Green Infrastructure for Asian Cities: The Spatial Concepts and Planning Strategies

Sadahisa KATO
Post-doctoral researcher, Department of Landscape Architecture and Regional Planning
University of Massachusetts Amherst USA

Urbanization is a global trend, particularly strong in many Asian countries, Africa, and some Lain American counties now. Designing and planning for sustainable and low-carbon cities is a complex process addressing the fundamental areas of economic, environmental, and social-equitable sustainability. This paper focuses on the environmental aspect with theories and applications of green infrastructure to support ecological and physical processes in urban regions including: hydrology, biodiversity, and cultural/recreational activities. Green infrastructure is an interconnected network of waterways, hybrid hydrological/drainage systems, wetlands, both designed and natural green spaces, working farms and other cultural landscapes, and built infrastructure that provides ecological functions. Green infrastructure plans apply key principles of landscape ecology to urban regions, specifically: a multi-scale approach with explicit attention to the pattern and process relationship and an emphasis on connectivity. Although green infrastructure concept and practice are gaining popularity in North America, the UK, and Europe, its systematic application in Asian cities and urban planning policies is yet to be seen. Through the examination of five case studies of green infrastructure-like approaches to address urban greenspace planning issues in Japan, important GI principles are distilled and the lessons learned from these cases are used to develop specific recommendations to facilitate further application of the GI concept in Asian cities. GI is argued to become a useful greenspace planning tool to protect important and fragile green spaces, mitigate the lost nature, and create new green spaces in the city. Four general design and planning guidelines of green infrastructure are proposed. Based on the lessons learned from the case studies and the preceding argument, the paper concludes with recommendation of four areas of application of the green infrastructure concept to Asian cities.

Keywords: green infrastructure, sustainability, urbanization, landscape ecology, connectivity, multi-scale approach

NOTE

I've noticed that this paper has been drawing much attention lately. This is actually a peer-reviewed paper. When you use this paper, please give it a proper citation as follows:

Kato, S. 2011. Green Infrastructure for Asian Cities: The Spatial Concepts and Planning Strategies. *Journal of the 2011 International Symposium on City Planning*: 161-170. Korea Planners Association.

Thank you.

1. Introduction

Developing sustainable cities is a valid societal goal as more people now live in urban areas than rural areas and sustainable development is a recognized international goal[23]. In landscape planning, the concept of green infrastructure (GI) has emerged as a way to provide multiple benefits to urban residents by an integrated connected network of open spaces toward the goal of making cities more sustainable[3), 6), 22), 30)]. Although GI planning is gaining popularity in North America, the UK, and Europe, it arguably lacks in Asian cities and urban planning policies. Among the three axes of sustainability (i.e., economy, environment, and social equity), this paper focuses on the environmental aspect of sustainability with theories and applications of GI to support ecological and physical processes in urban regions.

The aim of this paper is to explore the potential of GI application in Asian cities. Although there have already been individual cases of the application of the GI concept, as defined below, in Asian cities, there is a lack of systematic application of the GI concept despite its benefits. Based on the literature review of Asian urban planning, and Japanese greenspace planning in particular, I will argue that GI has a large potential to become a useful greenspace planning tool in Asian cities as well to develop more sustainable cities. First, the paper defines GI and describes its benefits. Second, Asian urban planning problems and those specific to green and open spaces in Japanese cities are stated. Third, three key landscape ecology principles that are useful for GI planning are discussed. Fourth, the paper reviews and discusses five Japanese greenspace planning examples to summarize important GI principles and learn from them to facilitate a more systematic GI application in Asian cities. Fifth, four general planning and design guidelines for GI are recommended. Finally, based on the case studies and the preceding argument, more specific recommendations for GI application in Asian cities are proposed to help solve the greenspace planning issues.

2. Concepts and benefits of green infrastructure

Following its historical precedents, GI has emerged as a planning concept among landscape researchers and practitioners in the UK, Europe, and North America since the late 1990's[22]. GI is defined as "our world's natural life-support system—an interconnected network of waterways, wetlands, woodlands, wildlife habitats, and other natural areas; greenways, parks, and other conservation lands; working farms, ranches, and forests; and wilderness and other open spaces that support native species, maintain natural ecological processes, sustain air and water resources, and contribute to the health and quality of life for communities and people"[4)]. Lately, Gill[6)] and Mell[22)] argue for the inclusion of open space for climate change mitigation and adaptation in the definition. GI is contrasted to conventional built infrastructure such as roads, sewers, utility lines, hospitals, schools, and prisons[3)]. GI provides environmental, social, and economic functions for human benefits[3), 13), 30)]. GI functions across jurisdictions and at different scales[13), 30)].

Examples of GI benefits to sustainability include: enriched habitat and biodiversity, maintenance of natural landscape processes, cleaner air and water, increased recreational opportunities, improved health, and better connection to nature and sense of place[30)]. Green space also increases property values and can decrease the costs of public infrastructure and services such as flood control, water treatment systems and storm water management[21)]. These are ecosystem services provided by urban green space.

3. Urban planning problems in Asian cities

Urban planning problems and issues in Japanese, Korean, and Chinese cities include: overpopulation of certain mega cities, uncontrolled urban sprawl, natural disaster planning, environmental pollution, lack of open space, and social structural problems such as income gaps[18]. Japanese cities' nature conservation issues are: loss of nature by urban sprawl, green space restoration and management in urban areas, and nature degradation due to the decreased use of satoyama near cities[17]. It is argued that GI can help protect important and fragile green spaces, mitigate the lost nature, and create new green spaces in the city.

4. Landscape ecology principles for green infrastructure

Landscape ecology provides a theoretical perspective and the analytical tools to understand how complex and diverse landscapes, including urban areas, function with respect to specific ecological processes[29]. Key ideas from landscape ecology that are relevant to GI for sustainable landscapes include: (1) a multi-scale approach, (2) the pattern and process relationship, and (3) connectivity. A multi-scale approach is based on hierarchy theory that addresses the structure and behavior of systems that function simultaneously at multiple scales. Holling and his colleagues have developed the concept of adaptive cycle and of panarchy—adaptive cycles linked in a nested hierarchy—to study the feedbacks and processes operating across scales[7]. These are important concepts to develop resilient landscapes that can be modified but still maintain essential structure and feedback loops after disturbance and "surprise"[19]. Therefore, GI designed with multiple scales (e.g., neighborhood, region, multiple regions) in mind is one way to develop a resilient landscape.

The pattern and process dynamic is arguably the fundamental axiom of landscape ecology because the spatial composition and configuration of landscape elements directly determine how landscapes function, particularly in terms of species movement, nutrient and water flows[29]. For example, using green spaces for climate change adaptation in urban areas, McMahon[21] points out different functions which green spaces play according to their classification of corridor, patch, and matrix.

Connectivity is a property of landscapes that illustrates the relationship between landscape structure and function[29]. In general, connectivity refers to the degree to which a landscape facilitates or impedes the flow of energy, materials, nutrients, species, and people across a landscape. As GI is a connected network of open spaces, functional connectivity (i.e., connectivity that can support a particular function) is a prerequisite for the provision of its functions. In other words, GI is a planning method which can protect, restore, and create connectivity to protect important natural and cultural resources, and to assure the services/functions which they can provide. Considering the concept of connectivity for target ecological and social/cultural functions helps landscape planners decide, for example, how to best place green spaces in urban environments. Different levels of connectivity provide a useful conceptual framework to organize green spaces across scales and challenge landscape planners to achieve connectivity in this manner.

5. Some cases of GI application in Japan

Literature review of Japanese greenspace planning shows that there have already been some examples of GI application in Japan since the 1960's. However, in most cases, the full potential of the GI concept has not been realized and there still is a lack of systematic

application of the concept in Japanese urban planning. Here I review and discuss some of the cases, regardless of the use of the term. The lessons learned from these cases will be used to develop recommendations (section seven) to facilitate further application of the GI concept in Asian cities.

5-1. Tokyo metro regional planning

With regards to Tokyo metro regional planning, in the 1960's there was a good amount of total green space but the concept of systematic connection among green spaces was non-existent[28]. However, currently Tokyo Metropolitan Planning Division (1) recognizes the importance of planning hierarchy from national to broad regional, prefectural, and to ward, city, town, and village levels, (2) attempts to coordinate green space planning among these different levels (3) plans the protection of riparian vegetation and corridor, and (4) incorporates the concept of adaptive planning[16] in its new privately-owned green space protection policy[14].

5-2. Kohoku New Town in Yokohama

Kohoku New Town in Yokohama City, planned in the late 1960's, is an example of one of the first application of the GI concept as defined in this paper. It realized a connected, integrated network of open spaces, including diverse open spaces, pedestrian paths, and water systems[24]. It developed a linked system of parks as a backbone (coarser landscape element), further connecting to other green spaces in the new town[24]. Also, it created a network of pedestrian paths (finer landscape elements), connecting to the backbone, so that the benefits of the parks can be shared by the residents[24]. Both the protective and opportunistic strategies[1] were used to develop the backbone by recognizing the distribution of green spaces to be protected in the valley slopes and intentionally planning most open spaces in the upper slopes[24]. Kohoku New Town's characteristics are that: (1) it valued open spaces equal to conventional infrastructure; (2) it used GI to shape development and conservation; and (3) it developed a layered, not hierarchical, system of linked parks and pedestrian paths[24].

5-3. Green parking space examples in Nagoya metro region

Six cases of green parking space in Nagoya metro region also incorporate the concept of adaptive planning by testing various greening technologies on the sites[11]. The significance of green parking space is not only the increase in the percentage of green cover in the metro region but also the creation of a "wind path"[11]. Nagoya City plans to make use of Hori River as a wind path to bring in breeze from the ocean into the city. The green parking spaces in the nearby area are expected to bring in the wind even further into the city by connecting the river and green spaces[11]. The effect of each green parking space for microclimate mitigation and other functions may be small but its cumulative effect can be significant[11].

5-4. Inochi-no-mori in Kyoto

Morimoto and Tabata[25] show a case of small (0.6 ha) biotope creation in the middle of Kyoto City. The target vegetation and species composition were those of floodplain forests and wetlands, formally existed in the area. Monitoring of the site has continued for 15 years since its development. Adaptive management has been applied to the management of the biotope since its development. The managing body set the management goal, keeps monitoring, and adaptively changes the management policies based on the monitoring result. The authors

suggest that even a small created green space in the middle of a city can greatly contribute to increasing biodiversity and supporting ecosystem services by proper design, planning, and management. Urban green spaces need to be considered along with various economic activities toward the goal of increasing biodiversity and providing ecosystem services[25].

5-5. Ecological networks

Ichinose[9] recommends ecological network planning for biodiversity conservation in the city. The premise is that green spaces in the city can be spatially configured to develop ecological networks that function as habitat for plants and animals although we lack empirical studies to strongly link the spatial configuration of green spaces to the movement of organisms and increase in local biodiversity of certain species. Moreover, there is no established method to develop ecological networks[9]. While we wait for more empirical studies, we must start planning ecological networks based on what we know right now and "learn by doing" by using adaptive planning[9, 16].

Ichinose[9] also points out the importance of scattered small green spaces in the city for improving the habitat quality of the urban matrix, which plays an important role for biodiversity conservation in the city. Although it is difficult to newly develop large green spaces or wide corridors in the city, it is possible to increase vegetation cover and improve the habitat quality of existing green spaces in the urban matrix[9]. For example, biotope development in city parks and schoolyards and even green parking spaces[11] can contribute to increasing green cover in the city and improving the overall habitat quality of the urban matrix[9].

6. Guidelines for planning and designing green infrastructure

These are not "how to" design formula but "big ideas," for each landscape plan or design is unique: it is for a specific place and a particular set of issues and landscape changes. If planned and designed based on the following guidelines, GI is more likely to provide its multitude of ecological, economic, and social benefits as previously discussed.

6-1. Articulation of a spatial concept

Spatial concepts convey the essence of a plan or strategy in simple terms. Spatial concepts are often used in the framework of developing a landscape plan to express its overall goal or vision in the form of conceptual metaphors[31]. For example, "Green Heart" denotes a central protected green space (formerly a peat land) around which major infrastructure lines and urban settlements lie in the Randstad, The Netherlands[27]. When implemented in landscape plans, spatial concepts provide opportunities to test various landscape ecological concepts associated with each spatial configuration that can realize the concept.

6-2. Strategic thinking

Ahern[1] put forward four planning strategies based on the existing landscape conditions on the trajectory of change, based on the assumption that landscapes keep changing. The four planning strategies are protective, defensive, offensive, and opportunistic strategies. When the existing landscape supports sustainable processes and patterns, a protective strategy may be employed[1]. Essentially, this strategy defines an eventual or optimal landscape pattern that is proactively protected from change while the landscape around it may be allowed to change. When the existing landscape is already fragmented and core areas are already limited in

area and isolated, a defensive strategy can be applied[1]. This strategy seeks to arrest/control the negative processes of fragmentation or urbanization. An offensive strategy is based on a vision or a possible landscape configuration that is articulated, understood, and accepted as a goal. The offensive strategy differs from protective and defensive strategies in that it employs restoration or reconstruction to rebuild landscape elements in previously disturbed or fragmented landscapes. The opportunistic strategy is conceptually aligned with the concept of GI by seeking new or innovative "opportunities" to provide abiotic-biotic-cultural functions[26] in association with urban infrastructure.

6-3. Greening of conventional built infrastructure

To achieve sustainability in urban landscapes, conventional (gray) infrastructure must be conceived of and understood as a genuinely possible means to improve and contribute to sustainability. For example, streets can incorporate street trees for air purification and microclimate remediation[12] and open drainage to retain and purify water on site. If one only thinks about avoiding or minimizing impact related to infrastructure development, the possibility to innovate is greatly diminished[2]. Existing and future infrastructure needs to be reconceived as opportunities to (re)greening the urban environment.

6-4. Learn by doing

The adaptive approach is promising for GI because the knowledge to plan and implement these systems is evolving. If experimental applications can be practiced routinely, the potential to build empirical knowledge, while exploring sustainability is quite profound. In adaptive planning, each plan or design can be treated as experiments[5] and a large plan can be divided into several small plans that can safely fail[20] to learn by doing, employing precautions and best practice[16].

7. Specific recommendations for GI application in Asian cities

GI is a useful greenspace planning tool to fight against nature conservation problems in Asian cities. GI can protect important green spaces, restore nature, and mitigate the lost nature by creating new green spaces in the city. Based on the lessons we learned from the earlier case studies, I propose four key ideas on the systematic application of GI concept toward solving the problems of Asian urban planning and those specific to green and open spaces. The recommendations are summarized in the representative, conceptual figure (Figure 1).

7-1. Waters' edge and watershed planning

Since many Asian cities are located at the waters' edge, the principle of connection between the waters' edge, riparian vegetation, coastal vegetation, and valley and ridgelines as part of a connected system of GI is important and applicable to Asian cities. Given the expected sea level rise by climate change, future design and planning of cities at the waters' edge would need to incorporate green space for climate change adaptation and need to plan for increased resilience to natural disasters such as flooding, typhoons, and tsunami.

Watershed can become a basic unit of designing and planning GI. Regional land use planning, for example, the former Tokyo metro regional green space plan, is based on watersheds[10]. Watershed is inherently multi-scale: from sub-watersheds to cities, regions, and to the nation[10]. The watershed scale, not administrative boundaries, is aligned with particular

ecological processes (i.e., water flow and cycle). Therefore, the developed plan (i.e., the pattern on a map) has a closer connection to ecological processes than if the plan were developed based on administrative boundaries that are usually irrelevant to ecological processes.

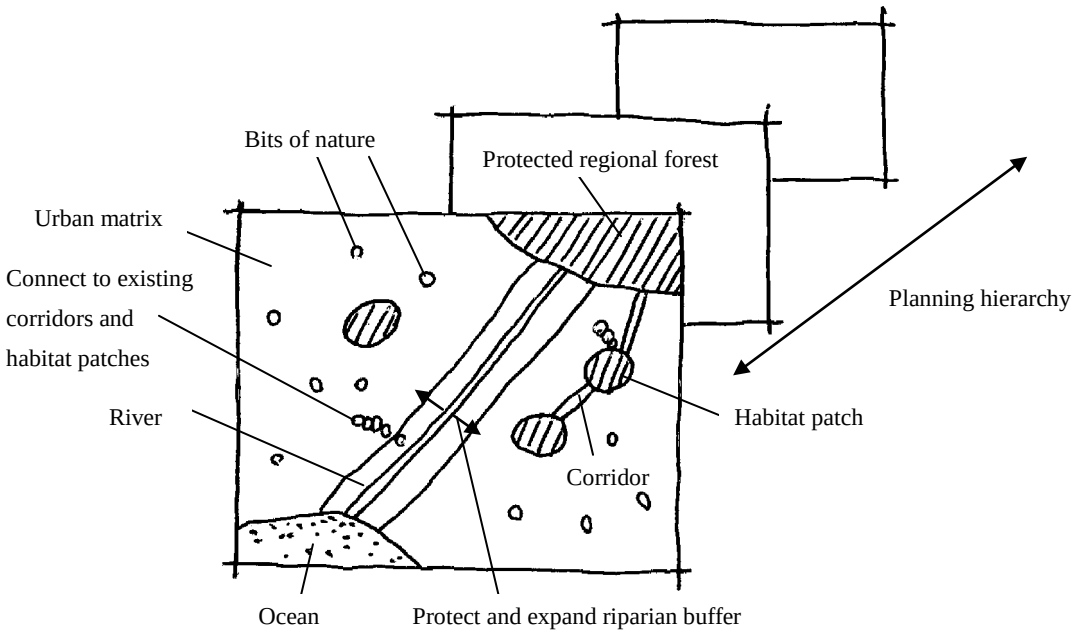

Fig. 1 Graphic representation of the specific recommendations for GI application in Asian cities

7-2. Bits of nature in the city

Representative urban greenspace planning issues in Asian cities include dense urban population and consequent small green (open) space per capita. Urban heat island effect is also an increasing environmental problem in the city. The problem is how to effectively green cities where open spaces are often scattered, small, and limited. Rooftop gardens, green walls, street trees, constructed biotopes, and green parking spaces are effective ways to increase greenery in the city, making use of limited surface area. These scattered green spaces, "bits of nature," even if they are not connected, can increase the overall habitat quality of the urban matrix[9]. Moreover, although the effect of each green space may be small for remediating the urban heat island effect and for providing other social and ecological services (e.g., purifying air and water, providing some habitat for plants and animals, and increasing aesthetics), the cumulative effect of all the increased greenery can be significant.

7-3. Connect habitat patches and bits of nature to existing corridors

Green spaces should be connected to access paths (roads) so that urban residents can receive their benefits. This is the issue of accessibility. When species conservation is the main planning goal, green spaces as habitat patches can be connected by corridors to form ecological networks[9]. Ecological networks are included in the concept of GI. Both emphasize connectivity among green spaces. Ecological networks focus on creating a connected network of habitat for species. GI is a broader concept, considering all types of open spaces both natural and artificial, and the benefits are more inclusive and multifaceted.

The "bits of nature" described above can be connected to river corridors as "wind

path”[11] and riparian vegetation. By this connection, both benefits can be shared. As mentioned, the cumulative effect of small green spaces can be significant. When they are connected to existing corridors such as rivers and ridgelines, the effect of the corridors can be brought further into the city. Also, bits of nature, if carefully spatially planned and created, can act as “stepping stones” to facilitate the movement of certain organisms. Therefore, bits of nature can become a part of functional ecological network.

7-4. Multi-scale approach

As illustrated in the important landscape ecology principles, a multi-scale approach is key to developing GI in Asian cities. An interconnected network of green spaces needs to be created across scales from neighborhoods to cities and to regions. For example, rooftop gardens, rain barrels, street bioswales, city and regional parks, constructed wetlands, and preserved regional forests can form a drainage network. Cross-scale networks of green spaces increase resilience with increased response and functional diversity[15].

7-5. Summary and conclusion

More specific recommendations to facilitate further GI application in Asian cities have been provided. To develop a systematic and strategic connection of green spaces (i.e., GI), we need to recognize hierarchical planning levels and coordinate greenspace planning among these different levels. Watersheds, which are inherently hierarchical, are recommended as a basic planning unit for GI and regional planning. GI can shape urban form and provide a framework for growth. If a GI is proactively planned, developed, and maintained, it has the potential to guide urban development by providing a framework for economic growth and nature conservation[27]. Adaptive planning is a suited planning tool to test various GI techniques and further develop its concept.

Green spaces created as part of GI serve to increase the percentage of green cover in the city. Created and restored green spaces (e.g., biotope development in city parks and schoolyards, green parking spaces, and rooftop gardens), even if they are small and scattered, can contribute to improving the overall habitat quality of the urban matrix. Even though the effect of each green space may be small, the cumulative effect of each green space can be significant to provide social and ecological services. These scattered green spaces, when strategically and proactively planned to connect to each other and to existing corridors such as rivers and ridgelines, can reinforce their functions. For example, green spaces connected to a river corridor can bring cooler air further into the city to remediate the urban heat island effect. Connected habitat patches by corridors can facilitate the movement and dispersal of organisms, and contribute to biodiversity conservation in the city. Finally, although I have focused on the ecological functions of GI in this paper, GI has a potential to include light infrastructure such as pedestrian paths and light rails in the network to provide more social and economic functions.

8. Conclusions

Although GI planning is gaining popularity in North America, the UK, and Europe, and some individual cases of application have been observed in Asian cities, GI arguably lacks in Asian cities and urban planning policies despite its multitude of benefits. To facilitate further application of the GI concept in Asian cities, this paper has succinctly reviewed the concept of GI and the functions it can provide, stated greenspace planning problems in Japanese cities, laid

out key principles of landscape ecology for GI, reviewed five greenspace planning cases for the application of GI concept, suggested broad guidelines for planning and designing GI, and made more specific recommendations for GI application in Asian cities. GI benefits are valued more in urban and suburban areas where green space is limited and natural environment is highly altered. In cities, GI can become a part of the means to control climatic change along with the sustainable design of housing and larger scale infrastructure development. GI plans apply key principles of landscape ecology to urban environments, specifically: a multi-scale approach with explicit attention to pattern-process relationships, and an emphasis on connectivity.

GI needs to be strategically planned and designed with the broad guidelines and landscape ecology principles in mind. A systems approach to planning GI as an integrated whole is needed[21), 22)]. A long-term thinking is also necessary to include GI as part of planning sustainable landscapes[13), 22)]. A strategic systems approach is suggested to ensure the functions of GI to be properly understood[6), 22)].

Moreover, an adaptive management approach[8)] could be tested in a planning process for GI. In an adaptive approach to planning, plans are made with the best knowledge available, but with explicit acknowledgement of uncertainty, followed by monitoring and re-evaluation of plans in order to close the loop, and to "learn by doing"[16), 19)]. Adaptive planning is appropriate for testing an emerging landscape planning concept such as GI.

GI, based on its precedents, links parks and natural areas for human benefits and counters habitat fragmentation[3)]. GI provides multiple functions for human benefits. GI engages key partners and involves diverse stakeholders[3), 13)]. GI provides a framework for both nature conservation and urban development. Future GI research needs to address the concept and planning of multifunctional GI to promote ecological services in the city. Also, more research is needed on quantifying the economic value of GI's benefits. A systematic application of the GI concept to Asian cities is in its beginning and we need to accumulate applied cases to document its benefits.

References:

1) Ahern, J. (1995), Greenways as a planning strategy, Landscape and Urban Planning 33(1-3): 131-55
2) Ahern, J. (2010), Planning and design for sustainable and resilient cities: theories, strategies, and best practices for green infrastructure, In: Novotny, V., Ahern, J., and Brown, P. (eds.), Water-Centric Sustainable Communities, pp. 135-176, John Wiley and Sons, Hoboken
3) Benedict, M.A. and McMahon, E.T. (2002), Green Infrastructure: Smart Conservation for the 21st Century, Renewable Resources Journal 20(3): 12-17
4) Benedict, M.A. and McMahon, E.T. (2006), Green infrastructure: Linking landscape and communities, Island Press, Washington, D.C.
5) Felson, A.J. and Pickett, S.T.A. (2005), Designed experiments: new approaches to studying urban ecosystems, Frontiers in Ecology and the Environment 3: 549–556
6) Gill, S.E., Handley, J.F., Ennos, A.R., and Pauleit, S. (2007), Adapting Cities for Climate Change: The Role of the Green Infrastructure, Built Environment 33(1): 115-133
7) Gunderson, L.H. and Holling, C.S. (eds.) (2002), Panarchy: Understanding transformations in human and natural systems, Island Press, Washington, D.C.
8) Gunderson, L., Peterson, G., and Holling, C.S. (2008), Practicing adaptive management in complex social-ecological systems, In: Norberg, J. and Cumming, G.S. (eds.), Complexity theory for a sustainable future,

pp. 223-245, Columbia University Press, New York

9) Ichinose, T. (2010), Ecological network planning in Japanese cities, City Planning Review 59(5): 38-41, in Japanese
10) Ishikawa, M. (2009), Creating New Horizon of City and Environmental Planning through Watershed Planning, City Planning Review 58(3): 17-20, in Japanese
11) Ito, T. (2011), Urban Environmental Design for Green Parking, City Planning Review 60(1): 53-56, in Japanese
12) Jim, C.Y. and Chen, S.S. (2003), Comprehensive greenspace planning based on landscape ecology principles in compact Nanjing city, China, Landscape and Urban Planning 65(3): 95-116
13) Kambites, C. and Owen, S. (2006), Renewed Prospects for Green Infrastructure Planning in the UK. Planning, Practice & Research 21(4): 483-496
14) 加藤範子(Noriko KATO), 竹内智子(Tomoko Takeuchi), (2010),「緑確保の総合的な方針について」, 都市計画 59(3): 78-79
15) Kato, S. (2010), Greenspace Conservation Planning Framework for Urban Regions Based on a Forest Bird-Habitat Relationship Study and the Resilience Thinking, Ph.D. Dissertation, University of Massachusetts Amherst, Massachusetts, http://scholarworks.umass.edu/open_access_dissertations/212
16) Kato, S. and Ahern, J. (2008), 'Learning by doing': Adaptive planning as a strategy to address uncertainty in planning, Journal of Environmental Planning and Management 51(4): 543-59
17) 川上光彦(Mitsuhiko KAWAKAMI), (2008), 都市計画, 156p, 森北出版
18) 日本都市計画学会九州支部（編）(Kyushu Chapter of the City Planning Institute of Japan, eds.), (1999), アジアの都市計画, 165p, 九州大学出版会
19) Light, S.S., Gunderson, L.H., and Holling, C.S. (1995), The everglades: Evolution of management in a turbulent ecosystem, In: Gunderson, L.H., Holling, C.S., and Light, S.S. (eds.), Barriers and bridges to the renewal of ecosystems and institutions, pp. 103-168, Columbia University Press, New York
20) Lister, N.-M. (2007), Sustainable large parks: Ecological design or designer ecology? In: Czerniak, J and Hargreaves, G. (eds.), Large parks, pp. 35-57, Princeton Architectural Press, New York
21) McMahon, E.T. (2000), Green Infrastructure, Planning Commissioners Journal 37: 4-7
22) Mell, I.C. (2008), Green Infrastructure: concepts and planning, FORUM Ejournal 8: 69-80
23) Millennium Ecosystem Assessment (2005), Ecosystems and human well-being: Synthesis, Island Press, Washington, D.C.
24) Miyagi, S. (2010), Invisible Structure of Natural Environment Underlies the Suburban New Towns Envisioned and Developed through 1960s, City Planning Review 59(2): 30-33, in Japanese
25) Morimoto, Y. and Tabata, K. (2010), Biodiversity oriented urban greenery and its management, City Planning Review 59(5): 13-17, in Japanese
26) Ndubisi, F. (2002), Ecological planning: A historical and comparative synthesis, The Johns Hopkins University Press, Baltimore
27) Schrijnen, P.M. (2000), Infrastructure networks and red-green patterns in city regions, Landscape and Urban Planning 48 (3-4): 191–204
28) Takeuchi, T. (2010), The legacy of the green belt policy in Tokyo, City Planning Review 59(2): 58-62, Japanese
29) Turner, M.G., Gardner, R.H., and O'Neill, R.V. (2001), Landscape in theory and practice: Pattern and process, Springer Science+Business Media, New York
30) Tzoulas, K, Korpela, K., Venn, S., Yli-Pelkonen, V., Kaźmierczak, A., Niemela, J., and James, P. (2007), Promoting ecosystem and human health in urban areas using green infrastructure: A literature review, Landscape and Urban Planning 81(3): 167-178
31) van Lier, H.N. (1998), The role of land use planning in sustainable rural systems, Landscape and Urban Planning 41(2): 83-91