour to the small water cycle; reducing air pollution; reducing the noise impact by traffic, neighbours; positively affecting natural urban ventilation; and providing urban areas with shade and lower temperatures in hot seasons”. At this point, the design and position of the green and built-up areas in the city become important. In

order to allow the penetration of cooling winds into the built-up areas, loose design of the urban edge is the solution (Milosovicova, 2010). In cold climate regions, the form and position of the green areas and plants should not be planned linearly with the cold wind. If it will be linear, it must be vertical to the direction of cold wind (Shaghaghi et al., 2011).

3. THE CASE OF ERZURUM

Figure 8. A View of the City of Erzurum

3.1. Climatic Specifications of Erzurum City

Erzurum is a city in eastern Turkey with nearly five hundred thousand people (urban population) and is the fourth largest city with an area of 25.066 km². As it is stated in the first section, it has a humid continental climate typified by large seasonal temperature differences with warm to hot summers and cold (sometimes severely cold) winters. While sunny days are at their minimum, snow is a major occurence. Average monthly temperature, snow and rainfall are as shown below (see Table I). This table simply shows the cold climate characteristics of the city. Erzurum is one of the coldest cities in Turkey with its very cold winter months having an average minimum during January of around 15 °C. The topographical structure and geographical position create this continental climate.

Winter months continuing for generally six months are rather cold, while the summer period generally is under the hegemony of a hot and arid climate. The annual number of rainy days is 126 and number of snowy days is 50. Snow cover duration is 114 days (Erzurum Valiligi, 2013). The differences between night and day temperatures are very high. In addition, the direction of the prevailing wind is southwest. Under these climatic conditions, some negative effects are observed in Erzurum, such as the short daytime, air pollution, temperature differences, icy road and pedestrian ways, and oblique angle of sunlight.

3.2. Analysis of the Three Districts: City Centre, Yenisehir (New City), Dadaskent

In this part of the study, three different districts of Erzurum city are analysed with factors deduced from the literature: density, floor area ratio, building coverage ratio, average height, sealed surface, H/W ratio, SVF, green areas and street orientation. These analyses are made with the aim of

proposing a set of climate sensitive design guidelines. For this reason, the existing urban structure is reviewed in this stage within this framework.

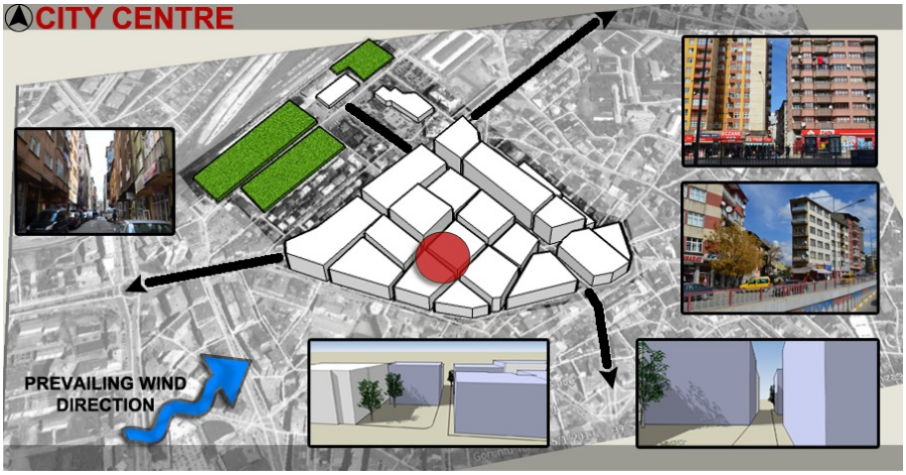


Figure 9. Existing situation of city centre (pictures and sketch-up simulations)

In the first part, the city centre is analysed due to the terrible winter conditions. In the winter months, due to the very narrow structure, it is almost not possible to pass across some of the streets in the city centre. Air pollution is the other important problem in this area (Fig. 9-10). Urban geometry as a climate related factor is analysed using the H/W ratio and sky view factor (SVF) with the aim of evaluating the existing situation of the built environment in the city centre. The H/W ratio is calculated as 4.2 in this area, demonstrating that it is a shallow street, and sunlight and radiation cannot reach the street ground or heat the air near the ground. On the other hand, the sky view factor is determined with the fisheye photograph taken in the selected street as 0.15 by using the RayMan module (Matzarakis et al. 2010). It shows that the ratio of sky visible at the middle of the street is 15%. It can be said for the city centre of Erzurum that it has a deep street canyon form and absorption stays high above the ground level. If we use Emmanuel's (2005) suggestion of the ideal value of an H/W ratio being an urban canyon with a ratio of 0.4-0.6, the city centre of Erzurum has a serious problem related to this ratio. The built environment decreases the solar access in the streets.

Another urban parameter, building volume, is analysed for this region. They are seven floor multi-unit buildings covering all parts of the building blocks. It seems positive at first glance but there is no height difference or open places providing ventilation and solar radiation absorption. When the street orientations are analysed, it is observed that they are parallel to the prevailing wind direction. However, design and positioning of the high density built-up areas prevents winds entering the city center. Setbacks on the building surfaces, strategical location of few high-rise towers, bridge-buildings, corridors and green fingers have not been considered in the planning process. The configuration of streets determining airflow in urban areas is narrow and deep in the city centre, slowing airflow and causing air pollution. On the other hand, orientations nearly coincide with the south-north direction as the ideal form for the sunlight to reach, but density does not allow the sunlight in.

Table 1. Climate Data for Erzurum

ERZURUM	**Jan.**	**Feb.**	**Mar.**	**Apr.**	**May.**	**June**	**July**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**
Average Temp. (°C)	**-9.4**	**-8.1**	-2.3	5.4	10.6	14.9	19.3	19.3	14.5	8.0	0.6	**-6.0**
Average Max. Temp. (°C)	**-4.0**	**-2.5**	2.8	11.2	16.9	21.8	26.7	27.2	22.8	15.3	6.7	**-1.0**
Average Min. Temp. (°C)	**-14.5**	**-13.2**	-7.1	0.0	4.0	7.0	10.9	10.6	5.9	1.4	-4.4	**-10.7**
Mean Monthly Sunshine Hours	**3.0**	**4.0**	4.6	6.1	7.6	10.1	11.1	10.5	9.0	6.4	4.3	**2.5**
Average Rainy Days	**11.6**	**11.4**	12.8	14.8	16.7	11.1	6.8	5.5	4.9	10.1	9.5	**11.5**
Monthly Rainfall (kg/m^2)	**19.8**	**23.0**	32.2	55.8	67.8	45.5	26.2	17.0	20.6	44.7	32.1	**21.4**
Record low (°C)	**-36.0**	**-37.0**	-33.2	-22.4	-7.1	-5.6	-1.8	-1.1	-6.8	-14.1	-34.3	**-37.2**
Record high (°C)	**7.9**	**9.6**	21.4	26.5	29.1	31.0	35.6	36.5	33.3	27.0	17.8	**14.0**

Source: Turkish State Meteorological Service, 2013

Density as an important parameter of urban climate is measured in the city centre and it is identified as a very high density region with 990 dwellers/ha. High population density, which is more than 250 dwellers/ha, is the reason of high thermal loads in this urban area. Its surfaces are one hundred percent sealed and there are no green areas, causing higher heat load and polluted air. The rate of cooling at night is slow due to the absorbed heat on sealed and multistorey building surfaces. In support of this, floor area ratio is calculated as 4.2 in the city centre. High urban density and compact urban form in the city centre can be considered as positive due to the effects on the climatic comfort with the low ratio of settlement areas and road infrastructure.

With the help of short walking and driving distances, transportation problems are decreased. However, the length of the shadow cast by buildings over other buildings located opposite prevents solar access to other buildings. Givoni's (1998) suggestion for the building design as two-to-three storey buildings oriented towards the south can be considered for this region of the city.

Land use and settlement patterns of the region are the other urban parameters analysed for the city centre. As the land use pattern and green areas are determined, it is observed that there are no green areas in the city centre (Fig.13). Air circulation as the essential feature of climatic comfort in urban areas can be provided by green areas. They transfer exhaust gases, sounds, heat and moisture from urban cores to the other parts of the city. Therefore, ventilation aspects of the design process of settlements should be considered at the first stages of planning with green areas especially in the city centre. When the settlement pattern is analysed (Fig. 15), high density spontaneous development can be observed. Land use mixing is the strategy can be used for this part of the city. Togetherness of office buildings, houses and stores with appropriate vertical and horizontal separation can be the solution for the climatic comfort in the city centre.

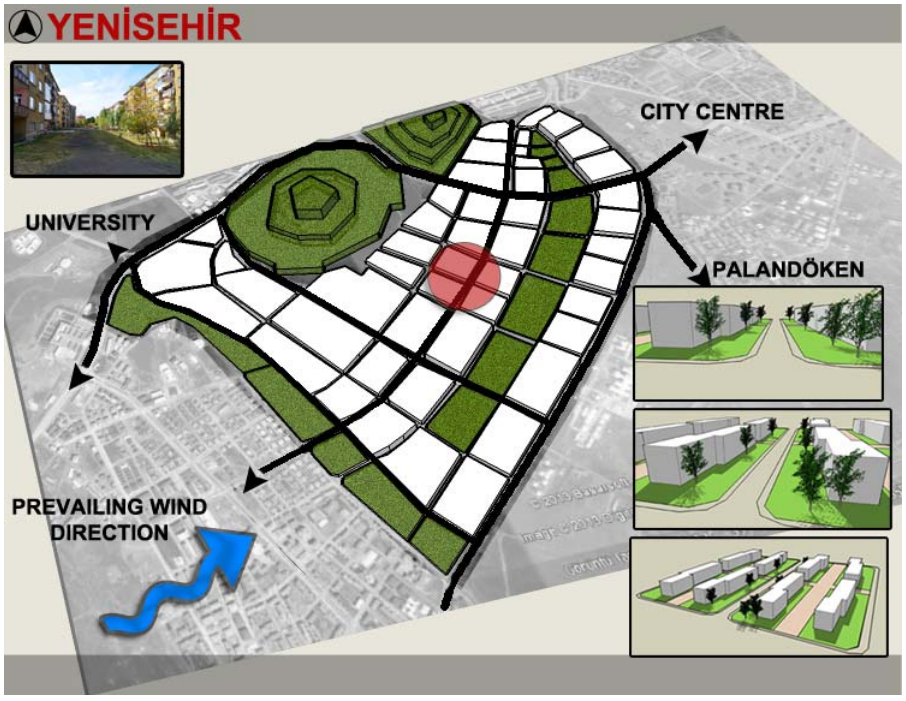
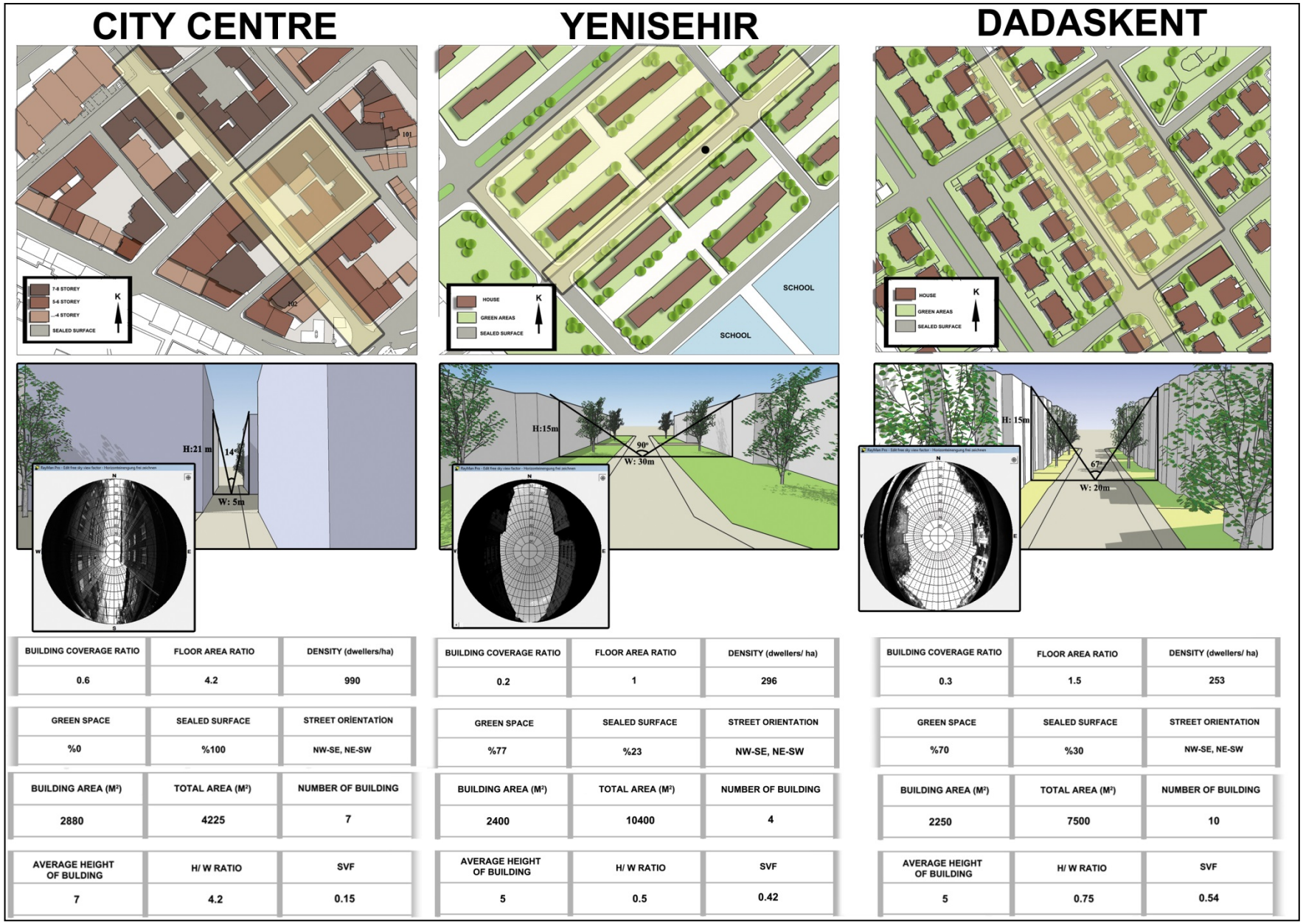


Figure 11. Existing situation of New City (picture and sketch-up simulations)



BUILDING COVERAGE RATIO	FLOOR AREA RATIO	DENSITY (dwellers/ha)
0.6	4.2	990

GREEN SPACE	SEALED SURFACE	STREET ORİENTATİON
%0	%100	NW-SE, NE-SW

BUILDING AREA (M²)	TOTAL AREA (M²)	NUMBER OF BUILDING
2880	4225	7

AVERAGE HEIGHT OF BULDING	H/ W RATIO	SVF
7	4.2	0.15

BUILDING COVERAGE RATIO	FLOOR AREA RATIO	DENSITY (dwellers/ ha)
0.2	1	296

GREEN SPACE	SEALED SURFACE	STREET ORIENTATION
%77	%23	NW-SE, NE-SW

BUILDING AREA (M²)	TOTAL AREA (M²)	NUMBER OF BUILDING
2400	10400	4

AVERAGE HEIGHT OF BUILDING	H/ W RATIO	SVF
5	0.5	0.42

BUILDING COVERAGE RATIO	FLOOR AREA RATIO	DENSITY (dwellers/ ha)
0.3	1.5	253

GREEN SPACE	SEALED SURFACE	STREET ORIENTATION
%70	%30	NW-SE, NE-SW

BUILDING AREA (M²)	TOTAL AREA (M²)	NUMBER OF BUILDING
2250	7500	10

AVERAGE HEIGHT OF BUILDING	H/ W RATIO	SVF
5	0.75	0.54

Figure 10. Analysis of City Centre, Yenisehir and Dadaskent (SVF, H/W, street orientation, physical analysis, etc.)

In the second part, Yenisehir (New City) is analysed because of its more organized structure. (Fig. 10-11). As an important urban parameter, geometry is analysed with the H/W ratio and SVF. The H/W ratio is calculated as 0.5 in this area. Sunlight and radiation are able to reach the street ground and heat the air near the ground. On the other hand, the sky view factor is measured as 0.42 by using the RayMan module. It shows that the ratio of sky visible at the middle of the street is 42%. It can be said for the New City of Erzurum that its urban canyon has an ideal H/W ratio of 0.4-0.6. The built environment increases the solar access in the streets. Building volume as the other urban parameter is analysed for this region. There are five-floor buildings covering limited parts of the building blocks. This is positive for climate sensitive consideration, but there are no height differences providing ventilation and blocking undesired cold winds. Open places as positive design elements leading solar radiation absorption are considered in this part of the city. When the street orientations are analysed, it is observed that they are parallel to the prevailing wind direction. As it is emphasized in the literature, they should be planned as perpendicular to the cold winds. However, design and positioning of the high-rise buildings in some parts of the region can be a strategy for blocking cold winds. The configuration of streets has been made as wide providing an increase in the speed of the airflow. On the other hand, orientations of the buildings have been planned consistent with the south-north direction providing sunlight.

Density as the second urban parameter influencing climate is measured in the New City. It is a high density region with 296 dwellers/ha. As Milosovicova stated (2010), high population density is the reason for high thermal loads in urban area. It has twenty-three percent sealed surfaces and seventy-seven percent green areas, decreasing higher heat loads and air pollution. The rate of cooling at night is high due to the absorbed heat on green areas. The floor area ratio is calculated as 1 in the New City. Urban form in this part of Erzurum is linear starting from east and developing toward a south-west direction. It is not in compact form. While the high urban density and linear urban form in the New City can be evaluated as negative due to the effects on the climatic comfort, low building coverage ratio (0.2) and sealed surfaces are positive aspects. The length of the buildings and the width among them does not cast a shadow over the other buildings. Therefore, it allows solar access to other buildings. However, as Givoni (1998) suggested, two-to-three storey buildings oriented towards the south are the ideal conditions, so lower buildings should be designed in this region.

Land use and settlement pattern are the last urban parameters analysed for the New City, showing different characteristics. Green areas are analysed and it is observed that there are many green areas in this region of Erzurum (Fig. 13). The air circulation as an essential feature of climatic comfort is provided by these green areas. There is no ventilation problem in terms of the transfer of gases, odours and noises from this region to other parts of the city space. When the settlement pattern is analysed (Fig. 15), high density and organized development can be observed.

In the third example, Dadaskent is analysed because it is the satellite settlement in Erzurum causing urban sprawl and effecting urban climate. Although, there is no need to settle in distant places. Dadaskent is located in the west part of the city with a rent based approach. It is a place having a high ground water level on the Erzurum plain. All climate and design based factors are analysed for this region (Fig. 10-12). Urban geometry as a

climate related factor is analysed with the H/W ratio and sky view factor. The H/W ratio is calculated as 0.75 in this area, demonstrating that it is a uniform street. It allows sunlight and radiation to reach the street ground and heat the air near the ground. On the other hand, the sky view factor is determined with the RayMan module as 0.54 (Matzarakis et al. 2010). It shows that the ratio of sky visible from the middle of the street is 54%. It can be said for Dadaskent that its urban canyon exceeds the ideal H/W ratio of 0.4-0.6. The built environment decreases the solar access in the streets.

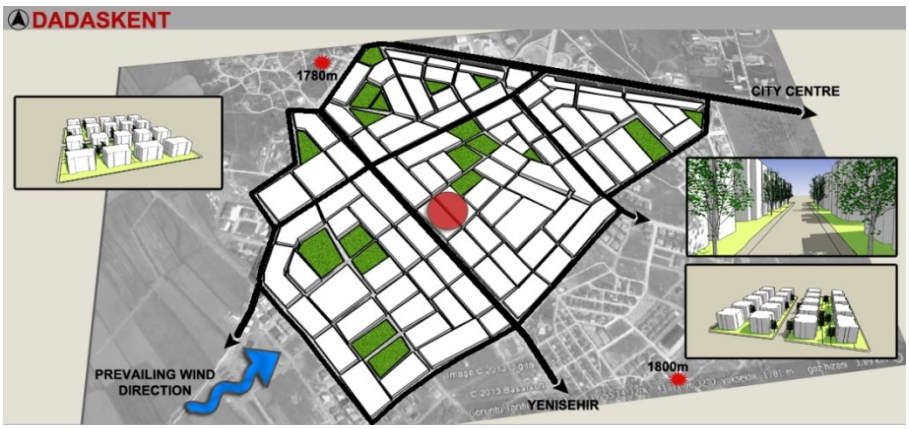


Figure 12. Existing situation of Dadaskent (sketch-up simulations)

Another urban parameter, building volume, is analysed for this region. There are five-floor buildings covering limited parts of the building blocks. It is positive for climate sensitive considerations, but there are no height differences providing ventilation and blocking undesired cold winds. Open places in the Dadaskent area allow solar radiation absorption. Street orientation analyses showed that they are parallel to the prevailing wind direction. Setbacks on the building surfaces, strategical location of few high-rise towers, bridge-buildings, corridors and green fingers have not been considered in the planning process. On the other hand, orientations of the buildings have not been planned consistent with the south-north direction, providing sunlight.

Density as a parameter of urban climate is measured in Dadaskent and seen that it is a high density region with 253 dwellers/ha. High population density, which is more than 250 dwellers, is the cause of high thermal loads in this urban area. It has thirty percent sealed surfaces and seventy percent green areas, decreasing higher heat loads and air pollution. The rate of cooling at night is high due to the absorbed heat by green areas. The floor area ratio is calculated as 1.5 in Dadaskent. The high urban density and compact urban form of Dadaskent can be considered as positive due to the effects on the climatic comfort with a low ratio of settlement areas and road infrastructure, however, this increases driving distances, creates transportation problems and causes urban sprawl. So, Dadaskent cannot be evaluated as a positive development in the cold climate city of Erzurum. As Givoni (1998) suggested, two-to-three storey buildings oriented towards the south are the ideal solution for climate sensitive design, but it is not considered in this region.

When the land use of the region is analysed, it is observed that there are small and unorganized green areas in Dadaskent (Fig. 13). The settlement pattern (Fig. 15) shows high density and planned characteristics.

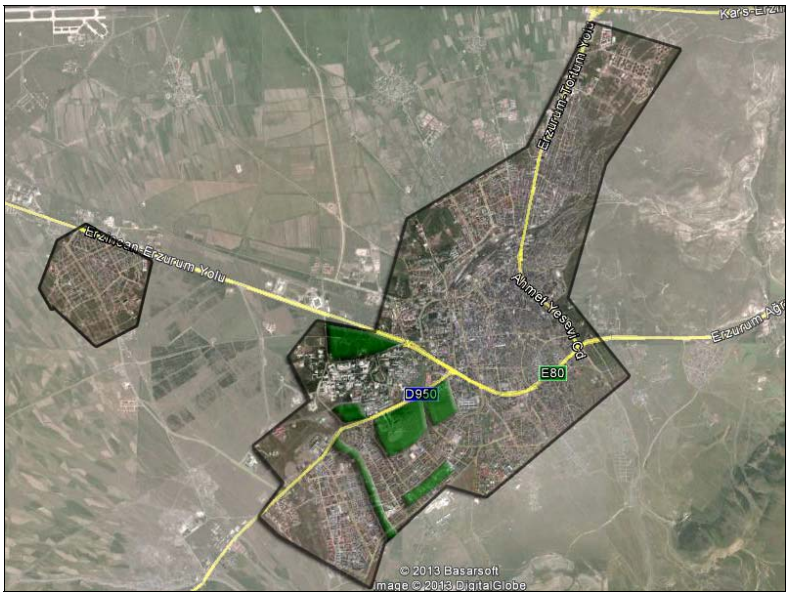


Figure 13. Green areas in Erzurum

4. URBAN DESIGN STRATEGIES

In this part of the study the urban design solutions for the city of Erzurum from a climate sensitive perspective will be summarized. In cold climate regions, selection of suitable places for urbanization is the first important point. Sites promoting solar radiation and reducing the effects of winter wind must be selected. South facing slopes are ideal places for settlements in terms of maximizing available solar radiation. On the building scale, dense layouts, referring to a group of larger building units, is the solution for the minimization of heat loss. A seperation of building becomes important for this type of urban design because minimization of shading by adjacent buildings in winter months is needed. As it is stated by St. Clair (2010, p.11), "the distance between buildings in the north-south direction should be based upon a height to width ratio of 1:1.5. This represents a winter midday solar angle of 30º". Streets and alleys should be designed with an average width to avoid creating wind tunnels. They must be planned as vertical to the direction of the prevailing cold winds. Many alleys can be designed nonlinear and curved in form to prevent the creation of wind tunnels (Shaghaghi et al., 2011).

For the better positioning of buildings in cold climate, they should be positioned in an urban area with an angle of 12.5 degrees towards the south-east, providing better absorption of sunlight on winter days (Fig. 14).

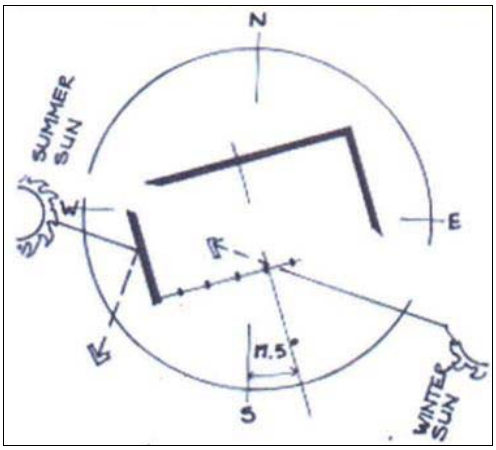


Figure 14. Building direction towards the sun (St. Clair, 2010, p.16)

The urban fabric should be in a compact form and the buildings should be constructed with a low area in front. Multi storey buildings are the solution for cold climate regions at a micro scale. Use of varied height buildings from north to south consisting of multi-storey buildings, medium density, row houses and villas minimises the penetration and speed of winds in winter (Givoni 1998). South facing clustering and the use of central yards are the other microscale solutions that can be considered in Erzurum. This would provide the ability to trap warm air in courtyards between buildings. Courtyards protect outdoor spaces against winds, maximise solar access and minimise shading in winter whilst opening to breezes in summer, maximising shading vegetation and minimising solar access to vertical and horizontal surfaces in summer (St. Clair, 2010). Use of underground floors can also be considered due to the ability of decreasing the thermal surfaces of the buildings (Shaghaghi etal., 2011). Outdoor space should be directed towards the south side in order to maximise solar exposure in winter. Additionally, connection of outdoor space to existing buildings must be provided with the aim of promoting urban ventilation and thermal comfort. Street widths, orientations and pedestrian pathways as tools of urban design should be considered in climate sensitive urban planning. Streets must be oriented perpendicular to the prevailing winter winds to reduce discomfort and temperature loss. On the other hand, streets must be oriented parallel or at 30-45 degree angles to the prevailing summer winds (Givoni 1998, p.439). Bridges between buildings can be considered in order to reduce the wind speed in the street. Use of thick walls on the side of the building facing cold winds reduces heat loss and provides thermal insulation (Shaghaghi et al., 2011). For the volume of buildings, cube forms must be selected because to provide maximum interior volume against minimum exterior surface.

In addition to the built-up areas, green areas in the urban space must be considered as an important climate sensitive design element. Green fingers connecting new vegetation to existing parks should be designed to promote cooling (Givoni, 1998). Urban parks must be designed with deciduous planting in enclosed forms so as to keep the heat in winter and to provide shade in summer (St. Clair, 2010). Pine (trees) can be trialled in those parks as they never lose their leaves in winter (Shaghaghi et al., 2011).

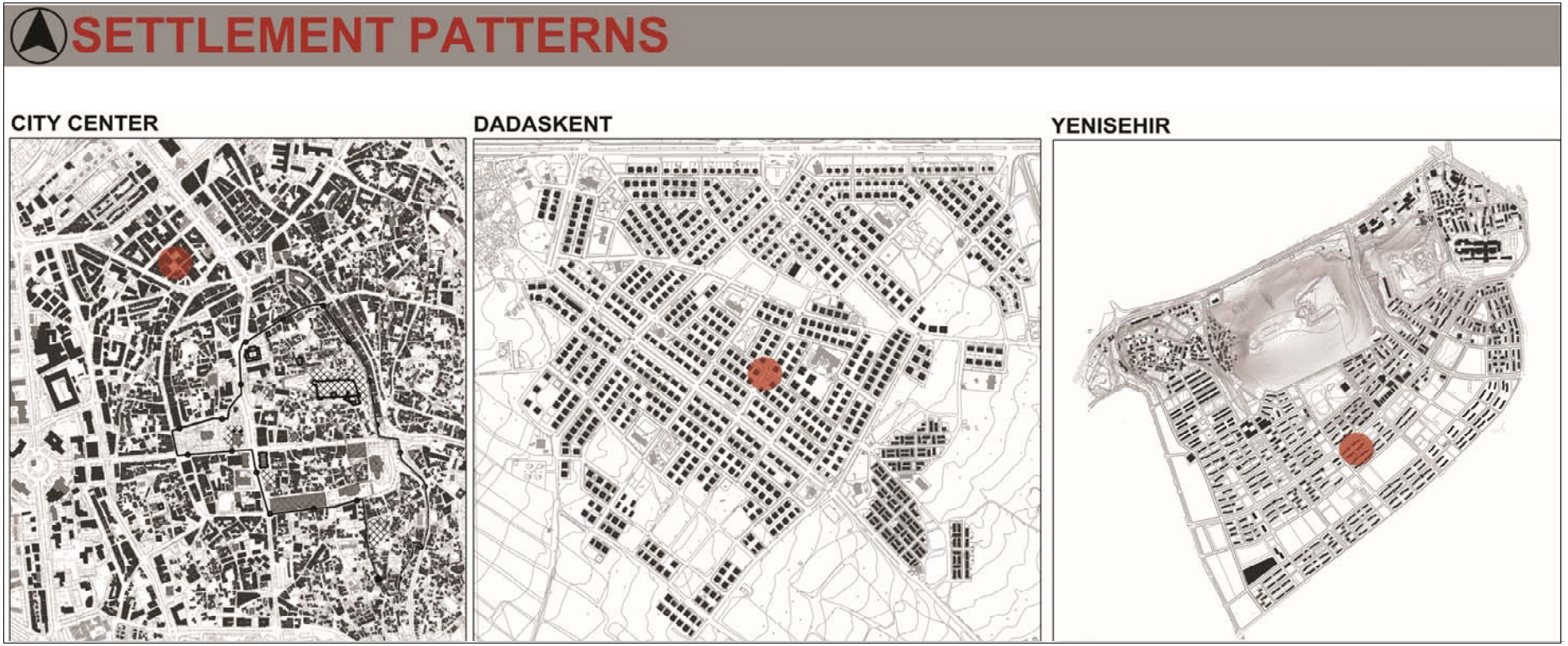


Figure 15. Settlement Patterns of Selected Districts

5. CONCLUSION

As seen in the analysis, urbanization in Erzurum has not followed climate sensitive processes. In fact, it can be redesigned as a winter city by focusing on the positive aspects of winter such as outdoor recreational activities, indoor art, culture and social activities, winter tourism and festivals. However, there is no awareness of the positive aspects and way of coping with the winter in Erzurum at both municipal and grassroot levels. Climate sensitive strategies can be used for the districts of Erzurum to protect them from the terrible cold weather in winter and reduce the need for artificial heating and cooling. Use of the suggested strategies will be a solution for air pollution and other design based problems and can be a guide for a new part of the city. In this process, it should always be remembered that climate sensitive design is a complicated process in urban planning, including different scale interventions depending on the land uses in the urban area, such as built-up or green areas, water surface and industrial areas.

On the other hand, hybrid strategies that address both summer and winter conditions should be considered or the weight should be on winter strategies and heat conservation in Erzurum. The key strategies should be based on the "protection against winter winds, maximising solar radiation gain, the use of insulation and the provision of a concentrated plan" (St. Clair, 2010, p.9). Erzurum's high summer temperatures and cold winters need adaptable strategies of site and building design. Compact and open planning suggested by Givoni may be useful in this climate type (1998).

All these climate related urbanization and environmental issues must urgently be included into the urban planning process of Erzurum. Otherwise, environmental crises will be the most critical issue in the near future. Inappropriate settlement areas, poor urban design and planning activities and an increasing number of automobiles are the major contributors to environmental damage. As can be observed from data (TUİK, 2013, Number of Road Motor Vehicle by Provinces), the city of Erzurum have both planning and planning led transportation problems. In the process of time, it can be clearly observed that all of the urbanization practices in Erzurum will further increase ecological damage.

Therefore, this study should be accepted as the very first stage of the climate related studies in Erzurum. Possible urban design strategies for cold climate regions are summarized in this study, but climatic map studies are still missing for Erzurum. In the following stages of this study, climatic map studies should be done. Both this and climatic map studies will be essential inputs for the urban planners in Erzurum and other cold cities in Turkey.

REFERENCES

Basibuyuk, A. (2005). "Dogu Anadolu Bolgesinde Ortalama Hanehalki Buyukluklerinin Dagilimi". *Eastern Geographical Review*, 10(13), s. 273-289.

Caliskan, O. (2012). "Turkiye'nin Biyoklimatik Kosullarinin Analizi ve Sehirlesmenin Biyoklimatik Kosullara Etkisinin Ankara Olceginde Incelenmesi". *Doktora Tezi*. Ankara: Ankara Universitesi Sosyal Bilimler Enstitusu.

Caliskan, O., & Matzarakis, A. (2013). "The Climate and Bioclimate of Nevsehir from the Perspective of Tourism. Advances in Meteorology", *Climatology and Atmospheric Physics Springer Atmospheric Sciences*, 397-402.

Caliskan, O., Cicek, I., & Matzarakis, A. (2011). "The Climate and Bioclimate of Bursa (Turkey) From the Perspective of Tourism". *Springer*, s. 417-425.

Ebrahimabadi, S., Johansson, C., Nilsson, K.L., (2012). "The challenges of incorporating climate considerations into urban planning of the subarctic regions", Paper I). (Submitted for publication in *European Planning Studies* in May 2012

Emmanuel, R., (2005), "An Urban Approach to Climate-Sensitive Design – Strategies for the Tropics", *Spon Press*, New York

Ercoskun, O. Y. (2007). "Surdurulebilir Kent Icin Ekolojik-Teknolojik (Eko-Tek) Tasarim: Ankara-Gudul Ornegi". *Doktora Tezi*. Ankara: Gazi Universitesi Fen Bilimleri Enstitusu.

Erzurum Buyuksehir Belediyesi. (2012). "Koruma Amacli Imar Plani" *Arastima Raporu*. Erzurum.

Erzurum Valiliği, "Cografi Yapı", *www.erzurum.gov.tr*., 19 July 2013.

Gehl, J., (1996), "Life between buildings, Copenhagen": *Arkitektens forlag*.

Girginer, S. (2006). "Kentsel Tasarim ile Ekolojik Surdurulebilirligin Iliskilendirilmesi ve Toplu Konut Gelisme Bolgelerinde Orneklenmesi". *Yuksek Lisans Tezi*. Izmir: Dokuz Eylul Universitesi Fen Bilimleri Enstitusu.

Givoni, B., (1998), "Climate Considerations in Building and Urban Design", *John Wiley & Sons*, Inc., NY

Guclu, K. (1988). "Erzurum Kentinin Yesil Alanlarinda Planlama ve Uygulama Sorunu". *Ataturk Universitesi Ziraat Fakultesi Dergisi*, 19(1-4), 51-63.

Gulten, A. (2007). "Kent Dokusunda Gunes Isinimindan Yararlanmak Icin Cadde-Bina Iliskisinin Arastirilmasi". Y*uksek Lisans Tezi*. Elazig: Firat Universitesi Fen Bilimleri Enstitusu.

Gulten, A., & Aksoy, T. (2010). "Gokyuzu Gorus Faktoru ve Bina Yuzey Sicakliklarina Bagli Olarak Cadde Geometrisi-Gunes Isinimi Etkisi". *Firat Universitesi Muhendislik Bilimleri Dergisi*, 22(2), 157-170.

Herrmann, J., Matzarakis, A., (2010), "Influence of mean radiant temperature on thermal comfort of humans in idealized urban environments". In: Matzarakis, A., Mayer, H., Chmielewski, F.-M. (Eds.), *Proceedings of the 7th Conference on Biometeorology*. Ber. Meteorol. Inst. Univ. Freiburg No. 20, 523-528.

Hisarligil, H. (2009). "Enerji Etkin Planlamada Konut Adasi Tasarimi: Hipotetik Konut Adalarinin Ankara Orneginde Mikroklima Analizi". *Doktora Tezi*. Ankara: Gazi Universitesi Fen Bilimleri Enstitusu.

Koseoglu, B. (2012). "Kentsel Kamusal Mekanlarin Iklim Duyarli Tasarlanmasi: Turkiye Orneklerinin Karsilastirilmasi". *Yuksek Lisans Tezi*. Ankara: Gazi Universitesi Fen Bilimleri Enstitusu.

Kottek, M., J. Grieser, C. Beck, B. Rudolf, and F. Rubel, (2006). "HYPERLINK "http://koeppen-geiger.vu-wien.ac.at/pdf/Paper_2006.pdf" \t "_blank" World Map of the Köppen-Geiger climate classification", updated . *Meteorol. Z.*, **15**, 259-263

Kuscu, C. (2010). "Landsat Tm Verileri Uzerinden Yuzey Sicakligi Haritasinin Olusturulmasi ve Yersel Olcumler ile Iliskisinin Incelenmesi". *I. Ulusal Planlamada Sayısal Modeller* (s. 423-436). Istanbul: Istanbul Teknik Universitesi.

Matzarakis A, Rutz F, Mayer H., (2010), "Modeling radiation fluxes in simple and complex environments − basics of the RayMan model". *Int J Biometeorol* 54:131-139

Milosovicova, J., (2010), "Climate-Sensitive Urban Design in Moderate Climate Zone: Responding to Future Heat Waves Case Study Berlin – Heidestrasse/Europacity", *Master Thesis* in Urban Design, Downloaded from http://jm-urbandesign.com/csud_thesis.html, on 11 July 2013)

Pressman, N. (1985). *Reshaping winter cities: Concepts, strategies and trends. Waterloo*, Ont.: Published under the auspices of Livable Winter City Association by University of Waterloo Press.

Pressman, N. (1995). *Northern cityscape: Linking design to climate*. Yellowknife, N.W.T.: Winter Cities Association.

Pressman, N. (2004). *Shaping cities for winter: Climatic comfort and sustainable design*. Prince George, B.C.: Winter Cities Association.

Piringer, M. and Joffrey, S., (2004), "The Urban Surface Energy Budget and Mixing Height in European Cities: Data, Models and Challenges for Urban Meterology and Air Quality", *Final Report of Working Group 2* of COST-715 Action

Sahin, E., & Dostoglu, N. (2007). "Kentsel Mekan Tasarımında Doğal Verilerin Kullanımı". *Uludag Universitesi Muhendislik-Mimarlık Fakultesi Dergisi*, 12(1), 29-40.

Shishegar, N., (2013), "Street Design and Urban Microclimate: Analyzing the Effects of Street Geometry and Orientation on Airflow and Solar Access in Urban Canyons", *Journal of Clean Energy Technologies*, Vol. 1, No. 1, January

Simsek, C. K., & Sengezer, B. (2012). "Istanbul Metropoliten Alaninda Kentsel Isinmanin Azaltilmasinda Yesil Alanlarin Onemi". *Megaron Article*, 7(2), 116-128.

Soysal, S. (2008). "Konut Binalarinda Tasarim Parametreleri ile Enerji Tuketimi Iliskisi". *Yuksek Lisans Tezi*. Ankara: Gazi Universitesi Fen Bilimleri Enstitusu.

St.Clair, P., (2010), "Guidelines for Climate Responsive Design in Cold Climates with Particular Reference To Beijing, China".

TUIK. (2011). *Secilmis Gostergelerle Erzurum*. Ankara.

TUIK. (2013). *Number of Road Motor Vehicle by Provinces*. Ankara.

Zengin, M., Oguz, H., & Ozer, S. (2009). "Kentsel Acik-Yesil Alanlarin Zamana Bagli Alansal Degisimlerinin Belirlenmesi: Erzurum Palandoken Ilcesi Yenisehir/Yildizkent Yerlesim Alanlari Ornegi". *3. DEU CBS Sempozyumu*. Izmir.

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Challenges and Tasks of Ecobridges in Seoul Based on the Ecobridge-use Behavior Survey

In the Case of Ecobridges in Dongjak-gu and Gwanak-gu

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Abstract: During the past 50 years, there have been strong demands for establishing the North and South Green Network and its eco-corridors to resolve problems of urbanization in Seoul. Following this, from 1994, the Seoul City Government began building ecological paths to re-establish ecological networks. 25 eco-corridors were created between 1994 and 2013 in Seoul, however, the designed eco-corridors presented some problems with biased functions, losing a major objective of eco-corridors which are required to perform as both a citizens' moving route as well as wildlife passage. In addition, eco-corridors in Seoul, a heavily populated city, are not likely to serve the originally intended functions as well as those in natural areas. Accordingly, to appropriately perform its own function as a moving route for humans and wildlife, eco-corridors in urban areas are required to be comprehensively analysed with consideration of both ecological and pedestrian aspects. Study sites have been selected from the green zone of the Gangnam area. Specifically, it includes Seodal-ro, Sadang-ro, Solbat-ro, and Nambusoonhwan-ro, which form a linking footpath between Seodal mountain neighborhood park, Gachi mountain and Gwanak mountain. This study is to examine some issues of the selected urban eco-corridors, which are supposed to act as moving routes for both humans and animals through analysis of the current situation and use-behavior survey of eco-bridges in Seoul, and to interpret the meaning of eco-corridors in urban areas. Through the results of user behavior analysis of four eco-bridges, on one hand, it is found that the appearance frequency of wild animals is very low and species diversity is quite limited. On the other hand, the frequency of human utilization is very high and the purposes of utilization are varied. As known from these results, eco-bridges in Seoul could have more functions and meanings, not only concentrating on the function as a wildlife passage. This study offers the insight that eco-bridges in Seoul could be considered in a broader sense, focusing on human use rather than focusing on their ecological function in a narrow sense.

1. INTRODUCTION

1.1 Background and Purpose

The Seoul City Government has declared the "Ecological Green Corridor Link Project" to connect 24 segmented green axes in the city by building

eco-bridges on a budget of 300 billion won. This project leads to the question of whether eco-bridges in Seoul are functioning properly.

Eco-bridges generally function as corridors of the ecological system. Forman and Gordon (1986) mentioned that corridors function as a habitat for species, a conduit for movement, a filter separating areas, and an environmental source for the surrounding matrix. Eco-corridors built over expressways have some visible effects, for example, decreasing road-kill. On the other hand, the effectiveness of eco-bridges in Seoul is controversial. Fleury and Brown (1997) suggested a framework for the design of wildlife corridors, involving the definition of critical corridor attributes, identification of target species, the determination of biophysical inventory, and evaluation of corridor designs.

In comparison, most eco-bridges in Seoul are designed and constructed without any regard for target species or ecological conditions. Moreover, they have been criticized for wasting the taxpayer budget. Consequently, contrary to the expectations (that wild animals would use them to migrate), they have mostly been used as walking trails for humans. In fact, wild animals can hardly survive in urban areas due to the lack of green space and vegetation, and the preservation of the urban ecological system by excluding human activity is impractical, because cities are heavily populated areas. That is to say, eco-corridors in heavily populated cities are not likely to serve the same functions as those in non-urban areas. New possibilities for eco-bridges in cities are necessary.

In this context, the purpose of this study is to find the genuine meaning of eco-bridges in Seoul through an analysis of the current situation. In South Korea, studies about eco-corridors have been ongoing since the Ministry of Environment constructed wildlife passages on Jiri Mountain and Odae Mountain as a pilot project in 1998 (Ministry of Environment, 2003).

Since the pilot project, over 200 eco-corridors have already been constructed in the country, 23 of which have been constructed in Seoul, the capital of South Korea. Most research studies in the country have investigated the cases of eco-corridors in non-urban areas, whose main purposes and functions are the migration of wild animals, however eco-bridges constructed in Seoul, although used as wildlife passageways, have been actively used by citizens.

1.2 Research Methods

Figure 1. Ecological axis of Seoul (Landscape Master Plan of Seoul, 2010)

Linking Seoul National Cemetery, Gachi Mountain Neighborhood Park, and Gwanak Mountain, all of which belong to the major stronghold green

zone of Seoul, the North and South Green Network plays a major role as an important habitat for the city ecosystem.

Along the ecological axis in Seoul, the Han River flows through the east and west, the south-north green axis is formed by mountains. Gwanak-gu and Dongjak-gu include stronghold green zones, such as Seoul National Cemetery, Gachi Mountain Park, and the south-north green axis of Seoul.

In Seoul, 25 eco-corridors were created between 1994 and 2013. Among these 25 eco-corridors, four eco-corridors in the southern area of Seoul were built to re-establish the disconnected North and South Green Network, which are selected as being study sites. Specifically, it includes Seodal-ro, Sadang-ro, Solbat-ro, and Nambusoonhwan-ro, which form a linking footpath between Seodal Mountain, Gachi Mountain and Gwanak Mountain. Four eco-corridors sequentially link the disconnected north and south ecological axis. By using GIS maps offered by the National Geographic Information System, we conducted a regional analysis using biotope evaluation, land use, biotope type, and vegetation maps. In addition, we determined the current situation, spatial layout, and usage state of eco-bridges through field investigation. The questionnaire items were presented in *Table 1*.

We conducted a questionnaire twice with target users passing through the four eco-bridges. The questions were as follows (*Table 2*):

Table 1. Questionnaire items

1. Individual Characteristics	Sex, Age, Residence
2. User behavior	Objective and Frequency
	Day of Week and Hours of Use
3. Wild Animal Observational Experience and Observed Species	Wild Animal Observational Experience
	Observed Wild Animal Species
4. Perception about Urban Eco-corridors	Necessity of Urban Eco-corridor
	Perception about Animal Passage of Urban Eco-corridors
	Perception about the Objectives of Urban Eco-corridors (People's movement)
	Perception about Limited Usage of Urban Eco-corridors
5. Users' satisfaction with Urban Eco-corridors	Advantage of Urban Eco-corridors for Leisure
	Nature Friendliness of Pavement of Urban Eco-corridors
	Diversity and Beauty of Planting of Urban Eco-corridors
6. Satisfaction with Management and Operation of Urban Eco-corridors	Satisfaction with Plant Management of Urban Eco-corridors
	Satisfaction with Management of Facility of Urban Eco-corridors

Table 2. Questionnaire Survey Outline

Survey	Period	The number of Respondents		Contents of Questions
The Primary Survey (Ⅰ)	2012.10.21, 2012. 11.3	Sudal-ro	20	Frequency of Use Purpose of Use Observational Experience of Wildlife animals Perception of Eco-corridor Improvement Demand Personal Characteristics
		Sadang-ro	20	
		Solbat-ro	20	
		Nambusoonhwan-ro	20	
		Total	80	
The main	2014.5.8,	Sudal-ro	40	User Behavior

Survey (Ⅱ)	2014.5.11	Sadang-ro	40	Observational Experience of Wildlife animals Perception of Eco-corridor Satisfaction of Pedestrian Environment Satisfaction with Management Personal Characteristics
		Solbat-ro	40	
		Nambusoonhwan-ro	40	
		Total	160	

2. TYPES OF ECO-CORRIDORS IN KOREA

Eco-corridors are artificial structures that connect ecosystems fragmented by roads and railways to allow wild animals to migrate. They are constructed to allow wild animals to cross over the road safely, and they are generally classified as either overpasses or underpasses (Ministry of Environment, 2010). According to the Natural Environment Conservation Act Article 2 in Korea, eco-corridors are meant to prevent the destruction and damage of wild animals' habitats by roads, dams, sluice gates, and estuary dams. They are artificial structures and ecological spaces aimed at maintaining the continuity of the ecosystem, including the migration of wild animals. There are similar Terms such as "ecological network," "ecological axis," and "greenway". The types of eco-corridors defined by Korean Ministry of Environment are shown in *Table 3*.

Table 3. Types of eco-corridors (Ministry of Environment, 2003)

Types		Features
Usage type	Trail Type	Used for exercise and passage
	Animal Corridor Type	Used for animal migration and as a habitat for animals and plants
	Trail – Animal Corridor Type	The trail and animal corridor are separated by a hedge or fence in an eco-corridor
Form type	Overpass (Bridge Type)	A structure built over a road (Difficult to build a passage for animals because of fragmented areas and obstacles)
	Underpass (Tunnel Type)	A passage made under the ground (Usually on a road where there is heavy traffic, or no connecting area to build a land passage)
	Linear Type	A structure built along a road, railway, or river

In Seoul, most eco-corridors are trail-animal corridors and bridge type corridors. In the case of the trail-animal type, the width of the trail should be under three meters without any pavement, and the width of the animal corridor should be over 30 meters. Furthermore, the two different spaces should be spatially separated by filled-up ground or vegetation. The entrance space should be wider than the inner space and encourage wild animals to migrate. In the case of the overpass type, the minimum width should be over seven meters and over 30 meters if the overpass type eco-corridor is located on a main ecological axis (Ministry of Environment, 2010).

3. CURRENT SITUATION

The regional analysis (land use, biotope evaluation, biotope type, and vegetation maps) was conducted (*Figure 2*). Most of the areas in Gwanak-gu and Dongjak-gu are commercial, business, and residential areas. Some green and open spaces exist. Sudal Mountain, Gwanak Mountain (Biotope Grade 1), and Seoul National Cemetery are significant strongholds of green areas. Gachi Mountain is a natural corridor that connects them. The green zones of Gwanak-gu and Dongjak-gu mainly consist of forest biotope and landscape gardening biotope. In addition, most of these areas have become urbanization areas. These areas do not have enough buffer zone to surround the core green zone. Sudal Mountain and Gwanak Mountain, which are core green zones, consist of pinus rigida (*Pinus rigida* Mill.) and acacia (*Robinia pseudoacacia* L.) forest as well as pine and oak forest in good condition.

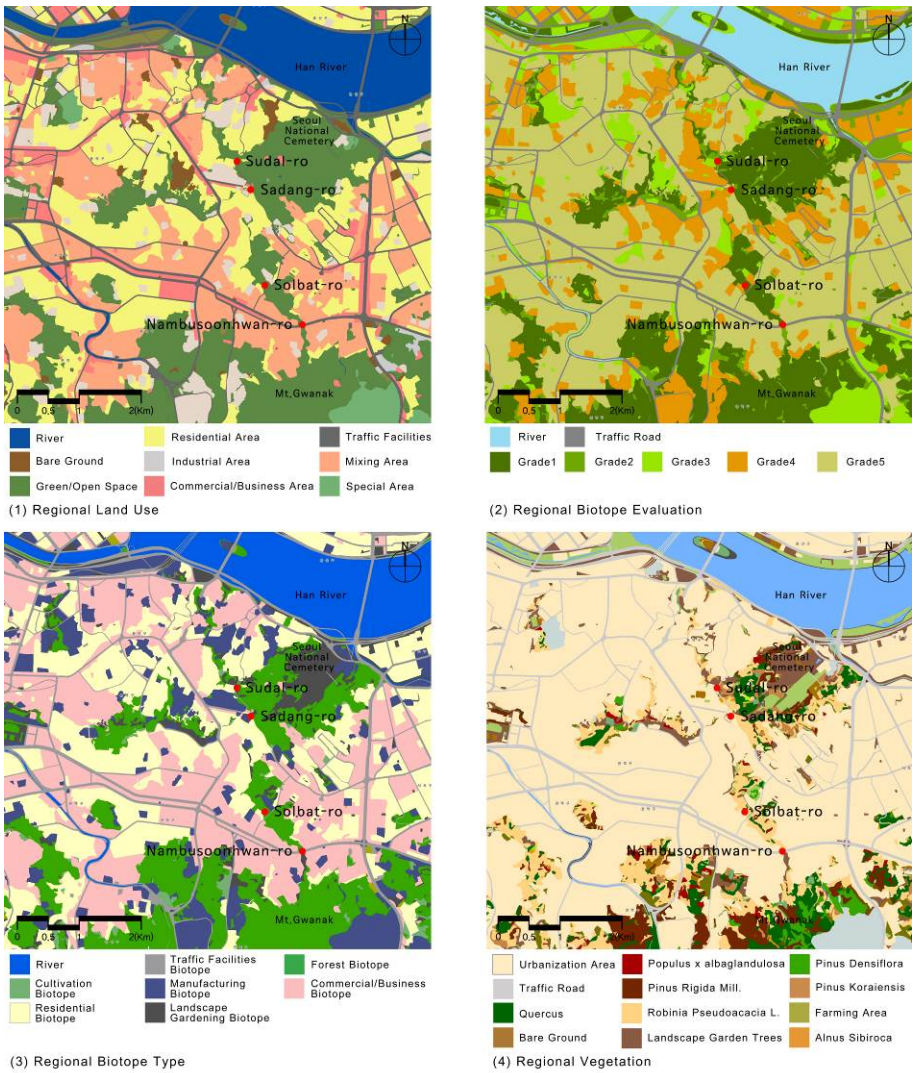

Figure 2. Regional analysis (National Geographic Information System)

3.1 Sudal-ro

The boardwalk for humans and the animal corridor are separated by a

fence. We found many people taking walks and doing exercise on it. Many trees looked young, likely because this eco-bridge was recently renovated. Considering the ecological side, Sudal Mountain (Biotope Grade 1), Arboretum, and the Nut Pine Forest (Biotope Grade 1 or 2) form an "ecological axis." However, there are oak and nut pine forests in good condition in Seoul National Cemetery, and on the other side of the eco-bridge, acacia forests and gardening tree forests are distributed. That is, the different types of vegetation on either side make it difficult for it to function as an animal habitat. Sudal-ro includes the walking trail 'the first route of Dongjak Cheunghyo-gil'. It is mainly used by residents who live in nearby apartments and wish to have a rest or take a walk. According to the survey results, mostly middle-aged residents use the passage for working out.

Location	Type	Installation Year	Length	Width	Management Authority
Heukseok dong 330	Bridge (Trail-Animal)	2007	22m	17m	Dongjak-gu

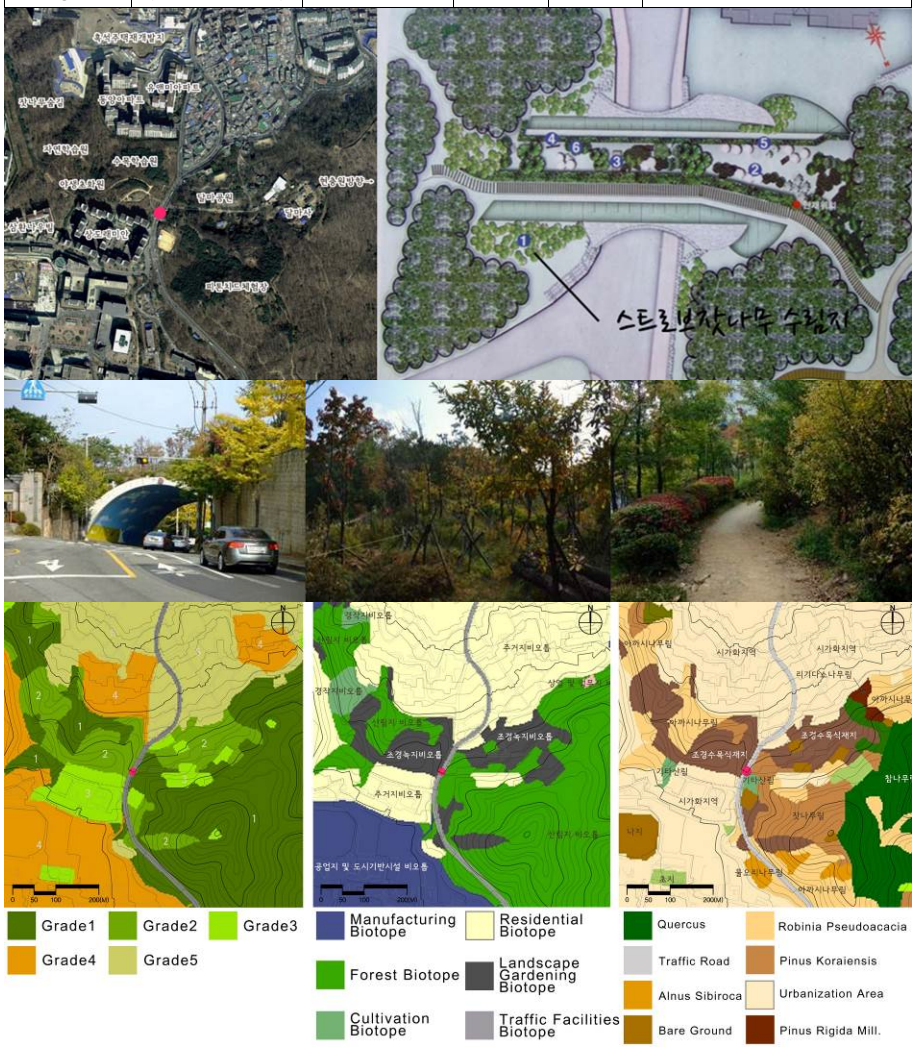

Figure 3. Analysis of Sudal-ro (National Geographic Information System)

3.2 Sadang-ro

Of the four eco-corridors, Sadang-ro is the newest one. The boardwalk and animal corridor were built separately, and there was a log cabin for small wild animals, such as squirrels. Only a few people passed by or used this

eco-corridor. Considering the ecological side, Sadang-ro is connected with Sudal Mountain (Biotope Grade 1) and a residential area (Biotope Grade 4). In addition, most vegetation around Sadang-ro is acacia forest, which does not function well as an animal habitat. Therefore, it is not expected to play the role of an animal habitat. Vegetation distribution is also unbalanced. Sadang-ro is mostly used to access Seoul National Cemetery or as a shortcut from one place to another by residents who live nearby. Safety is a concern, because one side of the eco-bridge borders a road.

Location	Type	Installation Year	Length	Width	Management Authority
Sadang-dong San 31-1	Bridge (Trail-Animal)	2008	20m	16m	Dongjak-gu

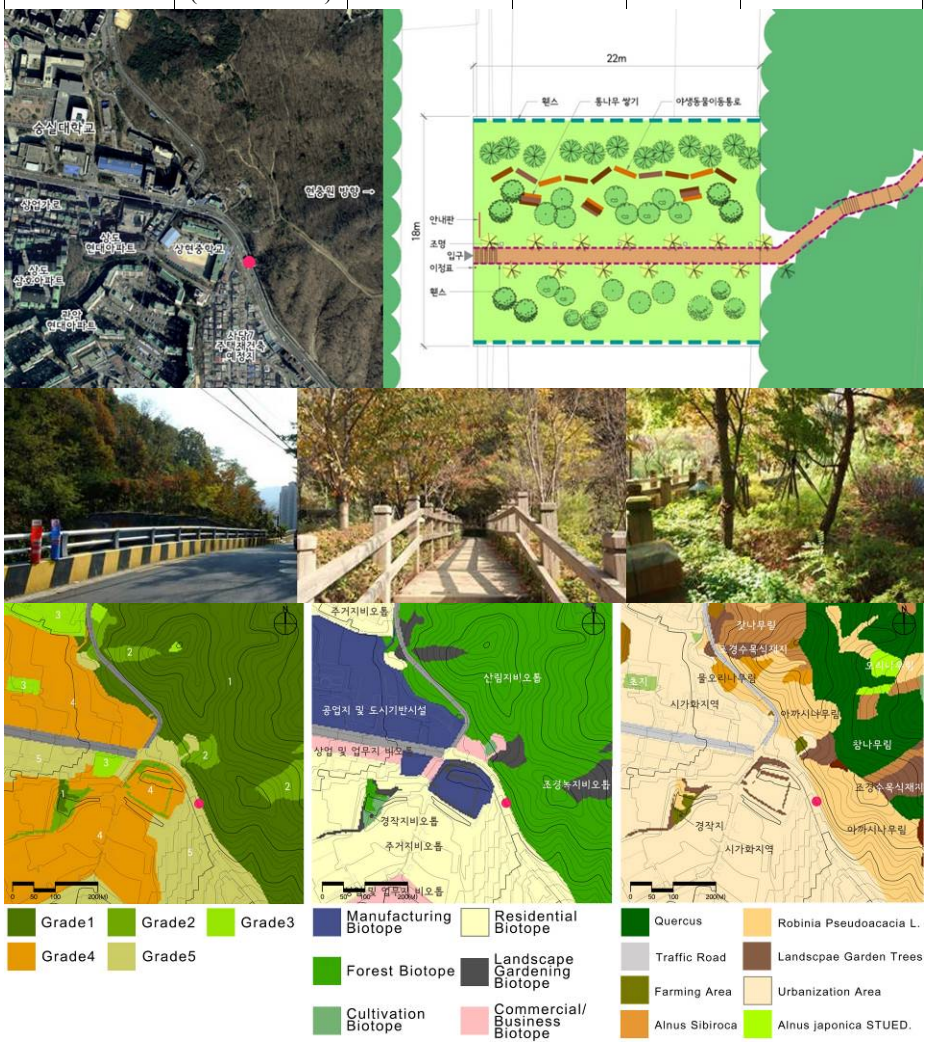

Figure 4. Analysis of Sadang-ro (National Geographic Information System)

3.3 Solbat-ro

The boardwalk is set up along the path, and the two areas (a trail and an animal corridor) are separated by thick bushes. Solbat-ro is an eco-bridge that connects the fragmented Kachi Mountain Park (Biotope Grade 1). The vegetation on both sides is the same as that found in an acacia forest. Despite the fact that there is no buffer zone between the urban infrastructure biotope and Kachi Mountain, diverse vegetation is distributed. Therefore, this space

can function as an animal habitat. Solbat-ro includes a walking route, “the se venth route of Dongjak Chunghyo-gil”. According to the survey results, 100 percent of users (middle-aged residents living nearby) used the passage “to work out.”

Location	Type	Installation Year	Length	Width	Management Authority
Sadang-dong San 31-1	Bridge (Trail-Animal)	2005	22m	15m	Dongjak-gu

Figure 5. Analysis of Solbat-ro (National geographic information system)

3.4 Nambusoonhwan-ro

Nambusoonhwan-ro is the only eco-bridge of the four that remains a soil path. The vegetation on this eco-bridge is quite dense and the path is narrow. Nambusoonhwan-ro connects the acacia forest biotope (Biotope Grade 1 or 2) and the gardening tree forest biotope. This eco-bridge is surrounded by commercial and official areas, and a broad road passes through it. Oak forest and pine tree forest are distributed through parts of it. Nambusoonhwan-ro belongs to Gwanak Mountain “Dulle-Gil” that is a walkable route for viewing Seoul. Middle-aged individuals wanting to climb Gwanak Mountain or Gachi Mountain primarily used this passage.

Key Map	Location	Type	Installation	Length	Width	Management

			Year			Authority
	Namhyun-dong, Sadang-dong San 55-2	Bridge (Trail-Animal)	2006	80m	15m	Gwanak-gu

Figure 6. Analysis of Nambusoonhwan-ro (National Geographic Information System)

4. RESULTS

4.1 Individual Characteristics

Individual characteristics of the urban eco-corridors from the respondents of the satisfaction survey are as follows in *Figure 7*. The number of female, 96 (60%), is larger than that of male, 64 (40%) users. Each of the age groups, “20s”, “30s”, “40s”, “50s”, “60s”, and “70s”, account for 5(3.1%), 6(3.8%), 18(11.3%), 57(35.6%), 57(35.6%), and 17(10.6%) respecticely. The age groups over 40s account for 93.15%. Among these, the 50s and 60s contain most of the respondents (71.2%).

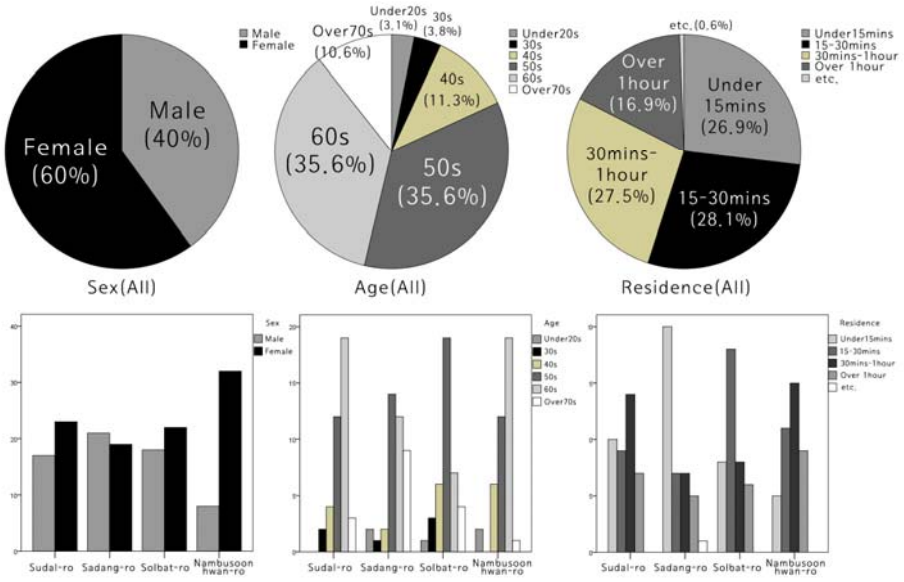

Figure 7. Individual characteristics of urban eco-corridor users

4.2 User behavior

Objectives of usage from the users of the urban eco-corridors are as follows in *Figure 8*. Utilization purposes in the four target sites have similar results. Overall, the majority of people are distributed in "Strolling" (55.0%) and "(Mountain) Climbing" (40.0%). "Travel" and "Natural environment education" were only 4% and 2% respectively.

Frequency of usage from the users of the urban eco-corridors is as follows in *Figure 9*. In the usage frequency of urban eco-corridors, "Three to six times a week" (36.9%), "Everyday" (28.8%), "Once or twice a week" (20.6%) were the usage rates of most respondents. Comparing the four target sites, Solbat-ro and Seodal-ro are frequently used in a week, but Nambusoonhwan-ro has a low frequency in the usage of the respondents. This is because there are many residents using Solbat-ro and Seodal-ro, but Nambusoonhwan-ro is mostly used for mid-passage of mountain climbers.

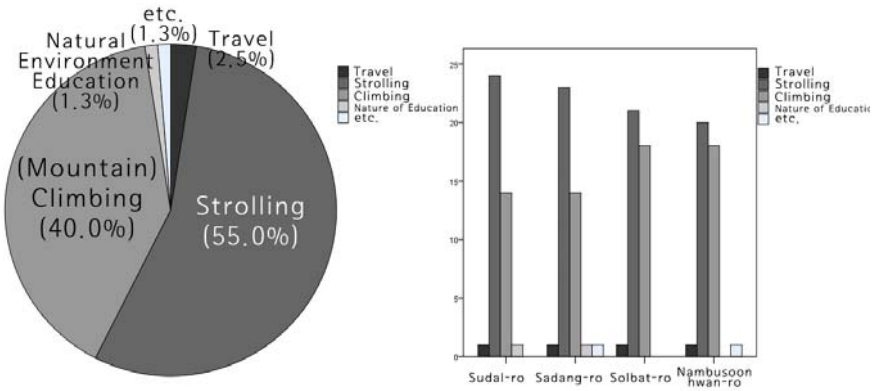

Figure 8. Objectives of the urban eco-corridor users

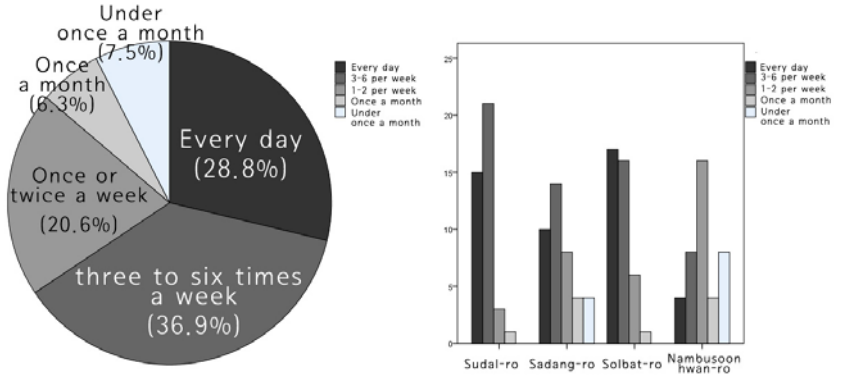

Figure 9. Frequency of the urban eco-corridor users

Usage days of the urban eco-corridor is as follows in *Figure 10.* Most users responded "Regardless of day" (60%), but only a few respondents (11.0%) use the corridors on "Weekends". "Weekdays" (33.1%) respondents are mostly residents of near-by areas. In particular, regarding their high percentage of "Weekdays" usage, Solbat-ro and Seodal-ro are frequently used by their residents.

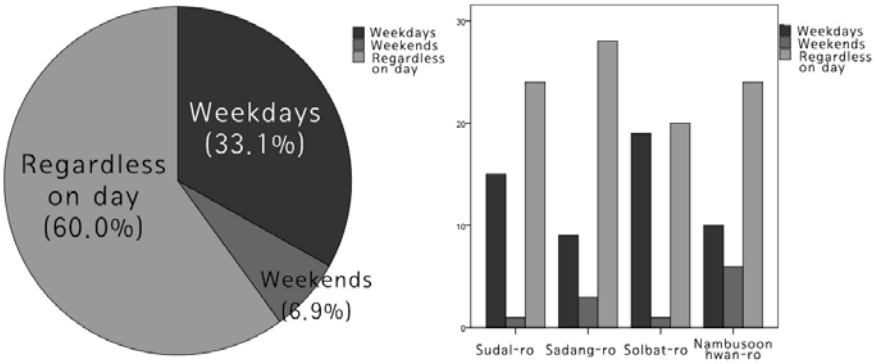

Figure 10. Day of week of the urban eco-corridor users

Hourly usage of the urban eco-corridor users are as follows (*Figure 11*). Most respondents use the paths between 9 AM and 12 PM (55.0%). Each of the "6am - 9am" and "12pm – 6pm" timeframes accounts for 29.4% and 15% respectively. However, there is low usage after 6pm (0.6%). By target site, the highest usage from "6am - 9am" is in Seodal-ro and Solbat-ro. But Sadang-ro and Nambusoonhwan-ro have the most users from "9am - 12pm".

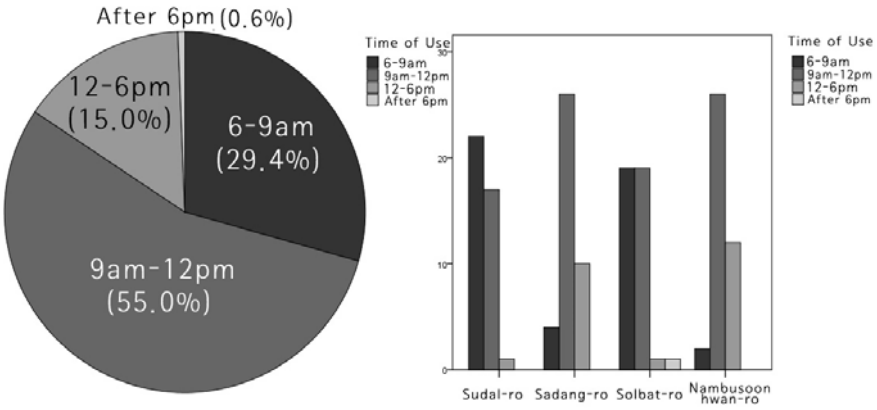

Figure 11. Hourly usage of the urban eco-corridor users

4.3 Wild Animal Observational Experience and Observed Species

56.3% of the respondents have had wild animal observational experience. However, the four target sites show a huge difference in the number of observational experiences: Seodal-ro, 77.5%; Sadang-ro, 62.5%; Solbat-ro, 52.5%; and Nambusoonhwan-ro,32.5%. This order of the four target sites corresponds to the order of the location of the urban eco-corridor connecting Seodal-san, Gachi-san, and Gwanak-san. This supposes that, even though Gwanak-san has a favorable natural environment for wild animals, the narrower connecting path results in a low percentage of movement of wild animals.

Observed wild animal species by the urban eco-corridor users are as follows (*Figure 12*). The survey allows duplicable options. The main animals that the respondents observed were Eurasian red squirrel, squirrel, Korean hare, and pheasant. Dog, cat, pigeon, and magpie are excluded from the result because of their irrelevance with habitat connection. The four target sites have similar distributions of the wild animals. Observation frequency follows the order: Eurasian red squirrel, squirrel, pheasant, and Korean hare.

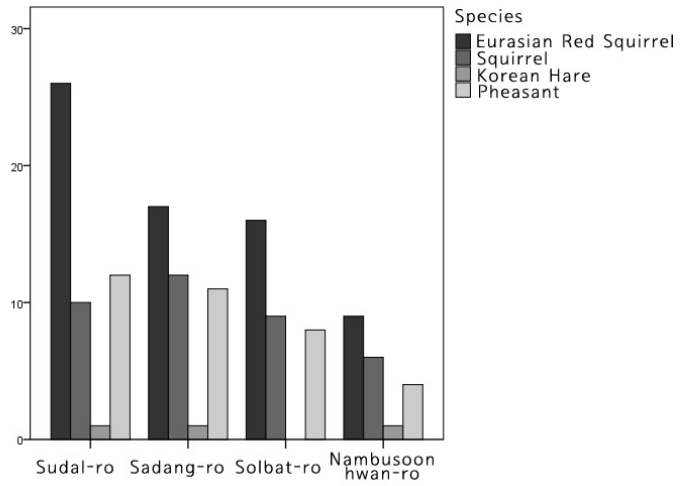

Figure 12. Observed wild animal species near urban eco-corridors

4.4 Perception about Urban Eco-corridors

Necessity of urban eco-corridor is as follows (*Figure 13*). The majority of the responding people (91.8%) replied positively regarding the necessity of urban eco-corridors. In particular, the respondents from Solbat-ro and Nambusoonhwan-ro, who have less observational experiences with wild animals, respond as “Highly positive” (57.5%), more than Seodal-ro and Sadang-ro.

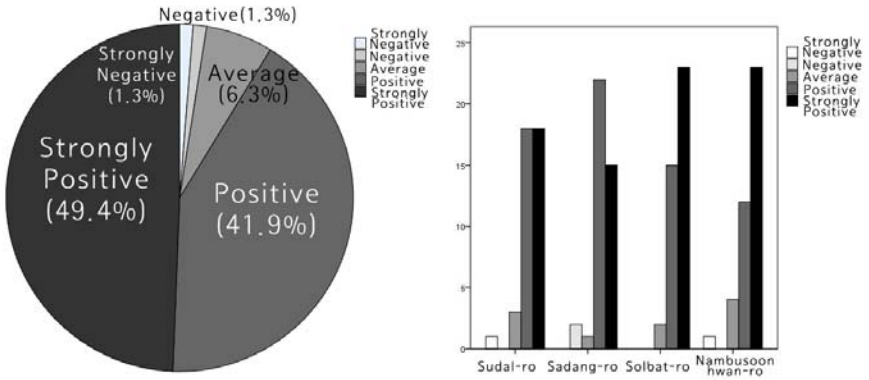

Figure 13. Necessity of urban eco-corridor

The result of the survey about the perception of the animal path of urban eco-corridors from the respondents is as follows (*Figure 14*). Only 28.8% of the respondents perceive the paths as animal paths, but 46.3% of the respondents do not perceive them as animal passages. In the case of Sadang-ro, even though there is little animal habitat, many people recognize it as an animal path because of a sign that reads "animal path". However, other target sites have no sign. The sign "animal path" itself seems to affect respondents' perception about animal paths as urban eco-corridors.

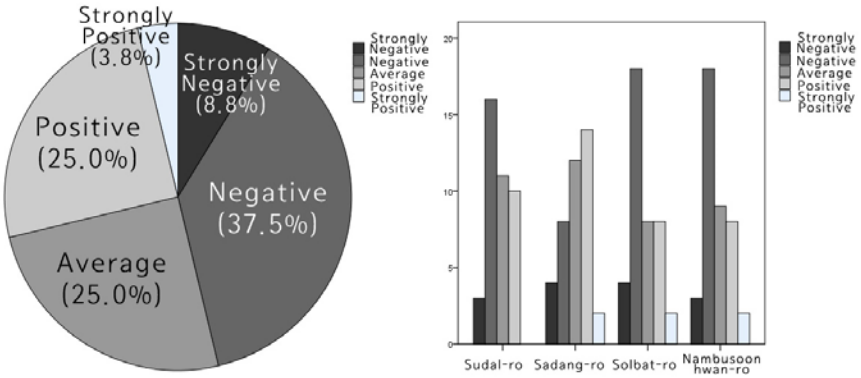

Figure 14. Perception about animal passage of urban eco-corridors

The result of the survey about the respondents' perception of the objective of urban ecological paths for human usage is as follows (*Figure 15*). Only 12.5% of the respondents have negative ideas about the objective of urban ecological paths for people; 70.6% of the respondents have positive ideas about it. In particular, in the case of Solbat-ro and Nambusoonhwan-ro, more people recognize the objective for pedestrians, but more respondents at Seodal-ro responded negatively than those at other target sites.

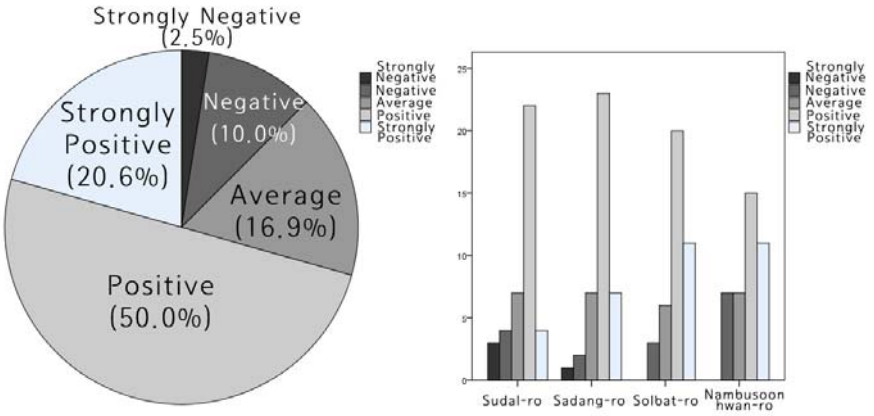

Figure 15. Perception about the objectives of urban eco-corridors (People's movement)

The result from surveys about the respondents' perceptions about limited usage of urban eco-corridors is as follows (*Figure 16*). 35.7% of the respondents answered positively regarding the animal's usage, but negative answers were more common at 45.7%. Considering the high percentage (81.3%) of positive answers about the coexistence of people and animals in urban eco-corridors, people seem not to perceive any inconvenience from the limited usage of urban eco-corridors.

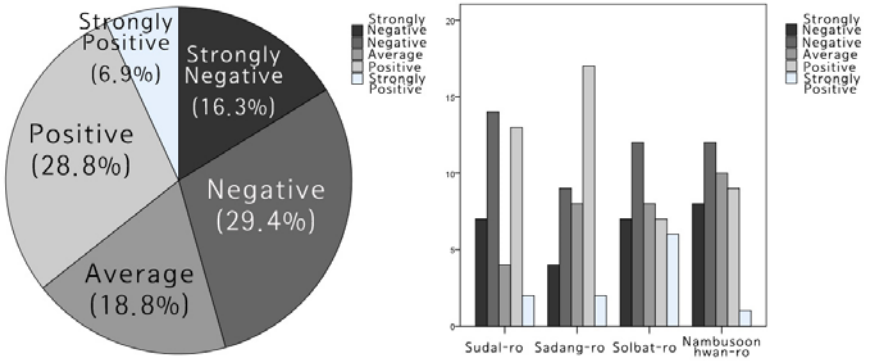

Figure 16. Perception about limited usage of urban eco-corridors

4.5 Users' satisfaction with Urban Eco-corridors

The result of the survey about the advantage of urban eco-corridors for leisure is as follows (*Figure 17*). Positive responses account for 95%, which means that the path gives users not only a path to walk through, but also is a source of their leisure. In particular, Solbat-ro and Nambusoonhwan-ro have more positive responses than the other two.

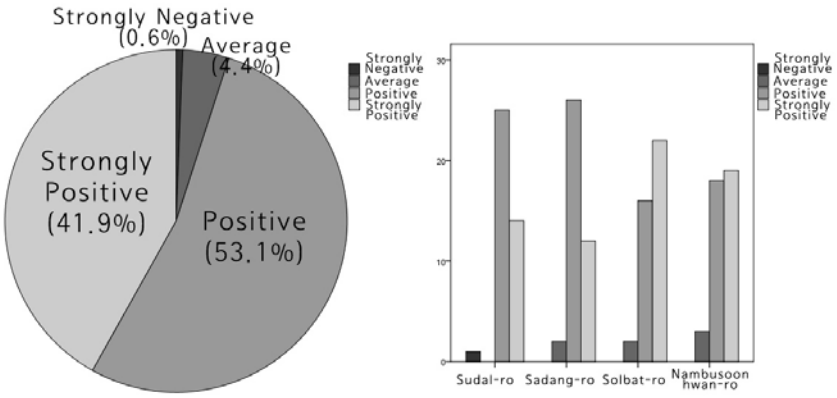

Figure 17. Advantage of urban eco-corridors for leisure

The result of the survey about how eco-friendly the pavements of urban eco-corridors are is as follows (*Figure 18*). In total, of the four target sites, the respondents mostly have "Strongly positive" (21.3%) and "Positive" (46.9%) perceptions of the nature friendliness of the pavements. "Strongly negative" and "Negative" responses were 12.5% in total. Nambusoonhwan-ro which is the only path paved with dirt among the four target sites resulted in 90% positive answers for its natural friendliness. According to this, people regard dirt-paved paths as more nature friendly than wooden boardwalks.

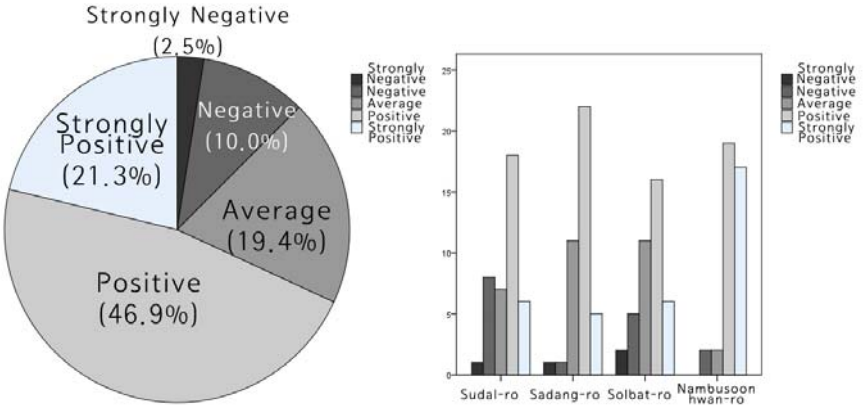

Figure 18. Nature friendliness of pavement of urban eco-corridors

The result of the survey about diversity and beauty of tree planting along the urban eco-corridors is as follows (*Figure 19*). Only 9.4% of the respondents have negative ideas about the diversity and beauty of tree planting along urban eco-corridors in addition, 18.1% of the respondents feel "Strongly positive", and 43.8% of the respondents feel "Positive". In particular, among the four target sites, Nambusoonhwan-ro has highly positive answers from the respondents (25.0% "Strongly positive" and 55.0% "Positive") because of its dense forest which mostly covers the traveling paths of humans and animals.

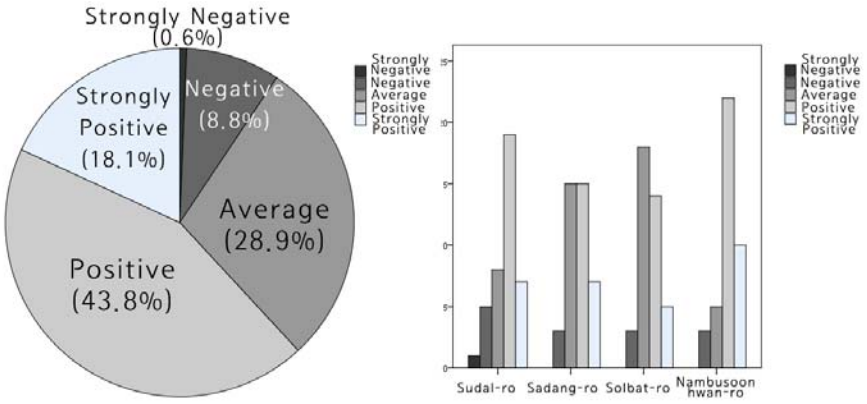

Figure 19. Diversity and beauty of tree planting of urban eco-corridors

The result of the survey about satisfaction with plant management of urban eco-corridors is as follows (*Figure 20*). Less than half of the respondents think positively (8.8% "Strongly positive" and 40.6% "Positive"), but 39.4% of the people think the plant management of the sites is "Average". This result suggests that many people are not satisfied with the plant management of the sites. Among those, Seodal-ro users show the strongest positive response, but Sadang-ro users are satisfied the least with its plant management.

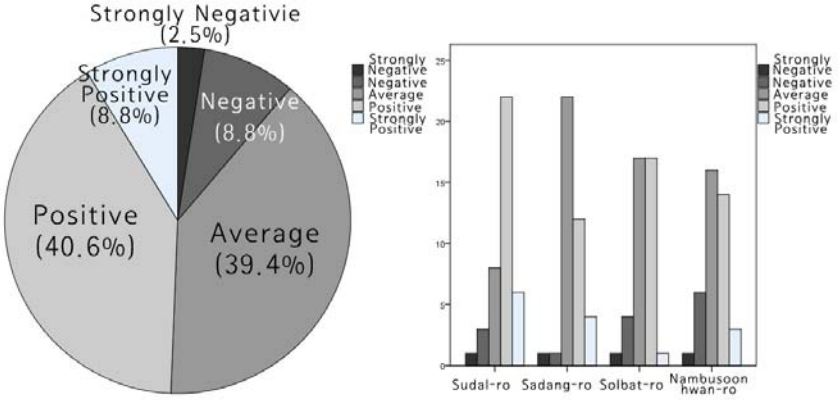

Figure 20. Satisfaction with plant management of urban eco-corridors

The result of the survey about satisfaction with management of the facility of urban eco-corridors is as follows (*Figure 21*). 56.9% of the respondents show positive answers to the question (9.4% "Strongly positive" and 47.5% "Positive"), and 35.6% of the peoples' responses are "Average". As for the plant management, many people are not satisfied with the management of the facility and the surrounding environment of the eco-corridors. Among the four sites, Seodal-ro users give the most positive responses to the issue.

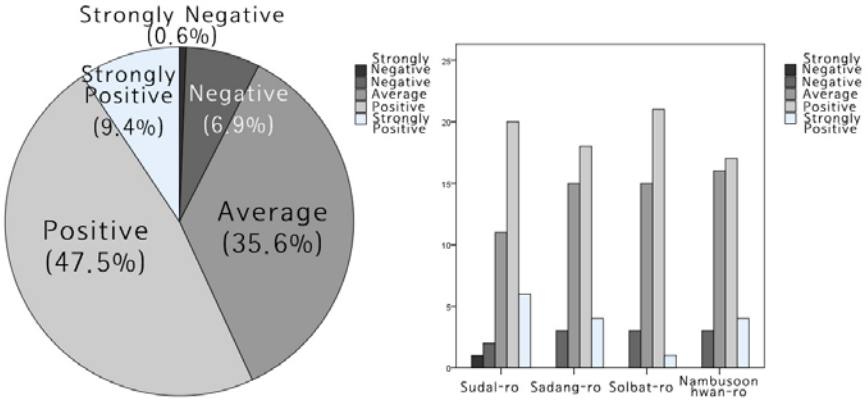

Figure 21. Satisfaction with management of facility of urban eco-corridors

5. DISCUSSTION

According to the result of the survey, firstly, both humans and animals demand the urban eco-corridors as a green space in the city. The objective of the respondents for using the urban eco-corridors is concluded not as a simple path for their movement, but as for leisure walking, sight-seeing and hiking. Secondly, there is an understanding that the urban eco-corridors are areas of coexistence with wildlife. Half of the respondents answer positively on the movement of wild animals through the path. Many of them want the path to be shared with wild animals.

Urban eco-corridors could have functions and meanings not only concentrating on the function as a wildlife passage. Eco-corridors would be a space where nature and humans make contact and coexist.

The terms eco-corridor, ecological axis, and greenway, are similar in urban environments. Eco-bridges in Seoul could be redefined in a broad sense, rather than focusing on their ecological function in a narrow sense. Eco-bridges in Seoul link the ecological network to sustain the ecosystem and reconnect fragmented habitat sites. They are also used as trails or as a kind of green road to promote public health. Urban eco-bridges are an example of precious green open space where people can commune with nature.

The utilization rate of eco-bridges in Seoul is increasing, but the appearance rate of wild animals is gradually decreasing. Even though the geographical locations of the eco-bridges in Seoul are generally appropriate, there are many challenges in terms of designing and managing processes in each field. User's opinions would have to be collected periodically. In addition, the actual growth of vegetation and the rate of animal appearances should be monitored and assessed periodically.

REFERENCES

Fleury, A. M., and Brown, R. D. (1997). "A framework for the design of wildlife conservation corridors with specific application to southwestern Ontario", Landscape and urban planning, 37(3), 163-186.

Forman, R. T., & Godron, M. (1986). Landscape ecology, Wiley and sons, New York.

Ministry of Environment (2003). *Guidelines for Creation and Management of Eco-Corridors for Fragmented Ecosystem Conservation,* Ministry of Environment.

Ministry of Environment (2010). *Guidelines for Design and Management of Wildlife Crossing Structures in Korea*, Ministry of Environment.

Seoul Development Institute (2010). *Seoul landscape master plan*.

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Key Factors for Renewable Energy Promotion and Its Sustainability Values in Rural Areas: Findings from Japanese and Chinese Case Studies

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Key words: Renewable Energy, Key Factors, Sustainability Values, Rural Development.

Abstract: The use of Renewable Energy (RE) is becoming popular for its clean and safe characteristics. The development of RE is also one of the crucial steps for the future sustainable development of energy resources. Nowadays, rural areas are facing issues such as depopulation and economic decline. How to find solutions to these issues while aiming to achieve sustainable development is a challenging task. Rural areas with RE in Japan and China have been established recently, and there are a few practical cases worth referencing. To identify key factors for RE promotion and its sustainability values in rural areas, this study presents two pioneer cases: Kuzumakicho in Japan and Chongming Island in China. Each of them stands for strong RE advancement in their home country and bears specific characteristics. Instead of a comparative study, this study examines the two cases as parallel case studies using a review of the literature, local plans, policy documents, and a questionnaire sheet with a SWOT analysis approach integrated in the methods. Key factors included municipal planning concepts and subsidies from national or regional governments among others, while contributions to sustainability include environmental education, local tourism, disaster prevention/mitigation, and waste re-use among others. In conclusion, the lessons learned and recommendations for future RE promotion in Japanese and Chinese rural areas are given.

1. INTRODUCTION

In June 2010, the Japanese Government announced their new "Basic Energy Plan" (Japanese Ministry of Economy, Trade and Industry, 2010). As one of the five main targets, they planned to increase the proportion of Zero Emission Electricity Power (nuclear power and Renewable Energy) to 70% of their total electricity generation by 2030. To achieve this target, they planned to increase Renewable Energy from 8% to 19%, and nuclear power from 26% to 50%. However, after The Great North Eastern Japan earthquake on March 11, 2011 and the consequent Fukushima nuclear crisis, the "Zero Nuclear" movements arose in many countries across the world, especially in Germany and Japan. In this context the Japanese Government is making efforts to change the energy structure. As an alternative energy resource,

Renewable Energy (RE) goes into their focus with its clean and safe characteristics. RE is energy generated from solar, wind, biomass, geothermal, hydropower, ocean resources, and biofuels (IEA, 2011). The Feed-in Tariff (FIT) of RE was announced and started in Japan in July 2012 and was expected to accelerate RE development in Japan. At present, the Japanese government is making efforts to spread the use and infrastructure of RE. In the meantime, China doubled its wind power capacity in 2009, and it still maintained its position as a global wind power leader in cumulative terms with a total of 75.32 GW (Global Wind Energy Council, 2013). China has also become the largest hydropower and wind power producer, as well as having the highest solar water heating capacity in the world (REN21, 2013).

In order to promote RE, there are several studies discussing the key or driving factors leading to the successful promotion of RE (Izutsu, Takano, et al., 2012). After RE has been promoted in an area, its supply and use plays a key role in the local sustainable strategy, and it represents a crucial part of the overall strategy for sustainable development in local areas (European Renewable Energy Council, 2012). The existing literature mentions that RE can contribute to local sustainable development by providing various environmental and socio-economic benefits. These benefits include CO_2 reduction, employment creation and enhancement of local development opportunities, among others. However, much emphasis is put on the environmental benefits, while socio-economic benefits have received less attention. Worldwide, several studies have analysed RE's environmental sustainability benefits. Gosens, Lu, et al. (2013), Reddy, Uitto, et al. (2006), Yang, Chen, et al. (2013), among other authors, emphasise RE's contribution to environmental aspects (Dincer, 2000). In contrast, socio-economic benefits are usually mentioned but their analysis has been general and mostly focuses on national and regional levels, while those at the local levels have been lacking (Rio and Burguillo, 2008). There is a lack of empirical evidence on RE's socio-economic contribution, especially to the rural areas that are experiencing depopulation and economic decline.

Therefore, the focus in this paper is on rural areas, taking into consideration two aspects of RE: key factors for RE promotion, and RE's contribution to sustainability. This study presents two cases: Kuzumakicho in Japan and Chongming Island in China. A review approach and a questionnaire sheet with an integrated SWOT (Strengths-Weakness-Opportunity-Threats) analysis approach were used with the following aims: 1) to identify key factors for RE promotion, and 2) to clarify RE's contribution to sustainability in rural areas. We understand that our cases only reflect a limited part of RE and its implementation status in Japanese and Chinese rural areas, but we are hoping to provide lessons learned through these cases. This can contribute to future RE promotion and sustainable development in Japanese and Chinese rural areas.

2. STUDY AREAS

Because the backgrounds and basic conditions of the two cases are different, this study examines the two cases as parallel case studies instead of as a comparative study. Kuzumakicho in Japan and Chongming Island in China were selected as case study sites (See Figure 1 for their locations).They were selected because they were some of the most progressive RE development cases in their respective home country's rural areas. Kuzumakicho started to promote RE from 1998, which is earlier than

other Japanese municipalities. They continued installation of multiple RE facilities such as wind farms, solar panels, and biomass plants in the ten years that followed. Kuzumakicho was selected as one of the "New Energy 100 Selections" by The Ministry of Economy, Trade and Industry, and The New Energy and Industrial Technology Development Organization (NEDO) (2009), for its standing for, and excellent efforts in local RE promotion. Chongming Island was selected because it is located in the most economically developed region in China, the suburban Shanghai, within The Yangtze River Delta Economic Zone. It is the first Modern Ecological Island in China. In addition, Chongming Island was designated as one of the first "National Green Energy Model Counties", for its advanced pioneer role in rural RE development (National Renewable Energy Center, 2011). Both of the cases bear specific characteristics or issues, such as: population loss and local business decline in Kuzumakicho, and rapideconomic and energy consumption increase in Chongming Island.

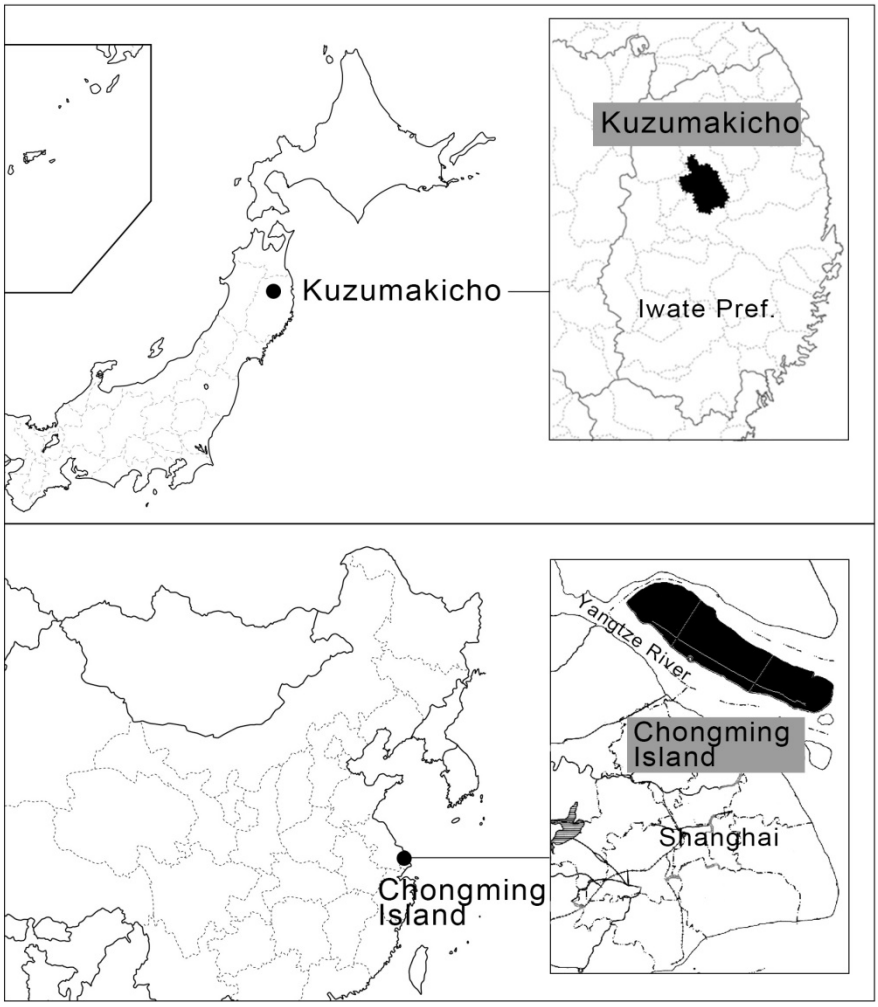

Figure 1. Location of case study areas

Kuzumakicho is located in Iwate Prefecture in the Tohoku region of Japan, which was one of the three prefectures that were greatly damaged by the Great North Eastern Japan Earthquake of March 11th, 2011. The town covers an area of 435km^2, with a population of 7,678 in 2,890 households (Kuzumakicho Gov., 2013a). It has an average annual inland wind speed of 8m/s at the height of 70m (NEDO, 2010), and a hilly topography that has

86% forest cover. This town suffered from population loss and local business decline during the 1980s. It is designated as a "Depopulated Area" by the Japanese Ministry of Internal Affairs and Communication. Local industries include agriculture, dairy farming, and forestry. Its local RE development came from efforts started in 1998, and Kuzumakicho now has a total electricity generation of 56,910MWh from RE facilities (wind 56,000MWh, biogas 50MWh, biomass 500MWh, and solar 360MWh). Its electricity consumption in 2011 was 36,725MWh (Kuzumakicho Gov., 2013b), indicating that RE provides 155.0% of Kuzumakicho's electricity consumption. However, the fact that all the electricity generated from the wind farms has been sold to Tohoku Electric Power Co., Inc. (Kuzumakicho Gov., 2012a), and not used by the local community, cannot be ignored. See Table 1 for current RE facilities in Kuzumakicho.

Table 1. Current RE facilities in Kuzumakicho (Kuzumakicho Gov., 2012a)

Year	RE facility	Capacity
1998	Eco wind farm	1200kW*3
1999	Solar panels	50kW
2003	Biogas plant	Electricity: 37kW; Heat: 43,000kcal
	Pellet boiler	500,000kcal*2
	Solar panels	20kW
	Green power wind farm	1750kW*12
2005	Biomass plant (cogeneration)	Electricity: 120kW; Heat: 230,000kcal
2008	Pellet boiler	50kW*2
2011	Solar panels	20kW

Chongming Island is located at the entrance of Yangtze River to the Pacific Ocean, about 25km from downtown Shanghai. It is the third largest island in China and covers an area of 1276km^2, with a population of 691,699 (2008). The island has an abundant wind resource; its average inland wind speed reaches 7m/s at the height of 50m (Yu, Zhou, et al., 2008). It also has wetlands, agricultural fields, and it is famous as a weekend tourist site for Shanghai City. Chongming Island now has a total electricity production of 432.5GWh from RE facilities (wind 430GWh, biogas 1.5GWh, and mega-solar 1.05GWh), while its electricity consumption in 2012 was 3,980GWh (Yu, Roddy, et al., 2009). RE is now providing only 10.9% of the island's electricity consumption. See Table 2 for current RE facilities in Chongming Island.

Table 2. Current RE facilities in Chongming Island

Year	RE facility	Capacity
2010	Mega-solar	1MW
2011	Biogas plant (Cogeneration)	380kW
2012	Wind farm	19.5MW(total)
Various	Solar thermal	140MW (Total installation area 200,000m^2)

3. METHODOLOGY

Regarding the case study methodology, in order to make the cases as reflective as possible from various viewpoints, information from various data resources was included. Two approaches were followed: the review approach and the questionnaire approach. Reviewed materials include

existing literature as well as local planning and policy documents, and reports. The questionnaire was designed with the SWOT analysis approach integrated in it, see Figure 2.

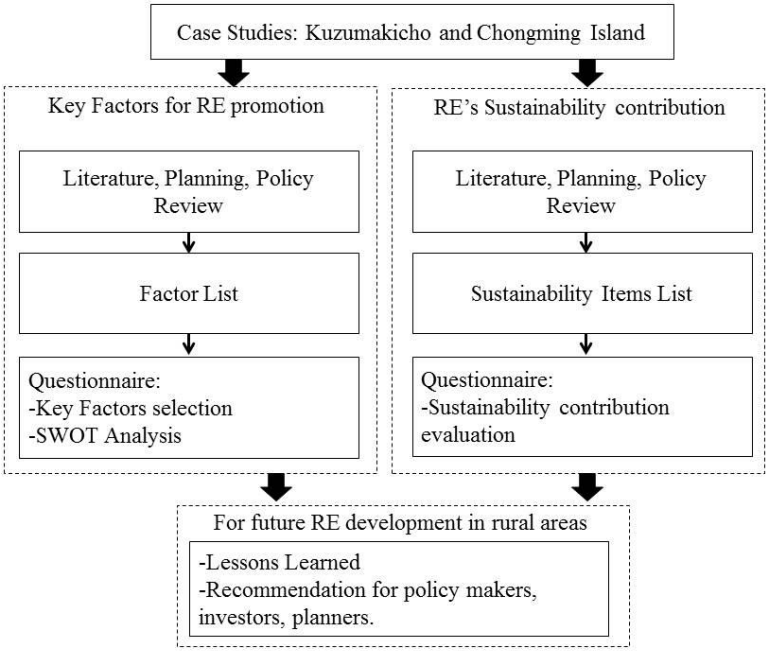

Figure 2. Methodology framework for this study

All the data reviewed is listed in Table 3 and Table 4, found below. The review approach was to identify keywords or statements of key factors for RE promotion and RE's contribution to sustainability.

A survey was conducted through a questionnaire among The Energy Department officers in Kuzumakicho and their counterparts in Chongming Island. The above departments were selected for their involvement in policy, planning, and management in local areas directly related to RE development, hence they have the background to identify the key factors for RE promotion, and to evaluate RE's contribution to sustainability in local areas.

Taking into account the total number of staff members in the energy departments, five questionnaires were hand delivered by the authors to Chongming Island's Energy Department on June 25, 2013, and a similar number was sent to Kuzumakicho's Energy Department on June 24, 2013 by mail. Each questionnaire package included an explanation letter, a questionnaire, and a mail-back envelope with a postage stamp. The explanation letter included a description of the study objectives and explanation of RE and sustainable development, to ensure uniformity on the basic understanding of study aims and questionnaire contents. The questionnaire was composed of three parts.

1) RE promotion factor list and SWOT analysis checklist of the key factors. The key factors for RE promotion listed in the questionnaire were adopted from past research, as well as a local planning and policy document review. The factors were arranged and coded in consecutive numbers. They were subsequently divided into five broad classifications of environmental, administrative, social, economic, and any other factors.

2) Evaluation of RE's contribution to the sustainability of local areas, where five score contribution levels were used, including "+2 very good, +1 good, 0 neither, -1 bad, and -2 very bad". Because there are three types of

RE facilities in Kuzumakicho and Chongming Island, namely wind, PV/solar thermal and biomass/biogas, evaluations were only conducted of these three. The RE contributions to sustainability listed in the questionnaire were also adopted from past research, as well as a local planning and policy document review. The factors were arranged and coded in consecutive numbers, and subsequently divided into five broad classifications of environmental, administrative, social, economic, and any other factors.

3) Two detailed questions: ranking of the top three factors from selected key factors in part 1, including the reasoning, and also ranking the top three RE contributions to sustainability, and including the reasoning.

All the responses had been received by July 5, 2013, after which their validity was checked and they were subsequently analyzed.

Table 3. Data list for Kuzumakicho case

Category	Year	Material
Planning and Policy	1995	Natural Environmental Conservation Regulation
	1999	New Energy Vision
	2002	Eco-Energy Comprehensive Project Subsidy
	2003	Energy Saving Vision
	2007	Biomass Town Plan
	2012b	Global Warming Prevention Action Plan (4^{th})
Reports	2011	Practical Use of Local Energy Report
	2012a	The Efforts to Clean Energy in Kuzumakicho

Table 4. Data list of Chongming case.

Category	Year	Material
Planning and Policy	2004	Master Plan of Chongming Three Islands
	2009	Construction Guidelines of Ecological Island
Academic Papers	2005	Wang, Zhou, et al., 2005
	2009	Yu, Roddy, et al., 2009
	2010	Liu, 2010

4. RESULTS AND ANALYSIS

4.1 Identification of RE promotion factors and sustainability elements

Through literature review and review of local planning and policy documents, factors for RE promotion were identified and they were divided into four broad classifications: 1) environmental, 2) administrative, 3) social, and 4) economic factors, see Table 5. Likewise, we identified the sustainability elements and divided them into three broad classifications: 1) environmental, 2) social, and 3) economic factors, see Table 6.

Table 5. Factors for RE promotion in literature, and local planning and policy documents

Factors List	Literature/ Local planning and policy documents
Environmental	
1. Abundant RE resources	Wang, Zhou, et al., 2005; Chongming Gov., 2009; Kuzumakicho Gov., 2007, 2012a; Yu, Roddy, et al., 2009; Liu, 2010.
2. Location	Chongming Gov., 2004, 2009; Wang, Zhou, et al.,

	2005; Liu, 2010.
3. Topography	Kuzumakicho Gov., 1995.
4. Climate	Chongming Gov., 2009; Kuzumakicho Gov., 2011, 2012b.
Administrative	
5. Municipal planning concept	Kuzumakicho Gov., 1995,1999, 2012a; Chongming Gov., 2004, 2009; NEDO, 2008; Yu, Roddy, et al., 200;
6. Positive initiative by the mayor	Chongming Gov., 2009.
7. Key person(s)	NEDO, 2008.
8. Cooperation between departments and divisions	Kuzumakicho Gov., 2007, 2012b; NEDO, 2008; Chongming Gov., 2009.
9. Position in municipal planning	NEDO, 2008.
10.High feasibility energy strategy	Chongming Gov., 2009; Kuzumakicho Gov., 2012b.
11.New energy vision/plan	Kuzumakicho Gov., 1999, 2012a.
12.Effective implementation and planning promotion	Chongming Gov., 2004, 2009; Kuzumakicho Gov., 2012b.
Social	
13.Understanding and support from external companies	Kuzumakicho Gov., 2003, 2011, 2012a, 2012b; NEDO, 2008; Chongming Gov., 2009; Yu, Roddy, et al., 2009.
14.Understanding and support from local citizens	Kuzumakicho Gov., 2003, 2011, 2012a; NEDO, 2008; Chongming Gov., 2009.
15. University/experts' support	Wang, Zhou, et al., 2005; Chongming Gov., 2009; Yu, Roddy, et al., 2009.
16. RE provider support	NEDO, 2008.
17. Ensure human resources	Chongming Gov., 2009.
18. Know local RE potential	Chongming Gov., 2004; Yu, Roddy, et al., 2009; Kuzumakicho Gov., 2011, 2012a.
19. Know local RE potential sites	Yu, Roddy, et al., 2009; Kuzumakicho Gov., 2011.
20.Know scale/capacity of RE project(s)	Chongming Gov., 2004; Yu, Roddy, et al., 2009.
Economic	
21. Sufficient budget	Kuzumakicho Gov., 2003; Chongming Gov., 2009.
22. Subsidy from national or regional/prefectural governments	Kuzumakicho Gov., 2002, 2003, 2012b; NEDO, 2008.
23. Electricity sale through FIT	Kuzumakicho Gov., 2011.
24. Ensure economic cost-benefits	NEDO, 2008; Kuzumakicho Gov., 2011.
25.Management/maintenance cost control	NEDO, 2008; Kuzumakicho Gov., 2011.
26. Cooperation with local businesses	Kuzumakicho Gov., 2007.

Table 6. Sustainability elements in literature, and local planning and policy documents

Sustainability Elements	**Literature/ Local planning and policy documents**
Environmental	
1. Global warming mitigation	Kuzumakicho Gov., 2003, 2011, 2012b; Yale University, 2005; Chongming Gov., 2009; Liu, 2010.
2. Safe to the natural environment	Yale University, 2005; Kuzumakicho Gov., 2012a, 2012b.
3. Air quality	Kuzumakicho Gov., 2003; Yale University, 2005;

	Chongming Gov., 2009.
4. Water quality	Kuzumakicho Gov., 2003, 2007, 2012a; Chongming Gov., 2004, 2009; Wang, Zhou, et al., 2005; Yale University, 2005.
5. Biodiversity	Kuzumakicho Gov., 1995; Chongming Gov., 2004; Yale University, 2005; Chongming Gov., 2009.
6. Landscape conservation	Kuzumakicho Gov., 1995, 2012a; Chongming Gov., 2009; Liu, 2010.
7. Noise	Chongming Gov., 2009.
8. Waste re-use	Chongming Gov., 2004, 2009; Wang, Zhou, et al., 2005; Kuzumakicho Gov., 2007, 2011, 2012b; Yu, Roddy, et al., 2009.
Social	
9. Connection with agriculture and forestry	Kuzumakicho Gov., 2003, 2007, 2011, 2012a, 2012b; Chongming Gov., 2004, 2009; Wang, Zhou, et al., 2005; Yu, Roddy, et al., 2009.
10. Local tertiary sector	Kuzumakicho Gov., 2003, 2007; Chongming Gov., 2004, 2009.
11. Forest management	Kuzumakicho Gov., 2007, 2012a.
12. Facility maintenance	Kuzumakicho Gov., 2007; Kuzumakicho on-site interview, June 29, 2012.
13. Local infrastructure/public facility maintenance/upgrade	Chongming Gov., 2004, 2009; Kuzumakicho Gov., 2012a, 2012b.
14. Land use	Chongming Gov., 2004; Wang, Zhou, et al., 2005.
15. Transportation	Kuzumakicho Gov., 2003, 2012b; Chongming Gov., 2004, 2009; Liu, 2010.
16. Energy local production-local consumption	Kuzumakicho Gov., 1999, 2003, 2007, 2011; Chongming Gov., 2004; Wang, Zhou, et al., 2005.
17. Energy autonomy	Kuzumakicho Gov., 2012a.
18. Disaster prevention/mitigation	Chongming Gov., 2004; Wang, Zhou, et al., 2005; Kuzumakicho Gov., 2011, 2012a, 2012b.
19. Job creation	Rio and Burguillo, 2008; Kuzumakicho Gov., 2012a.
20. Citizens' health improvement	Kuzumakicho Gov., 1995, 2011, 2012a.
21. Citizens' participation	Kuzumakicho Gov., 2003, 2011, 2012a; Chongming Gov., 2009.
22. Environmental education	Kuzumakicho Gov., 2003, 2011, 2012a, 2012b; Chongming Gov., 2004, 2009.
Economic	
23. Facility investment	Kuzumakicho Gov., 2011.
24. Maintenance cost	Kuzumakicho Gov., 2011.
25. Local businesses	Chongming Gov., 2004, 2009; Kuzumakicho Gov., 2011, 2012a.
26. Revitalize local companies	Chongming Gov., 2004.
27. Local tourism	Chongming Gov., 2004; Wang, Zhou, et al., 2005; Yu, Roddy, et al., 2009; Liu, 2010; Kuzumakicho Gov., 2012a.
28. Electricity sale	Kuzumakicho Gov., 2012a.
29. Increase local citizens' income	Kuzumakicho Gov., 2011, 2012a.

4.2 Key factors' evaluation based on the questionnaire survey

From the 10 questionnaire sheets we distributed, a total of four valid responses were received, two of them from Kuzumakicho energy department, and two from Chongming Island energy department.

4.2.1 Kuzumakicho, Japan

For Kuzumakicho, both respondents identified the following key factors for local RE promotion: abundant RE resources, municipal planning concept, positive initiative by the mayor, new energy plan/vision, understanding and support from external companies, RE provider support, subsidy from national or prefectural governments, and cooperation with local businesses. Also, one respondent indicated other key factors such as: position in municipal planning, effective implementation and promotion of planning, as well as 'knowing local RE potential' among others, as shown in Table 7.

Among all the key factors, 'Municipal planning concept' was ranked as the most important factor for local RE promotion by both respondents. For the second and third most important factors, one respondent indicated 'Abundant RE resources' and 'start RE promotion earlier than other municipalities' respectively. The other respondent indicated 'New energy plan/vision' and 'Abundant RE resources' as the second and third most important RE promotion factors respectively.

SWOT analysis results were as follows. In the environmental category, 'Strength' 12.5%, 'Weakness' 0%, 'Opportunity' 25%, and 'Threat' 62.5%. In the administrative category, 'Strength' 81.25%, 'Weakness' 0%, 'Opportunity' 18.75%, and 'Threat' 0%. In the social category, 'Strength' 12.5%, 'Weakness' 6.25%, 'Opportunity' 81.25%, and 'Threat' 0%. In the economic category, 'Strength' 33.3%, 'Weakness' 50%, 'Opportunity' 16.7%, and 'Threat' 0%. Regarding all the categories, the proportions were as follows: 'Strength' 37.7%, 'Weakness' 13.2%, 'Opportunity' 39.6%, and 'Threat' 9.5%. All the key factors identified by respondents were identified with 'strength' and 'opportunity'.

Table 7. Questionnaire results on the key factors for RE promotion, Kuzumakicho

Factor List	Key factors	S	W	O	T
Environmental					
1. Abundant RE resources	■	○		○	
2. Location				○	○
3. Topography					■
4. Climate					■
Administrative					
5. Municipal planning concepts	■	■			
6. Positive initiative by the mayor	■	■			
7. Key person(s)				■	
8. Cooperation between departments and divisions		○		○	
9. Position in municipal planning	○	■			
10.High feasibility energy strategy		■			
11.New energy vision/plan	■	■			
12.Effective implementation and	○	■			

promotion of planning					
Social					
13.Understanding and support from external companies	■			■	
14.Understanding and support from local citizens	○			■	
15. University/experts' support				■	
16. RE provider support	■			■	
17. Ensure human resource			○	○	
18. Know local RE potential	○	○		○	
19. Know local RE potential sites	○	○		○	
20. Know scale/capacity of RE project				■	
Economic					
21. Enough budget			■		
22. Subsidy from national or regional/prefectural governments	■	○		○	
23. Electricity sale through FIT		○		○	
24. Ensure economic cost-benefits			■		
25. Management/maintenance cost control			■		
26. Cooperation with local businesses	■	■			
Others from respondents					
27. Start RE promotion earlier than other municipalities	○			○	

○ One response. ■ Two responses.

According to the SWOT analysis results in Table 7, most of the environmental factors (62.5%) were identified as 'threat'. This could be due to 1) its remote location with no railway or Shinkansen (bullet train) through the town, 2) far away from prefectural capital city Morioka (90 min by bus), and/or 3) extreme cold temperatures in winter (minimum -16°C). As revealed in the key factors' selection, because of the positive attitude by the municipal government, early start of local RE development, and formulation of local planning policies, 81.25% of administrative factors were identified as 'strengths'. During local RE development process, there is a lot of external technical support. There is biomass plant technology support from NEDO, biogas technology support from T. Machinery Company in Tokyo, and financial support from The Ministry of Environment, Iwate prefecture, and NEDO among others. Thus, social factors were identified as 'opportunities'. Due to the local budget limitations and high RE facility maintenance cost, 50% of the economic factors were identified as 'weaknesses'.

4.2.2 Chongming Island, China

For Chongming Island, both respondents identified several factors as key factors for local RE promotion. They are: abundant RE resources, understanding, and support from external companies. One of the respondents indicated key factors such as: municipal planning concept, cooperation between departments and divisions, new energy plan/vision, and sufficient budget among others, see Table 8.

Table 8. Questionnaire results on key factors for RE promotion, Chongming Island

Factor List	**Key factors**	**S**	**W**	**O**	**T**
Environmental					

1. Abundant RE resources	■	■			
2. Location		■			
3. Topography		■			
4. Climate		■			
Administrative					
5. Municipal positive concept	O	O		O	
6. Positive initiative by the mayor	O	■			
7. Key person(s)		■			
8. Cooperation between departments and divisions	O	■			
9. Position in municipal planning		O		O	
10.High feasibility energy strategy	O	■			
11.New energy vision/plan	O	O		O	
12.Effective implementation and planning promotion		O		O	
Social					
13.Understanding and support from external companies	■	O		O	
14.Understanding and support from local citizens	O	■			
15. University/experts' support			O	O	
16. RE provider support		O		O	
17. Ensure human resources		O	O		
18. Know local RE potential	O	O		O	
19. Know local RE potential sites			O		O
20.Know scale/capacity of RE project	O		O		O
Economic					
21. Sufficient budget	O	O	O		
22. Subsidy from national or regional/prefecture government	O	O		O	
23. Electricity sale through FIT				O	O
24. Ensure economic cost-benefits	O	O		O	
25. Management/maintenance cost control		O		O	
26. Cooperation with local businesses		O		O	
Others from respondents					
None					

O One response. ■Two responses.

One respondent ranked the most important top three key factors as follows: 'abundant RE resources', 'municipal planning concept', and 'subsidy from national or regional/prefectural governments'. Another ranked them as follows: 'high feasibility energy strategy', 'sufficient budget', and 'abundant RE resources'. Although the ranking was different, the most important three key factors they pointed out were the same: abundant RE resources, positive RE concept and strategy, and financial support.

SWOT analysis results were as follows. In the environmental category, 'Strength' 100%, 'Weakness' 0%, 'Opportunity' 0%, and 'Threat' 0%. In the administrative category, 'Strength' 75%, 'Weakness' 0%, 'Opportunity' 25%, 'Threat' had 0%. In the social category, 'Strength' 37.5%, 'Weakness' 25%, 'Opportunity' 25%, while 'Threat' was 12.5%. In the economic category, 'Strength' 41.7%, 'Weakness' 8.3%, 'Opportunity' 41.7%, and 'Threat' 8.3%. Regarding all the categories, the proportions were as follows:

'Strength' 59.6%, 'Weakness' 9.6%, 'Opportunity' 25%, and 'Threat' 5.8%. Apart from 'know scale/capacity of RE' and 'sufficient budget' that were identified in 'Weakness' by one respondent, the remaining key factors were categorized in 'strength' and 'opportunity'.

In Table 8, in regard to environmental factors, 'strength' is particularly prominent (100%). Indeed, unlike the remote location and cold winter in Kuzumakicho, Chongming Island's location (25km from Shanghai) and climate (annual temperature range 4°C~30°C) are viewed as favourable. 75% of administrative factors were identified as 'strengths', while social factors got close proportions among 'strength' 37.5%, 'weakness' 25%, and 'opportunity' 25%. This could be due to the local government's efforts in RE development goals as outlined in its upper level master plans, such as The Master Plan of Chongming Islands (2005~2020). However, there is still a lack of support from universities/experts and RE providers. If these factors improve, they can turn into 'opportunities' in the future. 'Strength' and 'opportunity' had 41.7% for economic factors in Chongming Island, a high percentage that could be attributed to the rapid pace of economic and RE development in China.

4.3 Sustainability elements' evaluation based on the questionnaire survey

4.3.1 Kuzumakicho, Japan

For Kuzumakicho's RE contribution to sustainability, perception of these contributions is different among respondents. One respondent indicated that wind energy has a '+1 good' contribution to sustainability, and is 'safe to the natural environmental'. In contrast, another respondent indicated it as having '-1 bad' contribution. As shown on Table 11, wind energy's positive contributions were evaluated as '+2 very good' by both respondents, including for 'environmental education' and 'local tourism'. PV/solar included 'safe to the natural environment', 'local infrastructure/public maintenance/upgrade', and 'environmental education'. Biomass/biogas included 'waste re-use', 'connection with agriculture and forestry', 'energy local production-local consumption', 'energy autonomy', and 'environmental education'. Elements that had negative evaluations, such as 'noise', 'land use', 'energy local production-local consumption', and 'citizen participation' were identified for wind energy facilities. 'Landscape conservation', 'job creation', and 'facility investment' were identified for PV/solar facilities, while 'air quality', 'facility maintenance', and 'maintenance cost' were identified for biomass/biogas facilities, see Table 9.

Among all the sustainability elements, 'connection with agriculture and forestry' was ranked as the most important by both respondents. For the second and third important elements, one respondent indicated 'energy local production-local consumption' and 'environmental education' respectively, while the other respondent indicated 'energy autonomy' and 'local tourism'.

Table 9. Questionnaire results for RE's contribution to sustainability, Kuzumakicho

Sustainability Elements	**Wind Energy**	**PV/solar**	**Biomass Biogas**
Environmental			
1. Global warming mitigation	+2, +1	+1, +1	+1, 0
2. Safe to the natural environment	+1, -1	+2, +2	+2, -1

3. Air quality	0, 0	0, 0	0, -1
4. Water quality	0, 0	0, 0	0, +1
5. Biodiversity	0, -2	+2, 0	+2, -1
6. Landscape conservation	+1, +1	0, -1	0, 0
7. Noise	-1, -2	0, 0	0, 0
8. Waste re-use	0, 0	0, 0	+2, +2
Social			
9. Connection with agriculture and forestry	+1, 0	0, 0	+2, +2
10. Local tertiary sector	0, +2	0, 0	+1, +1
11. Forest management	0, 0	0, 0	+1, +2
12. Facility maintenance	0, +1	0, +1	-1, -1
13. Local infrastructure/public facility maintenance/upgrade	0, 0	+2, +2	-1, +1
14. Land use	0, -1	0, 0	0, -1
15. Transportation	0, 0	0, 0	0, +1
16. Energy local production-local consumption	-2, 0	+2, +1	+2, +2
17. Energy autonomy	-2, 0	+2, +1	+2, +2
18. Disaster prevention/mitigation	-2, 0	+2, +1	+1, +1
19. Job creation	0, +1	-2, 0	0, +2
20. Citizens' health improvement	0, 0	0, 0	+1, +2
21. Citizens' participation	-1, 0	+1, +1	+1, +1
22. Environmental education	+2, +2	+2, +2	+2, +2
Economic			
23. Facility investment	0, -1	0, -1	0, +1
24. Maintenance cost	0, +1	0, +1	-2, -1
25. Local business	0, 0	0, 0	0, +1
26. Revitalize local companies	+1, 0	+1, +1	+1, +1
27. Local tourism	+2, +2	+2, +1	+2, +1
28. Electricity sale	0, +2	0, +1	0, 0
29. Increase local citizen's income	+1, 0	+1, +1	0, +1
Others from respondents			
None			

According to the sustainability elements' evaluation results, different RE resources revealed different sustainability characteristics. In Kuzumakicho's case (see Table 9), the main sustainability contributions of wind energy were 'environmental education' and 'enhanced local tourism'. After an eco-wind farm was built in 1998, tourist numbers doubled from 180,000 (1999) to 370,000 (2000) and reached approximately 550,000 (2009) within 10 years (Nelsis Editorial Office, 2011). A Green Energy course provided by the local energy department for free to elementary schools, short-stay courses and local accommodation and restaurant providers, provided for tourists an increase in the chance for environmental education. As for PV/solar facilities, their 'safe to the environment', 'local infrastructure/public facilities maintenance/upgrade', and 'environmental education' contribution were highlighted by the respondents. After the Great North Eastern Japan Earthquake on March 11th, 2011, Kuzumakicho experienced power cuts three times because of energy shortages (On-site interview June 29, 2012, with the officer in charge of environmental energy in Kuzumakicho's Energy Department). The local government started to install PV on local community centers' rooftops, to ensure minimal power supply in the centers for local residents during power cut periods. This may be the reason they indicated 'local infrastructure/public facility maintenance/upgrade' to have

high scores. Biomass/biogas was highlighted for the largest number of contributions, 'waste re-use', 'connection with agriculture, forestry', 'energy local production-local consumption', 'energy autonomy', and 'environmental education'. This is attributable to raw material supply such as wood pellets, wood chips, and livestock waste giving a close connection between biomass/biogas with local agriculture, forestry, and waste re-use. This can also be considered an advantage, as well as a characteristic of biomass/biogas development in rural areas.

4.3.2 Chongming Island, China

For Chongming Island, respondents indicated several elements as positive with '+2 very good' and '+1 good' scores. They include 'global warming mitigation', 'energy local production-local consumption', and 'local tourism' among others. The only PV/Solar sustainability elements evaluated as '+2 very good' by both respondents was 'biodiversity'. Like wind energy, several elements were evaluated as positive with '+2 very good' and '+1 good' scores. They include 'safe to the natural environment', 'facility maintenance', 'energy autonomy', and 'citizens' participation' among others. For biomass/biogas, their sustainability elements evaluated as '+2 very good' by both respondents were 'waste re-use' as well as 'connection with agriculture and forestry'. Elements with negative evaluation, such as 'noise', 'biodiversity' and 'landscape conservation', were identified. For wind energy facility, 'waste re-use', 'landscape conservation' and 'environmental education' were identified by one respondent. For PV/solar facility, 'air quality', 'facility maintenance', 'land use', and 'disaster prevention/mitigation' were identified for biomass/biogas facility, see Table 10.

One respondent ranked the most important sustainability elements as follows: 'air quality', 'safe to the natural environment', and 'waste re-use'. Another one ranked them as follows: 'global warming mitigation', 'energy autonomy', and 'revitalize local companies'.

Table 10. Questionnaire results on RE's contribution to sustainability, Chongming Island

Sustainability Elements	**Wind Energy**	**PV/solar**	**Biomass Biogas**
Environmental			
1. Global warming mitigation	+2, +1	+2, +1	+1, +1
2. Safe to the natural environment	+2, +1	+2, +1	+1, +1
3. Air quality	+1, 0	+2, +1	0, -1
4. Water quality	+2, 0	+1, 0	+1, +1
5. Biodiversity	0, -1	+2, +2	+1, +1
6. Landscape conservation	0, -1	-1, +1	0, +1
7. Noise	-1, -1	0, 0	0, 0
8. Waste re-use	0, 0	-1, 0	+2, +2
Social			
9. Connection with agriculture and forestry	0, 0	0, 0	+2, +2
10. Local tertiary sector	0, 0	0, +1	+1, 0
11. Forest management	0, 0	0, 0	+2, 0
12. Facility maintenance	+1, +1	+2, +1	-1, +1
13. Local infrastructure/public facility maintenance/upgrade	+1, 0	0, +1	+1, 0
14. Land use	0, -1	+2, 0	+1, -1

15. Transportation	-1, 0	0, 0	0, -2
16. Energy local production-local consumption	+1, +2	+1, +2	0, +2
17. Energy autonomy	+1, +2	+1, +2	+1, +2
18. Disaster prevention/mitigation	0, +1	0, +1	0, -1
19. Job creation	0, +1	0, +1	+1, +1
20. Citizens' health improvement	+1, 0	+1, 0	+1, 0
21. Citizens' participation	0, 0	+1, +2	+1, +2
22. Environmental education	0, +1	-1, +1	0, +1
Economic			
23. Facility investment	0, +2	0, +2	+1, +2
24. Maintenance cost	0, +1	0, +1	+1, +1
25. Local business	0, +2	0, +1	0, +1
26. Revitalize local companies	0, +2	+1, +1	0, +1
27. Local tourism	+2, +1	0, +1	+1, 0
28. Electricity sale	+2, 0	+2, 0	+2, 0
29. Increase local citizen's income	0, +1	0, +1	+1, +1
Others from respondents			
None			

Table 10 shows that one of the respondents identified the contribution to the sustainability of wind energy as contributing to 'global warming mitigation' and 'local tourism' among others. Like wind energy in Kuzumakicho, the wind energy electricity is supplied to the national grid and not used by local people, thus wind energy facilities seem only to be used for tourism purposes in the local area. For PV/solar, their contribution to 'biodiversity', 'safe to the environment', 'energy autonomy', and 'citizens' participation' were highlighted. The Mage-Solar farm (1MW) built in 2010 is supplying electricity to the local area, thus helping on the 'energy autonomy' aspect. Similar to biomass/biogas in Kuzumakicho, the two main advantages of biomass/biogas in rural areas, 'waste re-use' and 'connection with local agriculture and forestry', were highlighted. After calculating the total mean score, we summarized each RE's total contribution to sustainability by environmental, social and economic categorization in Kuzumakicho and Chongming Island, see Table 11.

Table 11. Different RE resources' mean score results in Kuzumakicho and Chongming Island

	Kuzumakicho			**Chongming Island**		
	Wind	PV/Solar	Biomass Biogas	Wind	PV/Solar	Biomass Biogas
Environmental	0	3.5	3.5	2.5	7.0	6.0
Social	0.5	9.0	14.0	5.5	9.5	8.5
Economic	4.0	4.0	2.5	6.5	5.0	6.0
Total	4.5	16.5	20.0	14.5	21.5	20.5

By comparing the mean score of wind power, PV/solar, and biomass in Table 11, the low contribution score by wind energy to local sustainability could result from the fact that 'wind energy electricity is not used by the local people'. Although wind energy has the largest share in facility capacity, instead of being used by the local people, big electricity companies supply this electricity through the National grid to other areas. As mentioned above, the close connection between biomass/biogas raw material supply and local agriculture, as well as forestry, led to biomass/biogas having the highest scores. However, it is taxing to balance the cost-benefits for

biomass/biogas in rural areas, such as the initial investment and maintenance cost issues (On-site Interview June 29, 2012, with the officer in charge of environmental energy in Kuzumakicho's Energy Department). Like biomass/biogas, the economic issues limit further development of PV/solar in Kuzumakicho.

For Chongming Island, the difference between the scores is comparatively smaller than that in Kuzumakicho. The score highlighted the economic contribution of wind energy and the social contribution of PV/solar and biomass/biogas as well.

5. CONCLUSION AND DISCUSSION

Based on the above findings and discussion, the following conclusions have been made.

1) Multiple factors are necessary for local RE promotion. Such several factors are playing key roles in the two case study areas. As the basis for RE promotion, abundant RE resources are fundamental. To initiate local RE development, a positive municipal energy planning concept and a vision that is developed by the local government are significant. Furthermore, in order to achieve the energy planning concept and the vision, a detailed energy strategy and implementation of the plan should be supported by relative local policies. Last but not least, the support from external companies, citizens, and a sufficient budget for the RE facilities' installation are also highlighted in this study.

2) Various RE resources do not pose equal value in supporting local sustainability. Some of the highly evaluated sustainability values highlighted in this study are as follows. For wind energy, they contribute to climate mitigation, local tourism, and environmental education. For solar power, they are safe to the environment, citizens' participation, and environmental education. For biomass energy, waste re-use, connection with local agriculture and forestry are highlighted in the evaluation.

Recommendations to the rural municipalities which plan to develop RE in the future are proposed as follows. 1) How many types of RE resources exist in their local areas and the exploitable RE potential based on local conditions should be clarified. The municipalities can utilize GIS, which is a useful tool that can support the RE potential analysis (Wang, Ikiugu, et al., 2014). 2) An efficient, appropriate energy strategy and plan should be made, and then its implementation ensured. Both of the cases have highlighted the significant role that local governments and policies play. 3) Before developing RE projects, cost-benefits should be balanced first. 4) Full advantage of technical and financial support from local or external companies and national or regional governments should be taken. 5) Local agriculture and forestry resources should be used and connected closely with biomass/biogas RE development and other businesses. 6) RE facilities should be managed and maintained, keeping the monitoring data and summarizing know-how experience for future use.

Although this study focused on rural areas, the energy demand-supply mismatch between urban and rural areas cannot be ignored. Rural areas in Japan and China are currently both facing depopulation problems since there are more "job opportunities and better life infrastructure" in urban areas than in rural areas. This results in high energy consumption in urban areas. However, large scale RE facilities are difficult to install in urban areas because of issues such as land use, aesthetics, and noise pollution among

others. This is in contrast to rural areas that have more available land and resources for RE development. Therefore, in addition to considering key factors for RE promotion in rural areas, it is also important to take into account spatial planning for energy demand and supply between urban and rural areas to increase local and regional energy self-sufficiency. To support planning practice, GIS-based RE potential analysis and map making are useful tools to facilitate decision making in the RE planning process. The visualized information provided by GIS could be used in a participatory process for energy planning (Wang, Ikiugu, et al., 2014). Through a bottom-up approach for public participation, the current energy structure might gradually change by involving more and more people leading to creation of a more sustainable RE supply-demand network. It is hoped and expected that the energy transition occurs from citizens' movements at municipal levels, after which the new concept expands to influence the upper levels of regional and national governments. In addition to the spatial planning tasks for RE, landscape aesthetics problems emanating from RE facilities, such as the visual impact of wind turbines, also puts forward a new challenge to the landscape architecture field. A new multi-discipline that is composed of RE, planning, and landscape architecture is emerging. However, because of the professional limitations and lack of multi-disciplinary knowledge and know-how between the above fields, this new multi-discipline area is yet to take root. To evoke research awareness on this topic, more theoretical and application studies are needed, so that proper 'research-to-practice' transitions can be made.

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REFERENCES

Chongming Gov. (2004). Mater Plan of Chongming Three Islands (2005-2020). (In Chinese).

Chongming Gov. (2009). Construction Guidelines of Ecological Chongming Island (2010-2020). (In Chinese).

Dincer, I. (2000). "Renewable Energy and Sustainable Development: a Crucial Review", *Renewable and Sustainable Energy Reviews*, 4(2), 157–75.

European Renewable Energy Council. (2012). Sustainable Communities - Experiences, Success Factors and Opportunities for the EU-25. [Online] Available: http://www.erec.org/fileadmin/erec_docs/Projcet_Documents/Sustainable_Communities/Sustainable_Communities.pdf (July 17, 2012).

Global Wind Energy Council. (2013). Global Wind Report 2012. [Online] Available: http://www.gwec.net/wp-content/uploads/2012/06/Annual_report_2012_LowRes.pdf (June 8, 2013).

Gosens, J., Y.L. Lu, G.Z. He, B. Bluemling, T.A.M. Beckers. (2013). "Sustainability Effects of Household-scale Biogas in Rural China", *Energy Policy*, 54, 273-287.

International Energy Agency. (2011). Clean Energy Progress Report. [Online] Available: http://www.iea.org/publications/freepublications/publication/name,3973,en.html (July 28, 2012).

Izutsu, K., M. Takano, M. Furuya, T. Iida. (2012). "Driving Actors to Promote Sustainable Energy Policies and Businesses in Local Communities: a Case Study in Bizen City, Japan", *Renewable Energy*, 39, 107-113.

Japanese Ministry of Economy, Trade and Industry. (2010). Basic Energy Plan. [Online] Available: http://www.enecho.meti.go.jp/topics/kihonkeikaku/100618honbun.pdf （June 8，2013). (In Japanese).
Kuzumakicho Gov. (1995). Natural Environmental Conservation Regulation. (In Japanese).
Kuzumakicho Gov. (1999). New Energy Vision. (In Japanese).
Kuzumakicho Gov. (2002). Eco-Energy Comprehensive Project Subsidy. (In Japanese).
Kuzumakicho Gov. (2003). Energy Saving Vision. (In Japanese).
Kuzumakicho Gov. (2007). Biomass Town Plan. (In Japanese).
Kuzumakicho Gov. (2011). Practical Use of Local Energy Report. (In Japanese).
Kuzumakicho Gov. (2012a). Kuzumakicho: the Efforts to Clean Energy. [Online] Available: http://www.town.kuzumaki.iwate.jp/images/library/File/kankyo/sinene-panf.pdf (Jan 8, 2013). (In Japanese).
Kuzumakicho Gov. (2012b). Global Warming Prevention Action Plan (4th). (In Japanese).
Kuzumakicho Gov. (2013a). Kuzumakicho Profile. [Online] Available: http://www.town.kuzumaki.iwate.jp/article.php?story=gyosei_010_020 (July 2, 2013). (In Japanese).
Kuzumakicho Gov. (2013b). The Electricity Consumption of Kuzumakicho (1993-2011). Obtained by e-mail.
Liu, D. (2010). "An Analysis of Low-carbon Construction of Ecological City in Chongming Island", Shangxi Architecture, 36(32), p. 20-21.
Ministry of Economy, Trade and Industry, New Energy and Industrial Technology Development Organization (NEDO). (2009). New Energy 100 Selection. [Online] Available: http://www.nedo.go.jp/news/press/AA5_0049A.html (August 25, 2014).
New Energy and Industrial Technology Development Organization (NEDO). (2008). Report of Municipal New Energy & Energy Saving Status Survey. [Online] Available: http://www.nedo.go.jp/content/100072518.pdf (Jan 8, 2013). (In Japanese).
New Energy and Industrial Technology Development Organization (NEDO). (2010). Wind Status Map. [Online] Available: http://app8.infoc.nedo.go.jp/nedo/top/top.html. (July 15, 2013). (In Japanese).
National Renewable Energy Center. (2011). National Green Energy Model County. [Online] Available: http://www.cnrec.info/sfxm/lsnyx/ (August 26, 2014).
Nelsis Editorial Office. (2011). "Special Issue: Coexistence with Wind, the Sun and Forestry, Iwate Kuzumakicho", in: Nelsis (eds.) *Renewable Energy and Machizukuri*. Vol. 12, 06.
Reddy, V., J.I. Uitto, D.R. Frans, N. Matin. (2006). "Achieving Global Environmental Benefits through Local Development of Clean Energy? The Case of Small Hilly Hydel in India", *Energy Policy*, 34(18), 4069–80.
Rio, P.D. and M. Burguillo. (2008). "Assessing the Impact of Renewable Energy Deployment on Local Sustainability: towards a Theoretical Framework", *Renewable and Sustainable Energy Reviews*, 12, 1325–1344.
REN21. (2013). Global Status Report. [Online] Available: http://www.ren21.net/REN21Activities/GlobalStatusReport.aspx (July 4, 2013).
Wang, K.Y., C.J. Zou, Z.H. Kong, T.H. Wang, X.Y. Chen. (2005). "Ecological Carrying Capacity and Ecological Construction in Chongming Island", *Chinese Journal of Applied Ecology*, 16(12), 2447-2453. (In Chinese).
Wang, Q.N., M. M. M. Ikiugu, I. Kinoshita. (2014). "A GIS-based Approach in Support of Spatial Planning for Renewable Energy: A Case Study of Fukushima, Japan", *Sustainability*, 6, 2087-2117.
Yale University (Center for Environmental Law and Policy) and Columbia University (Center for International Earth Science Information Network). (2005). Environmental Sustainability Index. [Online] Available: http://www.yale.edu/esi/ESI2005_Main_Report.pdf (June 13, 2013).
Yu, H.M., H.Z. Zhuo, W.Xin. (2008). "Analysis and Assessment on Wind Energy Resource in Chongming Island", *Renewable Energy Resources*, 26(3), 76-79. (In Chinese)
Yu, Y.F., D. Roddy, L. Ma. (2009). "Study and Analysis of Renewable Energy Utilization Potential in Chongming Islands", *Shanghai Energy Conservation*, 3, 173-177. (In Chinese).
Yang, Q., G.Q. Chen, S. Liao, Y.H. Zhao, H.W. Peng, H. P. Chen, (2013). "Environmental Sustainability of Wind Power: an Energy Analysis of a Chinese Wind Farm", *Renewable and Sustainable Energy Reviews*, 25, 229–239.

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Legacy Creation Strategy in Olympic Cities

The path towards sustainable development?

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Abstract: Mega-event strategies and their impact on the development of host cities have drawn increasing interest as they have become part of wider city development strategies. However, many city leaders are challenged by a gigantic and complex task after the events: how to deal with the post-use of large event venues and facilities, and how to use the events as a catalyst to facilitate urban development. Mega-event strategies may provide a stimulus for wider urban investments and change. They help to provide host cities an engine for economic growth, facilitating city revitalisation and even urban physical restructuring, enhancing city image, and transforming a city into a globally competitive city. Where every host city expects to experience some form of short and long term impacts, the so-called 'legacy', it is, however, difficult for most host city organisers to think beyond the Games in any systematic fashion due to the pressing nature and planning complexities involved. Therefore, although the post-Games period is by far the longest period that stretches for decades after the Games to affect a host city, it is "clearly the least-planned for period". Due to time pressure, poor consideration of the long-term impact may make Olympic venues 'white elephants' after the Games have taken place, isolated in their city landscapes. These possible negative impacts raise the following questions: 1) What strategies can help a host city improve post-event usage of event-related facilities? 2) What strategies should a host city follow to facilitate post-event development in a more sustainable way? Based on the examination of legacy creation strategies of a number of Olympic host cities, with Beijing and London in particular, the research aims to identify what urban strategies lead to the improvement of the post-event usage of event-related facilities and long-term benefits for the city development of host cities.

1. INTRODUCTION

The role of the Olympic Games as a catalyst for urban development and regeneration has been recognized in recent years (Chalkley and Essex, 1999; Gold and Gold, 2008). The mega event triggers the erection of landmarks and the development of infrastructure, and urban renewal processes frequently transform an urban space (Chalkley and Essex, 1999; Roche, 2000; Gold and Gold, 2008). The use of mega events, such as the Olympic Games, to reinvigorate sluggish or declining urban economies, arose from the late 1970s, when growing awareness of the pervasiveness of deindustrialization led city planners to take action to stimulate new sources of economic engines, investment, and employment (Gold and Gold, 2007, p.4) The role of the Olympic Games as a catalyst for urban development and regeneration was first recognized when Barcelona was preparing for its

Olympics in 1992. By hosting the Games, Barcelona was able to boost its economic growth, enhance its image, and transform itself into a globally competitive city. Following Barcelona's experience, Olympic host cities or potential candidate cities increasingly view the Olympics as a means of stimulating urban development processes, on the grounds that the erection of landmarks, the development of infrastructures, and urban renewal processes frequently transform an urban space (Gold and Gold, 2007).

Despite the stated significance host cities expect to achieve, researchers and policymakers have also become more aware of the downside of the catalyst effect embodied in it. The amount and size of the Olympic facilities have outgrown the needs of host cities. It is also difficult for the host city organisers to think beyond the Games in any systematic fashion due to the pressing nature and planning complexity. Therefore, although the post-Games period is by far the longest period that stretches for decades after the Games to affect a host city, it is "clearly the least-planned period" (Cashman, 1998).

The Olympics of the 21st century are increasingly held in emerging markets, rather than the traditional advanced economy. By 2016, the Olympics will have been held in China (Beijing), Russia (Sochi) and Brazil (Rio de Janeiro). In comparison with previous Olympic cities, the host cities in emerging economies face even higher costs of staging such sporting events. Often these host cities have limited existing sport infrastructure and inadequate urban infrastructure to accommodate sporting events at such a scale. Besides, these host cities may lack the technology and management expertise available to their counterparts in advanced economies (Ponomarenko and Plekhanov, 2014). Furthermore, they are constrained by limited investment, which results in difficult choices for the local leadership, between grand sport facilities or investment in social welfare of local inhabitants. If not done well, social conflict demonstrations will be the consequence. Therefore, host cities in emerging economies may face bigger challenges regarding how to balance effort and expected legacy than advanced economies.

To explore the Olympic development for host cities' transformation in an optimal way, one possible point of departure in this research might be to connect the Olympic development strategy closely to the long-term perspectives of the urban regeneration strategy of host cities. This research therefore raises the following questions: 1) What strategies can help a host city improve post-event usage of event-related facilities? 2) What strategies should a host city follow to facilitate post-event development in a more sustainable way? This paper is to examine the experiences of cities that have hosted the Summer Olympic Games, from the perspective of urban development. The paper begins with a brief review of past studies on sustainable development and Olympic legacy creation. This will be followed by characterizing the development strategies of previous host cities regarding the post-event legacy on different levels and tiers. The legacy creation strategies of Beijing and London will be highlighted in particular. Findings and discussion on how host cities use program definition, organisation structure and development processes to increase the leverage of a positive legacy are presented. Finally, concluding remarks highlight the contrasts and contradictions provoked by the strategy of using the Summer Olympic Games as a catalyst for stimulating positive legacy in host cities and, ultimately, sustainable development.

2. OLYMPIC LEGACY

The understanding of legacy cannot be separate from the historical revival and development of the modern Olympics. Preuss (2006, p.86) defines legacy as "all planned and unplanned positive and negative, intangible and tangible structures created by and for a sport event that remains for a longer time than the event

itself". Although there has been much discussion of legacy from the time of Coubertin, the term legacy remains a neglected area (Cashman, 1998). The International Olympic Committee (IOC) congress on legacy recognized different meanings of legacy across different cultures and in different languages, and therefore encouraged each host city to "reflect its own goal right from the beginning of the bidding process and to look at how the Games can be a catalyst for development" (IOC, 2010). Tangible aspects may include architecture, urban planning and sports infrastructure or economic achievements. Intangible aspects include the production of ideas, cultural values, education, voluntarism, experience and knowhow (IOC, 2002). When governments increasingly use mega-event strategies to include city development in a more comprehensive way, evaluation of the strategies and impacts should similarly adopt a more comprehensive approach, combining economic, social, environmental and other concerns (Chen et al., 2013). Following this integral approach, we highlight the legacy in terms of economic, spatial, environmental and social terms as follows.

Economic legacies

Among the various legacies that are listed in the literature, economic benefit is considered to be the prime motivation for those parties with an interest in hosting the Games. Studies often position host cities, especially western industrial cities, in the context of deindustrialization (Surborg et al., 2008). These cities choose to host the Olympic Games as a strategy for facilitating the growth of the service sector, creating new leisure and consumption spaces, and the creation of new business opportunities (Andranovich et al., 2001; Kasimati, 2003; Weed, 2008). Preuss (2004) and Gratton et al. (2006), for example, identify several important tangible economic aspects of holding the Games, such as improved employment possibilities in the construction industry, event revenue, event-related investment, real estate growth, (Olympic) tourism, and retail sector growth. Increasingly, host cities are gearing themselves towards more long-term economic impacts that are intended to sustain such cities after the Olympics have taken place.

Spatial legacies

Improving urban function and facilitating urban regeneration have become increasingly important drivers for host cities in recent years. The construction of Olympic venues and facilities have been seen as a process of forming urban spectacles through the creation of new, iconic stadiums and the construction of landmarks (Gotham, 2005; Coaffee and Johnson, 2007). At the urban level, the Olympic project is increasingly used to facilitate the creation of new urban centres with service, leisure, sport, business and residential functions. Other attempts include upgrading deprived neighbourhoods or transforming heavily polluted suburban areas. Sakai (2006) suggests that hosting mega-events speeds up governmental investment in the construction of venues, facilities and other forms of infrastructure over short time periods. One related issue is the re-branding and marketing of a city or location. Sports events such as the Olympic Games are a powerful tool for developing a city as a 'brand' (Waitt, 1999; Smith, 2001; Hall, 2001; Van den Berg et al. 2002; Surborg et al. 2008). The development of sports facilities may provide a city with important visual symbols that create memorable and positive images in tourists' minds (Smith, 2001, p.136). The global media and the general publicity surrounding the Games can be used to highlight improvements in a city's urban environment, transportation system and organisation, attracting both sports tourists and a more general audience, such as companies, investors and conference delegates. As a result, in both advanced economies and emerging economies, host cities invest heavily in public space. As will be explained in the next section, this has resulted in a form of comprehensive strategic planning that combines Olympic site development with the provision and improvement of infrastructure, tourism facilities, the creation of high-quality public spaces, tourism planning, and

general urban regeneration programmes, so as to maximise urban impact.

Environmental legacies

Environmental commitment has been added to the IOC Charters (IOC, 2005) in recent years. The increasing environmental concern has prompted the host cities to apply certain environmental principles on design, planning and implementation. In the case of Sydney, Beijing and London, host cities not only established green Olympics guidelines, but also experimented in the use of environmentally-friendly materials and technology during construction, and the recycling of water and renewable energy sources, thus limiting the environmental impact (Chen et al., 2013). Host cities generally created a greener image after the Games by cleaning up polluted soil, improving public transportation, enforcing stricter environmental control, adapting advanced technology in energy, water and air quality, and investing in green and open spaces (Chalkley & Essex, 1999). In specific cases, ecologically vulnerable areas and endangered species are protected.

Social legacies

The social impact of the Olympic Games was often neglected in the past, but has been increasingly paid attention to in recent host cities. Much of the social concern expressed in the literature is related to the effects of the Games on local communities. This is due to the fact that not only is community support an essential aspect of a successful mega-event, but also community groups tend to be more vulnerable to, and more affected by, Olympic-led development. Long and Sanderson (2001, pp.189) list a number of community benefits that are key to a smooth event, including: enhanced confidence and self-esteem, empowerment of disadvantaged groups, improving a community's capacity to take the initiative, increased social integration and co-operation, the promotion of a collective identity, and increased cohesion. Jones (2001) and Chen (2012) both suggest that hosting the Olympics should lead to wider participation in sport and greater community access to improved sports facilities in the long term. Olds (1998), meanwhile, draws attention to the importance of guaranteeing housing and tenant rights, particularly for low-income groups, through specific, target-oriented housing programmes.

However awe-inspiring during the Games, many of the venues created or modified for the Olympic Games later fall into disuse or are used sporadically without generating a profit, and many Olympic Parks remain largely empty and unused. Besides the underused facilities, host cities are often faced with substantial debts and the operating costs of Olympic venues in post-Games periods that take years to pay off. These problems may stem from inadequate consideration and planning of the post-event period because host cities are under enormous pressure to fulfil the requirements of the IOC before the delivery deadline. Since organizing the Games involves both opportunities and risks, it is important to seek strategies that are effective at implementing the cities' main motives, and thereby achieving tangible and intangible legacy aspects in the context of sustainable development. Section 3 addresses various legacy strategies explored in Olympic host cities. The legacy strategies are further investigated upon the transition of the general focus in Olympic legacy, strategies on how to improve post-event usage of event-related facilities, as well as how to combine Olympic plans with the city's strategic plan to ensure post-event development in a more sustainable way.

3. OLYMPIC LEGACY STRATEGIES: PLANNING THE GAMES AND BEYOND

3.1 Olympic-led regeneration

Earlier Olympic preparation emphasized mainly the construction of gigantic sport facilities and urban infrastructure but later evolved to take into account a much broader urban regeneration and urban restructuring program using Olympic Games as a catalyst. Host cities such as Berlin (1936), Rome (1960) and Tokyo (1964), reconstructed and expanded existing facilities, added new landmark constructions, and made more general infrastructural improvements to achieve urban upgrading. Some early attempts to combine Olympic preparation and urban restructuring programs to supply long-term demand were explored in Montreal (1976) and Seoul (1988). In Barcelona (1992), not only had the urban structure of Barcelona been modified through the development of four Olympic sites in four different types of locations (like low quality neighbourhood, declining industrial site and waterfront areas), but many earlier proposed programs, such as the creation of public open-space, the general improvement of public transportation, the opening of the city to the sea, the renovation of the city's cultural infrastructure, the landscaping of squares and commissioned new sculptures, were able to be realized which might otherwise have been long delayed or even cancelled (Chalkley and Essex, 1999; Marshall, 2000 and 2004; Monclú, 2007; Coaffee, 2007). Another Olympic host city that followed a similar scattered model is Athens (2004). 20 different locations were chosen for Olympic development. These sites were owned by the public sector and were predominantly greenfield sites. The focus of the developments was put on the historical values of ancient Greece and stressed even more the spatial improvement of infrastructure. Nevertheless, the intention to use different locations to facilitate the development of the whole city was not realised. Research indicated problems in the implementation process arising from conflicts between agencies as well as between different parties, time-consuming planning procedures and archaeological findings on the chosen sites (van Prooye, 2010). The scattered model was not adopted since Athens. Sydney, Beijing and London have all adopted a more concentrated model.

Since 2000, sustainability became a new focus for Olympic preparation. Both Sydney and Beijing adopted the IOC's environmental agenda and produced a 'Green Olympics'. In Sydney, Homebush, a derelict 760 hectare former industrial site that had housed the city abattoir and a rubbish dump, some 19 kilometres from the city centre, was cleaned up and regenerated to accommodate an urban core with sporting, entertainment, exhibition and commercial facilities, an Olympic village and a metropolitan park. Beijing, on the other hand, developed an Olympic plan attempting to integrate the main ideas from the pre-existing 10th Five-Year Plan, as well as the major urban regeneration projects and infrastructure projects proposed in the Beijing Master Plan (2004-2020). About 200 polluting factories inside Beijing's 'fourth ring' were moved out to Beijing's suburbs or even to neighbouring provincial cities (Chen 2012). In addition, Beijing cleaned up 40km of river, planted one million new trees and established 83km of greenbelt. To improve accessibility, Beijing completed two new Ring Roads, eight new subway lines and extended new airport terminals. In this way, Beijing could use OAP to realize both its urban restructuring strategy and the city's economic restructuring strategy, environmental improvement measures and its infrastructure development plan.

Legacy creation has become the newest focus for host cities in preparing for Olympics since London 2012. The Lower Lee Valley, a location surrounded by the most deprived neighbourhoods, was regenerated to become a new sub-centre of London. It is worth mentioning the way London incorporated legacy plan

in its existing master plan. The master plan of the whole area was the first vision for planners before the Olympic venues, and the facilities were incorporated in the site.

3.2 Planning Olympic sites and venues

A common problem occurring after the Olympic Games is the creation of the so-called "white elephants". Barney suggests that a "white elephant" is a facility that is built at great cost and after its initial use for a particular event becomes less and less used and therefore the cost of it out-weighs what it offers back to society. When host cities deliver venues or urban areas that are not, or are under-used, after the Games, they usually face major financial difficulties in maintaining the operational cost, as is in the case of Montreal, which found difficulties in connecting Olympic facilities with its surrounding urban functions.

There are several strategies that Olympic host cities explore to improve post-event usage of event-related facilities. First, most host cities attempt to reuse as much as possible the existing or temporary faculties. In Barcelona, the stadium of Montjuïc that was built in 1929 was renovated to become the main stage of the Olympic Games of 1992. In Athens, 75% of the venues already existed. Beijing utilized 32 venues, with only 12 newly-built venues. The remaining 20 venues were either renovated existing venues or temporary venues. In London only six venues were newly constructed. London made extensive use of temporary facilities. The basketball and hockey stadiums were dismantled after the Games so they could be reassembled and used in future competitions. Using existing venues does not necessarily reduce costs. In Athens, many existing venues required extensive renovation, which led to intensive investment. Nevertheless, such a strategy does not result in an over-supply in the post-event period.

Figure 1. Large residential districts were constructed around the Olympic Green and the Olympic Village (left) in Beijing before and after 2008, combined with other urban functions (right) (Source: Scout Real Estate (left), author (right))

Second, some host cities tend to locate newly built sport venues in areas that provide easy accessibility to potential local users. In Beijing, the Olympic village was transformed into luxury apartments for middle-class inhabitants and were sold out even before the Games started. Around the Olympic Green (where the Olympic Stadium Bird Nest, Beijing Aquatics Centre and Beijing National Indoor Stadium are located, see Figure 1) and the Olympic village, large residential districts were built before and after the Games that provided for a

large number of potential users. Besides the Olympic Green as the location for new venues, the rest of the Olympic facilities were located either in university campuses or in existing dense residential areas. In London, most of the venues were aiming at community needs in their post-usage plans. To further facilitate the post-event usage of the sports venues by local communities, it is essential to improve the accessibility of these venues with good public transportation such as metro line and bus systems.

Third, the Olympic villages and venues need to integrate other urban functions such as commercial, residential, retail, and other functions to ensure the Olympic sites are well used and attract inhabitants after the Games. An active sub-centre can gradually integrate with other urban fabrics in host cities and not stand alone after the Games. In Barcelona, the program of Parc de Mar - one of the four Olympic sites in the former harbour area included a commercial centre for leisure and retail, with a temporary function as the Olympic Port for sailing and surfing activities. After the Games the area was transformed into nightlife and restaurant functions, creating a mix of functions in the area. In Beijing, other urban functions were added surrounding the Olympic Green after the Games, including residential districts, parks, a conference centre, science museum, hotel, supermarkets, restaurant and cafes, bus and metro stops. Within the Olympic Green, public events are occasionally held using public space. Despite the popularity among Chinese tourists, walking around the Olympic Green is still not convenient due to the enormous scale of the venues and the oversized and massive fences that prevent the site from being integrated with other urban functions in the surrounding areas.

Fourth, Olympic venue design aims toward post-usage and the reduction of maintenance costs may include flexible concepts that address adaptation. Related design concepts like downsizing, flexibility and multifunctional design were integrated to facilitate the transformation process. The seat number in the London Bowl was reduced from 80,000 to 25,000 after the Game. The Olympic stadiums in Barcelona, Sydney and Beijing have all adopted similar measures to reduce the size of their venues. Furthermore, adopting advanced technology helps sports venues to be sustainable in the long-term. In the design and construction of Olympic venues in Sydney, the Olympic village was intended to be a model of eco-sensitive design, which was undertaken jointly with Greenpeace, incorporating solar power, water recycling and passive heating and cooling. A detailed set of ‘green’ guidelines that were intended to govern the design, layout and construction of Olympic facilities were published by the Sydney Organizing Committee. 90 Ecologically Sustainable Development (ESD) principles were included, with statements on recycling, renewable energy sources, public transport, derelict land and protection of threatened environments and endangered species (Chen and Spaans, 2010).

Fifth, securing post-event users is important for the sustainable usage of the sports venues. In Barcelona, the Olympic stadium has been used by a local soccer club. In Atlanta, the Olympic stadium was transformed to become the new baseball stadium for the Atlanta Braves. In Athens, the stadium managed to get users such as the Greece National Football Team, Olympiacos Piraeus, Panathinaikos and AEK Athens after the Games. Panathinaikos was the last user of the stadium, but have returned to their home grounds. Football is a sport that can pull large crowds besides the Olympic Games that is able to use the large capacity Louis Spiros Stadium has. Only athletics stadiums are not fully suitable for football due to the 400m track around the pitch, creating a large distance between the field and the spectators.

3.3 Olympic legacy planning

Although most ambitious Olympic hosts use the Games as an opportunity to bring forward long-term plans, accelerate the pace of change, or introduce new planning concepts, using major events to achieve long-term urban goals is a task

that has proven difficult to manage and implement. In most host cities, a main strategy for legacy planning is to integrate the Olympic plan as much as possible with host cities' master plans. In the city development strategies of Barcelona, its long-term and short-term goals were combined. Firstly, the most essential experience of Barcelona involves its emphasis on a long-term vision towards urban revitalisation and the continuity in city development strategies. Many plans and projects associated with the 1992 Olympics had already been generated in the 1960s and the 1970s – they were thus not the result of new proposals that had been developed purely for the Games (Chen et al., 2013). Among which, the experience of two host cities -Beijing and London - may shed some light on how legacy planning can be integrated in long term urban strategies.

The Olympic plan in Beijing (2008) was an attempt to integrate the main ideas from the pre-existing 10th Five-Year Plan as well as the major urban regeneration projects and infrastructure projects proposed in the Beijing Master Plan (2004–2020). Beijing used its Olympic Action Plan to realize its urban and economic restructuring strategies, environment improvement measures, and infrastructure development plans (Chen, 2012). During the preparations for the Olympics, about 200 polluting factories inside the fourth ring were moved out to Beijing's suburbs or even to neighbouring provincial cities. At the same time, eight new subways, two ring roads, and more than 200 kilometres of new highways that were part of a long-term plan for the city were realized within a decade. The transformed Olympic site, owing to its new sport venues, leisure facilities, retail and business space as well as a rapidly growing retail sector, has gradually grown into a new urban district in Beijing with a strong sport and culture identity.

In London's Olympic Games, creating legacy for its citizens after the Games was focussed very early in the process. The master plan was created to define what would be permanent in 2030 (Figure 2: right plan) and what should be temporary in 2012 (Figure 2: left plan) following the IOC's requirements. The middle Olympic Plan below shows how the urban area should look after the Games. In this way, the Games not only creates a framework for the area to develop within the expected urban vision, but also ensures a smooth transition for both permanent buildings and temporary buildings after the event. In addition, the London Legacy Development Corporation was established and given the mandate to continue developments on the Olympic site after the event. London could ensure the transition from the Olympic event to post-event period according to the demand of the time.

Figure 2. Olympic plan of London in 2012, 2014 and 2030 (source: Robouts 2013)

3.4 Olympic legacy strategies in comparison: Beijing vs London

In this section, the Olympic legacy strategies of Beijing and London are compared. In Table 1, the characteristics and adopted urban development strategies of two Olympic host cities – Beijing, from an emerging economy, and London, from an advanced economy - are summarised. Both cities have strongly emphasized the integration of Olympic plans with the cities' master plans and measures for venues and sites in the post-event era. At the urban level, both cities use the strategy to incorporate Olympic legacy plans into the wider master plans of the cities and use the games as a catalyst for urban transformation. Because Beijing is still busy transforming itself from an industrial city to a post-industrial city, it mainly focused on economic restructuring, moving out the manufacturing sector out of town and creating a new sub-urban centre focusing on retail and leisure. London, already in its post-industrial era, specifically focused on transforming the deprived Lower Lee Valley, which would not have had a chance to attract any investors without the Games. Similarly, Beijing spent mass investment on establishing a proper infrastructure system while for London the infrastructure system had already been developed, so only small modifications were necessary. While both cities invested heavily in environmental efforts, London drastically worked on the improvement measures decades before while Beijing faced serious environmental challenges. Although drastic measures helped bring blue sky to Beijing during the Games, temporary measures could not result in sustainable results after the Games. Both cities paid attention to social progress. Beijing advocated for sport participation by adding sports facilities in neighbourhoods. London, on the other hand, focused on young people and job creation for the surrounding neighbourhoods. At the Olympic site and venue level, both cities examined previous Olympic cities and explored similar strategies to take post-use into account. Nevertheless, the transformation plan has not led Beijing to find permanent tenants for the Olympic Stadium, while in London, the tenants were settled before the

transformation plan was implemented. In these cases, the Olympic sites and their surroundings have been improved with a mix of retail, sport, cultural, residential and infrastructure functions. Nevertheless, there are fragmentations when crossing over from one function to the other. This fragmentation may be caused by the enormous scale of individual buildings, not well designed public space, accessibility problems, or simply ownership barriers (for example, fences between two venues in the Olympic Green, or boundaries between different boroughs). Both cities have focused on the comprehensive development of the area to achieve a more sustainable outcome, therefore the chosen strategies inevitably cover economic, physical, environmental and social perspectives.

Table 1. Legacy creation strategies in Olympic host cities: Beijing and London

Comparison items	**Beijing**	**London**
Goal	International recognition; economic restructuring	Catalyse urban regeneration, create city spectacles
Initiative stakeholders	Central government, supported by local government	Non-profit organisation BOA, supported by Municipal government and mayor
Olympic plan	Concentrated model	Concentrated model
Size of Olympic park	1215 ha	227 ha
Location of Olympic park	Olympic Green is located north of Asian Game Village, north Beijing, relative well developed urban area adjacent to existing 1990 Asian Game facilities	Queen Elizabeth Olympic Park is located in Stratford, in the Lower Lee Valley, in East London.
Strategy at urban level		
Relation with city vision	Integrating Olympic plan with long-term master plan; Economic restructuring from manufacturing sector to service sector as the goal.	Help city expand to the east; [d] incorporate legacy plan in Olympic plan to define what is permanent and what is temporary; Regeneration of deprived districts. [c]
Infrastructure strategy	Massive investment in constructing new infrastructure, like ring roads, expressways and regional railways; eight new urban subway lines, Third Terminal of Beijing Capital International Airport.[a]	Develop Stratford International Railway Station; upgrade the Stratford Region (Metro), in combination with the development of private-invested 460,000 m^2 Westfield Stratford City Shopping Centre [d]
Environmental strategy	Permanent measure: moving about 2000 polluting factories out of city; planting 126 km rings of trees around Beijing; 30 million trees and rosebushes were planted in newly created public green space; using renewable energy, recycled water and other advanced environmental technology; [b] Drastic temporary measures including shutting down factories and construction sites in Beijing and neighboring cities and provinces; strong restriction of car use. [a]	Remediation of contaminated land; re-use or recycle demolished materials; the combination of biomass boiler, photovoltaics and small scale wind turbines as renewable energy; large-scale energy solution by developing a combined cooling heat and power (CCHP) system to serve the largest community in the UK.[b]
Social strategy	Sports facilities provided in all residential communities, along major roads and in residential	Improve skill level of local workforce; Olympic trust to offer young people and diverse

Comparison items	Beijing	London
	neighbourhoods. [a)]	communities the opportunity to fully participate [d)]
Governance strategy	Local government as leadership to ensure the efficiency and effectiveness of the process; Involving private sector through bidding, BOT and public–private partnership models [a)]	Non-profit organisation BOA to ensure the legacy creation is focused from preparation to post-event transformation [c,d)]
Focal point of strategy at site and venue level		
Venue planning strategy	Making use of 32 existing venues; building 12 new venues; locating most new venues on university campuses to ensure post-event use. [a)]	Making use of existing 20 venues; make use of two temporary facilities; only building five new venues. [d)]
Venue design strategy	Iconic design that drew world attention; using advanced sustainable technology in venue development; including post-event transformation plan in venue design; adopting design techniques include downsizing the venue capacities, designing multi-functional venues and establishing commercial plans for Olympic facilities. [a)]	Taking into account clear post-event use strategy in design, such as recycling, dismantling, or down-sizing; create flexible stadium in terms of use; combine sport function. [c)]
Post-use strategy	Using iconic design to attract large tourist group; creating mix-function area by adding new function in venues; selling apartments in Olympic village before the Games.	Securing permanent user/tenants; construction materials and chairs recycle to other venues and to Rio de Janeiro; selling apartments in Olympic village before the Games. [c)]
Governance strategy	Involving private sectors and private investment [a)]	Involving private sectors and private investment

Sources:
a) Chen 2012
b) Walker, Kopec and Elliott 2012
c) Kirchert and Reinders 2014
d) Rombouts 2013

4. DISCUSSION AND CONCLUSION

"Sport is increasingly seen as a central strategy for cities to promote their image and global position, undertake regeneration, and tackle problems of social exclusion" (Herring, 2004). The Olympic Games are particularly attractive to cities due to the unique impact that the intense media interest associated with the Games can have on a global audience. Whilst much is known about the event's impact, there are considerable gaps in our knowledge about the event's strategies in creating post-event legacy. Can the efforts city make before the Games lead to sustainable development of cities? This paper attempts to fill the gap by examining what kinds of strategies host cities have explored that can lead to a comprehensive impact on buildings, districts and cities in the post-event era in terms of economic, spatial and social development. Host cities need to consider the sustainability of the facilities and projects of the host cities,

maintaining the quality of the facilities for the athletes, but avoiding any form of luxury and the investment that cannot be justified for the long-term benefit of local citizens. From the trend of Olympic-led regeneration, we can see host cities not only use the opportunity to improve existing facilities and construct new venues, but also upgrade the cities' urban structures by developing difficult urban locations, for example, brownfield or deprived neighbourhoods. These areas, if developed properly and connected with fast transportation systems, can become new urban sub-centres. The focus on sustainability, especially from an environmental perspective has been high on the IOC's agenda since 2000. The introduction of the Green Olympics concept has led to the adoption of advanced environmental technology in building design, construction, and planning and Olympic site management. From the perspective of Olympic site preparation and venue construction, host cities can enhance post-usage by introducing concepts that increase the flexibility of adaptation. Existing facilities should be made use of. The location of new facilities located next to potential users and easily accessible by public transportation increases the chance of re-use. It is important to search for permanent tenants for venues even before the Games to ensue post usage. Whether London has reduced unnecessary construction and reduced the chance of underused facilities needs to be further tested in the next decades.

From the perspective of legacy planning, it is not only important to consider how to combine all urban visions and (existing) planned urban projects, but also, more significantly, to have a vision regarding how the urban locations for Olympic preparation should be developed in the long-term. The long-term vision should include its economic function, spatial structure, as well as social improvement. In this way, both the Beijing and London cases are useful examples demonstrating how host cities can put sustainability and post-event legacy into preparation at the building, district and urban scales, and how a host city can develop its strategy in terms of spatial, economic and social development. It is clear that cities in emerging economies, as in the Beijing case, face higher costs of staging the Olympic Games due to the need to amend limited sport infrastructure, poor urban infrastructure, dreadful environmental situations and the pressure of excellence. Beijing's experience also shows that drastic measures can be implemented using the Games as a legitimate argument. While technology and management expertise can be borrowed from previous host cities, and lessons can be learned from other host cities, it is important for the local leadership, business society and local communities to jointly define the vision, means and expected legacy.

REFERENCES

Andranovich, G., Burbank, M.J. and Heying, C.H. (2001) "Olympic cities: lessons learned from mega-event politics", *Journal of Urban Affairs*, 23(2), 113-131.

Cashman, R. (1998) *Olympic Legacy in an Olympic City: Monuments, Museums and Memory*. International Olympic Committee, *International Symposium on Legacy of the Olympic Games, 1984-2000 – 14th-16th November 2002.* Olympic Studies Centre, Barcelona, Spain.

Chalkley, B. and Essex, S. (1999) "Urban development through hosting international events: a history of the Olympic Games", *Planning Perspectives*, 14, 369-394.

Chen, Y. (2012) "Beijing: Beyond Olympic City", *Real Estate Quarterly*, (11) 7, 22-29.

Chen, Y., Qu, L. & Spaans, M. (2013) "Framing the Long-Term Impact of Mega-Event Strategies on the Development of Olympic Host Cities", *Planning Practice & Research*, 28 (3), 340-359.

Chen, Y. and Spaans, M. (2010) "Mega-event Strategy and Urban Transformation: a Case Study of Sydney", In: J. Liu and X. Jiang (eds) *Keeping the Olympic Flame Burning*. Beijing: Beijing Olympic City Development Association, 327-345.

Coaffee, J. (2007) "Urban regeneration and renewal", in: Gold, J. and Gold, M. (eds.) *Olympic Cities: Urban Planning, City Agendas and the World's Games, 1896 to the*

Present (Planning, History and Environment). London: Routledge, 2007, 150-162
Coaffee, J. and Johnson, L. (2007) "Accommodating the spectacle". In: Gold, J. and Gold, M., (eds.) *Olympic Cities: Urban Planning, City Agendas and the World's Games, 1896 to the Present (Planning, History and Environment)*, London: Routledge, 138-149
Gold, J. and Gold, M. (2007) *Olympic Cities: Urban Planning, City Agendas and the World's Games, 1896 to the Present" (Planning, History and Environment)*, London: Routledge,
Gold, J. and Gold, M. (2008) "Olympic cities: regeneration, city rebranding and changing urban agendas", *Geography Compass*, 2(1), 300-318.
Gotham, K. (2005) "Theorizing urban spectacles: festivals, tourism and the transformation of urban space", *City: Analysis of Urban Trends, Culture, Theory, Policy, Action*, 9(2), 225-246.
Gratton, C., Shibli, S., and Coleman, R. (2006) "The economic impact of major sports events: a review of ten events in the UK". The Sociological Review, 54(2), 41-58.
Hall, C. (2001) "Imaging, tourism and sport event fever: the Sydney Olympic and the need for a social charter for mega-events", in: Gratton, C. & Henry, I. (eds.) *Sport in Cities: The role of Sport in Economic and Social Regeneration*. London and New York: Routledge, 166-183.
Herring, R. (2004) "Governance, sport and the city: using case studies to inform policy", *Cross-National Research Papers*, 7(5), November 2004. European Research Centre.
International Olympic Committee (2002) *International Symposium on Legacy of the Olympic Games, 1984-2000 – 14th-16th November 2002.* Olympic Studies Centre, Barcelona, Spain
International Olympic Committee (2005) *Manual on Sport and the Environment*, Lausanne, Switzerland.
International Olympic Committee (2011) *The Olympic Charter*, Lausanne, Switzerland.
Jones, C. (2001) "A level playing field? Sport stadium infrastructure and urban development in the United Kingdom", *Environment and Planning A*, 33(5), 845-861.
Kasimati, E., 2003, "Economic aspects and the Summer Olympics: a review of related research", *International Journal of Tourism Research*, 5(6), 433-444.
Kirchert, J. and Reinders, J. (2014) Rethinking the Olympics. A new strategy for future Olympic cities. Master Thesis, Delft: Delft University of technology
Long and Sanderson (2001) "The social benefits of sport. Where's the proof?", In: Gratton, C. & Henry, I. (eds.), *Sport in cities: the role of sport in economic and social regeneration*, London and New York : Routledge, 187-203.
Marshall, T. (2000) "Urban Planning and governance: is there a Barcelona model?", *International Planning Studies*, , 5 (3), pp. 299-319.
Marshall, T. (2004) *Transforming Barcelona*, London and New York: Routledge,
Monclú, F. (2007) "Barcelona 1992", in: Gold, J. and Gold, M. (eds.) *City Agendas, Planning and the World's Games, 1896 to the Present (Planning, History and Environment)*, London: Routledge, 218-236.
Olds, K., (1998) "Urban mega-events, evictions and housing rights: the Canadian case", *Current Issues in Tourism*, 1, 2-46.
Ponomarenko, O. and Plekhanov, A. (2014) "*Economic impact of the 2014 Sochi Winter Olympics*, European Bank for Reconstruction and Development. http://www.ebrd.com/pages/news/press/2014/140205.shtml
Preuss, H. (2004) *The Economics of Staging the Olympics: A Comparison of the Games 1972-2008*, Cheltenham and Northampton: Edward Elgar.
Preuss, H. (2007) "The Conceptualisation and Measurement of Mega Sport Event Legacies", *Journal of Sport & Tourism,* 12(3), 207-228.
Rombouts, R. (2013) *Legacy strategies for future Olympic host cities. Olympic-led regeneration projects.* Master Thesis. Delft: Delft University of Technology
Roche, M. (2000) *Mega-Events and Modernity: Olympics and Expos in the Growth of Global Culture*, London and New York: Routledge.
Sakai, M. (2006) "Public sector investment in tourism infrastructure" in Dwyer, L., Forsyth, P. (eds), *International handbook on the economics of tourism*, Cheltenham and Northampton: Edward Elgar.
Scout Real Estate, n.b. The Olympic city in Beijing. http://www.beijingrelocation.com/blog/the-olympic-city-in-beijing/
Smith, A. (2001) "Sporting a new image? Sport-based regeneration strategies as a means of enhancing the image of the city tourist destination", in: Gratton, C. & Henry, I. (eds.), *Sport in the City: The Role of Sport in Economic and Social Regeneration*, London and New York: Routledge, 127-148
Surborg, B., van Wynsberhe, R. and Wyly, E. (2008)"*Mapping the Olympic growth machine: transnational urbanism and the growth machine diaspora*", City, 12(3), pp. 341-355.

Van den Berg, L., Braun, E., and Otgaar, A.H.J. (2002) "*Sports and City Marketing in European Cities*", Aldershot: Ashgate.

Van Prooye, E.J. (2010) *Real estate development strategies towards a successful Olympic legacy*, 2028, master thesis, Delft University of Technology, Delft

Waitt, G. (1999) "*Playing games with Sydney: marketing Sydney for the 2000 Olympics*", Urban Studies, 36(7), pp. 1055-1077.

Walker, S., Kopec, K. and Elliott, L. (2012) Gold, Silver or Bronze? Sustainable development and regeneration – has London done enough? Jones Lang LaSalle office. http://www.bpf.org.uk/en/files/reita/reita_org_documents/analysis/jll/JLL_UK_Gold_Silver_or_Bronze_Report.pdf

Weed, M. (2008) *Olympic Tourism*, Oxford: Elsevier.

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Spontaneous Urban Agricultural Lands as Potential Green Open Space

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Key words: Urban agricultural land, Non building area, Types of agricultural land, Gwanak-gu of Seoul,

Abstract: Seoul City promotes 'Urban Agriculture' by consistently building vegetable garden parks and community vegetable gardens and inviting citizens to participate in the new movement. However, far too little attention has been paid to proper evaluations on the existing spontaneous agricultural lands, despite the fact that some agricultural lands remain neglected or public lands are being illegally used by individuals. Our research area, Gwanak-gu, is a representative case with many spontaneous agricultural lands that carry various risk factors such as that of disaster, environmental pollution, and degradation of the landscape in the city. The purpose of this study is to categorize the types and problems of agricultural lands in Gwanak-gu through a field survey. By using Geographic Information System and satellite images, field surveys and interviews, we showed the current distribution status. As a result, 45 areas of agricultural lands, mainly located around the edges of Mt. Gwanak, were found. The agricultural lands were classified into six categories: three of those, *flat Vegetable Garden, Edge Vegetable Garden and Private Weekend Farm,* are well managed, while three types, *Farm in Forest Edge, Farm in Forest, Shabby Farm,* are in poor condition. The study discusses what caused lands to be either well managed or ruined. This study has an objective to discover whether spontaneous agricultural lands have the possibility to become community open spaces.

1. BACKGROUND

1.1 Purpose of Research

Gwanak-gu (District) is located in the southern part of Seoul with an area of 29.57km^2 and 526,341 residents as of the year 2012. Seoul National University is situated in the district and Gwanak Mountain, an Urban Natural Park (632m^2), is located at its south.

Gwanak District in the 1960s was mainly a mountainous area surrounding the Gwanak Mountain and its valleys. With rapid urbanization along with the building of *Nambu Sunhwan Doro* (A road circling the southern part of Seoul) in the 1970s, relatively gentle slope areas on the mountains turned into residential areas. The residents who moved first to the

area at the time were mainly poor people and some of them used the woodlands surrounding the residential area for cultivation without proper authorization of public offices.

Presently, the park green ratio of Gwanak-gu is 46.5%, which is very high in Seoul, and yet, mountain occupies 95% of this park green. Planned park areas, designated areas for redevelopment and development restriction zones of this mountainous area are usually neglected and used illegally for personal cultivation activities.

Gwanak-gu has various types of urban agricultural lands in the neglected areas. These agricultural lands have spontaneously come into being. The purpose of the farmland varies from self-sufficient use to leisure. These unauthorized agricultural lands on the hills are causing difficulties for administrators, such landslide from forest destruction and degradation of the city landscape. In addition, since the use of fertilizers and agricultural pesticides on agricultural lands are out of control, they are also a risk factor regarding the environmental pollution of the city. On the other hand, considering the new ideas of temporary usage for the restricted areas, there are social, economic and functional values in urban farming.

The purpose of this study is to limit the risk factors of illegal cultivation on the city by finding out and categorizing the characteristics of city farmland in Gwanak-gu. Through investigation of cases and in searching for the possibility of providing green open spaces in an effective manner, an efficient management plan for the green spaces can be suggested.

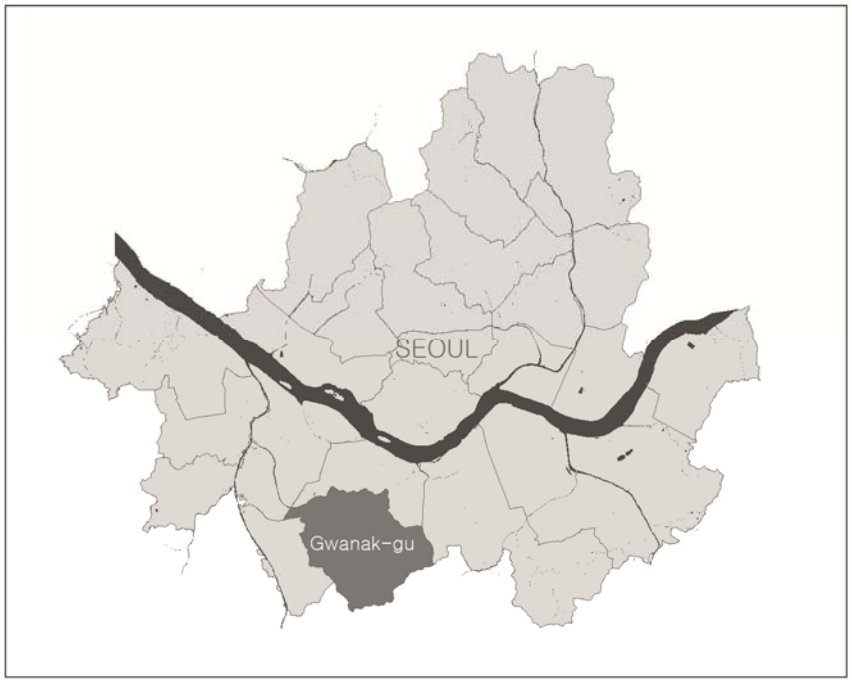

Figure 1. Location of Gwanak-gu

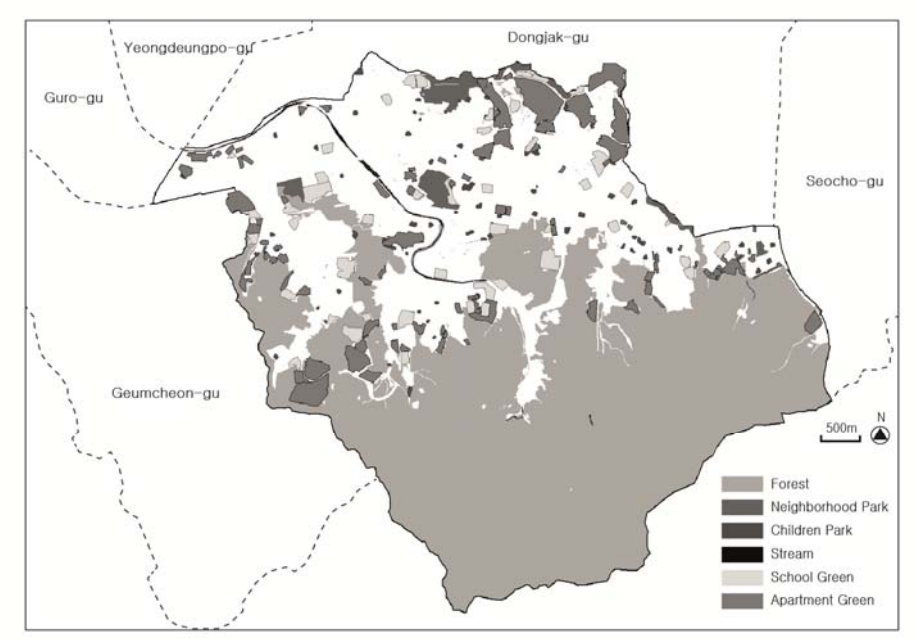

Figure 2. Green spaces in Gwanak-gu

1.2 Method of Research

This study deals with the city farms located in Gwanak-gu, with a size of over 100㎡ that can be identified by satellite. This study draws out current distribution status with GIS and collects data through field survey to identify geographical characteristics.

In the field survey, the survey sheet is filled with such items as location, type, position, accessibility, visibility and state of management. At the same time interviews with the users were also conducted. Agricultural lands were classified in consideration of sustainability and functionality for the local community. Lastly, effective management alternatives are suggested.

First, overall agricultural lands were investigated using satellite images and GIS. Agricultural lands identifiable by satellite in Gwanak-gu consisted of 45 areas, mainly located around the neighbourhood of Gwanak Mountain. The survey sheets containing the items are indicated in Table 1. After the field trip, additionally collected data such as photos, interviewed information and other significant facts were recorded in the survey sheets and land ownership status and regulation information were later procured through the forest land cadastre (register).

Table 1. Survey Items

General	Location / Area
Land Ownership	Public / Private / Etc (Mixed / Unseizable)
Placement	Mountain Plain / Mountain Slope / Valley / Nearby Residential / Urban Stream / Urban Plain
Farmland Form	Dense / Scattered / Mixed other use
Main Crop	Cabbage and Lettuce / Pepper and tomato / Bulbs / Flowers
User Behaviour	Farming / Rest / Take a walk (Number of User)
Accessibility	Easy / Normal / Hard
Visibility	Good / Normal / Bad
Natural State of Surrounding	Very good / good / normal / bad / very bad
Degree of Pollution	Very good / good / normal / bad / very bad

General	Location / Area
Management Condition	Very good / good / normal / bad / very bad

1.3 Related Studies

Lately, with urban farming standing out as a new solution to the problems of cities and a place for leisure, plenty of research has been conducted on the development and utilization of farmland in the cities.

Kim, Soo Bong (2002), Song, In Joo and Jin, Yoo Lee (2003) and Jang, Don Hun (2009) researched the expected effects of the development of urban farming in terms of ecology and public interest. Yet, their research mainly dealt with the correlation of the two words, 'city' and 'agriculture' and recognized urban farming as 'quasi-natural areas' that contribute to the cities' environmental problems. More recently, research on the concept of urban agriculture for non-commercial cultivation for leisure by city residents in the neighbouring parts of a city has been increasing (Hwang, Jung-im, et al., 2010).

Kang, Ki Nam, et al. (2007), through questionnaire survey on the usage of vegetable gardens, conducted research on farmland management methods under citizen autonomy and Park, Yong Bum (2008) tried to analyze the characteristics of accessibility, popularity and sustainability according to six categories of urban farming, residential type, farm type, school type, public welfare facilities type, park type and commercial-industrial type. Kim, Ok Jin (2009) established the concept of city farmland, conducted value analysis on Suncheon city through GIS analysis and researched a plan to utilize and manage city farmland.

Summarizing the previous studies, we see the authors mainly have focused on the positive aspect of the introduction of urban farming, while the effects that city agricultural lands under poor status had were generally overlooked. In addition, most research was conducted on large areas through GIS and questionnaire surveys with e-mails, and lacked practical surveys. Their alternatives are macroscopic and too general so it is difficult to consider them as reflecting the distinct problems of subject lands.

This study has distinctive meaning in that it classifies the subject lands into categories through detailed field investigations and analysis on the management status. Then it suggests proper alternatives to each category regarding whether to maintain or restore them.

2. STUDY RESULT

2.1 Distribution and General Conditions

Figure 3 indicates the distribution of Agricultural lands in Gwanak-gu. Table 2 is the summary of field survey results. Agricultural lands with a size over 300m^2 are 75%. Agricultural lands with a size over 300m^2 are used by over 10 people and because they occupy a large area, many are located in urban natural park or redevelopment areas. Management statuses of agricultural lands vary widely according to location and user's attitude. On the other hand, each farmland with a size less than 300 m^2 is managed by individuals or less than five people who live in the vicinity of the agricultural lands, and they are relatively well managed.

About 65% of agricultural lands are located in mountain areas, mainly on the slope of lower parts of the mountain. Agricultural lands scattered around trails or in the mountains are generally in very poor states. While agricultural lands located around residential areas are generally in good states, agricultural lands in redevelopment areas are in very poor states.

As for ownership of the lands, over 70% of agricultural lands are privately owned and large-size lands are owned by religious organizations or family clans. Many actual cultivators are not the owners of the lands. There have been some conflicts on the selling and buying illegally of cultivating rights. In most cases cultivation activities are legally prohibited as redevelopment areas or planned park areas account for all except only 11% of the general area. While most agricultural lands have good (53%) or normal (20%) accessibility. Management conditions vary such as Bad and Very Bad (34%), Normal (34%), Good and Very Good (32%).

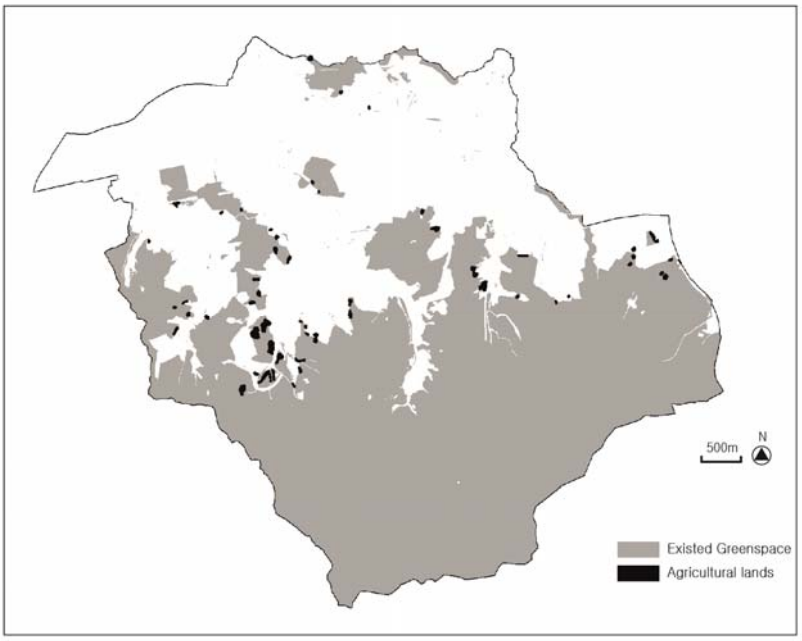

Figure 3. Distribution of agricultural lands

Table 2. General conditions of agricultural lands

Area	Under 300㎡ (25%)	301~1,000㎡ (36%)	1,001~5,000㎡ (34%)	Over 5,000㎡ (5%)
Placement	Plain in Mt. (14%)	Slope of Mt. (41%)	Nearby Valley (9%)	
	Nearby Residential (23%)	Urban Plain (9%)	Urban Stream (5%)	
Ownership	Public (12%)	Private (70%)	Undefined (18%)	
Region	Park Area (69%)	General Area (11%)	Redevelopment Area (20%)	
Agricultural lands' Form	Concentration (80%)	Scattering (9%)	Mixed Use (11%)	
Accessibility	Easy (53%)	Normal (20%)	Hard (27%)	

Area	Under 300㎡ (25%)	301~1,000㎡ (36%)	1,001~5,000㎡ (34%)		Over 5,000㎡ (5%)
Visibility	Good (41%)		Normal (27%)		Bad (32%)
Management Condition	Very Good (18%)	Good (14%)	Normal (34%)	Bad (20%)	Very Bad (14%)

2.2 Classification

45 Agricultural lands were classified into six types based on their management state and other conditions (such as location, size, and usage). Table 3 shows the classification of 45 agricultural lands. Well-managed agricultural lands have three types (Figure 4): Flat Vegetable Garden, Edge Vegetable Garden and Weekend Farm. These types are located in or near residential areas and are easily manageable flat land or lower slopes at the foot of the mountain. Land owners and cultivators live in the vicinity and these lands have characteristics of easy accessibility. Some agricultural lands are rented to cultivators in small sections.

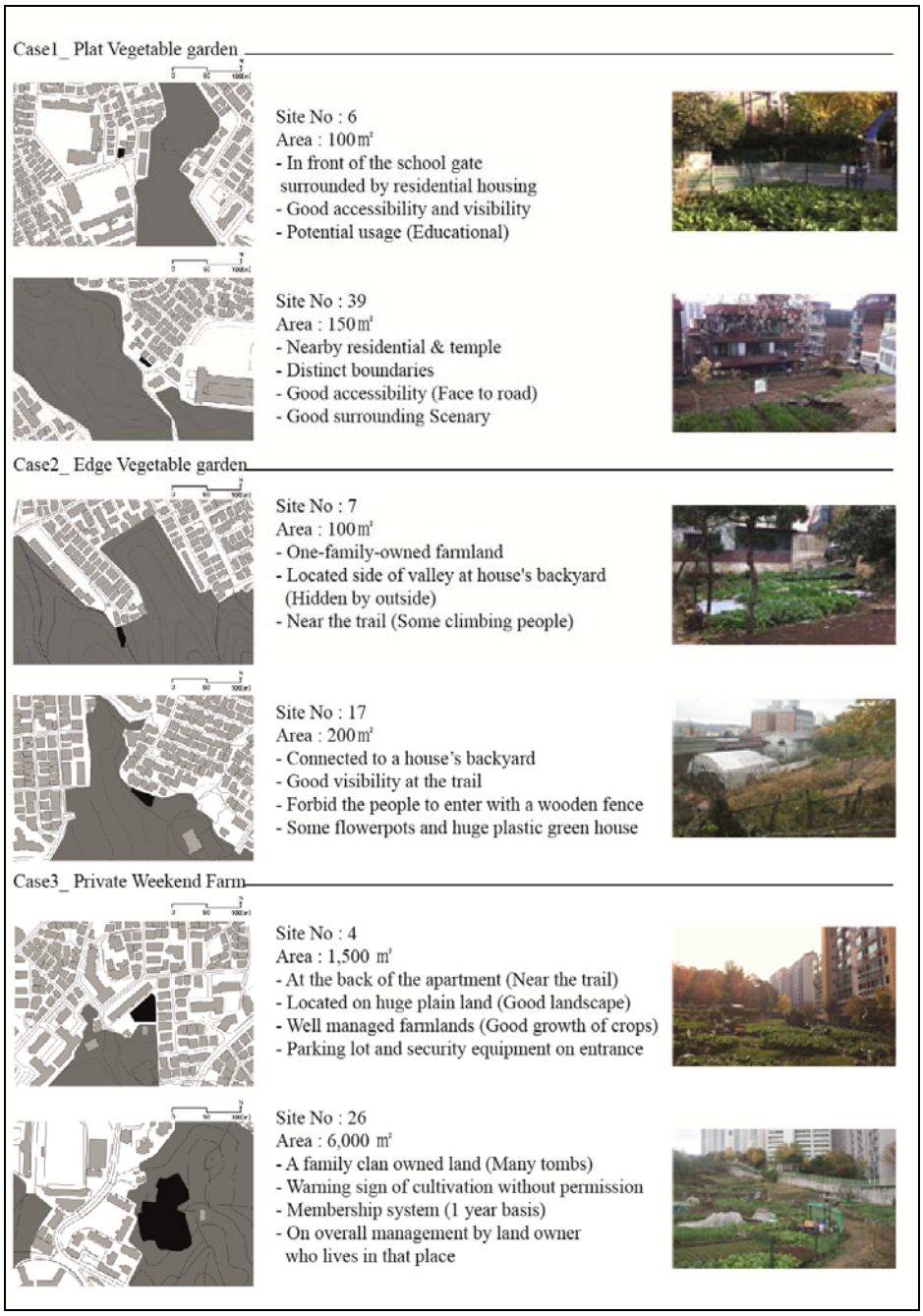

Figure 4. Well-managed Agricultural lands

2.2.1 Agricultural lands in poor condition

Agricultural lands in poor condition have three types (Figure 6): Farm in forest edge, Farm in Forest and Shabby Farm. These types are randomly-scattered agricultural lands. Most are strewn all over the forests of the mountain. Forest destruction and environmental pollution is under way in these areas.

Mostly located on the slope, they take the form of terraces and there are cut down trees and illegally thrown garbage in some places. It has poor accessibility. Sometimes they are located in shabby surrounding environments that are fairly large in scale. Management status of the

agricultural lands is not good and the degree of pollution of their surroundings is high.

Figure5. *Agricultural land in poor condition*

Table 3. Classification for 45 agricultural lands

Classification	Site No	Area (㎡)	Land ownership	Placement	Accessibility	Management
Ⅰ	1	250	Private (Park area)	Foot of Mountain (Residential)	3	5
	5	100	Private	Urban plain	3	4
	9	300	Private (Park area)	Urban plain	3	5
	11	300	Public (Park)	In Park	3	5
	34	230	Private (Park area)	Urban Plain	3	4
	39	150	Private (Park area)	Urban Plain	3	5
Ⅱ	6	100	Public	Foot of Mountain (Residential)	3	4
	7	100	Public (Park area)	Foot of Mountain (Residential)	2	4
	8	1,000	Private (Park area)	Mountain (Residential)	3	5
	14	800	Private (Park area)	Foot of Mountain (Residential)	3	4
Ⅲ	4	1,500	Private (Park area)	Urban plain	3	5
	26	6,000	Private (Park area)	Mountain	3	4
	33	1,700	Private (Park area)	Foot of mountain (Residential)	3	5
	45	1,500	Private (Redevelopment)	Foot of mountain (Residential)	1	4
Ⅳ	17	200	Private	Foot of Mountain (Residential)	3	2
	19	1,000	Private	Foot of Mountain (Residential)	3	3
	20	1,300	Private (Park area)	Foot of Mountain (Residential)	2	1
	21	1,000	Private (Redevelopment)	Foot of Mountain (Residential)	3	3
	22	100	Private (Redevelopment)	Foot of Mountain	3	3
	24	1,500	Private (Redevelopment)	Foot of Mountain (Residential)	2	2
	27	300	Private (Park area)	Foot of Mountain (Residential)	3	2
	30	670	Private (Park area)	Foot of mountain (Residential)	2	3
	31	1,400	Private (Park area)	Foot of mountain (Residential)	2	1
	32	1,000	Private (Park area)	Foot of mountain (Residential)	3	1
	36	800	Private (Park area)	Foot of mountain (Residential)	1	3
	37	170	Private (Park area)	Foot of mountain (Residential)	3	3
	38	220	Private	Foot of mountain (Residential)	3	3
	41	900	Private (Redevelopment)	Foot of mountain (Residential)	2	1
	43	350	Private (Redevelopment)	Foot of mountain (Residential)	1	1
	44	1,050	Private (Redevelopment)	Foot of mountain (Residential)	1	1
Ⅴ	3	1,500	Private (Park area)	Mountain	3	3
	12	1,000	Public (Park area)	Mountain	3	3
	13	400	Private (Park area)	Mountain	2	2
	16	125	Private (Park area)	Mountain	1	3
	18	1,500	Private	Mountain	1	1
	35	950	Private (Park area)	Mountain	1	2
	40	250	Private (Park area)	Mountain	1	2
Ⅵ	2	2,500	Private (Park area)	Mountain	1	3
	10	2,000	Private (Park area)	Foot of Mountain	2	2
	23	5,000	Private (Park area)	Mountain	2	2
	25	4,000	Private (Redevelopment)	Foot of Mountain	1	1
	28	2,300	Private (Redevelopment)	Foot of Mountain	1	3
	29	3,000	Private (Park area)	Mountain	1	2
	42	4,500	Private (Redevelopment)	Foot of mountain (Residential)	3	2

- Accessibility : 3(easy).2(normal),1(hard) - Management : 5(very good),4(good),3(normal),2(bad),1(very bad)

3. CONCLUSION

Recently, Seoul City has come to have grown an interest in urban agriculture. Users of the urban farmland try to get satisfaction and earn actual benefits through their own experiences and management. Governments are strongly encouraging this urban agriculture as a means to use remnant green spaces and reduce costs for building park facilities with unexecuted parks.

However, the circumstances of Gwanak-gu are a little different. There are lots of spontaneous agricultural lands that can be used in daily lives. So far, these agricultural lands have only been considered as targets to be restricted as illegal activities. Although local governments of Seoul City have been building vegetable garden parks and community vegetable gardens these days, evaluations on the typical agricultural lands have not been conducted and their availability has been overlooked.

This study is conducted basic research to evaluate current status and consider availability of agricultural lands in Gwanak-gu. While we found lots of agricultural lands having environmental or management problems, we also found some cases being utilized as city green spaces in good condition.

For the first and second types, they are relatively well managed. They have merits as small scale agricultural lands that can be easily managed. For the third type, they can possibly be used as an alternative measure for utilizing lands that belong to restricted areas. In this case, they should be managed by responsible people in charge and in accordance with management regulations. Support by governments such as subsidies and community spaces or public service programs are needed.

The fourth and fifth types have poor landscapes. Degradation of forests is very severe due to their locations in the deep mountain and lack of civic awareness for the public environment. Moreover, areas of the agricultural lands are large and they are scattered around, it is difficult to manage or restore them. Efforts are needed to be made to restrict the spread of illegal agricultural lands through periodical monitoring, and to gradually restore forests. Especially the sixth type has severe problems, both environmentally and ecologically, because of its large areas and ruined living conditions. Moreover, most residents of these areas are low-income class who use agricultural lands as self-sufficiency tools. The solution should not be just to restrict use. They can be used as a food bank for the low-income class for the short term, and in the establishing of a long-term plan, they could be used for parks or community vegetable gardens.

This study discovers that spontaneous agricultural lands have the possibility to be community open space. In order to develop a diversity of patterns of urban green space in Gwanak-gu, the current agricultural lands are important space planning elements. They need to be re-evaluated and some potential lands should be strategically managed. The agricultural lands in Gwanak-gu have the potential to be distinctive green spaces. Well-arranged farming activities would represent a healthy community. It is necessary to grasp the demands of users and induce them to adjacent legalized agricultural lands.

REFERENCES

Hwang, Jung-im., et al. (2010).” Segmentation and Characteristic Analysis of Urban Farmers Behavior”. *The Korean Journal of Community Living Schience.* 21(4), 619-631.

Jang, Dong-hun. (2009). “Policy Implication for Improving Urban Agriculture”, *Korean Industrial Economic Association*, 22(2), 979-994.

Kang, Ki-nam., et.al. (2007). “Revitalization Planning of Urban Farming Based on Vegetable Gardens”, *Institute of Construction Technology@ CBNU*, 26(1), 167-176.

Kim, Ok-jin, (2009). A Study on the Characteristics and Application of the Urban Farmland. Master theses, Suncheon University

Kim, Su-bong., et.al. (2002), “Environmental Friendly City and City Farming”, *Journal of Environmental Science.*

Park, Yong-bum., et.al. (2008). A Study on the Activation of the Urban Agriculture for the Living Agriculture. Rural Development Administration.

Song, In-joo. Jin, Yu-ri. (2003).” A Model of Enhancing Biodiversity through Analysis of Landscape Ecology in Seoul Cultivated Area”, *Korean Society of Environment and Ecology*, 16(3), 249-260.

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The Perception of Land Rights Impacts due to the Abolition of a Native Title (NT): Evidence from the Bakun Hydroelectric Project (BHP) and the Kelau Dam Project (KDP) in Malaysia

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Key words: Indigenous People, Native Title, Institution and Credibility

Abstract: What is the best way in designing a credible institution? Can one be designed using a top approach through mass social engineering where rules mainly come from the top level? Or designed from the bottom level where the rules of the institution are taken from the local level? Do the socio-economic contexts of the local people need to be considered in designing policies? These are the main empirical and theoretical questions that this paper intends to answer. This paper is a study of the land rights impact on two Indigenous groups in Malaysia, namely the Orang Ulu and the Orang Asli. Both Indigenous groups have been affected by the Bakun Hydro Electric Project (BHP) in Sarawak and the Kelau Dam Project (KDP) in Pahang. By using land rights as a subject of exploration, this paper demonstrates how the development of resettlement schemes carried out in Malaysia have failed in giving credibility to the institution. In this research study, land rights impacts are part of the impacts caused by the development project which has involved Indigenous people who have strongly relied on land as a source of their livelihood. This research study has employed a mixed method study which involves various data generation instruments, namely survey, interview, observation as well as content analyses. This research study has found that the negative impacts of the loss of land rights have altered the ways Indigenous people governed their land including how they own, use and enforce the land system. It was obvious that land rights are a fundamental feature in creating a credible institution in the context of Indigenous people in Malaysia. This paper hopes to illustrate the indigenous peoples' perception on the loss of their land rights as well as to enrich the debates on the credibility of the institution.

1. INTRODUCTION

Together with the state laws, customary law is a system that has governed the Indigenous peoples' lives in Malaysia, including land matters. The Native Title (NT) has been proven to be a success in maintaining and managing their local social stability and ways of life. As a multi-ethnic country, Malaysia has practices in the legal system which recognise custom as one of the sources of the law system. It is clearly stipulated under Article 160(2) of the Federal Constitution (GOM, 2013). This is also clearly evident

through the establishment of the 'syariah' or Islamic court system as well as the native court (The native court established only for the Indigenous people in the states of Sabah and Sarawak). At the national level, albeit a Malaysian judicial recognition of the NT which has evidently been seen as an Indigenous victory (see a few leading cases, for example Sagong Tasi; Adong bin Kuwau and Nor Ngawai (HRCM, 2009)), the reality paints a different picture. There is an increasing number of encroaching activities of land seizures by the state, as well as its corporations, into lands belonging to the Indigenous people. These cases have been reported in the local media (see protest by Indigenous people, Baram Dam, northern Sarawak, Malaysia by Stephen, T., (2014)). To these poor Indigenous people, the illegal encroachments, which have always been justified by the state in the name of development, appeared to have obtained the green light from the state authority. As such, it is difficult to deny the public perception that the government has deliberately been reluctant to accord the same legal tenure land rights to the Indigenous people as has been done for the Malay Reservation Land (MRL) (HRCM, 2010). However, such discussion is beyond the scope of this paper. Instead, this paper attempts to demonstrate how the Indigenous groups lose their land rights due to these two dam development projects where they have been forced to resettle under new resettlement schemes. In relation to this, for example, at the Resettlement Schemes of Batang Air in Sarawak and the Resettlement Schemes of the Semenyih Dam, the displaced Indigenous people have pointed out that the socio-economic impacts from the loss of their NT has consequently resulted in a deteriorating quality of Indigenous life itself (Ibrahim, 2010; Carol-Yong, 2008; HRCM, 2007; Banerjee, and Bojsen, 2005; Nicholas, 2000, 1997).

These entire scenarios have led to the issue of crafting a credible institution. The question is whether the state is able to design a credible institution through social engineering, such as through resettlement schemes where the customary institutions would be abolished and be replaced with a new institution in a land tenure system. To explore this issue, this paper is giving serious attention to the land rights impacts that have occurred due to the two development projects, namely the Bakun Hydroelectric Project (BHP) in Sarawak and the Kelau Dam Project (KDP), the Interstate Raw Water Transfer Project from Pahang to Selangor. Both projects have badly affected the Indigenous people of Malaysia namely the Orang Ulu in Sarawak and the Orang Asli of the Malay Peninsula. For the Orang Ulu, they have been resettled from their original settlements (villages) of Ulu Balui to the Resettlement Scheme of Sungai Asap, Bintulu Sarawak (RSSA). Meanwhile, the Orang Asli have been moved out from Sungai Temir Village to the Resettlement Scheme of Lurah Bilut, Raub Pahang (RSLB).

Following the introduction, this paper is structured into three parts. The first part mainly touches on the concepts and terms used in this paper, namely institution, land rights, property rights and credibility. The second part introduces the concept of the statutory land rights in Malaysia, the Native Title and its outlook, as well as a brief discussion on the state's position regarding the NT. The third section is the analysis the Indigenous peoples' perception on the land rights impacts is discussed.

2. EXAMINING INSTITUTION, CREDIBILITY, LAND RIGHTS, PROPERTY RIGHTS AND NATIVE TITLE

In order to facilitate clear understanding, it is useful to provide some theoretical background on the main concepts applied in this paper. It is clear that there is no single term that can represent the definition of 'institution'. It is a multifaceted term and the concept consequently varies between scholars. However, in a simplified approach and as asserted by Ho (2005b), 'institution' can be defined in two different ways: 1) from the behavioural perspective, institution is the rules of the game in society. This definition has been employed by others, for example, Knight (1992) who has defined institution as a social set of rules that structure social interactions in a particular way. The same line of definition was given by North (1990) who has viewed institution as 'the rules of the game in a society or, more formally, the humanly devised constraints that shape human interaction', and; 2) on the flipside, Ho (2005a) has viewed 'institution' as the "legal and state administrative sphere or institutional arrangement which is embodied in promulgated policies, formal laws and customary rules well as the state administration". For the context of this paper, the straight forward definition of 'institution' which is the *'social rules'* is adopted here. As such this paper has regarded the societal and economic phenomena of land rights that have been affected by and at the same time are affecting the institution in Malaysia.

According to Knight (1992), institution is the human interaction agent's decision and action of structures through formal and informal rules. Custom or 'adat' is part of the informal rules, therefore, custom in this regard is the set of rules which have regulated activities and maintained order and social relationships. In relation to land rights, custom would define the individual's right to the land. It also dictates the law of inheritance and/or transferability of land from the pioneering ancestor to the present generation (Hong, 1987 ; Ngidang, 2005).

What is then the relation between land rights and institutional credibility? The current debate on the institutional change has suggested that any institution designed must possess the element of acceptance or trust (the credibility) to the system as a key determinant of policy success. Only by having the credibility, the institution would bring about a positive effect as it intends to do. Therefore, establishing a credible institution means that it is able to rally social and political support for the project or policy. (Ho, 2006; Ho, 2005a; Ho, 2005b). To put it in different words, the institution without credibility would lead to low credibility, or even a negative effect on the action of the social and political actors. Therefore, the institution must be seen to acquire credibility in order for the institution rules to be supported by the local and social actors.

As development projects require land, they inevitably involve the land rights issue. The United Nations (UN) – Habitat (2012) has defined land rights in four ways: 1) the allocation of rights in land; 2) the delimitation of boundaries of parcels for which the rights are allocated; 3) the transfer from one party to another through sale, lease, loan, gift or inheritance, and; 4) the adjudication of doubts and disputes regarding rights and parcel boundaries.

For simplicity, however, this paper regards land rights as rights to use, rights to control and rights to transfer.

Relating to the land rights concept, this paper takes the stand that the concept of land rights relates to the concept of property rights, where property rights itself involves rules (formal and informal) that designate the appropriate use, control and right to transfer (Knight, 1992). Other scholars, on the other hand, have suggested that property rights are a concept of rights and duties with settings and circumstances (including objects) capable of producing income. It is a social relations concept in the general sense (Ho, 2005a; Weimer, 1997). This paper follows the concept of property rights as advocated by Haber, S., Razo, A. and Maurer, N. (2003) who have provided two perspectives in approaching land rights issues: 1) firstly, from the holder's view where it touches on three main rights: i) the rights to use an asset; ii) the rights to use the asset and to earn income and contract regarding the asset; iii) the rights to alienate, sell or transfer the asset, and 2) secondly, on the state's view, the rights are related to two rights: i) to specify property rights and; ii) to enforce them.

Another term used in this paper is Native Title (NT). It is an umbrella term which covers the concept of the Native Customary Rights (NCR) over land for the Orang Ulu in Sarawak and Sabah. It also includes the Aboriginal Reserves/Areas for the Orang Asli in the Malay Peninsula. NCR is a term in Sarawak and Sabah which describes the interests of the natives in their traditional land. As asserted by HRCM (2009), the court in Malaysia has regarded both of these Indigenous peoples' customary rights as synonymous. Therefore, this paper refers to both customary titles as the NT. The NT is a generic term that relates to rights held by the Indigenous people of Malaysia on land which can be assessed on three broad aspects: 1) rights to own; 2) rights to use land, and; 3) rights to enforce and transfer. Besides conceptualising the NT in terms of ownership, this paper acknowledges that the NT also relates to the concept of the sovereignty of the indigenous people in managing and controlling its land and natural resources. This conceptualisation was actually in line with the self-determination principle as advocated by the United Nations (2007). For example, at the village level, the customary institution which governs the Orang Ulu affairs including regulating and monitoring land rights has comprised of the 'Pemanchar', 'Penghulu', 'Tuai Rumah' and the Elderly Council. Likewise the Batin, Ministers and the Custom Council on the Malay Peninsula can be in charge in the case for the Orang Asli. It is true that the powers of this traditional institution at the resettlement schemes have been diminished to some extent, if not totally abolished, through the introduction of the new administrative state structure, namely the Land and District Office, which consequently has changed the NT rights from the communal titles to the individual land titles. However, such deeper enquiry on the sovereignty concept is beyond the intention of this paper.

3. STATUTORY LAND RIGHTS IN MALAYSIA

This section discusses the statutory land rights in Malaysia. It aims to demonstrate the institution of the NT and land rights as have been accorded to the Indigenous people prior to their resettlement. Only by having

discussion on the previous system, then will one be able to identify the reasons as to why Indigenous people were found to be dissatisfied with the new resettlement schemes.

As clearly stipulated in Article 160 in the Malaysian Federal constitution, it has asserted that law in Malaysia also constitutes *'custom and usage having the force of law'*. The Constitution also conferred to the state jurisdiction on custom (GOM, 2013). The position of custom over land in the Malaysian land laws and policies is further strengthened through the existence of Section 4 (1) of the National Land Code 1965 (NLC) which states that *'if there's a conflict between the NLC and any customary legislation, the customary provision prevails'* (GOM, 2010).

3.1 Native Title (NT)

Under the NT system, communal rights are inherited and retained by the Indigenous community and passed down to their future generations. The land rights also include the right to cultivate the cleared farming land. To those who have first cleared the land, they would have the priority with respect to the rights of the land. He/she may pass down the land to his/her heirs. However, as the name suggests, the NT cannot be transferred, leased, transmitted or sold outside to non-indigenous owners. The restriction is made based on the interpretation of the definition of 'indigenous' itself - be it the Orang Ulu or the Orang Asli where only Indigenous people who have been accorded by their community with the Indigenous status can have the right to acquire the NT (Fong, 2011). The reason behind it is to protect the land from falling to other ethnic groups (Buang, 2010; Fong, 2011). In addition, it also cannot be transferred from one category of land use to another, for example, from agricultural land use/activity to industrial use.

Since the NT is a communal title, the land technically falls under state land, unless the land has been surveyed and granted a title. In terms of value, the NT would get a lower value as compared to the individual land (Fong, 2011). In terms of the governance of the land, both these Indigenous groups have their own systems in governing the land. In Sarawak, the four aristocrat leaders (or Maren Uma) of the Orang Ulu are the 'Temunggung', 'Pemanchar', 'Penghulu' and 'Tuai Rumah' and the elderly/village council are involved in making any decisions regarding land matters. They are the entrusted parties to manage the NT land system at the longhouse level. Meanwhile in the Malay Peninsula, the Batin (headman) and two of its Ministers, as well as the Customary Council, are responsible to govern land matters for the Orang Asli at the village level.

The chief tasks of the local Indigenous institution are monitoring and enforcing the rules on the using, controlling and transferring of the land rights within the communities. In addition, they also have the power to allocate land to individual households in the area and to settle disputes on land matters, for example on boundary claims. The power accorded to them is quite wide and powerful (interview with Penghulu Saging, at RSSA on 30 October 2012; interview with Pemanchar Umek at RSSA on 29 October 2012; interview with Cham, a Batin at RSLB on 24 November 2012). In the case of the Orang Ulu, if conflicts on the land rights have occurred, the disputants can bring their disputes to the native court. The native court operates from the village level to the district level (interview with Sindang,

an officer in the Customary Council of Sarawak (MAIS) on 9 November 2012). However, to the Orang Asli in the Malay Peninsula, even prior to the resettlement at the RSLB, there is no existence of the Orang Asli native court system whatsoever for them (Nicholas, 2010). The community has to depend on the civil court system to settle their land rights problems. However, the power on land matters was found by researchers to still exist for the Batin and the Ministers during field works in 2012. Unfortunately, as previously mentioned, the local Indigenous peoples' powers in managing their local affairs in order to maintain their communal forms of ownership, and their right to the use and enjoyment of their land have been diminished due to the relocation exercise and the setting up of new administrative institutions such as the District and Land office by the state. For example, the previous power conferred to the Tuai Rumah or Batin in managing land disputes at the village level, including the determination of the size, area and location have now been completely taken over by the District and Land Office.

3.2 The Orang Ulu Land Rights

This section briefly elaborates the state's position on the NT of the Orang Ulu in Sarawak. According to HRCM (2009), the recognition of the NCR position in Sarawak can be traced to Section 2 of the Sarawak Land Code 1958 (SLC) which has defined the Native Customary Land (NCL) as:

> *'Land in which native customary rights, whether communal or otherwise, has lawfully been created prior to the 1st day of January 1958 and still subsist as such.*

It further details:

1. *That it states a cut-off point by which a native has to prove the creation of NCR; i.e. before 1st January 1958. (If a native creates the NCR over land after 1958, the native must be provided with a permit under section 10, as provided for under Section 5 of the Code).*
2. *That the said NCR Land can be created and therefore claimed by a community or an individual.*
3. *That it subsists as such until today.*

In principle, the SLC has stated that prior to 1958, the indigene must demonstrate to have carried out certain lawful methods of activities in order to establish the NCR, where Section 5(2) Part 11 states the following methods (HRCM, 2009):

1. *The felling of virgin jungle and the occupation of the land thereby cleared;*
2. *The planting of land with fruit trees*
3. *The occupation or cultivation of land*
4. *The use of land for burial ground or shrine*
5. *The use of land of any class for rights of way*
6. *By any lawful method (which was deleted in 2000)*

While some forms of recognition on the NCR are given by the state, it has, however, come with limitations as the above methods are only applicable in the interior areas and only if a permit was obtained under Section 10 from the Land and District Office. Anyone attempting to acquire

customary rights without permission is deemed to have unlawful occupation of the State land (Cramb, 2007). To further curtail land rights in Sarawak, it was done through the amendment of the Land Code (amendment) Bill 2000, when the Sarawak State Assembly on 9 May 2000 nullified the additional provision (Section 5(2)) which previously has included *'any lawful methods' as a way to establish a claim on the NCR'*. This time this method was appealed by the state (HRCM, 2007).

Another hot dispute on the NCR relates to customary claims where Indigenous claims of their land rights go beyond the *'temuda'*. It includes their communal lands or territorial domain locally referred to as *'menua'* or '*pemakai menua'* and the 'reserved virgin forests' *or 'pulau galau/pulau' or 'Tuan Long'* in the Orang Ulu terms. The Pulau is an area where a communal preserved or reserved area is specifically allocated to meet the domestic needs of the Indigenous people (BRIMAS, 2005). The community would enforce rules with respect to the collective rights of the *'pulau'* consumer products such as rattan, timber, fruit trees and so on. According to Bian (2000), the unrecognised 'temuda' status also relates to the issue of compensation. This is because the time-frame definition adopted by the Sarawak Government is very narrow. It is only applicable as *'temuda'* when it has been cultivated or farmed before 1st January 1958.

3.3 The Orang Asli Land Rights

Like the Orang Ulu in Sarawak, the Pahang Orang Asli's land category is divided into three categories, namely: 1) active/productive, where land is being cultivated; 2) inactive land (or 'rang' land), where land is temporarily left in order to make it regain its fertility; 3) Roaming/ foraging/game area, where products for communal use can be found such as medicine, rattan, herbs, wood and house materials. However, it is important to note that unlike the Orang Ulu, these land categories cannot be considered fully established by the Orang Asli themselves since the majority of them are now practicing cash crops (Interview with Yusri, a committee member of the Orang Asli Network Villages (JAKOSAM) cum deputy 3 of the Association of Orang Asli Peninsular Malaysia (JOAS) on 3 December 2012). In the Orang Asli's ancestral territory there is the communal land where activities like hunting, fishing, gathering and cultivation are carried out. However, individual land rights exist where there are fruit trees and swidden which are cleared and are being used by individual members of the group (Hong, 1987).

It is a fact that the Indigenous customs in relation to land have been incorporated into the state law through the establishment of the Aboriginal Peoples Act 1953 (APA). The APA recognises the creation of the Orang Asli Reserve Area. It empowers the Federal Minister concerned to declare, through publication in the gazette, certain plots of land to be protected as the Indigenous reserves and areas. However, the glaring deficiency of the APA is that Section 8 (2) (c) does not treat the Orang Asli as the legal owners of the reserves, instead, the best recognition that could be obtained by the Orang Asli is the *'tenant-at will'* (GOM, 1997; Hamid and Nor Ashikin, 2011). While Section 12 of the APA recognises that the compensation 'shall' and must be paid by the government for the acquisition of the Orang Asli's crops. But the unfortunate fact is that Section 11 of the same Act, does not mandate government's compensation for the acquisition of their reserves. In terms of extinguishment, Sections 6 (3) and 7 (3) of the same Act allows

the Federal Minister to revoke the whole or part of the declaration of the Aboriginal area and the Aboriginal reserve.

The problem concerning land rights of the Orang Asli on the Malay Peninsula is also complicated by the issue of the federal-state relationship. Since Malaysia is a Federation, Article 8 (5) (c) of the Federal Constitution has stipulated that the power and relationship between the federation and the state on land and the Orang Asli matters are under the federal jurisdiction which read as below:

> *"… for the protection, well-being or advancement of the aboriginal peoples of the Malay Peninsula (including the reservation of land) or the reservation to aborigines of a reasonable proportion of suitable positions in the public service" (GOM, 2010).*

On the one hand, land matters in general are under the purview of the respective state which can then lead to serious implications for the Orang Asli's land. Land matters have become bureaucratic and tend to involve a long process. In this sense, the constitutional shortfall has tied up their hands with regard to the land titling process (Interview with Abdul- Razak, A., an officer at the DOA on 9 July 2012; Nicholas, 2010). In addition, despite being a leading agency in the Orang Asli affairs, the Department of Orang Asli (DOA) has also been accused of being ineffective in preventing the territorial dispossession of the Orang Asli lands. As such, the current policies and laws are deemed as deliberate denials of the Orang Asli's recognition of their rights (CAP, 2000).

4. RESEARCH METHODOLOGY IN SURVEY DATA COLLECTION

This research study adopts a mixed methods study through a variety of data generation instruments which include a survey of both the Orang Ulu at the RSSA, Sarawak and the Orang Asli at the RSLB, Pahang. Besides that, interviews were also carried out with the selected government officers, dam project developers and Non-Governmental Organisations (NGOs). To strengthen the analysis, participatory observations in both of the resettlement schemes as well as reviews of the existing policies and guidelines on the Indigenous people and land rights were also done.

This research study involved two groups: 1) two Indigenous groups, the Orang Ulu and the Orang Asli; 2) two projects in two different states/regions, the BDP in Sarawak and the KDP in Pahang, and; 3) two indigenous land policies, the SLC and APA. As asserted by Yin (2009) through two case studies, the researcher would be able to carry out a comparison study of similar results (literal replication) or contrasting result (a theoretical replication). However, the main intention of this research was that by using the multiple-case study, it would blunt any criticisms and scepticisms about the findings of this study. A multiple-case study also could produce an even stronger effect when compared to a single case study (Yin, 2009). In simple words, the two groupings would provide a solid reflection of the land rights battle in Malaysia. In this sense, this paper posits it would not be necessary to separate the analysis results based on the Indigenous groups because the

main intention of this research paper is to highlight the pattern of respondents' perceptions on land rights in general.

In terms of field work, the first preliminary data collection for the BDP was done in May 2011. The survey first involved semi-structured interviews and participatory observations. Later, the second round of site visits was carried out from September until November 2012. This time, the questionnaire survey was carried out with 220 respondents from ten longhouses which comprised five different sub-groups, namely the Kenyah, Kayan, Lahanan, Ukit and Penan of Sarawak. Prior to that, to test the validity of the research questionnaire, a pilot survey on 15 households of the RSSA in Sarawak was carried out, a week before the actual survey.

In view of the fact that the KDP is located in Raub Pahang, which is situated near to Kuala Lumpur, preliminary site visits to the KDP had been done three times between May 2011 and July 2012. The pilot survey on seven households had also been commenced before the final questionnaire survey of 37 respondents of the Orang Asli was done. The actual survey and interviews were carried out in the second and third weeks of November 2012. Table 1 below shows the population and sampling profile in both the resettlement schemes.

Table 1. Population and sampling profile in both the resettlement schemes

Population profile	Orang Ulu in Bakun Sarawak	Orang Asli in Kelau Pahang
Number of population	11,616*	330**
Number of head of family	2219	137
Number of samples	220	37
Number of interviewees (local communities leaders only)	16	5

Sources: *Sub-District of Sungai Asap, 2011; **DOS, 2011.

As shown in Table 1, the total population of the Indigenous residents of the Orang Ulu in the RSSA was 11,616 and 330 of the Orang Asli in the RSLB respectively. Meanwhile, in terms of the number of heads of family, there were 2219 of the Orang Ulu at RSSA in Sarawak, while there were only 137 for the Orang Asli at RSLB in Pahang. The number of samples chosen were 257, of which 220 were from the Orang Ulu, Sarawak, and 37 were from the Orang Asli Pahang. In this case, this study has surveyed about 10.0 percent of the total heads of family of the longhouses at the RSSA and about 27.0 percent from the heads of family at the RSLB. The percentage of Orang Asli surveyed was a bit higher as compared to the Orang Ulu. This was due to the fact that the former population was small than the latter. In terms of sampling method, the stratified method was chosen because it could give a high degree of representation (Newman, 2011; Babbie, 2010). Moreover, representation in this research means that the number of heads of family was based on the percentage of the number of households in each longhouse or houses that was equally selected. All questionnaires and interviews were done using the face-to-face interview method.

In this study, the head of family was referred to as the head of the household, either male or female, as long as he/she claimed to be the head of the family. However, from the researcher's observation, most of the respondents were male. This was likely because in the Indigenous household

structure decision making was normally made by the males (Carol-Yong，2008). The reason for choosing only the heads of family was because the survey questions were answered better by the heads of family who would normally hold more authority in answering the survey questions, for instance, questions on household income level, the family's perception on land rights, et cetera. In this sense, it has allowed for only one view from one household, which was selected as representative of each household.

In order to complement the quantitative part, the semi-structured interviews were also carried out with the local community leaders at the RSSA and the RSLB. 16 of the local village leaders (aristocrat or *'Maren Uma'*) of the Orang Ulu and five with the Village Development and Security Committee (VDSC) members of the Orang Asli were able to be interviewed.

5. STUDY AREAS: PEOPLE AND CONTEXT

Malaysia is a federation of 13 states which is divided into two regions namely the Malay Peninsula, previously known as Malaya, and East Malaysia which consists of the states of Sabah and Sarawak (Figure 1). The Malay Peninsula covers 132,339 square kilometres while East Malaysia with the states of Sabah and Sarawak covers an area of 73,631 square kilometres.

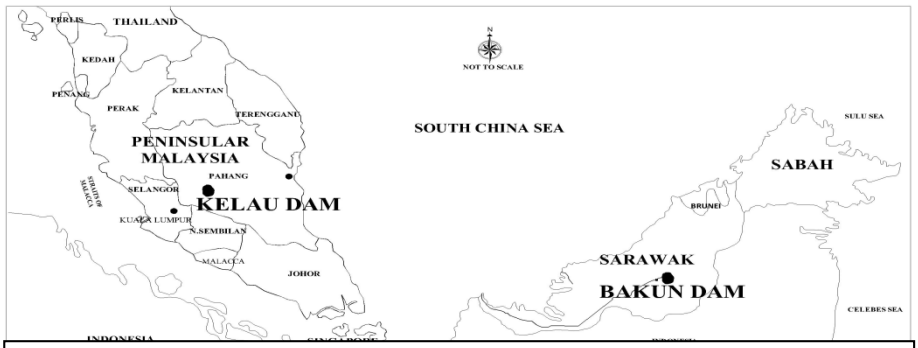

*Figure 1***.** Project locations for the Bakun Hydroelectric Project (BHP) and Kelau Dam Project (KDP) of Malaysia.
Source: Drawn by Nor-Hisham, M-S, 2014

In this study, the Indigenous' land rights were affected by the dam projects, namely the BHP and KDP. The BHP is one of Sarawak's dam projects which was constructed to generate electricity for Sarawak and the Malay Peninsula. It also aims to supply electricity to neighbouring countries such as Brunei, Kalimantan Indonesia and the Southern Philippines. The BHP is situated under the Belaga District which is one of the third districts in the Kapit Division in Sarawak. Belaga is bordered by the Central Kalimantan Region of Indonesia to the south and Brunei to the north. Topographically the Bakun area is a hilly and predominantly forested region. On the other hand, KDP is located in the Bentong and Raub Districts. The project is designed to provide raw water from the Pahang State to the Selangor State including the Federal Territories of Kuala Lumpur and Putrajaya.

Both of these projects have directly affected the Orang Ulu and the Orang Asli in the respective states. The total population of the Orang Ulu in 2011

was roughly around 84,775, while the Orang Asli in 2011 were 198,197 (DOS, 2011; DOA, 2012). Prior to the resettlements, both of these Indigenous groups were found to be largely engaged in the agriculture and forest based sectors which include farming, hunting, fishing, gathering as well as small trading and retailing (State Planning Unit of Sarawak (SPU), 1996; DOS, 2011).

5.1 Socio-economic Aspects of the Orang Ulu and the Orang Asli in General

While the poverty rate in Malaysia has been significantly reduced in general, both the Indigenous groups are characterised by a high incidence of poverty. Approximately 15.0 percent of the Orang Ulu and 31.6 percent of the Orang Asli are still considered poor and hard-core poor (DOA, 2012; Implementation Coordination Unit (ICU), 2012). As shown in Table 2, in the sub-district of Sungai Asap alone there are 4,082 Orang Ulu and there are 36 heads of households of the Orang Asli receiving aid from the Department of Welfare (DOW).

Table 2. Socio-economic aspects of the study areas

Aspects	Orang Ulu	Orang Asli
Employment	Agriculture and forest based activities	Agriculture and forest based activities
Poverty Rate	In 2012, 4,082 households received aid from the DOW*	In 2012, 36 received aid from the DOW
Active labour Age Structure	16-30 (32.3%) from 15, 397	16-30 years- 41.6%

Sources: Department of Statistics (DOS), 2012; ICU, 2012; DOA, 2012.

*Including the Sub-District of Sungai Asap which includes outsiders other than the Orang Ulu (beyond the actual population of the RSSA).

In terms of employment opportunities, based on the level of education in the sub-district of Sungai Asap Sarawak, 1,293 of the Orang Ulu have received education at Lower Secondary School. Out of these figures, only 66 people, or 5.1 percent, have completed their tertiary education (DOS, 2012). On the other hand, by using the drop-out rate in 2011 as an indication, the Orang Asli have recorded a high number of drop-outs. 50 percent of their children have failed to complete primary school (DOA, 2012). In terms of the age structure, both Indigenous populations were in the active age group for the labour force. For the Orang Ulu in Sarawak, out of 15, 397, there were 32.3 percent of them in the 16 to 30 year old bracket. There was an almost similar pattern recorded for the Orang Asli in Sungai Temir Pahang where 41.6 percent of them were in the age group of 16 to 30 years old.

6. RESPONDENTS' PERCEPTION OF THE NATIVE TITLE (NT)

This section discusses land rights impacts at the two resettlement schemes where survey respondents and interviews were carried out. In sub-section 6.1, this paper provides the socio-economic profile of indigenous respondents at the both the RSSA and RSLB. Section 6.2 then gives the perception of land rights impacts due to the abolition of the NT.

It is important to re-emphasize at this stage that the data presented here are the combined results of these two Indigenous groups. As previously mentioned, the reason for employing such an approach was because this papers main intention is to understand the general patterns of the respondents' perception on the land rights in general, rather than to make a comparison between these two Indigenous groups.

6.1 Respondents' profile

As shown in Table 3, there are three variables concerning the respondents' profile, namely education, occupation and monthly income. It was found that there were as high as 44.1 percent and 32.4 percent of the Orang Ulu and the Orang Asli in the study areas who had no formal education at all. Meanwhile nearly a quarter or 24.5 percent of the Orang Ulu and 29.7 percent of the Orang Asli, 26.4 percent on average, have completed their education at the Junior High School level. At the high school level, the majority of the Orang Asli (32.4%) have a better educational level compared to the Orang Ulu (26.4%). Meanwhile, at the university level, the Orang Ulu were recorded at 3.63 percent while the Orang Asli were at 5.41 percent only.

Table 3. Respondent Profile of the Orang Ulu and The Orang Asli

Aspect	**Orang Ulu**		**Orang Asli**	
Education	Total	%	Total	%
University	3	1.4	0	0
College	8	3.6	2	5.4
High School	58	26.4	12	32.4
Junior High School	54	24.5	11	29.7
No Formal Education	97	44.1	12	32.4
Total	220	100	37	100
Current Occupation				
Professional and Administrator	6	2.7	0	0
Clerical	3	1.4	0	0
Farmer	164	74.6	32	86.5
Logging worker	18	8.2	0	0
Transport Operator	12	5.5	0	0
Others	17	7.7	5	13.5
Total	220	100	37	100
Monthly Income				
RM 450 and below	97	44.1	0	0
RM 451 – RM 700	56	25.5	21	56.8
RM 701 – RM 1,000	41	18.6	14	37.8
RM 1,001 – RM 1,300	6	2.7	0	0
RM 1,3001 – RM 1,600	3	1.4	0	0
RM 1,601 – RM 1,900	8	3.6	2	5.4
RM 2,200 – RM 2,499	6	2.7	0	0
RM 2,500 – and above	3	1.4	0	0
Total	220	100	37	100

Source: Author's Survey, 2012.

From Table 3, it was found that a substantial number of respondents in the resettlement schemes were working in the farming sector. 74.6 percent Orang Ulu and 86.49 percent Orang Asli were discovered to be farmers. The second highest employment category was logging where 8.8 percent of the

Orang Ulu were found to be involved in this occupation whereas none of the Orang Asli were. 7.7 percent of the Orang Ulu were found to be doing odd jobs including labouring, doing multiple jobs or handcraft.

Perhaps, the most striking finding from Table 3 was the monthly income earned by the respondents. It was found that nearly half of the Orang Ulu (44.1%) earned a monthly income below RM 450.00. Meanwhile, the Orang Asli, a majority of them (56.8%), received a monthly income between RM 451.00 – RM 700.00 which is one ladder better than the Orang Ulu. For the Orang Ulu, 25.5 percent were found earning a monthly income within the bracket of RM 451 – RM 700.00, which is the second highest income. This is followed by the second highest income for the Orang Asli where 18.6 percent of them earn a monthly income of RM 700 - RM1000.00. However, it is important to note that the income figures of the Orang Asli could be misleading because during the survey, they were found to be still receiving an RM683.00 per month compensation for each household. This income was given from the stabilisation programme, a programme under the compensation package.

In comparison to the poverty line at the national level, this research finding on income brackets at these two resettlement schemes has shown an alarming trend. According to Malaysia's poverty standard, households with a total income of less than or equal to RM 740.00 per month are considered poor in the rural area in the Malay Peninsula and at RM 880.00 for the rural area in Sarawak. Meanwhile, households with a total income of less than or equal to RM 440.00 per month are considered extremely (hard-core) poor (ICU, 2012).

6.2 The loss of land rights due to project implementation

The following six questions from Table 4 were formulated in order to investigate the respondents' perception on land rights impacts since the Indigenous people have been resettled at both of the new resettlement schemes. Consequently, the displacement has brought about changes in their land laws, for example, their land tenure status has changed from communal land titles to individual land titles. The respondents were asked questions related to the aspects of land rights which were previously enjoyed by them. In this section, respondents were asked to evaluate the statements using the Likert Scale ranging from strongly agree, agree, uncertain, disagree and lastly strongly disagree. It is important to note here that in discussing each of the issues, the data findings from the interview were incorporated in the discussion.

Table 4. The perception of loss of land rights due to project implementation

Question	Strongly Agree		Agree		Uncertain		Disagree		Strongly Disagree	
	Total	%	Total	%	Total	%	Total	%	Total	%
Project has reduced free food resources due to the absence of the roaming area.	184	71.6	52	20.2	10	3.9	11	4.3	0	0.0

Project has reduced free food resources since the individual lot is not sufficiently large enough.	184	71.6	61	23.7	3	1.2	4	1.6	5	1.9
No shifting cultivation due to the changes in individual lots' land tenure.	156	60.7	77	29.4	18	7.0	6	2.3	0	0.0
Increase in illegal agricultural activities on state land because of the insufficient land area.	117	45.5	120	46.7	18	7.0	2	0.8	0	0.0
The amount of the land compensation does not take into consideration the additional increase of family members.	165	64.2	64	24.9	15	5.8	8	3.1	5	1.9
The power of the Customary Council had been reduced due to the changes made to the individual land titles.	51	19.8	153	59.5	39	15.2	8	3.1	6	2.3

Source: Author's Survey, 2012

It is clearly apparent from Table 4 that the negative responses have dominated all of the six questions provided. The study has found that 71.6 percent of the respondents have strongly and 20.2 percent agreed that both dam projects had reduced their free food resources due to absence of the roaming area in their communal area. To support this finding, perhaps the observation made by Pemanchar Umek Jeno, one of the Orang Ulu leaders can been seen to fit well:

> *"Previously, if we wanted to get food such as wild boar, deer, fish, fruits and so on, we could just easily find them in our 'pulau'. The'pulau' is our food store. However, since we have resettled here, the 'pulau' has simply vanished. Free food is gone, all gone! We now cannot simply go to other areas to find free food as they belong to other parties. So, here everything needs money and without it we cannot live properly"* (Interview with Umek, a Pemanchar at RSSA on 29 September 2012).

Batin Cham, the previous headman of the Orang Asli Sungai Temir and RSLB in Kelau Pahang has echoed the same sentiment. He has reasoned why the Orang Asli have to make frequent visits to their original village at the Sungai Temir despite the fact they had already moved to RSLB:

> *"Life is getting difficult here, everything needs money. We need to buy fish. Even the ferns need to be bought. Previously we could freely pluck them around our village or go to the forest (roaming area) to gather them"* (Interview with Cham, a Batin at RSLB on 24 November 2012).

The second impact was the perception that the projects have reduced the free availability of food due to the insufficient lot size of the individual lots as well as the loss of the communal forest. As shown in Table 4, 71.6

percent of the respondents strongly agreed, while 23.73 percent of respondents agreed with the above statement. Again, the study found that 1.2 percent of the respondents strongly disagreed while 1.3 percent disagreed accordingly. This perception was particularly true of the Orang Ulu in Sarawak who have previously enjoyed huge land areas. For example, prior to resettlement, the largest land size allocated to each family in the Uma Balui Liko Longhouse was 66 hectares while the smallest was in the Uma Buket Longhouse with 3.9 hectares (DOE, 1997). It has shown that the resettlement exercise has considerably changed the size of the land with three acres per household only. It is interesting to quote what Tony Kulleh (Interview with Tony, a Pemanchar at the RSSA on 2 October 2012) has said on this matter:

> *"Each family was given only three acres of land which clearly were not adequate. That has become one of the main reasons why the local people have lost respect and trust of the government. Being granted an individual land title is nothing and makes no difference to us".*

The Indigenous agriculture system required alternate land which could be used for shifting cultivation (rotation system). This was the system which was predominantly practised by the Indigenous people before they were forced to resettle at the resettlement schemes. Again, this was largely true of the Orang Ulu in Sarawak, however, since each individual household land has been limited to three acres per family, plus there was now no communal forest, shifting cultivation is no longer practised. The introduction of cash crops, namely black pepper and cocoa in the case of the Orang Ulu, or palm oil for the Orang Asli has made it impossible for them to continue with shifting cultivation. In support of this it was found that 60.7 percent strongly agreed and 30.0 percent of them agreed that one of the negative impacts of the project on land rights was that there was no more shifting cultivation practised in the new resettlements schemes.

Illegal farming by the Indigenous people on state land was found to be another manifestation of the loss of land rights. Again, the substantial percentage of the respondents, or 46.69 percent of the respondents who agreed and 45.52 percent of the respondents who responded strongly agreed, were of the opinion that the illegal land encroachment made on the state land by them was due to the limited individual land size compensated to them. This survey finding was parallel to researcher's observations at both of the resettlement schemes as well as interviews with both of the Orang Ulu and the Orang Asli. They have admitted that they have illegally expanded their agriculture activities into state land mainly due to the present inadequate land size allocated to them (interview with Cham, a Batin at RSLB on 24 November 2012). According to Tony Kulleh, this was particularly true for families who have expanded yearly (Interview with Tony, a pemanchar at RSSA on 2 October 2012). He went on to say that:

> *"The three acres of land are insufficient and how can we make a living with just three acres of land? We have to make a decent income to feed our family. In order to get extra income, some settlers have to expand their farm into state land, that's because they have to."*

Based on the survey and the interviews as shown above, it is clear that the allocation of three acres of land in the case of the Orang Ulu and six

acres of land in the case of the Orang Asli have failed to take into consideration the future of the extended family size of the Indigenous people. As mentioned earlier, although without formal land titles, the customary system managed to maintain its credibility since the social support of the Indigenous people in the case of land distribution and the future size of the extended family was taken into account. As a result and as shown in Table 4 above, 64.2 percent of the respondents strongly agreed and 24.9 percent agreed that the amount of land compensated did take into consideration the additional increase of family members. There were only a small percentage of respondents (15.8%) who were uncertain, whereas merely 3.11 percent and 1.94 percent disagreed and strongly disagreed respectively that land size had posed no problem to them. It is worth mentioning at this stage too that as a comparison to the FELDA scheme resettlers, who were given 8 to 10 acres at the new resettlement schemes, the treatment of the Orang Ulu and the Orang Asli has clearly been unfair (interview with Nicholas, a Coordinator for Center for Orang Asli Concern (COAC) in Subang Jaya on 25 October 2011).

Another important right in the land rights issue is on the position of the Customary Council. Again, this study found that there was a huge negative perception on land rights. 59.9 percent of the respondents agreed with the statement that there was decreased power and rights of the Customary Council at the new resettlement schemes. Meanwhile, about 19.8 percent of them were strongly agreed on the statement that the power of the Customary Council had been reduced due to the changes made to the individual land titles. It was found that 15.2 percent of respondents were uncertain and 3.1 percent and 2.3 percent disagreed that the Customary Council had decreased its power and rights. The finding was not surprising because the Indigenous Customary Council was no longer entitled to govern land affairs for their own community (Nicholas, 2010).

6.3 Employment and Land Rights Impacts

This section intends to examine the correlation between employment and the land rights impact. The hypothesis postulated here was thst there would be differences between the respondents' perceptions of the land rights impact and their employment. To validate this hypothesis, this research study has employed an analysis of variance (ANOVA) using the Statistical Package of Social Science (SPSS) software where respondents were asked to evaluate five statements (variables) of perception on land rights impact such as the following: 1) the resettlement schemes or projects (BHP and KDP) have reduced free food resources due to the absence of the roaming area; 2) the resettlement schemes or projects (BHP and KDP) have reduced free food resources since the individual lot allocated was not sufficiently large enough; 3) no shifting cultivation was continued due to the individual and small lots; 4) increase in illegal agricultural activities on government land occurred because insufficient land was compensated; 5) the amount of land compensation did not take into consideration the yearly increase of the additional family members, and; 6) the power of the Customary Council has been reduced due to changes from communal land to individual land titles. Again, in this section, the results were a combination of the Orang Ulu and the Orang Asli data because the main intention was to illustrate the general pattern of data per se.

Table 5. Mean of perception of land rights impacts by occupation

Occupation	Perception of Land Rights Impacts		
	N	Mean	Std. Dev.
Professional and administrator	6	4.4167	0.64765
Clerical	3	4.0000	0.60093
Farmer	196	4.4474	0.55553
Logging worker	17	4.4020	0.57148
Transport operator	12	4.0139	0.66080
Others	23	4.3333	0.57953
Total	257	4.4080	0.57014

Using SPSS for the ANOVA analysis, the results were arrived at as in Table 5. It was found that the total overall mean between employment and the perception of land rights impacts was 4.41 which is close to 5 (the maximum score value). It has shown that respondents who have worked as 'farmer' would have the highest perception towards the land rights impact scoring an average of 4.44 (SD = 0.56). This was closely followed by 'professional and administrator' (M = 4.42, SD = 0.65) and 'logging worker' (M = 4.40, SD = 0.57). 'other occupations' accounted for an average mean of 4.33 (SD = 0.58) while 'transport operator' was placed at lowest with an average mean of 4.01 or 0.66 in SD.

*Table 6***.** Summary results of the Levene's Test and ANOVA

Perception of Land Rights Impacts	p-value (The Levene's Test)	Assumption of Homogeneity of Variances	p-value (ANOVA)	Significant Difference
	0.801	Yes	0.125	No

Consequently, an ANOVA was carried out as shown in Table 6 which aimed to identify the mean differences in perception towards the land rights of respondents who work as 'professional and administrator', 'clerical', 'farmer', 'logging worker', 'transport operator', and 'others'. Table 6 shows the summary results of the Levene's test and ANOVA. Based on Table 6, the variance was found to be equal to the *p*-value of the Levene's test, which was greater than 0.05 (*p*-value = 0.801). The results also pointed out that there was no statistically significant difference in perception towards land rights impact between occupations at the $p > 0.05$ level: $F(5, 256) = 1.746$, $p = 0.125$.

From the ANOVA analysis, the results have indicated that those Indigenous groups who were farmers were more affected than those who worked as transport operators who were least affected by the resettlements. However, in general and based on the Levene's test, statistically, the respondents were found to have similar negative perceptions towards the land rights impacts regardless of their having different occupations. In other words, land rights impacts were found to produce the same impacts across the different types of employments.

7. CONCLUSION

This paper has revealed that the abolishment of the NT and replacement of it with individual land titles has resulted in negative impacts on the Indigenous' land rights. Therefore, this new institution was unable to gain social support from them. This was evidently shown in the respondents' survey as well as through the interview analysis. Regardless of the type of occupations, the respondents shared the common opinion that the resettlement schemes have brought negative effects on their land rights. As demonstrated by the findings of the analysis section, although individual land titles could give them more security in terms of dealing with modern transactions (for example, to sell, lease et cetera), it has failed to rally social support. The perception of the NT benefits such as its ability to accommodate the size or the future expansion of the family and the larger size of land ownership per household as well as the existence of the 'pulau'/forest game area have outweighed the security mantra offered by the individual land titles. In addition, authority and powers of the customary institution which were previously in place to maintain and control land rights have found to have been diminished due to the introduction of the individual land tenure. The findings from this study are parallel to previous revelations by Ho (2005a; 2005b; 2006) on customary land in China. The implication of this research study on the credibility of institution debates has once again proved that institutional credibility is a matter that goes beyond the simple matter of security of land titling. The pertinent criteria that are missing from the new resettlement schemes or institutions are the socio-economic supports.

The planning of a resettlement scheme must take into account the policy, which in this case is where the Indigenous people have been found to be socially and economically backward. The monetary and land compensation accorded should be able to uplift the socio-economic status of the respondents. Findings from this study have pointed out that the land rights are one of the vital elements of project acceptance and provide credibility to the institution. With their low educational status and the advanced age structure, thus it is not surprising to find that the Indigenous people would experience severe effects from the abolishment of the NT. They are not able to get well-paying jobs outside their resettlement schemes other than to depend on the farming activity on their small plots of land. This situation has been found to have threatened the indigenous livelihood and, consequently, this insecure scenario has made them resist change and, in the end, has led them to have low trust in the government and its politicians.

The whole exercise of land resettlement schemes as has happened in both cases in this study has also raised some significant questions. Chief among them is that the institutions would not be successful even though they have been engineered by the state. Eventually, the findings from this study have also raised the pertinent question of the design of the institution. From this study, it can be pointed out that a credible institution would require shared rules or rules that first existed at the local level before they can be scaled to a higher level in order to become land law, such as the SLC and APA. Only by doing so, can the institution be credible.

REFERENCES

Babbie, E. (2010). *The Practice of Social Research* (Twelfth Edition.), Thomson Higher Education, USA.

Banerjee, N. and. Bojsen, K. P. M. (2005). "Negotiability and Limits to Negotiability - Land Use Strategies in the SALCRA Batang Ai Resettlement Scheme, Sarawak, East Malaysia", *Danish Journal of Geography, 105(1), 17-28.*

Bian, Baru. (2000). "Native Customary Land Rights in Sarawak, The Impact of Adong's Case, Seminar on Customary Land Rights, Recent Developments", *Faculty of Law, University of Malaya, Kuala Lumpur*, 313-358.

BRIMAS (Borneo Resources Institute). (2005). "A Seminar Proceedings on Indigenous Peoples' Sustainable Management of Land and Forest Resources", *BRIMAS and Persatuan Orang Asli Semenanjung Malaysia (POASM), Kuching and Kuala Lumpur, Malaysia.*

Buang, S. (2010). *Malaysian Torrens System (Second Edition)*, Dewan Bahasa dan Pustaka, Kuala Lumpur Malaysia.

CAP (Consumers' Association of Penang). (2000). *Land Issues in Malaysia: Based on CAP's National conference "Land: Emerging Issues and Challenges",* Consumers' Association of Penang, Penang Malaysia.

Carol-Yong, O.-L. (2008). "Autonomy Reconstituted: Social and Gender Implication on the Orang Asli of the Peninsular Malaysia". In Resurreccion, B. P. and Elmhirst, R. (Edt.), *Gender and Natural Resource Management: Livelihoods, Mobility and Interventions*. Earthscan, United States of America (USA).

Cramb, R.A. (2007). *Land and Longhouse,* Nordic Institute of Asian Studies (NIAS), Copenhagen S, Denmark.

DOE (Department of Environment) Malaysia, (April 1997). *Bakun Resettlement Project: EIA for Socio-economic Study*, PELITA, Sarawak.

DOA (Department of Orang Asli) Malaysia. (2012). *Profile of Orang Asli Sungai Temir*, Unpublished Data, Kuala Lumpur.

DOS (Department of Statistics) Malaysia (2012). *Profile of Sungai Asap Population*, Unpublished Data, Kuala Lumpur.

DOS (Department of Statistics) Malaysia. (2011). *Yearbook Statistics Sarawak 2011,* Government Printers. Kuala Lumpur.

Fong, J.C. (2011). *Law on Native Customary Land in Sarawak*, Thomas Reuters Malaysia Sdn Bhd, Selangor Malaysia.

GOM (Government of Malaysia). (2013). *Malaysia Constitution*, International Law Book Services. Selangor, Malaysia.

GOM (Government of Malaysia). (2010) N*ational Land Code*, Penerbitan Akta (M) Sdn. Bhd., Batu Caves, Selangor, Malaysia.

GOM (Government of Malaysia). (1997) *Aboriginal People Act 1954*, Pesuruhjaya Penyemak Undang-Undang Malaysia, Jabatan Orang Asli Malaysia, Kuala Lumpur, Malaysia.

Haber, S., Razo, A., and Maurer,N. (2003). *The Politics of Property Rights,* University Press. United Kingdom (UK),

Hamid and Noor Ashikin. (2011), "Judicial Recognition of The Orang Asli Land Rights in West Malaysia: Triumph and Hope", *Current Law Journal*, 7 CLJ, 1- xxiii

Ho, P. (2006). Credibility of Institutions: Forestry, Social Conflict and Titling In China, *Land Use Policy,* 23, 588–603.

Ho,P. (2005a). *Institutions in Transition: Land Ownership, Property Right and Social Conflict in China*, Oxford University Press Inc., New York.

Ho,P. (2005b). *Developmental Dilemmas: Land Reform and Institutional Change in China*, Routledge, London United Kingdom (UK).

Hong, E. (1987). *Natives of Sarawak: Survival in Borneo's Vanishing Forest*, Institut Masyarakat, Malaysia, Pulau Pinang, Malaysia.

HRCM (Human Rights Commission of Malaysia). (2007). *Penan in Ulu Belaga: Right to Land and Socio-Economic Development*, Human Rights Commission of Malaysia, Malaysia.

HRCM (Human Rights Commission of Malaysia). (2009). *Legal Perspective on Native Customary land Rights in Sarawak*, Human Rights Commission of Malaysia, Malaysia.

HRCM (Human Rights Commission of Malaysia). (2010). *SUHAKAM's Report on The Roundtable Discussion on The Rights of Ethnic Minorities and Marginalised Communities in Malaysia* , Human Rights Commission of Malaysia, Malaysia.

Ibrahim, N. (2010). *Rural Development in Malaysi*a, Monograph 4, Universiti Teknologi Malaysia, Skudai, Johor Malaysia.

Knight, J. (1992). *Institutions and Social Conflict*, Cambridge University Press, United Kingdom (UK).

Newman, W. L. (2011). *Social Research Methods; Qualitative and Quantitative Approaches* (Seventh Edition), Pearson Education Inc, Boston, United States of America (USA).

Ngidang, N. (2005). "Deconstruction and Reconstruction of Native Customary land Tenure in Sarawak", *Southeast Asian Studies*, 43(1), 47-75.

Nicholas, C. (1997*).* "Putting the "People" In EIAs Assessing Environmental Impacts on Indigenous Peoples", *Malaysia Nature Society (MNS) EIA Seminar*, 9th March 1997 Kuala Lumpur

Nicholas, C. (*2000). The Orang Asli and the Resources: Indigenous Politics, Development and Identity in Peninsular Malaysia,* International Work Group for Indigenous Affairs, Copenhagen, Denmark.

Nicholas, C. (*2010)."*The Rights of Orang Asli in Malaysia", *The Malaysian Journal on Human Rights, 4(1), 58-67.*

North, Douglass C., (1990). *Institutions, Institutional Change and Economic Performance*, Cambridge University Press, United States of America (USA).

State Planning Unit of Sarawak (SPU). (1996). *Report on the Bakun Hydroelectric Project: Socio-Economic Impact study of the Catchment, Reservoir and Downriver Communities,* Sarawak, Malaysia.

Sub-district of Sungai Asap, *Basic Profile of Sungai Asap Population*, Unpublished Data, Sarawak.

UN (United Nations) (2007). United Nations Declaration on the Rights of the Indigenous People, The United Nation, New York, United States of America (USA).

United Nations-Habitat. (2012). *Land and Conflict: Toolkit and Guidance for Preventing and Managing Land and Natural Resources Conflict*, The United Nations Interagency Framework Team for Preventive Action. New York, United States of America (USA).

Weimer, David L. (1997). *The Political Economy of Property Rights: Institutional Change and Credibility in the Reform of Centrally Planned Economies*, Cambridge University Press, United Kingdom (UK).

Yin, R. K. (2009). *Case Study Research : Design and Method (Fourth Edition)*. Sage Inc., California, United States of America (USA).

ONLINE REFERENCES

Implementation Coordination Unit (ICU), Prime Minister's Office of Malaysia at www. Icu.gov.my. Retrieved on 12 August 2012

Subramaniam, Yogeswaran, http://Aliran.com/2514.html.Retrieved on 13 September 2011

Stephen, T., at http://www.thestar.com.my/News/Nation/2013/10/29/baram-dam-natives-protest/Retrieved on 13 June 2014

NEWS PAPERS

(CAP) Consumers' Association of Penang. May 2000. *Seek Public Feedback before Implementing Amendments to Sarawak Land Code*, 7-8.

INTERVIEWS

Abdul Razak, A., an Officer at the Land Policy Section at the Department of Orang Asli (DOA) on 9 July 2012

Sindang, A.L., an Officer at the Sarawak Customary Council, Kuching Sarawak on 9 November 2012

Cham, B., a Batin at RSLB on 24 November 2012

Nicholas, N., a Coordinator for the Center for Orang Asli Concern (COAC) in Subang Jaya, Selangor on 25 October 2011

Saging, B., a Penghulu at RSSA on 30 October 2012

Tony, K., a Pemanchar at RSSA on 2 October 2012

Umek, J., a Pemanchar at RSSA on 29 September 2012

Yusri, A., a Committee member of the Jaringan Orang Asli Semenanjung Malaysia (JAKOSAM) cum Deputy President 3 of the Association of Orang Asli Peninsular Malaysia (JOAS) in Temerloh Pahang on 3 December 2012

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The Favorable Settlement Relocation Process After the 2011 Earthquake and Tsunami Disaster in Japan by Evaluating Site Environments and Accessibility

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Key words: Disaster, Citizen and public co-determination, Resilience, Community planning, Fukushima, Semantic Differential Method, Neighbourhood relocation

Abstract: As a new estimate, we analyzed a mismatch between public evaluation and planning decisions. In this paper, we call this mismatch "the failure of spatial planning for sustainable development". This paper will compare two adjoining municipalities (*α town* and *β city*) that employed different settlement relocation processes after the Great East Japan Earthquake and Tsunami (March 11, 2011). *α town* selected seven new candidate relocation sites from non surplus land of pre-existing city plan by a citizen participation and holistic land selection process. On the other hand, *β city* selected unused city planning sites (pre-existing), which were already planned before the 2011 disaster. The reconstruction process of *α town* involved citizen and public co-determination, whereas *β city* only determined a quick-fix solution without renewed planning. Unfortunately, most disaster reconstruction efforts in Tohoku appear similar to *β city*. With a field survey on 16 relocation sites in 2012, we asked 80 university students to evaluate the environments of the two municipalities' relocation sites by Semantic Differential Method. As a result, *α town*'s relocation sites, which are determined with citizen and public co-determination, are higher valued that of *β city*. Then, by overlay, analyzing the accessibility of the relocation sites with a new transportation network, we found that the accessibility of relocation sites in *α town* is better. Our result suggests that planning processes with low administrative agency and public participation, tend to be more successful in producing an attractive redevelopment plan.

1. INTRODUCTION

A distinguishing feature of this study is the evaluation of relocation sites in the planning process early after big natural disasters, since land formation technology can make any land to similar housing environment within a few years. We found the damage of earthquake and tsunami differs with different site characteristics; land on historic fens incur severe earthquake damage, and land on historic sea beds incur serious tsunami damage. Hence site planning is important for avoiding damage from natural disasters—a lack of local resident's knowledge of site character will further worsen the damage.

Formerly, many Japanese people believed that modern technology could prevent damage from any natural disaster, but this belief is proved at fault by the 2011 Earthquake and Tsunami Disaster in Japan. Thus, we should change from the fragmentary approach to a new holistic approach with citizen participation.

In fact, the disasters of our society are becoming more and more frequent and unpredictable. Unfortunately, many relocation sites after the disasters are still based on fragmentary approaches. Considering that, our goal in this paper is to evaluate the post-disaster land selection result with different planning processes.

Amendola et al. (2008) indicated that between 1984 and 2003, more than 4 billion people were affected by extreme natural events, and that between 1990 and 1999, the cost of natural disasters was more than 15 times higher than during the period 1950– 1959 (World Bank, 2006). The research noticed that while there had been progress toward integrated and proactive disaster risk management in many countries, the standard planning approaches to disasters were too reactive.

Moreover, in most countries there has been little integration among the relevant responsibilities— for example, disaster prevention generally has nothing to do with land-use planning. In addition, Amendola et al. (2008) indicated, "better is more important than bigger in redevelopment from natural disasters." Though it is often the case that in the immediate aftermath of disasters (for example, Hurricane Katrina in New Orleans, Louisiana), hopeful boosters and politicians proclaim that the reconstructed area will be bigger and better.

Kates, et al. (2006) suggested that natural hazard and reconstruction research over the past 60 years provided a comparative and historical perspective on the reconstruction of New Orleans after Hurricane Katrina. In addition, Golant and Burton (1970) attempted to derive meaning from 12 hazard situations in a sample group of subjects using the Semantic Differential method, and Wu and Lindell (2004) compared earthquake recovery plans for the city of Los Angeles, California, and Taichung County in Taiwan. HUD's Office of Policy Development and Research (1995), which conducted an earthquake mitigation report after the earthquake in Northridge, California, concluded a mismatch between federal mitigation and local recovery needs—Almost 80% of damaged residential units were multi-family housing, particularly low-cost rental housing; unfortunately, the city's recovery programs were designed to serve middle-class owners of single-family dwellings. This suggests that one way of overcoming the limitations for land-use planners is to establish links with their counterparts in emergency management.

Although these studies are useful in examining the political initiatives of reconstruction planning, they lack residents' and next-generations' opinions on the actual site planning process. Users' needs and preferences, in addition to those of the politicians and architects, should be taken into consideration during the relocation/new settlement selection process.

There is little information available on this aspect for Japanese city planning or sustainable planning in Asia, even though many Asian and Oceanian countries have experienced similar natural disasters; for example, large earthquakes have happened 19 times in 10 years:

1. Lushan earthquake, Magnitude (M)7.0, April 20, 2013, China
2. Sistan and Baluchestan earthquake, M7.8, 2013, Iran
3. Aceh earthquake, M8.6, April 11, 2012, Sumatra, Indonesia
4. Visayas earthquake, M6.7, February 6, 2012, Philippines

5. Van earthquake, M7.1, October 23, 2011, Turkey
6. Sikkim earthquake, M6.9, September 18, 2011, India
7. Tohoku earthquake, M9.0, March 11, 2011, Japan
8. Burma earthquake, M6.9, March 24, 2011, Myanmar
9. Christchurch earthquake, M6.3, February 2011, New Zealand
10. Sumatra earthquake and tsunami, M7.7, October 25, 2010, Indonesia and Malaysia
11. Yushu earthquake, M6.9, April 2010, China
12. Sumatra earthquake, M7.9, September 30, 2009, Indonesia
13. Sumatra earthquake, M8.5, September 12, 2007, Indonesia
14. Sichuan earthquake, M 8.1, May 12, 2008, China
15. Java earthquake, M6.2, May 27, 2006, Indonesia
16. Kashmir earthquake, M7.6, October 2005, Pakistan
17. Indian Ocean earthquake and tsunami, M9.1, December 2004, Indonesia
18. Chuetsu earthquake, M6.8, October 2004, Japan
19. Hokkaido earthquake, M8.3, September 2003, Japan

The 2011 Tohoku earthquake in Japan was the worst disaster resulting from a single earthquake, which caused a tsunami and subsequent accident at the Fukushima nuclear plant. Hence, this case should be a useful lesson for other countries susceptible to this type of disaster.

Generally, housing reconstruction passes through three stages, the last of which is permanent housing, which is often at a new site away from the disaster. Until now, a few reports have discussed this process, but did not cover the effect of early adaptation and citizen participatory planning after natural disasters.

In this paper, our approach is different in its evaluation of early adaptive planning for natural disasters. We compared two different relocation plans: one is a holistic land selection plan in a small town; the other is a large municipality's basic substitution process of unused city planning zones for housing. The goal is for the results and discussion to meaningfully contribute to design studies and planning approaches toward sustainable development.

2. METHOD

March 11th, 2011 saw the tragedy of the Great East Japan Earthquake and Tsunami, even though many researchers' extensive disaster information compilations had already been used to prepare hazard maps. The number of fatalities and missing people was 18,498, and the number of collapsed housed was up to 40,438. From these numbers, we assume that it is important that local people have an understanding of the potential for disaster in their neighborhoods. In this paper, we define environmental evaluation as in experts having an understanding of the site characteristics of their neighborhoods.

The numerous lost lives and collapsed housing in the 2011 disaster seem to be a failure of sustainable development. Further planning, without reviewing the above failures, is wrong. Hence, in this paper, we describe the process for design of sustainable development as a confirmation of citizen - public cooperation. We believe that a holistic and open planning approach aiming at a sustainable development, is a useful perspective.

2.1 Field survey of two adjoining municipalities with opposite planning processes for rehabilitation projects following Japan's 2011 Earthquake and Tsunami

The evaluation of relocation sites is critical. As Wu, et al. (2004) pointed out, a mismatch between the allocation of resources and recovery needs occurred after the Northridge, California earthquake, resulting in a significant loss of funds.

However, there have been few case studies that have examined the reconstruction programs under the context of local residents' evaluation and opinions, primarily because reconstruction processes tend to be rushed.

As a new estimate, we analyzed a relationship of mismatch between peoples' evaluations and the spatial planning decisions.

We selected *α town* and *β city* in Fukushima Prefecture for comparison (Figure 1). While the damage resulting from the earthquake and tsunami

were similar, the revival processes of each area were quite different: small *α town* took a holistic land selection approach, while big municipality *β city* used a substitution method.

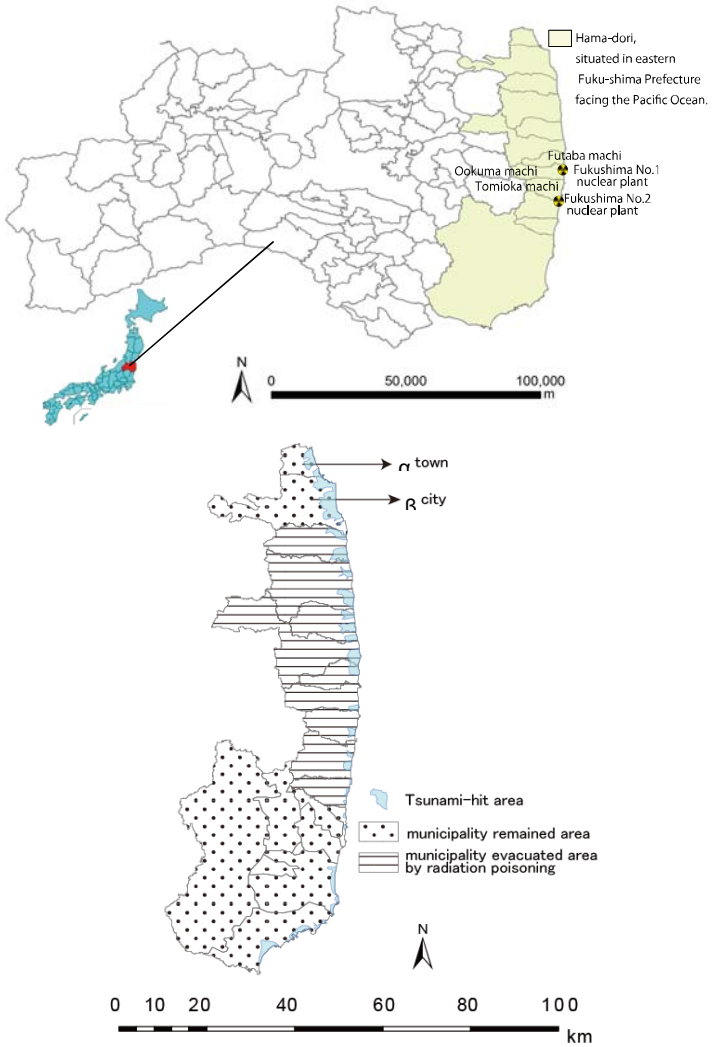


Fig 1. Outline of study area

α town, a small municipality, selected seven relocation sites that were proposed (and prioritized) by the local people. *β city*, a large municipality,

substituted pre-existing unused city-managed sites for its new relocation sites (nine places).

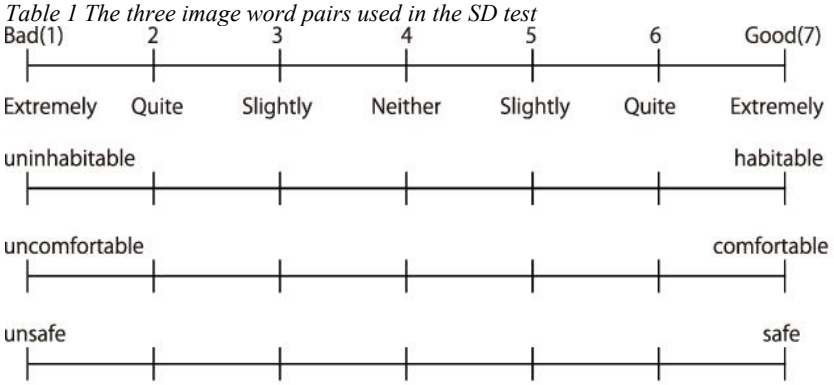
We used post-construction photographs of the two municipalities' relocation sites in December 2012 in order to conduct our comparison. The photographs of the sites (Figure 3) are important because land formation technology can make any land into a similar housing environment within a few years. It will become difficult to see natural disaster possibilities due to the sites' land use history; for example, houses on marshes and paddy fields are more vulnerable to earthquake liquefaction and tsunami damage.

2.2 Environmental evaluations using a Semantic Differential Method

In 1967, Osgood, Suci, and Tannenbaum introduced the Semantic Differential Method in their book, *The Measurement of Meaning.* In this method, the respondents are asked to compare a series of bipolar adjective pairs with respect to an anchor concept. The respondents decide whether a concept (for example, land for development) is associated more with suitable or non-suitable, or safe or unsafe conditions and to what degree.

A Semantic Differential scale is a combination of the adjective checklist and the rating scale. In the scale, a single topic is described by at least seven points, with opposing adjectives or short phrases at each end. A point value is assigned for each of the spaces on a seven-point scale so that a set of seven spaces or a continuous line between the opposing adjectives could be constructed. When the positive adjective is on the right side, assign the values 1–7 from left to right; for example, 1 = uninhabitable, 4 = no opinion, 7 = habitable (*Table 1*). Sixteen real new housing sites and three image words (in Japanese) were picked for our test.

Table 1 The three image word pairs used in the SD test



In this test, image and perception preferences were scored on a seven-point scale. The total score was calculated by summing the values circled. While we believe that users' needs and preferences should be taken into consideration during the relocation selection process, it is often difficult for afflicted people to evaluate objectively (for example, people tend to believe their relocation site is better than other suggested sites). Our questionnaire subjects are sophomore university students. The semantic differential test was given during December of 2012. Paper questionnaires lasted approximately 20 to 25 minutes.

Before we can carry out a test to compare two groups' (municipalities') site evaluation, we need to test whether the sample variances are

significantly different. In this case, the variances of the two groups are the same; it would be right to compare the two samples (different revival processes) using *t* –test score.

2.3 Layer analysis to evaluate the settlement relocation site's accessibility to renewed traffic network and public facilities

The accessibility of the relocation site's victim community is important regarding the issue of sustainable development. Unfortunately, many post-disaster reconstruction projects failed to consider relocation holistically after the 2011 disaster. Post-tsunami recovery sites located in inconvenient places is a waste of both tax money and donations made to the disaster area. Hence, we investigated accessibility of the sites to the new traffic network by layer analysis.

We superpose two municipalities' planned housing sites and renewed railroads and other public facilities. This area's railroad was destroyed by the 2011 tsunami disaster.

3. RESULTS

3.1 Field survey of two adjoining municipalities with opposing planning processes for relocation sites for Japan's 2011 Earthquake and Tsunami.

After the 2011 disasters, the housing recovery passed through three stages: (1) emergency shelter; (2) temporary shelter and housing; and (3) permanent housing.

Emergency shelters are usually established after a disaster at the instigation of individuals based on chance availability, convenience, proximity, and perceived safety. Temporary housing and shelter is often sought in the homes of friends and relatives, though mass care facilities are also used. Following the 2011 disaster, it was decided that the last stage of housing reconstruction (permanent housing) would not be built within the tsunami disaster area, but rather on higher, more stable ground to avoid future tsunami disasters.

In *α town,* citizen and public sectors turned most suitable land into new community housing sites. They did not adhere to the existing land use plans. The planning process of *α town* was a rare case, as the revival plan took the residents' opinions into consideration.

Conversely, *β city*, a large municipality, basically substituted unused sites into relocation sites (nine places) from existing planned housing zones, which had been decided before the 2011 disaster. In reality, most municipalities adopt this method for relocation because they would like to save time rather than workshop with many victimized residents. Figure 2 shows six permanent housing sites in *α town* located along the boundary of forest and farmland, while *Figure 3* shows four permanent housing sites in *β city* located on marshes and paddy fields, which will be at risk of potential flooding. Because *β city*'s sites were secured prior to the earthquake in 2011, the examination of the vulnerability of the disaster was not performed thoroughly.

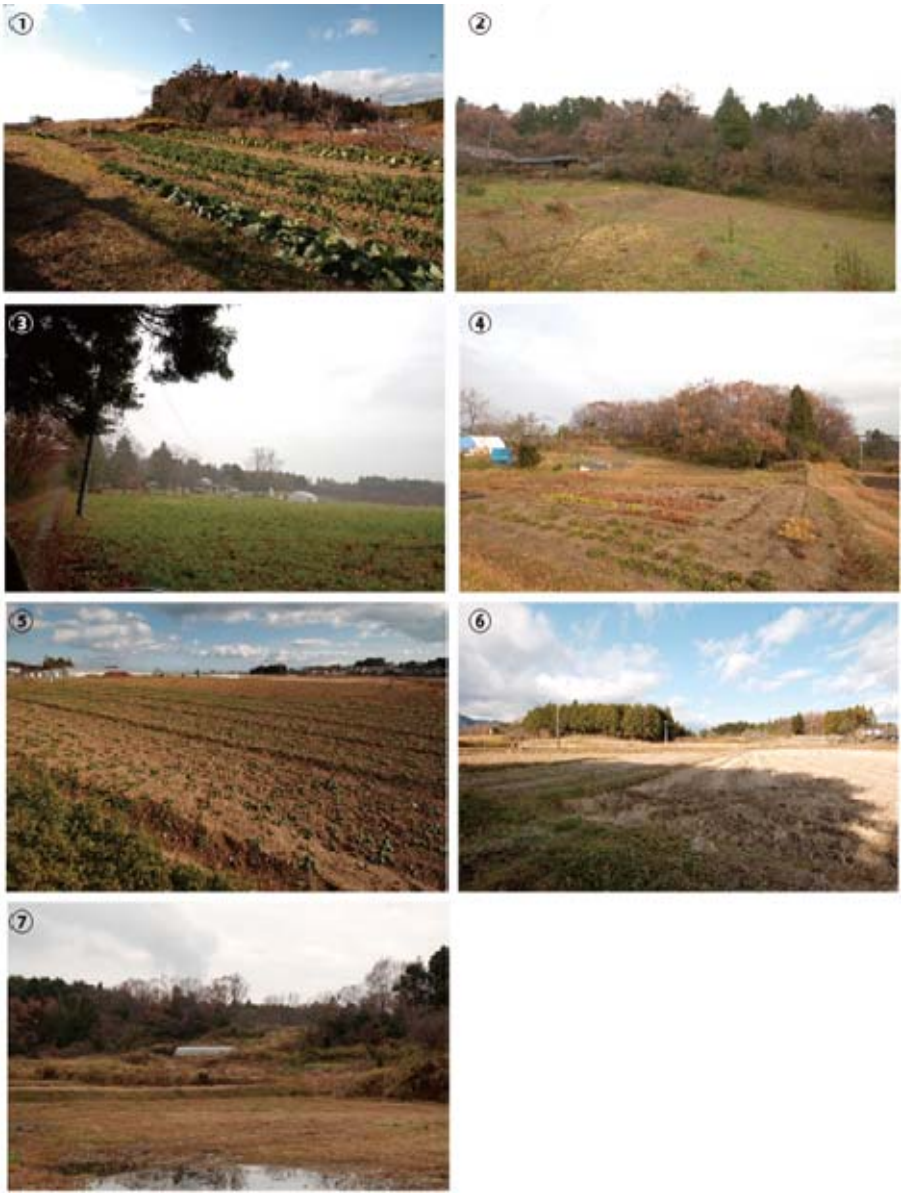


Figure 2 Seven photos of relocation settlements
(Numbers in this figure corresponded to Figure 5)

Figure 3. Nine photos of settlement relocation candidate sites in β city
(Numbers in this figure correspond to Figure.5)

3.2 Environmental evaluations using a Semantic Differential Method

In order to conduct a Semantic Differential Method test, a total of 16 photographs of the relocation sites for the two municipalities were displayed with a brief description (in Japanese). In this test, preferences on the images

were scored along a seven-point scale. A score of 7 points means that the subject has a strong positive impression of the sample, while a score of 1 point denotes a strong negative impression.

The survey results are summarized in Figure 4. Overall, the evaluated scores of relocation sites were significantly higher in *α town* than *β city*. In other words, the majority of the 80 students preferred the smaller municipality's relocation sites to the large municipality's relocation sites (Figure 4).

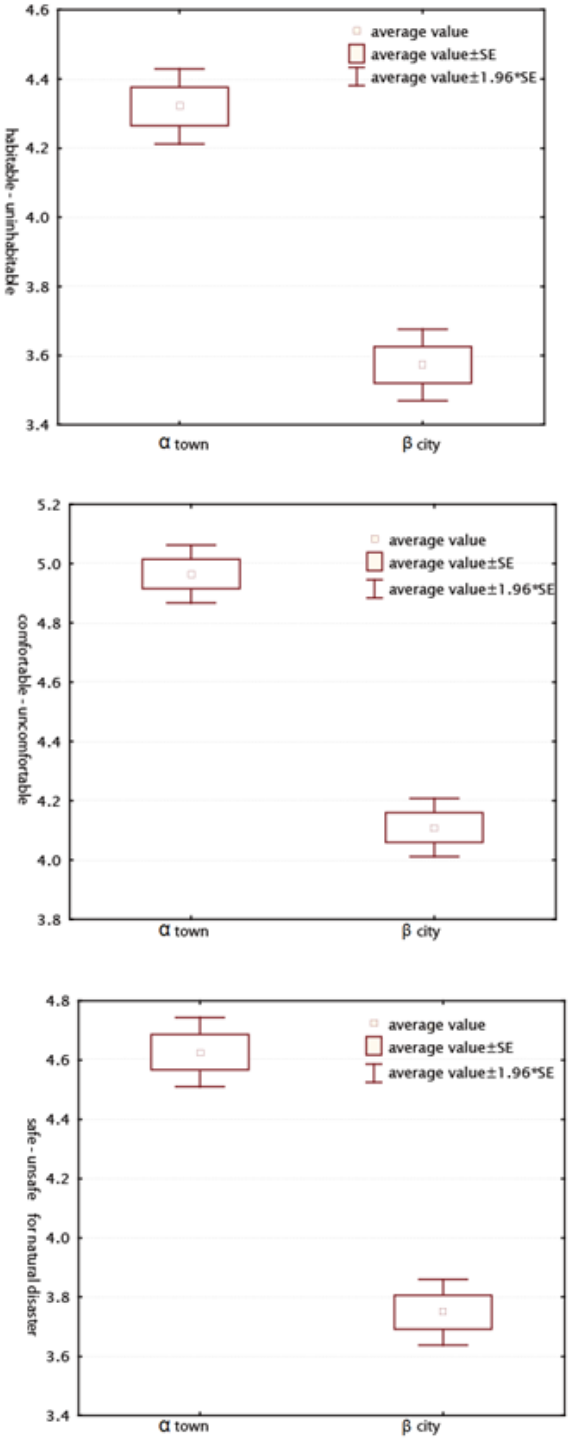


Figure 4 The comparison of settlements relocation candidate environments evaluation betweenα town (seven sites) and β city (nine sites)

The site evaluation of habitable(7) to inhabitable(1) was significantly higher in *α town* (mean 4.3) than in *β city* (mean 3.5), with t=9.86, p=0.001 (two-tailed), df=1118.

The site evaluation of comfortable(7) to uncomfortable(1) was significantly higher in *α town* (mean 4.9) than in *β city* (mean 4.1), with t=11.91, p=0.001 (two-tailed), df=1118.

Similarly, the site evaluation of safe(7) to unsafe(1) was significantly higher in *α town* (mean 4.6) than in *β city* (mean 3.7), with t=10.55, p=0.001(two-tailed), df=1118.

The results suggest that citizen and public co-determination will lead to more favourable outcomes of planning than quick-fix determination without renewed planning.

From the study, we also inspected a relationship (and a validity) of mismatch with peoples' evaluation' and the spatial planning decision. Surprisingly, there is not much difference in the time period needed to implement the plan in *α town* and *β city*, for in *β city* it takes time to persuade the residents to accept the plan that they were not involved with making. Relating to this study, we would like to show the result of actual reconstruction work in these two municipalities.

Interestingly, the results showed that fewer residents in *β city* would move to the reconstructed places (Kahoku Shimpo, 2012). On the other hand, more residents in *α town* actually got relocated at the locations that they chose.

3.3 Relocated housing sites' accessibility to mobility and convenience for relocation

People might argue that the above-mention evaluation is not sufficient in terms of site convenience. Figure 5 shows the location of the main transportation corridors (national road and restoration railroad) around the relocation sites for both of the two municipalities.

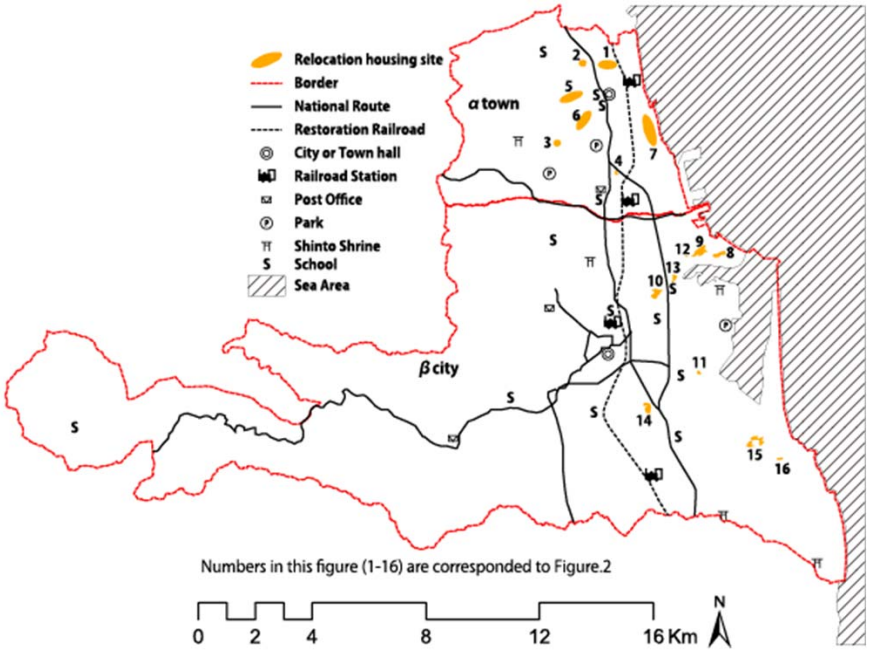


Figure 5 Result of each reconstruction site's accessibility to new traffic network by layer analysis. (β city candidate site seems smaller than α town site. Indeed, β city site is surplus land of past city planning, and α town site is a)

In particular, *α town*'s relocation sites appear to be convenient to the town center and traffic network nodes because of *α* residents' physical site determination demands. . On the other hand, *β city*'s relocation sites do not appear to be convenient to the city center and traffic network nodes because *β city*'s site planning allocated unsold or unused land in pre-quake city planning for physical site determination.

4. DISCUSSION

The purpose of the study is to evaluate the results of different reconstruction processes in Japan after the 2011 earthquake and tsunami disaster.

In this paper, we inclusively accomplished an analysis of the mismatch between peoples' evaluations and the spatial planning decisions. We have found considerable differences in landscape preferences amongst the two municipalities' disaster relocation site selections.

Many students did not prefer *β city*'s relocation sites' environments despite the fact that *β city* has many possible land selections from its 197.7km^2 area, compared with *α town*'s (46.35km^2).

This study's result may be similar to the actual residents' opinions.

In *α town,* victims' wish for getting a new detached house could be accomplished since relocation settlements were selected using residents' opinions, while *β city* could not accomplish this. Because of the poor relocation selection, some condominiums were kept vacant in *β city* (Kahoku Shimpo, 2012).

Moreover, the result of accessibility analysis shows that the outcome with citizen and public co-determination planning is better than quick-fix determination without renewed planning.

As a result, we achieved an indication of the importance of a holistic planning process for natural disasters which has not been sufficiently analysed.

Compared to previous research, this study offers additional evidence on the value of citizen participation and holistic land use planning in the early stages of the reconstruction planning processes.

This paper's preferred planning process appears to be a rare case, so additional evaluation on different types of sites and demographic groups is necessary.

REFERENCES

A.Amendola, J.Linnerooth-Bayer, N.Okada, P.Shi (2008). "Towards integrated disaster risk management:case studies and trends from Asia- Natural Hazards", *Natural Hazards*, Volume 44(2) , 163-168.

Kahoku Shimpo (local newspaper). "Hesitation of elder tenants to disaster relocation housing" (August 10, 2012). Accessed on November 8, 2014. http://www.kahoku.co.jp/news/2012/08/20120810t65018.htm

Jie Ying Wu, Michael K. Lindell (2004). "Housing Reconstruction After Two Major Earthquakes:The 1994 Northridge Earthquake in the United States and the 1999 Chi-Chi Earthquake in Taiwan,Disasters", *Disaster* , 28(1), 63-81.

R. W. Kates et al, (2006). "Missing from rapid recovery has been adequate attention to the needs of evacuees who lived in rental housing, especially public housing", *PNAS*, *National Academy of Science*, Washington, DC.

R. W. Kates, C. E. Colten, S. Laska and S. P. Leatherman (2006). "Reconstruction of New Orleans after Hurricane Katrina:A research perspective", *PNAS*, 103(40), 14653-14660.

Sinchi Town Reconstruction Development Plan of the 9th [6th] change (August 5, 2014).Accessed on August 25, 2014. http://www.shinchi-town.jp/pdf/hontai1.pdf.

Stephen Golant and Ian Burton (1970). "A Semantic Differential Experiment in the Interpretation and Grouping of Environmental Hazards", *Geographical Analysis*, 2(2), 120–134.

World Bank (2006). "Hazards of nature, risks to development: an IEG evaluation of World Bank assistance for natural disasters", The World Bank, Washington, DC.

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