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Nature in the city, city in the nature: case studies of the restoration of urban nature in Tokyo, Japan and Toronto, Canada

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Abstract Increasing demands for the restoration of nature in cities have led planners to seek an effective form, configuration and maintenance scheme for parks and open spaces in urban areas. This paper aims to introduce two contrasting examples of ways that planners have met the challenge of restoring nature in the city. It takes Tokyo Bay Bird Sanctuary Park (TBBSP), Tokyo, Japan, and Tommy Thompson Park (TTP), Toronto, Canada, as case studies. TBBSP is located on reclaimed land facing Tokyo Bay, and is surrounded by heavily industrialized areas. The absence of green corridors which connect TBBSP to surrounding green patches have turned TBBSP into an isolated oasis for migrating birds. TTP in Toronto is also located on reclaimed land facing Lake Ontario. However, TTP has become to be an indispensable green patch of the open space network of Toronto because it is located at the node of green corridors. The principles of landscape ecology may dictate that TTP, integrated in the green network of the area, is in far better condition than isolated TBBSP. However both case studies are based on the same early post-war parks and open space planning concept, which aimed to clearly separate urban greens from surrounding urban fabrics. To restore nature in cities it is important to understand that alternative models of parks and open space planning can exist. We therefore refer to the authentic urban pattern found in Japanese cities, which historically have not intended to clearly separate each land use types but have sustained a mix of open spaces and urban fabrics. In the context of the global concern to realize ecological cities, restoring a city by integrating greens in the urban fabric should be understood as a way of achieving a ''city in nature''.

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Introduction

Since the early 1990s public attention has increasingly focused on the conservation of global biodiversity. As a consequence planners have to consider ways of conserving biodiversity in the city. The following paper investigates two contrasting approaches to the conservation of biodiversity. We point out the similarities in both cases, but also show why they are fundamentally different. As an alternative to these approaches we propose a third way of planning nature in the city.

Planners first used parks and green open spaces for recreation and improving public health in urban areas during the start of the modern planning movement. As urban growth accelerated during the twentieth century, planners increasingly used parks and green open spaces for restricting the disordered expansion of urban areas into surrounding rural areas. One of the most famous examples of this use was the implementation of a green belt around the city. As a result of this, it is possible to identify three major components of planning urban parks and green open spaces during the post-war period: urban parks as core areas in the city, an outer green belt surrounding the city, and green corridors along rivers and streets connecting the core and the outer areas. This early post-war model of greenspace planning has influenced planning in areas as far apart geographically and culturally as London (Abercrombie 1945), Tokyo (Ishida 1992) and Seoul.

Increasingly, the recreational and aesthetic function of parks and green open spaces are being superseded by their function as habitats for wildlife. Planners are seeking an effective form, configuration and maintenance scheme for restoring nature in cities. This paper will introduce two contrasting examples of ways that

planners have met the challenge of restoring nature in the city. We select the case of Tokyo as an example of an intensely managed island in the middle of an industrial city scape. We then select Toronto on the other hand as an example of an area left to nature but forming part of an overall regional plan. Even though both cases are very different we aim to show that they are typical of the early post-war model of greenspace planning. To restore nature in cities it is important to understand that alternative models of greenspace planning can exist. Therefore we refer to the authentic urban pattern found in Japanese cities, which historically have not intended to clearly separate each land use types but have sustained a mix of urban and rural land uses. In the context of the global concern to realize ecological cities, restoring a city by integrating rural greens should be understood as a way of achieving a ''city in nature''.

Tokyo Bay Bird Sanctuary Park, Tokyo, Japan

History of the land

Tokyo Bay Bird Sanctuary Park (TBBSP) is located on reclaimed land in Tokyo Bay, approximately 10 km from the center of Tokyo. The site is almost entirely surrounded by industrial facilities such as factories, warehouses, and vegetable and fruit markets. Haneda Airport, one of the busiest airports in Japan, is only 2 km away from the site. The land for the TBBSP was originally reclaimed in the early 1970s following a Tokyo Metropolitan Government (TMG) plan to relocate a fish market from the center of Tokyo. However, the fish market refused to be relocated and the land was abandoned. Over time, vegetation covered the land. Rain water also started to accumulate forming a fresh water lagoon ideal as a nesting and resting site for migrating birds.

Characteristics of the park

As a result of the land's importance for nature, the Tokyo Metropolitan Government (TMG) designated the area as a bird sanctuary park in 1978. Today, the area of parkland covers 25 ha, is divided into two zones. The east zone covering 15 ha consists mainly of two lagoons; one with fresh water and the other with sea water. A visitors' center known as the ''Nature Center'' and several hides surround the lagoons. A smaller west zone is covered by 10 ha of small rice paddy and crop field patches, creeks and ponds (Ueno and Ogawara 1994). The park receives more than 50,000 visitors per year. The park is located at the mouth of Tama River that flows along the western edge of Tokyo. As well as protecting the area as a bird sanctuary the TMG also intended to restore the Tama River's original wildlife habitats. These habitats existed in the downstream area of the Tama River basin before it was affected by intensive urban developments in the 1960s. It was thought that by restoring a miniature of the Tama River basin ecosystems, many bird species would be attracted to the park. To ensure that these target habitats remain the park has been intensively managed ever since. For example, some of grass meadows in the park have intensively been mowed annually so as to maintain vegetation attractive for certain bird species which nest on the ground. The result of this maintenance can be seen in the number of bird species that inhabit the park. As many as 160 bird species visit the park annually. These bird species include endangered bird species such as cormorants, herons, sandpipers, and plovers [http://www.tptc.or.jp/park/yacho/index.html (in Japanese), cited October 2004].

Sanctuary as an isolated green patch

Although it only occupies a small land area, TBBSP is still the largest and the most diverse bird sanctuary remaining in the Tokyo Bay area today. However, unlike Toronto referred to below, the bay area of Tokyo does not have a park system that connects individual parks with green corridors. TMG does not intend to implement such a park system. TBBSP may function as an indispensable green spot for migrating birds, but it is a sanctuary: totally isolated from its surrounding environment. TBBSP is in effect a green oasis in a desert of industrial urban development.

There is a historical irony in this isolation. In 1939 the government of Tokyo and its surrounding municipalities announced a comprehensive parks and open spaces plan to implement a green belt around the city (Fig. 1; Ishida 1992). This green belt was enacted by the air defense plan during the Second World War and the Post-War Rehabilitation Plan of Tokyo in 1947. The TBBSP is located at the southern end of this green belt (Figs. 2, 3). If the green belt plan had been fully implemented, the TBBSP would have been connected to other green patches further inland by a green corridor. However, Tokyo's green belt was fiercely resisted and eventually developed so that the plan was finally abandoned in 1969. Had the original Tokyo green belt been implemented it is likely that maintaining the park's biodiversity would have been easier.

Tommy Thompson Park, Toronto, Canada

History of the land

Toronto is Canada's largest city accommodating almost four million people today. The city faces Lake Ontario, one of the five Great Lakes in the north-east corner of North America. Historically the city has been important as a gateway to northern Ontario. In fact, the name ''Toronto'' comes from an old American-Indian word meaning ''meeting place'' as it lies at the confluence of

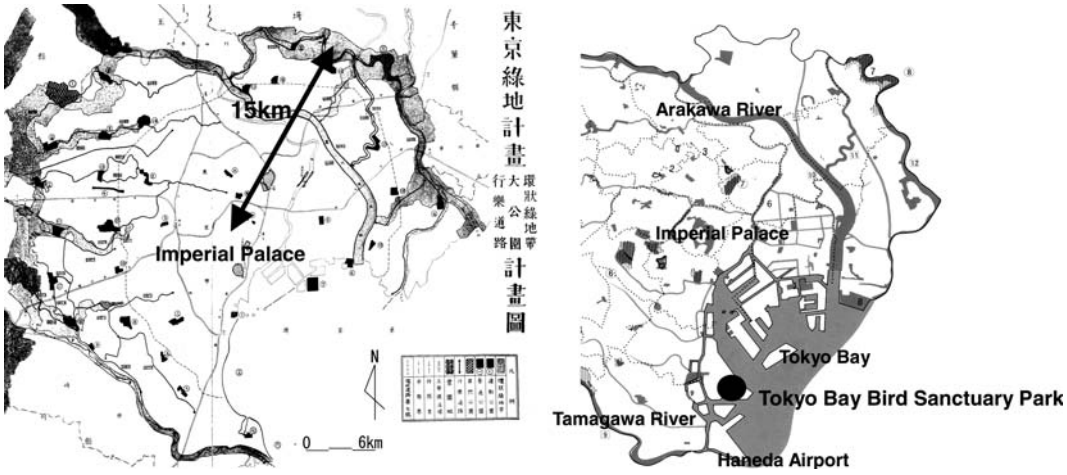

Fig. 1 Parks and open space of Tokyo. The comprehensive parks and open space plan proposed in 1939 (*left*), and the current parks and open space plan (*right*). A belt surrounding downtown Tokyo in the 1939 plan is the greenbelt proposed on the administrative boundary of Tokyo at the time, approximately 15 km from the Imperial Palace (*left* Koen-Ryokuchi-Kyokai 1939, *right* Tokyo Metropolitan Government 2000)

several rivers that were main transportation corridors until the twentieth century. As a result of this history, Toronto came to be one of the most important ports in the Great Lakes for surface transportation.

In the late 1950s the City of Toronto decided to expand the Port of Toronto to increase its cargo handling capacity. It initiated a landfill operation in 1959. Bricks, asphalt wastes and concrete blocks were brought in from construction sites as landfill materials. Sands and silts dredged from the bottom of the lake were also used. However, by the mid-1960s surface transportation suffered a decline and the port expansion was already no longer viable. Nonetheless, the site continued as a landfill for dumping construction debris, creating an area of abandoned land in Lake Ontario (Yokohari and Takeuchi 1995).

In 1973, Metro Toronto and Region Conservation Authority (MTRCA) decided to restore the abandoned reclaimed land into a park so that it could function as a core area for Toronto's park system. The park's master plan (Fig. 4) included various recreational facilities such as a marina and an amusement park (MTRCA 1977). Naturalist groups in Toronto, however, protested against the plan and campaigned to stop any development on the land. These groups protested because, as in the case of Tokyo, vegetation had started to cover the land and the site was already used as a nesting site by migrating birds. These protests were backed up by data that showed that the number of species found and the number of total nesting birds on the site had increased year by year. As a result of this action, the MTRCA submitted a revised park plan in 1989 that aimed to conserve the ecosystem of the area. They also renamed the park the Tommy Thompson Park (TTP; Fig. 5).

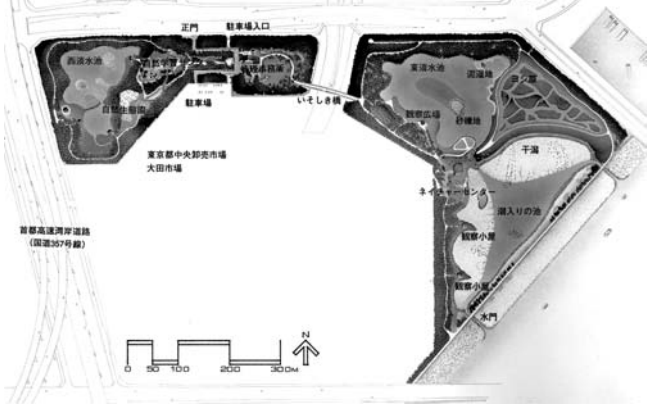

Fig. 2 Tokyo Bay Bird Sanctuary Park (TBBSP). The *zone to the right*, 15 ha, consists of fresh water and sea water lagoons as well as the Nature Center, while the *zone to the left*, 10 ha, has small patches of rice paddies and crop fields, creeks and ponds as a miniature of ecosystems in the Tamagawa River watershed (Ueno and Ogawara 1994)

Wildlife of TTP

The land started to be colonized by vegetation in the early 1970s. In 1975 the first vegetation survey revealed the existence of 152 different plant species (Catling et al. 1977). Only seven of these were woody species, with the rest being herbaceous plant species. In 1980 258 plant species were identified, including 29 woody species (Temple 1980). Today more than 390 plant species, almost one-third of the total plant species identified in Toronto region, are found on the site (Banville 1990).

The vegetation of the TTP is characterized by a dominant number of naturalized plant species. Seventy-two (70%) out of 93 species found in 1989 were naturalized plants. This rate of naturalized plant species is much higher than the 40% for the Toronto region as a whole (Banville 1990).

For avifauna in the TTP, 185 species were identified by the first bird census conducted in 1976 (Steers 1979).

Fig. 3 View of TBBSP

The number gradually increased over time, so that it stood at 290 in 1991 (MTRCA 1992b). In addition, the number of birds nesting on the site significantly increased during the 1970s and 1980s. For example, there were only 40 nests of ring-bill gull (*Larus delawarensis*) in 1973, but in 1982 the number jumped up to 80,000 (Parker 1983). Today the colony of ring-bill gulls on the TTP is the largest in the world (Fig. 6). Finally, the park also contains a large number of other fauna. Twenty species of mammal, 7 species of reptile, 2 species of amphibian and 30 species of fish have been identified in and around the park (MTRCA 1992b).

The most significant difference with the Tokyo Bay Bird Sanctuary Park (TBBSP) is that the 1989 master plan of TTP was based on the idea of allowing ecosystem succession to occur naturally in the park (MTRCA 1989). Instead of designating a certain target species to be protected, or an ecosystem to be achieved, MTRCA regarded that the succession taking place in the park as a part of ''nature'' and decided not to have any control over the wildlife species in the park. Instead controls were imposed on humans. MTRCA decided to restrict visitors to the park during the nesting season, from late May to early July.

Green network of Toronto

A significant difference between the Tokyo and Toronto regarding their parks and open space is the amount of the land occupied. Tokyo has in total 66 km^2, 3% of the land area of Tokyo, while Toronto accommodates 75 km^2, which amounts to 12% of the land area. Not only is the size of the area important but also its role in a comprehensive network of green areas. In 1954 Toronto experienced a serious hurricane storm that caused floods killing more than 50 people in the city . The provincial government of Ontario acted to prevent a similar calamity occurring again by establishing an organization to control the rivers flowing through Toronto. This led to the establishment of the MTRCA which is now called Toronto Region Conservation Authority (TRCA).

To control the floods the MTRCA decided to purchase land along river ravines and turned them into a series of urban parks. These function as water reservoirs in case of a flood but as recreational parks for daily use. Today, Toronto has three major greenways, those along Humber, Don and Rouge rivers, running from north to south throughout the city, forming vertical spines for its parks and its open space network (Fig. 7). When the MTRCA implemented greenways along river ravines they initially functioned as flood control and recrea-

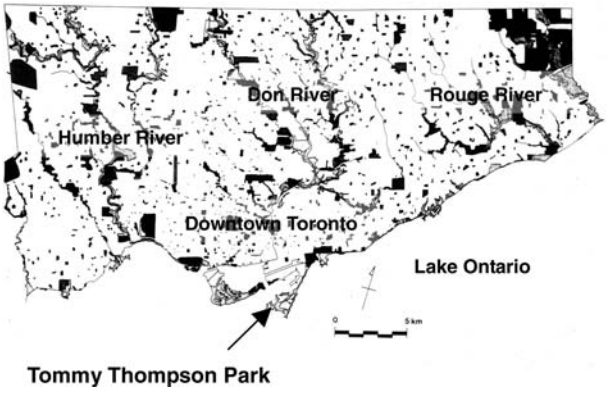

Fig. 4 Parks and open space of Toronto Greenways along Humber River (*left*), Don River (*center*) and Rouge River (*right*), as well as a number of detached parks cover in total 12% of the land area of Toronto

Fig. 5 View of Tommy Thompson Park (TTP)

Fig. 6 Ring-bill gulls nesting in TTP. The colony of ring-bill gulls (*Larus delawarensis*) in TTP is estimated to be the largest in the world

tional corridors. The indirect effect of these green corridors has been to provide ideal corridors for wildlife habitats and migration routes. The Tommy Thompson Park (TTP) is located at the mouth of Don River, at the southern end of a greenway along the Don River ravine. MTRCA reports that many of the wildlife species, especially large mammals such as deer and coyote, came to the park using the Don River greenways as a migrating route (MTRCA 1992a).

Additional green corridors are currently planned and may be implemented in the future. The Government of Ontario, along with the Federal Government and the City of Toronto, established an organization named Waterfront Regeneration Trust (WRT) to restore the waterfront of Lake Ontario, and has announced plans to develop a greenway along the waterfront (Royal Commission on the Future of the Toronto Waterfront 1992). Most of the land along Toronto's waterfront is private which restricts public access in many cases (MTRCA 1991). WRT therefore plans to either purchase or borrow land to turn it into a greenway allowing public access to the waterfront.

WRT is also planning the conservation of green open space on Oakridge Moraine (Royal Commission on the Future of the Toronto Waterfront 1992). Oakridge Moraine defines the hilly area in the northern suburbs of Toronto, approximately 30 km from the lakeshore. The area has been used for agriculture but is currently under threat from urban development. WRT proposes a plan to restrict urban development to conserve a network of green open space in the area (Fig. 7).

With the existing greenways along river ravines running north to south, and the proposed greenways along the Lake Ontario waterfront and on the Oakridge Moraine running east to west, Toronto's parks and open space network is planned to become a true "net" that covers the entire region. Located at the mouth of Don River on Lake Ontario's waterfront, TTP is expected to function as an ecological node, or a "meeting place" for wildlife species, as part of the parks and open spaces network.

City in nature: ecological restoration of cities with agriculture

The above sections describe two contrasting approaches to the challenge of bringing nature into the city. On the one hand, Tokyo Bay Bird Sanctuary Park (TBBSP) represents a green oasis in a desert of concrete and asphalt. On the other hand Tommy Thompson Park (TTP) represents an ecological node which forms part of a network of greenways in Toronto. We can easily argue that the ecological network approach demonstrated by Toronto is a better solution than the approach taken by Tokyo. Not only does Toronto have a vast network of greenways it has also demonstrated a sensitivity and a concern for planning an ecological and sustainable city into the twenty-first century.

However, it is also possible to argue that bringing nature into the city cannot be the final word on ecological planning. Instead, when we consider the future of cities, it is necessary to plan for the survival of cities and

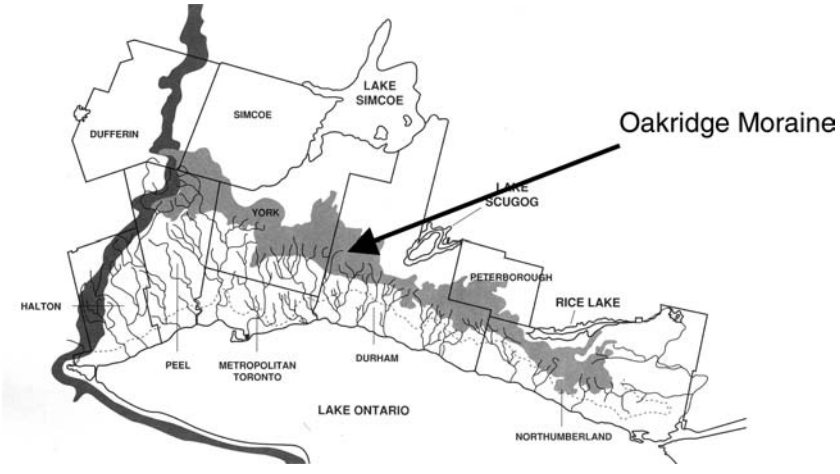

Fig. 7 Greater Toronto bioregion (Royal Commission on the Future of the Toronto Waterfront 1992)

their species as part of a larger, more global ecosystem. In this sense, therefore understanding the city in nature becomes as important as understanding nature in the city. In the final section we consider the history of planning Edo, the former name for Tokyo. We aim to show that the history of Edo has lessons to teach both of the above cases for planning a city in nature.

Edo's land use: a mixture of urban and rural land uses

Edo, the former name for Tokyo, is well known as a city based on a cyclic system of material flow (Kito 1996). The city of Edo was established as the effective capital city of Japan in 1603 by Ieyasu Tokugawa. The Tokugawa family's shogunate government established a period of relative peace and tranquility known as the Edo era that lasted for over 250 years until the Meiji Restoration in 1868. Before the establishment of Edo castle, Edo was merely a maritime village. During the Edo era its population sharply increased so that by the early nineteenth century the population of Edo had reached 1.3 million (Fig. 8). This made Edo one of the largest cities in the world at the time.

Despite Edo's large population, it was also a city that contained a substantial amount of agriculture. A number of vegetables that can be found in the supermarket today are named after the area where they were grown in Edo (JA Tokyo 1992), e.g. Komatsu-na (a variety of Chinese cabbage), Nerima-daikon (a variety of radish), and Yanaka-shoga (a variety of ginger). Fujii (2002) estimated the land use of Edo in 1850s by using various documents and maps, and identified that Edo's land-use exceeded 40% agricultural land. Fujii (2002) also noted that the actual coverage of agricultural land may have been higher than 50%. This is because vacant lands that formed part of the residence of shogun families were commonly loaned to neighboring farmers for agricultural use (Watanabe 1983).

Farmers spread human waste from urban areas over their fields to fertilize the vegetables. People living in the city were the main consumers of these vegetables. The land use in Edo was also characterized by a complex mixture of urban and agricultural land in its fringe areas (Tamura 1992). By calculating the link value of agricultural land patches, Fujii (2002) identified an area of between 4 km and 6 km from the core of Edo that mainly consisted of small and segmented patches of agricultural lands among the residential neighborhoods (Fig. 9). This mixture of urban and rural land uses was a symbol of the functional relationship that existed between the urban fabric and the agricultural lands of this small-scale recycling system.

Urban agriculture in Tokyo

Agriculture still survives in the dense urban fabric of today's Tokyo. Inside the 600 km^2 of Tokyo's central core, more than 900 ha of land is farmed, forming a patchwork of farmlands. This land is worked by 6,500 professional farmers. Nine hundred hectares of farmland, or 1.5% of the land area of Tokyo Wards and 0.02% of the total farmland in Japan, is a small quan-

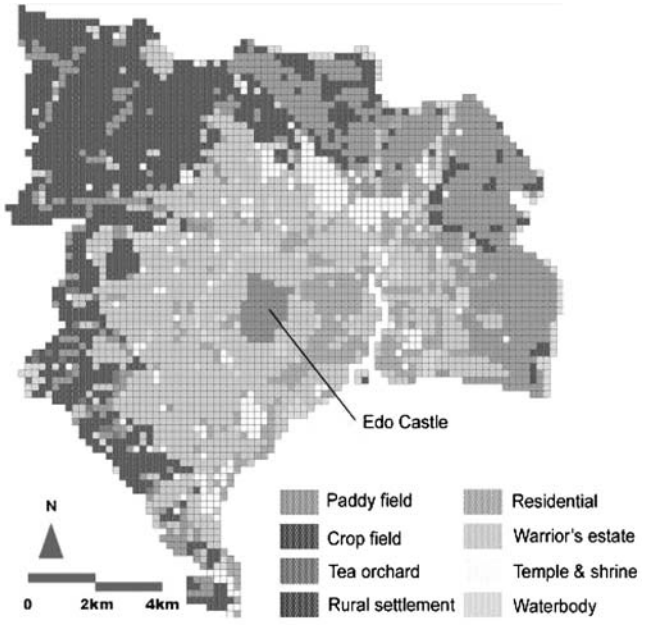

Fig. 8 Land use of Edo in mid nineteenth century. More than 40% of the land area of Edo was for agricultural use (Fujii 2002)

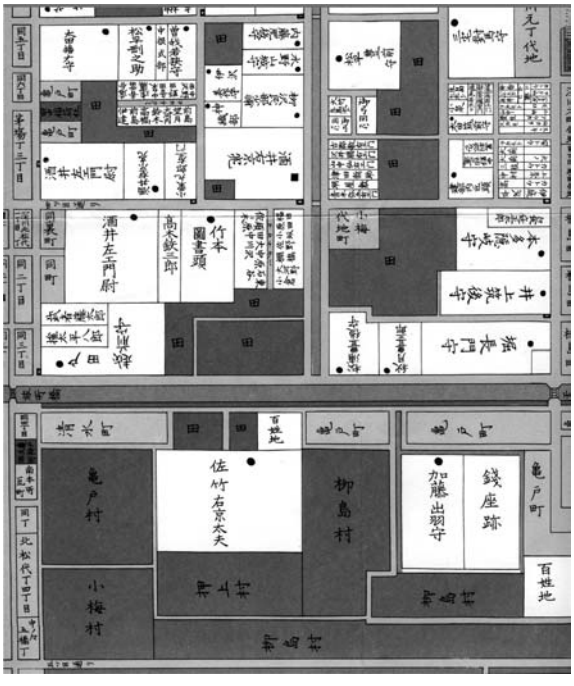

Fig. 9 Segmented paddy fields remaining in a residential neighborhood of Edo. The scene is from Honjo-Fukagawa district, only 2 km east of the Edo Castle. A series of segmented patches of paddy fields, *hatched in black*, surrounded by urban fabric are seen

tity. However, considering the fact that this agriculture produces 0.3% of vegetables and 0.2% of flowers and ornamental trees produced in Japan, the agriculture in Tokyo's Wards should not be regarded as a marginal concern.

The City Planning and Zoning Act of 1968 designated areas where urbanization was to be promoted. At the time, planners intended to completely convert the farmland in such areas to urban land uses. The Tokyo Wards are completely zoned as urbanization-promotion areas. This means that the farmland found in Tokyo Wards has survived despite 30 years of the Act's implementation. Today, nearly 60% of farmland in Tokyo Wards is designated as "Seisan ryokuchi (productive green open space)", where continuity as farmland is ensured by the Productive Green Open Space Act.

A representative example of farmland in Tokyo can be found in Setagaya Ward, one of the most agriculturally active wards with more than 3% of its land area employed for agriculture. The farmer who owns the site has a total of 1 ha of farmland segmented into 40 patches. Products such as vegetables, fruits and ornamental trees are not brought to the market but are sold directly to consumers living mostly in the surrounding areas. The use of organic fertilizers made on-site is encouraged to meet consumers' demands for safe food, and to avoid conflicts with surrounding residents over the use of agricultural chemicals.

City in nature: ecological restoration of cities with agriculture

The concept of clearly separating urban areas from the surrounding rural areas is a fundamental concept of modern urban planning theory. It is rooted in the idea of building and planning a medieval European city with a densely populated urban core, surrounded by a moat that clearly separates the urban area from surrounding rural areas (Spirn 1984). However, the history of Japanese cities shows a different model for planning a city and for integrating it with nature. Historically, Japanese cities have not intended to clearly separate urban and agricultural land uses, but have sustained a mix of agricultural and urban land right to the center of the city (Yokohari et al. 2000). Modern urban planning theory may tend to describe this mixture as chaotic and disorderly. Ashihara (1986) however notes that such an urban form contains a hidden order. The mixture of urban and agricultural land uses should not be interpreted as a disordered situation which reflects the absence of sufficient controls, but as a condition rooted in the Japanese way of understanding and planning space.

The two cases described above, Tokyo Bay Bird Sanctuary Park in Tokyo and Tommy Thompson Park in Toronto, both tried to restore nature in the city, and thus can be regarded as successful examples even though their appearance is different. However, the fundamental concept they share is that of separating urban and rural areas. The ecological restoration of cities is not merely meant to bring back wildlife species to urban areas but to re-design cities in accordance with ecological processes. The Japanese city represents an example of implementing a city with a system for circulating environmental nutrients. In the context of the global movement to connect cities to nature, the Japanese model of planning should be understood as a way of achieving a city in nature.

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