Understanding Change in Tokyo Through Food, Energy, and Water Security

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Abstract Japan, one of the most developed countries in Asia, is recognized for having well-managed infrastructure and for its living environment. This apparent utopia is collapsing amid the ever-growing risks posed by climatic disasters and the unsustainability of natural resources. This chapter looks back at the development path of urbanization in Tokyo, reveals the vulnerabilities of massive urban development, and raises concepts that could help remake the city to be more resilient and adaptive to climatic and social changes in the twenty-first century.

Keywords Urbanization · Food–energy–water security · Resilience · Natural resources

1 The Urban Systems of Tokyo

Depending on the definition, Tokyo has different metrics for geographical coverage and population. Administratively, Tokyo-to (Tokyo Metropolis) is one of the 47 first-class administrative prefectures in Japan, with a population of approximately 13.7 million and a land area of over 2200sq. km. It includes 23 special districts (in terms of jurisdiction, equivalent to cities) in its eastern part, the Tama region (26 cities, 2 towns, and 1 village) in the western part, and a remote island region in the southeast. The 23 special districts are undisputedly the central core of the metropolitan area, with a population of nearly ten million. The remote island region is unlike the rest of Tokyo in terms of urbanization, so it will not be covered further in this book.

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The Tokyo Metropolitan Area (TMA) refers to Tokyo-to and three neighboring prefectures (Chiba, Kanagawa, Saitama) and has a population of about 35,154 million and 12,000 sq. km in total land area.

The Greater Tokyo Area (GTA) contains Tokyo-to and the prefectures of Chiba, Kanagawa, and Saitama as well as parts of Gunma, Ibaraki, and Tochigi prefectures. It is statistically defined by the administrative area in which more than 1.5% of the working-age population is commuting to the TMA for work and school. The population of this region is about 36.44 million and the land area is about 13,565 sq. km.

The Greater Capital Area (GCA) covers Tokyo and seven prefectures (Chiba, Gunma, Ibaraki, Kanagawa, Saitama, Tochigi, Yamanashi). It was politically designated by the National Capital Region Planning Act in 1956 (https://en.wikipedia.org/wiki/Greater_Tokyo_Area#National_Capital_Region). It has a population of approximately 44 million and a land area of 36,898 sq. km.

The Greater Kanto Region (GKR) is the concept in the National Territorial Planning. It includes Tokyo and six prefectures in the Kanto plain (Chiba, Ibaraki, Gunma, Kanagawa, Saitama, Tochigi), three prefectures in the Koshin-etsu region (Nagano, Niigata, Yamanashi) and Shizuoka Prefecture, for a total of one capital and ten prefectures, with a total population of 52 million and a land area of over 70,000 sq. km.

According to the national census in 2015, TMA consists of 105 cities, 35 towns, and 3 villages (townships). These cities are systematically divided into “city center, sub-center, new urban center, central cities, stronghold cities, and general towns” by the National Capital Region Planning Act based on population and functions. Except for the Tokyo 23 special cities, all the cities regardless of size are equivalent to local governments in the political system.

In addition to the 23 special districts of Tokyo, a municipality with a population of over 500,000 can apply to be a designated city by decree. These municipalities within TMA include, in descending order of population: Yokohama City, Kawasaki City, Saitama City, Chiba City, and Sagamihara City, of which the first three have populations over one million. Chiba city is close to one million. The rest are medium sized, with populations of around 500,000 or less. The urban composition of the TMA is illustrated in Fig. 1.

2 Development Path of the Tokyo Metropolitan Area

Tokyo emerged as a city during the Edo era (1650–1868), took off during Meiji (1868–1912), and Taisho (1912–1925), developed further during Showa (1925–1989), and matured in the Heisei era (1989–2018). The Reiwa era began in 2019. The progress of urbanization in Tokyo is shown in Fig. 2, which illustrates the sprawl of Tokyo since the seventeenth century. Edo was a small castle at the beginning. It started to grow in Meiji, the later of the nineteenth century. The remarkable sprawl was observed in Showa before and after WWII.

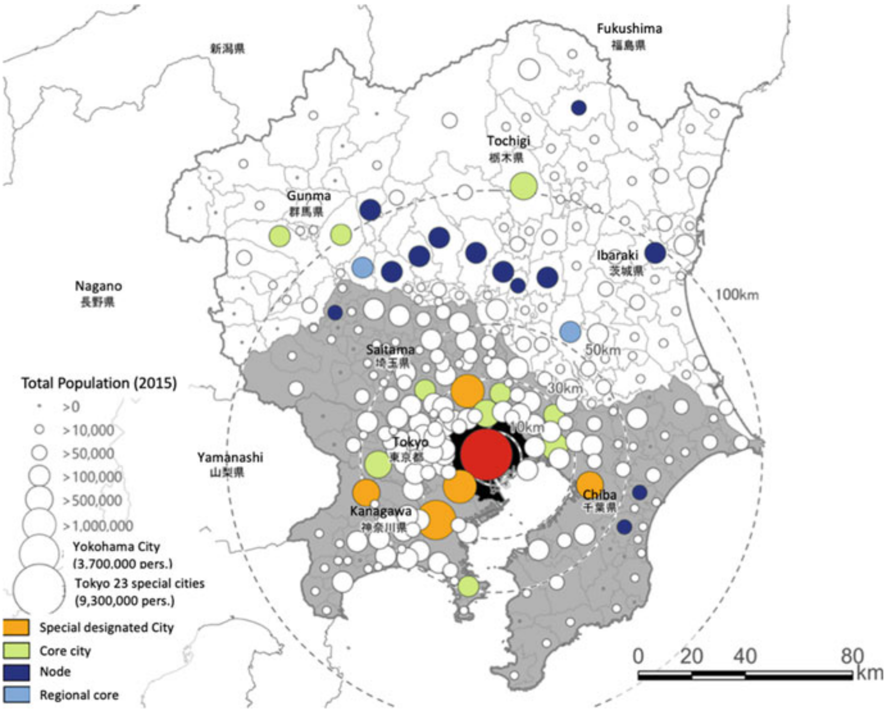

Fig. 1 The urban composition of the Tokyo Metropolitan Area. (Data source: e-Stat)

At the end of the Edo era, Western ideas and technologies began to enter Japan. The Edo military government started to construct roads, railways, and other urban infrastructure under modern concepts of urban planning. The Meiji government expropriated land from the samurai class for universities, government offices, and public parks. Since this conversion happened on a parcel-by-parcel basis, the land shapes and forms of use were mixed everywhere (resulting in the complex and diverse urban landscapes we see in Tokyo today.

The Great Kanto Earthquake of 1923 caused severe damage to the city center, with 40% of houses burned down and the streets demolished. The post-earthquake reconstruction triggered the first modern wave of urbanization in Tokyo and had significant impacts on later generations. The state and influential industry leaders strongly advocated for the construction of railways. By about 1930, a major railway network was almost completed, stretching from the terminal stations of the Yamanote ring railway to the hinterlands of the suburbs. Countless railway stations dot the metropolitan area today, serving as the most important transportation infrastructure system of the metropolis. Most of the development first happened around the railway stations, then expanded the outward as the stations became the centers of communities. Some of those residential communities were developed in a planned manner as the so-called garden cities, such as Tamagawadai and Denenchofu, in the

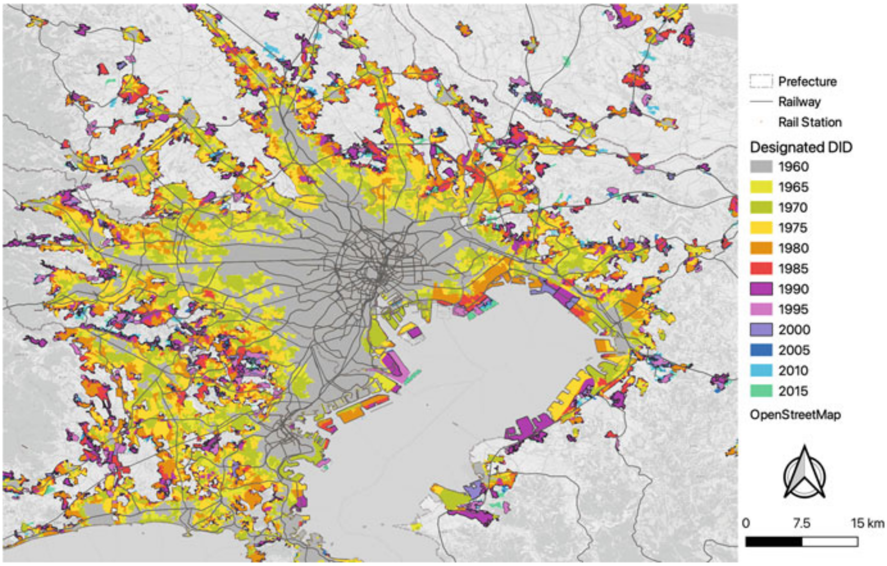

Fig. 2 The progress of urban development in Tokyo. (Data source: Digital land numeric information, MLIT)

1930s. However, those planned developments were very limited. Many neighborhoods were constructed on the agricultural infrastructure without any city planning, resulting in small properties, narrow streets, and inadequate public spaces.

The air strikes of the Second World War damaged a wide area of the city. The post-war reconstruction was designed under the General Headquarters Supreme Commander for the Allied Powers (GHQ/SCAP). Ambitious reconstruction plans were made, city roads were to be widened in order to meet the expected demand for automobiles. However, some of the plans were never completed due to financial constraints and difficulties in land acquisition. In 1958, the First Metropolitan Area Basic Plan was formulated with reference to the Greater London Plan, intended to control population growth in the city center, reduce congestion, and conserve a green belt to prevent urban sprawl. However, this vision had to be abandoned in the Second Metropolitan Area Basic Plan due to pressure from the urban development industry and a metropolitan population that was burgeoning beyond expectations (Takeuchi and Ishikawa 2008).

Changes in land use and built-up areas in suburban areas of the TMA mostly happened after 1960, along with the developed private railways. In response to urban problems such as overpopulation, environmental pollution and rising land prices, growth in the suburbs became the main coping strategy during the period of rapid economic development. People were eager to have bigger homes and better living environments, which resulted in a large increase in demand for housing. This brought a second wave of urbanization to Tokyo, eventually feeding an asset price bubble that became known as the "bubble economy." During this period, developments of various scales were carried out, greatly expanding the urban area. By the end of the 1980s, the current spatial structure of Tokyo had basically taken shape. Subsequent large-scale developments became less common except for several government-led projects such as Tama New Town, Kohoku New Town, Chiba New Town, and Tsukuba Science City. The only private company-led large-scale development was the Tama Garden City project, by Tokyu Company along today's Denentoshi Line, which occupies 3000 ha of land and serves a population of 890,000 (Tokyu Corporation, https://www.tokyu.co.jp/global/).

In recent years, the maintenance and renewal of infrastructure has become a major issue (Tsuzuki et al. 2007). The renovation of many densely populated areas with wooden houses in central areas was never improved due to the shrunken post-war reconstruction. Factories have been relocated to remote regions even overseas due to soaring land prices and high labor costs leading to the hollowing out of urban centers.

Conversely, the collapse of the bubble economy in the early 1990s was the opportunity to launch renewal programs to promote the return of population to the urban center. The Act on Special Measures concerning Urban Reconstruction was enacted in 2002, and with it the government initiated special urban regeneration zones in Tokyo to vigorously promote the development of the urban center. The redevelopment has included projects based on urban planning as well as projects involving building reconstruction. These redevelopment projects can greatly improve the efficiency of land use and have a spillover effect on the transformation of the surrounding densely populated areas.

3 Securing Food–Energy–Water Resources in the Metropolis

3.1 Securing the City from Disasters

Tokyo is geographically located at the inner reaches of Tokyo Bay and extends to the hinterlands of the Kanto Plain (Fig. 3). This geographic location has brought great benefits to the city in transportation and land development but vulnerabilities to natural disasters. From the early days of urban development, the builders of Tokyo have paid much attention to protect themselves from natural disasters. The ancient Edo Castle was built on the edge of the Musashino Terrace at the mouth of the Ara and Tone Rivers, right on the edge of the terrace and wetlands (near the present Imperial Palace and Tokyo Station). This ensured that the castle was protected from flooding on the one hand and allowed the use of water transportation and land reclamation on the other. As Edo Castle was built, the Shogunate (Bakufu) initiated large-scale water conservation projects to ensure the safety of Edo Castle and to better develop land resources. The biggest project was to redirect the flow of the Tone River to the sea. From then on, the Kanto Plain was flood-and-drought-

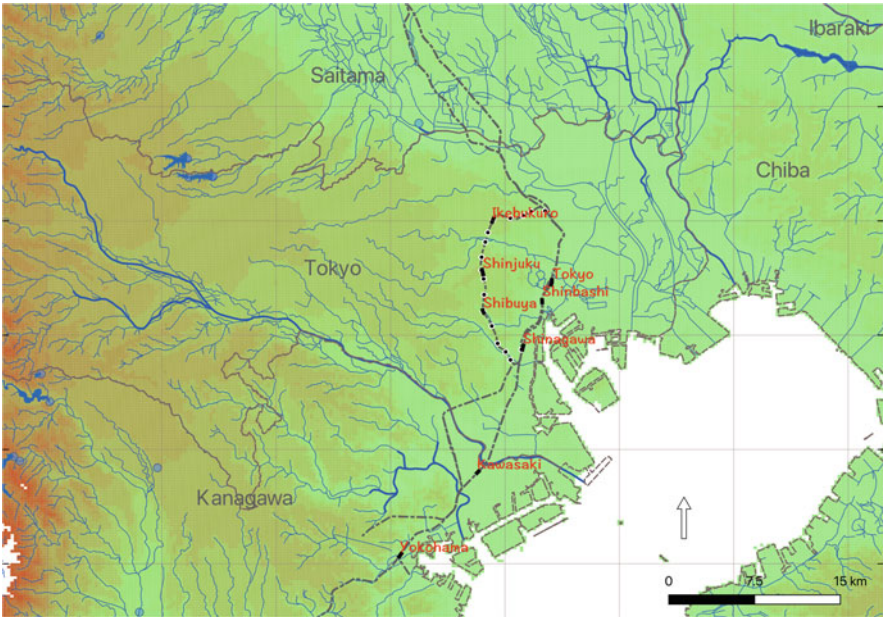

Fig. 3 The geographic layout and elevations in Tokyo. (Data source: Digital land numeric information, MLIT)

protected, and as commerce-flourished, it rapidly developed into the political and economic center of Japan.

In terms of topography, the eastern part is on an alluvial plain, while the western part of Tokyo is built on a hilly terrace. This provides easy transportation between the inland and the bay area. The terraces were favorable, first for flood and earthquake prevention, and second for superior landscape features. From Edo Castle, it was possible to reach a large area of the northern Kanto Plain inland via eight rivers, ensuring a constant flow of agricultural, forestry, and mining resources from the northern Kanto Plain. The spatial layout of TMA today is closely linked to these conditions.

3.2 Food Security

Food, energy, and water resources are indispensable for survival, and their conservation and efficient use are necessary for the sustainability of urban society. Food security as being when "all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (https://www.fao.org/3/w3613e/w3613e00.htm). The vast Kanto Plain ensured the production and provision of food along the

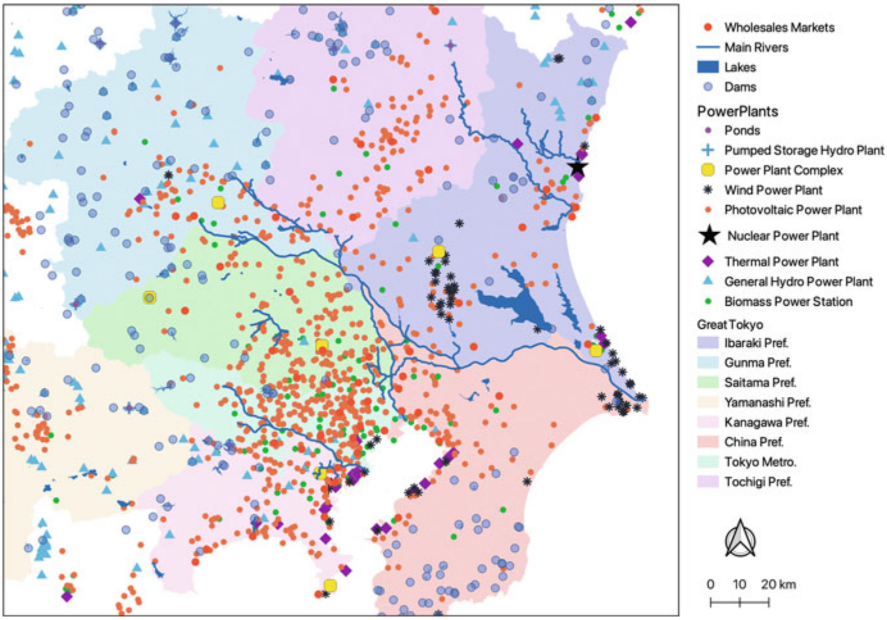

Fig. 4 Food–water–energy resources in Tokyo. (Data source: Digital land numeric information, MLIT)

well-established water transportation systems from the hinterland along rivers, helping the ancient Edo became a self-sufficient mega-city.

Modern cities are premised upon high population concentrations. Urban growth is accompanied by the conversion of land for food, energy, and water into industrial products and services. Tokyo has also converted massive agricultural and natural land to built-up areas, and food self-sufficiency is very low. The process of urbanization has resulted in a steady decrease in agricultural land and the agricultural labor force in Tokyo since 1955. Meanwhile, farmers are aging. Consequently, Tokyo is only 1% self-sufficient for food today. Kanagawa, neighboring prefecture to the West, with a population of eight million, is only 2% food self-sufficient. The Japanese food table depends mostly on food from overseas. The country currently provides only 37% of its own food calories (MAFF 2022).

To secure the food market, the Japanese government has designated 14 types of vegetables that account for 74% of the market including cabbage, spinach, Chinese cabbage, green onion, lettuce, potato, taro, Japanese radish, carrot, onion, cucumber, eggplant, tomato, green pepper. More than 70% of fresh meat, fish, and vegetables are distributed through wholesale markets to supermarkets and finally to consumers. E-commerce and direct trade between producers and consumers are growing in popularity, especially after the outbreak of the COVID-19. These factors make the regional food system very complicated. Figure 4 illustrates the distribution of land use and wholesale markets in the TMA. It clearly displays that food is produced and transported from the northern Kanto region.

3.3 Water Security

An integrative definition of water security considers access and affordability of water as well as human needs and ecological health (Cook and Bakker 2012). It was introduced at the Second World Forum in 2000 by the Global Water Partnership. As mentioned above, Tokyo was originally vulnerable to flooding, yet well-protected since the Edo era with well-developed channels for irrigation and urban water supply. The ancient city of Edo withdrew water from the upper stream of the Tama River. A complicated irrigation and water supply system called Tamagawa Josui and Shinagawa Josui were constructed 400 years ago. The expansion of built-up lands in modern times increased the demand for water, so the government had to look for more abundant water resources while still protecting the city from flooding. Fortunately, TMA benefits from the abundant water resources in the Kanto Plain. The Tone River, second longest in Japan, originates in the Kanto Mountains north of the plain and flows through the mountainous area in the northwest to the Pacific Ocean in northeast, forming the largest watershed area of the country. The Arakawa River originates in the Chichibu Mountains and like the Tama River flows into Tokyo Bay via the central cities of the Tokyo metropolitan area. In the southern part of the plain, the Sagami River flows into Sagami Bay from the Tanzawa Mountains through Kanagawa Prefecture. There are many flooded terraces in northern Chiba Prefecture, northern Kanagawa Prefecture, and southern Tokyo. This topography is the basis for a diverse urban landscape. Figure 4 shows that most of the water supply of the metropolis originates from outside the prefectural boundaries. The dams in the upper reaches of all these rivers are well managed and developed. Because of urban development in the western hilly terraces the water to serve that region must first be transported to higher land and then distributed to those consumers. Due to restrictions on the location of water intakes, about 80% of the total capacity of all water treatment plants is taken from points at an elevation of 5 m or less. However, about 70% of the water supply plants to which water is sent are located at elevations of 20 m or higher. Tokyo Waterworks is considering redesigning the water intake and distribution system by relocating water intakes from lowlands to highlands so that water can flow naturally with gravity while generating hydropower (https://www.waterworks.metro.tokyo.lg.jp/).

3.4 Energy Security

Energy security from the perspective of energy consumers is defined by the International Energy Agency as “uninterrupted physical availability at a price which is affordable while respecting environmental concerns” (IEA, http://www.iea.org/). This definition can be parsed into three indicators: availability, affordability, and acceptability (Hughes 2012). Despite consuming the most energy in Japan, the TMA itself does not produce any of its own primary energy. Oil, gas, and coal are imported from overseas, while electricity is sourced in neighboring regions. Figure 4 shows that the Fukushima Nuclear Power Plant is one of the providers of electricity to the region. The Tohoku earthquake, tsunami and nuclear accident of 2011 revealed the vulnerability of the TMA's energy systems (Vivoda 2012). With the temporary and/or permanent closure of many nuclear reactors, Japan has accelerated the installation of renewable energy in the process of reconstruction, while mainly coal-thermal power plants were also constructed in the coastal area of Tokyo Bay to meet urgent demand.

The 2011 earthquake gave more momentum to renewable energy, especially solar photovoltaic systems. It is interesting to note differences in the spatial distribution of power generation facilities. Hydropower plants are in the upper reaches of rivers, thermal power plants are along the coastline to access oil and gas imports from overseas, and nuclear power plants are in villages and towns far from the urban core. In contrast, many solar and biomass power plants were installed closer to the urban core. Although the capacity of these generators may currently be small, the patterns of decentralized distribution demonstrate the potential of new energy systems based on renewables. Progress with renewables in Japan has been driven by regulatory reforms of the electricity market. After the disasters of 2011, the monopoly previously held for decades by the Tokyo Electric Power Corp. (TEPCO) collapsed. Electricity retailers emerged in the market, propelled by subsidies under the feed-in tariff (FIT) system. The capacity of photovoltaic installations soared by a factor of 2.6 from 2011 to 2019 (http://www.jpea.gr.jp/). Photovoltaic power generation also presents opportunities everywhere in both urban and rural areas to utilize the ubiquitous solar resources. Nevertheless, the installation rate is still low, with only 3–5% of established houses equipped with solar panels in suburban Tokyo. The government is planning to accelerate solar power generators to 60% of the newly constructed homes by 2040.

4 The Legacy of Urbanization in Tokyo

Securing the supply of FEW is an arduous and long-term task for mega-cities. It requires not only quantity but also quality of resources.

As Tokyo's economy grew, the population shifted from rural areas to cities, and Tokyo became one of the most crowded cities in the world. This growth was accompanied by urban problems such as overpopulation, environmental pollution, and rising land prices. These pressures resulted in growth shifting from the city center to suburban areas to take advantage of lower housing costs but resulted in long daily commutes for many. In response, the government pushed hard to upgrade and expand railroads to increase train capacity, improve suburban-urban connections, and increase transportation efficiency. To some extent these efforts have led to improvements of commuter train congestion rates from more than 200% previously at the end of 1970s to 160% of load capacity just prior to the COVID-19 pandemic.

Along with population concentration and industrial development, water and air pollution from industrial and domestic sources became serious problems. The Tama River was considered a symbol of the problem of deteriorated water quality in those days. Urbanization triggered other environmental hazards from four major pollutants, including particulate matter (PM10 and PM2.5), ozone (O_3), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2). Due to these pollution problems and the oil crises of 1973 and 1979, people began to pay attention to the ecological environment, urban infrastructure, and the concept of environment began to be introduced in development. In the 1970s, the governor of Tokyo had a mid-term and long-term comprehensive plan of "Public Square and Blue Sky Initiative" (Tokyo-to 1971), promising to improve the living environment in the city center. The central government subsequently initiated development plans for Tsukuba Science City (1961), Tama New Town (1963), Minato-Kita New Town (1965), and Chiba New Town (1966).

As a result, the urban problems in Tokyo were resolved gradually through the cooperation of government and industry and the involvement of citizens in the late twentieth century. Since the end of 1990s and after entering the new millennium, the sustainability of cities has risen to the top as an issue for urban management. Urban sustainability is typically expected to promise three things: stable provision of urban infrastructure including food, energy, and water (FEW) services, a constant improvement in quality of life, and the significant reduction of environmental impacts. For urban residents, FEW is the basis of life. Government and industry are responsible for securing the provision of resources and services.

Regarding sustainability, Japanese cities are facing three major crises today in the form of climate change, aging populations, and the deterioration of infrastructure. Japan has always been a country prone to various disasters, especially earthquakes and typhoons. Disaster management is always a key priority of the national and local governments. Severe damage from past disasters has left bitter memories. In recent memory, the Great East Japan Earthquake of 2011 resulted in power blackouts and severe shortage of food supplies. Typhoon Etau in 2015 flooded parts of northeastern suburbs of the metropolis and breached the levees of the Kinu River. Typhoon Hagibis in 2019 struck the central area of Tokyo and flooded several neighborhoods along the Tama River. More extreme weather due to climate change could make the situation worse in the Tokyo region by 2080 (Miyamoto, chapter "Climate Change in Global Cities", this volume).

The second crisis in Tokyo, and across Japan as well, is a shrinking population. Urbanization has pushed and pulled people to large cities. The more people moving to Tokyo, the fewer people will be producing food in rural areas. Meanwhile, the average age of agricultural laborers is ever increasing. These factors have enlarged the gap between domestic food production and consumption. One response might be to import more food from rural areas and even from overseas, but this is made more difficult with the gradual decline in the Japanese population, and declining birth rates particularly in rural areas. Tokyo itself is not yet at the stage of significant population decline, and many topics are still at the discussion stage, but population decline and land idleness are foreseeable in the future. The population has already peaked in some cities in the TMA in certain areas that are somehow inconvenient to live in. So one looming question is who will feed the urban population in future?

Third, much urban infrastructure was built during the period of high economic growth in the twentieth century, such as roads, bridges, waterworks, and tunnels. This infrastructure has aged and is approaching the time for renewal. The government is making efforts to improve efficiency and develop management methods to extend the lifespan of infrastructure, but this is a very costly challenge due to population decline, the aging of the labor force, and urban decay. This situation is particularly true in suburban areas (Ozeki et al. 2010) where the population is shrinking more quickly. The growth of suburban built-up areas will be sporadic, while the performance of maintenance gets worse. Who should pay for all of this and where can investment funds be secured?

One of the answers is the strategy of making cities more compact to optimize spatial configuration. The national government has initiated new urban zoning systems under the dual concepts of being compact and using network design. It aims to attract population to neighborhoods that are located near to railway stations while connecting those areas by public transportation. Areas with less population could be rezoned from urban promotion areas to urban control areas. More than two-thirds of municipalities have revised their city master plans and introduced this initiative since the enactment of the Act on Special Measures concerning Urban Reconstruction in 2002, though will still takes some time to see the effects.

Another response to this challenge is the concept of green infrastructure (GI), which has emerged in Europe and the USA. The basic concept is that the ecological functions of the natural environment can partially replace the functions of "gray" infrastructure. The definition of GI is still rather broad, but discussions are already active in Japan. Representative GI in Japan includes the Watarase Yusuichi (a natural river flood plain/wetland and water detention basin and levee system) created in the early twentieth century in the northern TMA, and kasumi levee systems built long ago in rural areas to retain overflow waters during flood seasons (Ichinose 2015). GI has attracted more attention in Japan since the Tohoku earthquake and tsunami disaster of 2011, when the nation was shocked by scenes of collapsed seawalls in the Sanriku coastal region. Each area has certain ecological resources that can be suitable for GI and serve various functions, such as disaster prevention, ecology, and soil and water conservation. Some local governments have moved quickly. For example, Setagaya City in Tokyo is planning to improve green cover from the current 25–33% in the future (https://www.city.setagaya.lg.jp/).

5 Perspectives About Resilient and Adaptive Cities in Terms of the FEW Nexus

Japan's highly urbanized and consumption-oriented society has seen big increases in food manufacturing and the demand for food and beverages. The convenience and security of life are based on the resources of food, energy, and water transported from distant places. Conversely, the impacts of human activities on the environment have increased dramatically, as measured through indicators such as food mileage (Specht et al. 2014; Murphy 2007), CO_2 emissions (Munksgaard et al. 2000), and virtual water (Allan 2003). This dilemma is illustrated in Fig. 5, which expresses environmental impacts conceptually with the FEW triangle (demand for food, energy, and water) and the quality of life is illustrated by the AHR triangle (accessibility, health, and resilience). In the ancient city of Edo, the intensity of resource use was limited, while the quality of life was low (in the sense of material consumption). The required provisions could be mostly met with local products. Modernization and urbanization have changed the landscape completely. A huge amount of farmland and forest has been converted to factories and residences, and the main industry has shifted from agriculture to manufacturing. Consequently, greenery disappeared, air was polluted, and water was contaminated, but through the determined efforts by the Japanese government and citizens, urban pollution problems had largely been mitigated by the end of the twentieth century, while the material satisfaction of life improved dramatically. Conversely, the convenience of life admittedly imposed costs on the natural environment. The comforts of urban life are built on the transboundary movement of FEW resources. Food, energy, and water are imported from remote regions. All of this has eventually been manifested

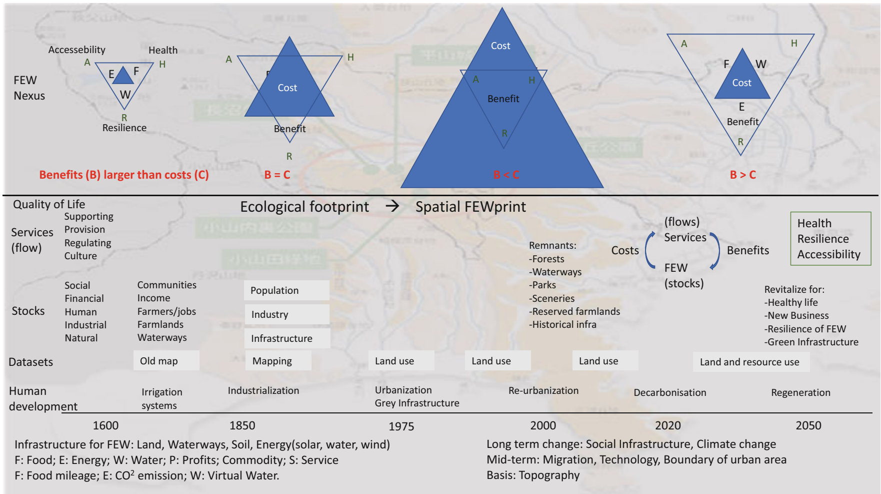

Fig. 5 Progress of urbanization and environmental costs through the lens of food–energy–water (FEW)

as pressure on the Earth system, resulting in ecological overshoot of planetary boundaries (Rockström et al. 2009).

To turn things around, significant improvements are needed in resource efficiency. The Paris Agreement was eventually adopted in 2015 after lengthy negotiations, with the international community agreeing on the goal to reduce GHG emissions by 50% by 2030 and by 80% by mid-century in order to keep the rise in mean global temperature to well below 2 °C from preindustrial levels and preferably limit the rise to 1.5 °C (Rogelj et al. 2016). Cities as major emitters have an obligation to be leaders in these efforts. The Japanese government has promised to reduce GHG emissions by 46% by 2030 relative to 2013 and achieve carbon neutrality by 2050. The Tokyo metropolitan government too has made a political decision to aim for net zero carbon emissions by 2050.

It is clear that we must think about how to reduce environmental impacts and make more room for the environment and nature and at the same time to rebuild our society to be smarter and more sustainable. This may be easy to say but difficult to do. Some leaders in Japanese industry believe that they have already done a lot and that there is not much more that needs to be done in cities. To make more progress we need to break through silo-based thinking. Nexus thinking is such an approach from the academic community. It involves connecting sectors and disciplines (Hoff 2011) in order to build a circular economy, realize the so-called donut economics (Raworth 2019), reduce our environmental load to within economic/ecological limits, and create a more just and health society.

6 Closing Remarks

The development story of Tokyo this chapter told us that the megapolis itself could be rebirthed through severe events. The first wave of urbanization occurred in the 1920s–1930s through the recovery from the Great Kanto Earthquake in 1923. Modern urban planning was introduced during reconstruction. The air strikes of the Second World War burned the city down again. The post-war recovery brought suburbanization along with a long period of economic growth. This recursive process is theorized by the notion of panarchy (Gunderson and Holling 2002), which posits that all societies repeat a circle of four phases: birth, growth and maturation, death, and renewal. *Change is normal through the process. The key for sustainability is to learn how to make our cities resilient and adaptive to change.* This was one of the lessons learned from the 2011 Tohoku earthquake and tsunami disaster (Yan and Galloway 2017).

The Japanese people have deeply reflected on the resulting nuclear accident and accelerated the energy transformation to renewables. TEPCO monopoly hold has been broken. Solar power generation as well as community-based renewable businesses have been growing in popularity. Ten years later Japan had largely recovered from the shock of 2011, but then the world became embroiled in the havoc of the COVID-19 pandemic. The unprecedented pandemic brought a big shock to the metropolis. The movement of migrants to the city center was suddenly redirected to the suburbs, for health and safety reasons from coronavirus. The volumes of commuters by train decreased by 20%, and the vacant rate of office buildings in the city center rises to historic high. People were requested to stay home and work remotely. Shops and restaurants were closed, or service hours were shortened, and alcohol sales were restricted. The pandemic provided time for us to rethink about the sustainability (Yan and Roggema 2017, 2019): the relationship between the places of production and places of consumption of FEW resources; the relationship between costs and benefits of investments; and the relationship between places of work and places of living. It is also an opportunity to translate many ideas into actions. During the pandemic, people discovered that they could work remotely while also being able to spend more time with family and community. This inspires us another vision of cities that can adapt to a new normal for managing natural and social resources of cities more effectively. Nexus thinking could be a promised approach to make the concept true (Hoff 2011). The design-led nexus concepts and practices in this volume are expected a reference for students and practitioners.

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