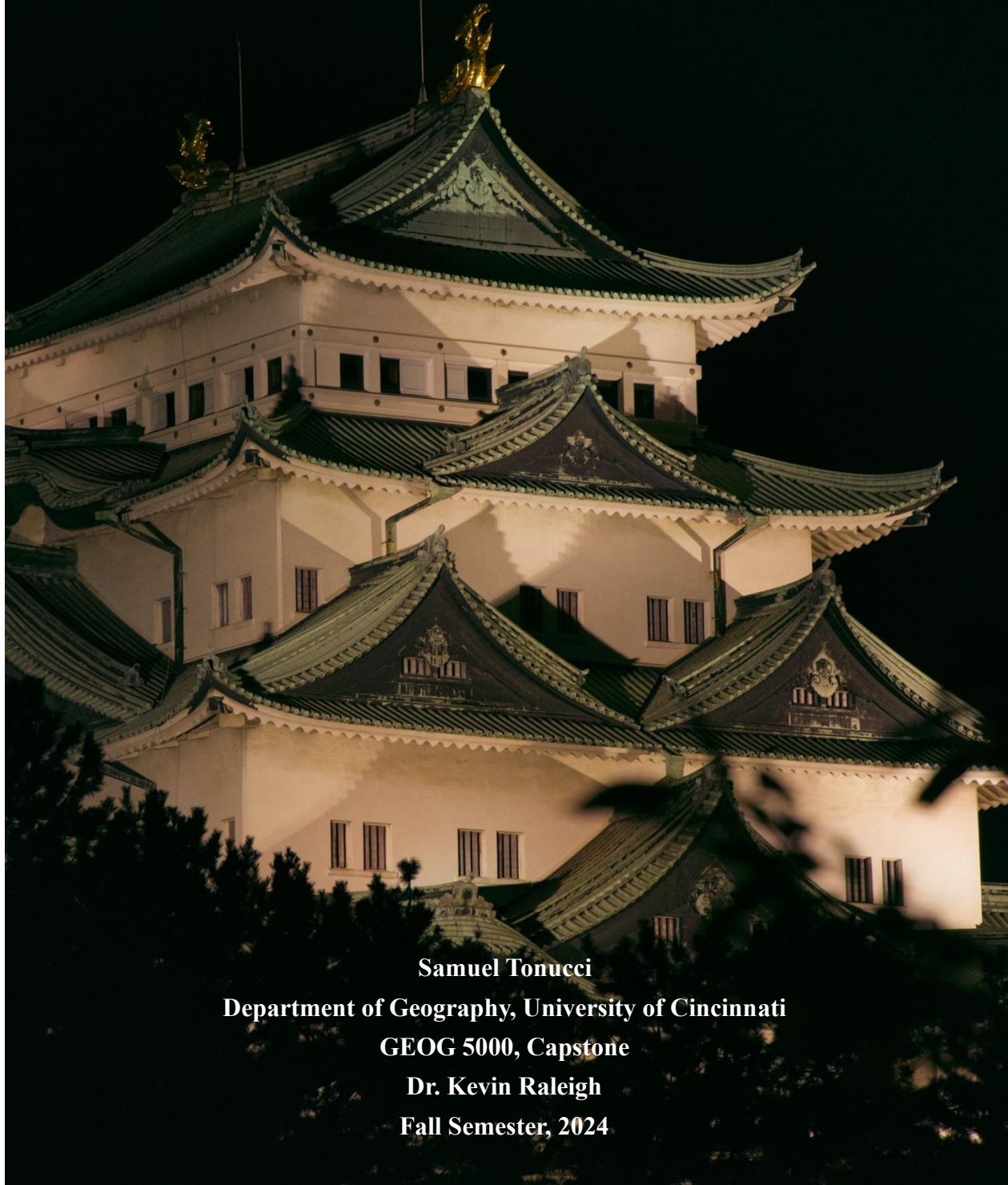


Exploring Green Space Implementation in Urban Areas

By Analyzing The Nagoya City Green Master Plan 2030



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Abstract

This paper explores the implementation of green space in urban areas, with a focus on Nagoya, Japan, through the lens of the Nagoya City Green Master Plan 2030. Combining an analysis of the plan with firsthand observations during my time in Japan, it explores how urban planning strategies address the challenges of industrialization, limited space, and environmental sustainability. The study highlights the potential of green spaces to improve livability in dense urban environments while considering the cultural and geographical factors that shape policy implementation. By evaluating the effectiveness of this plan, this paper contributes to broader discussions on sustainable urban development and its application in diverse contexts.

Exploring Green Space Implementation in Urban Areas

Nagoya is a key industrial hub in central Japan. It has historically been associated with manufacturing and heavy industry. Nagoya is currently where Toyota is headquartered as well as Central Japan Railway Company, with numerous other large, industry leading companies. As the city developed, rapid urbanization and industrial growth have posed significant environmental challenges, including air pollution, urban heat islands, and limited green spaces. While Japan as a nation has started to address these challenges, Nagoya has created a new, more focused approach in the *Nagoya City Green Master Plan 2030*, starting in 2021 with planning out to 2030. Nagoya, with this plan, hopes to better mitigate these challenges and create a more sustainable environment. This plan aims to integrate green space into the city's landscape, enhance air quality, and improve the quality of life for its residents.

The focus of this paper is to examine the effectiveness of these policies in addressing the unique challenges faced by Nagoya as a commercial center. The main question guiding this research is: What challenges does Nagoya face as a commercial center of Japan, and how have urban and land use policies, specifically the *Nagoya City Green Master Plan 2030*, been used to address them? Through this analysis, the paper will explore whether such policies can be adapted for smaller cities, applied beyond industrial and commercial areas, or implemented in other countries. These questions aim to broaden the scope of the study, assessing the transferability of Nagoya's strategies to different contexts and scales.

By analyzing the case of Nagoya and its innovative approaches to urban planning, this paper seeks to contribute to a broader understanding of sustainable urban development in industrial cities, offering insights that may be valuable for both local and global applications.

Japan as a nation experienced a large boom in both economic and population growth after rebuilding its core societal cornerstones following World War II. Starting around 1965, Japan had experienced increases in population across its metropolitan areas, while seeing losses of green space within said areas [2]. For example, the core of economy, politics, and culture in Japan, the Tokyo Metropolitan Area, made up of Tokyo, Saitama, Chiba, and Kanagawa. This global powerhouse with thirty-seven million people [1][6] taking up residence within the region has seen a loss of over twenty-two percent of green space from 1965 to 2005 [2]. These losses came from farmland and woodland, while there has been steady growth in green spaces over the same period. However, Japan's level of developing land as parks remains low given the large population when compared to other cities. Canberra for example, the capital of Australia, has 103.2 m² of park area per person, while Tokyo's twenty-three wards have 4.5m² per person [2].

Nagoya is only two places behind Tokyo in terms of economics and area, has also seen loss of green space in the past fifty years. Between 1990 and 2005, approximately sixteen hundred hectares of green space were converted to other land usage. This figure is closer to eight thousand hectares as of the mid-2010s. That is a loss of twenty-five percent of the total city area [4][8]. The drastic change has continued as shown below in Figure 1.

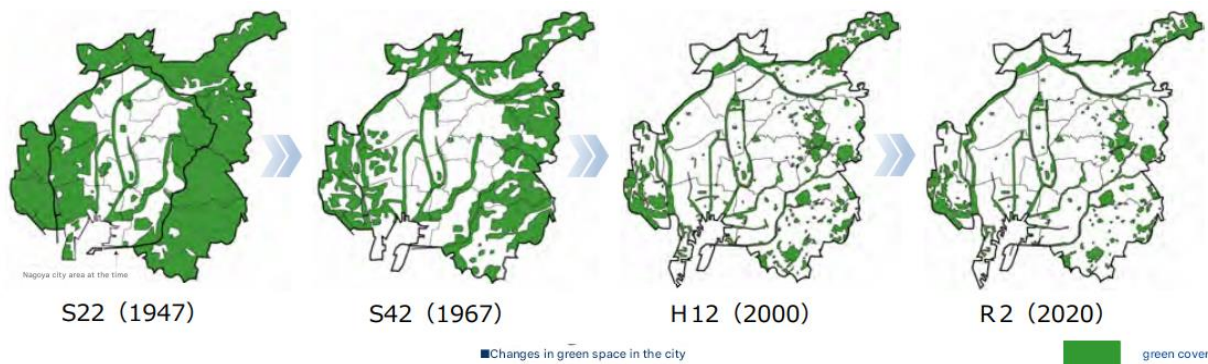
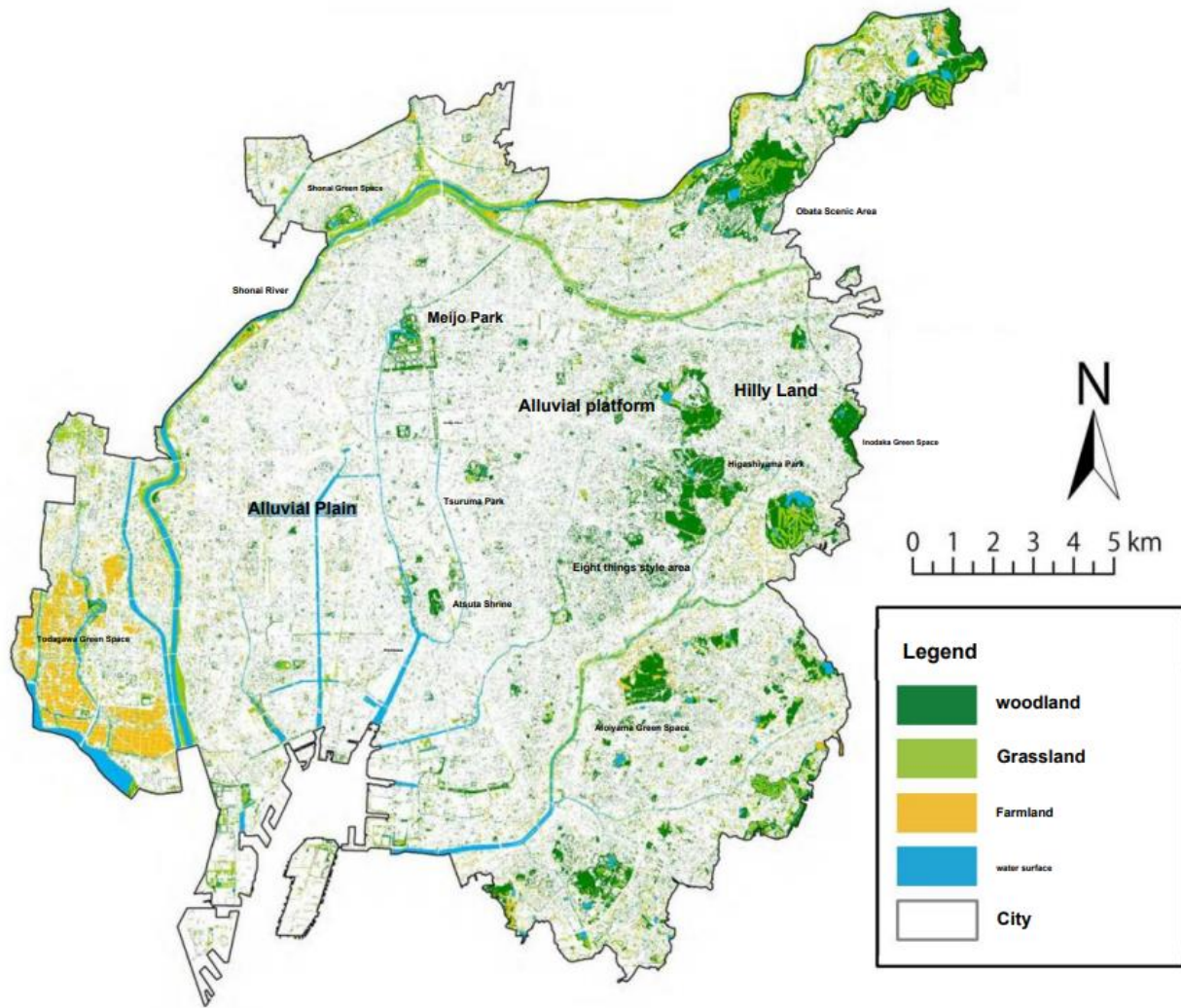


Figure 1 - Nagoya City Green Master Plan 2023 - pp. 12

Translations were conducted using Google Machine Translation and the Jisho Japanese-English dictionary. While every effort was made to ensure accuracy, translations may not be entirely precise due to language nuances and the limitations of the tools used.

To try and preserve the remaining green space and while adding new green space, Nagoya implemented a first of its kind, in Japan, incentive-based initiative in 2008, called the “Greening Area” initiative [4][8]. It targets privately owned land, requiring property owners to set aside ten to twenty percent of their total land area for green space on property more than three hundred square meters inside the city [4]. A certification system was created alongside as a guide for green development called “NICE GREEN Nagoya.” One-to-three-star ratings are given to private development “based on certain criteria such as ratio of green area to total area, the ratio of trees to other vegetation on the site, preservation of existing trees, the greening of rooftops and walls and efforts to maintain and manage green spaces” [4]. Depending on the rating given, a 0.1 – 0.2% discount is given on the standard bank rate home loan [4][8]. The city itself will also provide financial support for private facilities wishing to go greener with a third part of the initiative called the “Nagoya City Private Facility Greening Support Program.” This program helps cover part (less than 50%) of the budget for roof greening, wall greening, and other greening projects [4]. A precedent of awareness towards greening, and an understanding of its importance to its population is already apparent in Nagoya.

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Regional characteristics of the city's topography and greenery

Source: Green Current Status Survey Report (R2)

Figure 2 - Nagoya City Green Master Plan 2023 - pp. 11

The map above is the most recent data presented by Nagoya from 2020. Even with the large urban core and loss of green space since the early 1960s, a noticeable amount of woodland and grassland still permeates through the city, especially on the alluvial platform and in the east side of the region.

Translations were conducted using Google Machine Translation and the Jisho Japanese-English dictionary. While every effort was made to ensure accuracy, translations may not be entirely precise due to language nuances and the limitations of the tools used.

The Nagoya City Green Master Plan 2030 is the newest edition to Nagoya’s green initiatives. Along with the incentives from the Greening Area initiative, this plan is the culmination of numerous local and national plans, as well as specific mention of the “Comprehensive Green Plan” of 1980, and a direct response to the drastically changing social conditions, driven by new goals set by the United Nations in 2015 and as a response to the outbreak of COVID-19 in 2019 through 2021 [5]. On a surface level, it is made up of three basic policies, referred to as “Three Strengths for Greening” [5], with eight “facets of green,” referred to as “8K” [5]. The three basic policies are enhancing urban power through greenery, enhancing regional power through greenery, and increasing sustainability through greenery. The plan summarizes them as the “Three Strengths Enhanced by Greenery,” stating, “Nagoya, a city that coexists with nature, sparkling with greenery and people. Create an attractive green city, utilize the greenery around you, while strengthening the green infrastructure” [5].

The facets of “8K” are labeled as such due to the alliteration of the Japanese words. K1 is 観光 (Kanko), which translates to sightseeing, followed by K2, 景観 (Kei kan), which translates to landscape. K3, 活力 (Ka tsu ryo ku) translates to vitality, energy, and dynamism. K4, 交流 (Kō ryū) translates to exchange. K5 has two parts that relate to each other 子育て (Ko so da te), and 教育 (Kyō I ku), which encompasses childcare and education when translated. K6 is also made up of two parts, with 健康 (Ke n kō) and 福祉 (Fu ku shi), which together encompass health and welfare when translated. K7 環境 (Ka n kyō) translates to environment, followed by the last facet, K8 危機管理 (Ki ki Ka n ri) which means crisis management.

Translations were conducted using Google Machine Translation and the Jisho Japanese-English dictionary. While every effort was made to ensure accuracy, translations may not be entirely precise due to language nuances and the limitations of the tools used.

The 8K and basic policy create the foundation of which is filtered through a formation of a green network, green infrastructure initiatives promotion, and achievements of Sustainable Development Goals (SDGs), striving for “a city that coexists with nature, sparkling with greenery and people” [5]. This has been simplified into a graphic as seen below.



Figure 3 - Policy Development - Nagoya City Green Master Plan 2023 - pp. 46

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Nagoya is in position as a strong binder in both a regional green network, and as a city green network. As seen in Figure 2, the remaining natural green space is in the eastern portion of the region. Due to its location in Aichi Prefecture, the Mikawa Mountains located farther east help create a backbone with forest and numerous rivers that connect rural areas to the sea. The alluvial plane that encroaches on the city from the west contains farmland that stretches all the way past Kiso River. The hills found in the east of the region are part of a network of 里山 (Sa to ya ma), with 里 (sato) translating to village, and 山 (yama) translating to mountain. It encompasses areas where mountains and hills meet flat, arable land that promote small villages that capitalize on agricultural potential. This network of Satoyama stretches to the Chita Peninsula, close to fifty kilometers (Approximately thirty miles) to the south of Nagoya [5].

Using the previous green plan, the Aichi Prefecture Wide-area Green Space Plan, Nagoya continues to use large parks and green spaces as “green hubs,” with major roads and river as links, forming “green city axis” [5]. The policies outlined in the Green Master Plan will contribute to this existing framework, but now involve not only the government, but include more businesses and citizens [5].

The plan outlines examples of hard and soft measures. Distinct zones are used to classify different geographical areas within Nagoya. The first zone is Ocean, tidal flats, harbor, and canals [Figure 4]. The second zone is farmland [Figure 4]. The third zone is commercial and business sites, as well as public spaces and facilities [Figure 4]. The fourth zone is roads and streets [Figure 4]. The fifth zone is parks and green spaces [Figure 5]. The sixth zone is residential areas, including housing, sites, gardens, parking lots, and vacant lots [Figure 5]. The seventh zone is woodlands, wetlands, and reservoirs [Figure 5]. The final zone is rivers [Figure 5]. These zones emphasize the key areas that Nagoya has deemed important for maintaining and expanding within a green city.

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Zones and Example Measures

対象	海、干潟、港、運河	農地	商業・業務地、公共用地 民間施設、駐車場、公開空地、公共公益施設	道路、街路樹
ハード 施策 (例)	<ul style="list-style-type: none"> ○干潟の保全 ○植生の復元 	<ul style="list-style-type: none"> ○農地の保全 ○農作物の生産基盤の確保 	<ul style="list-style-type: none"> ○建物緑化 (屋上緑化・壁面緑化など) ○敷地緑化 ○雨水流出抑制施設 (透水性舗装、 雨庭・雨花壇・緑溝など) ○ミスト装置 	<ul style="list-style-type: none"> ○道路緑化 ○街路樹再生 ○雨水流出抑制施設 (透水性舗装、雨花壇など)
ソフト 施策 (例)	<ul style="list-style-type: none"> ○水辺の利活用・魅力の創出 ○干潟とふれあう機会の提供 	<ul style="list-style-type: none"> ○農地の利活用・魅力の創出 ○農とふれあう機会の提供 	<ul style="list-style-type: none"> ○緑地の利活用・魅力の創出 ○みどりとふれあう機会の創出 ○景観・緑化の評価 ○エリアマネジメント ○緑化のガイドライン作成 	<ul style="list-style-type: none"> ○街路樹の利活用・魅力の創出 ○みどりとふれあう機会の提供
<ul style="list-style-type: none"> ○情報発信 ○普及啓発 ○学習機会の拡充 				

■本市におけるグリーンインフラのイメージ図・期待される効果・対象・施策例

Figure 4 - Examples of Initiative Promotion - Nagoya City Green Master Plan 2023 - pp. 48

公園、緑地	住宅地 住宅、敷地、庭、駐車場、空地	樹林地、湿地、ため池	河川
<ul style="list-style-type: none"> ○緑地の保全 ○公園づくり ○公園再生 ○雨水流出抑制施設 (透水性舗装、雨庭・雨花壇 ・緑溝など) ○ミスト装置 	<ul style="list-style-type: none"> ○建物緑化 (屋上緑化・壁面緑化 ・緑のカーテンなど) ○敷地緑化 ○雨水流出抑制施設 (透水性舗装、縦樋の非接続、 雨庭・雨花壇・緑溝など) ○ミスト装置 	<ul style="list-style-type: none"> ○樹林地・湿地・ため池の保全 ○森づくり ○植生の復元 	<ul style="list-style-type: none"> ○治水施設整備 ○多自然川づくり ○植生の復元
<ul style="list-style-type: none"> ○公園・緑地の利活用・魅力の創出 ○みどりとふれあう機会の創出 ○ガーデンツーリズム ○パークマネジメント ○公園での防災訓練 	<ul style="list-style-type: none"> ○緑地の利活用・魅力の創出 ○みどりとふれあう機会の創出 ○景観・緑化の評価 ○エリアマネジメント ○緑化のガイドライン作成 	<ul style="list-style-type: none"> ○樹林地などの利活用・魅力の創出 ○みどりとふれあう機会の創出 	<ul style="list-style-type: none"> ○水辺の利活用・魅力の創出 ○水辺環境とふれあう機会の提供
<ul style="list-style-type: none"> ○情報発信 ○普及啓発 ○学習機会の拡充 			

Figure 5 - Examples of Initiative Promotion cont. - Nagoya City Green Master Plan 2023 - pp. 49

These tables are displayed untranslated due to size constraints

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The tables in Figures 4 and 5 lists examples aimed at integrating green infrastructure into both urban and rural areas. Hard measures focus on physical development such as conserving tidal flats, farmland preservation, implementing building and site greening (e.g., rooftop gardens, green walls), and rainwater management systems (e.g., permeable pavements and rain gardens). Mist devices are given as an example to help cool urban areas. Soft measures aim to promote public engagement and appreciation of these green spaces through activities such as creating attractions in waterfronts, farmland, and green areas, providing interaction opportunities, managing landscapes, and developing greening guidelines. Both hard and soft measures emphasize physical sustainability and social participation to foster a harmonious relationship between the city, people, and nature. Using these examples for initiatives combined with the focus of the “8K” facets could create a comprehensive framework for advancing the United Nations’ Sustainable Development Goals (SDGs.) By addressing aspects such as environmental conservation, community engagement, and infrastructure resistance, Nagoya’s approach directly contributes to key SDGs.

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Figure 6 - SDGs from United Nations Department of Economic and Social Affairs

Looking at the 17 SDGs outlined by the UN, Nagoya’s approach contributes specifically to key SDGs, including Goal 11 (Sustainable Cities and Communities), Goal 13 (Climate Action), and Goal 15 (Life on Land). The synergy between the 8K principles—emphasizing areas like health, education, and crisis management—and the practical measures outlined in the Figures 4 and 5 ensures that Nagoya’s Green Master Plan is not only addressing local challenges but also aligning with global efforts toward sustainable urban development. A majority of the 8k principles apply to multiple SDGs, as well as the internal goals of Nagoya city. By focusing on enhancing urban vitality, regional strength, and sustainability through greenery, infrastructure, and community engagement, the 8K strongly aligns with UN Sustainable Development Goals.

While the 8K framework is robust, there are several challenges that may hinder its implementation. Large-scale green projects will require substantial investments. Japan has implemented the usage of Private Finance Initiative (Park-PFI) systems to supplement when funding at a public level will not satisfy the project. The Park-PFI is similar to the Public-private

partnerships (PPPs) found in the United States. However, PPPs are typically led by non-profit organizations rather than direct private investments that are looking for a return on said investment. This could lead to uneven implementation if commercial interests diverge from public needs. The plan emphasizes participation from both public and private entities, but if interests begin to compete with one another with no clear mediation, it could be difficult for projects to maintain long-term commitment from both parties. For example, it takes nearly a hundred million dollars a year to maintain, restore, and fulfill day-to-day care of Central Park through the Central Park Conservancy in New York City [3]. Majority of funding comes from individual donations [3]. Central Park generates a substantial amount of economic activity for New York City, incentivizing individual donations for the park.

While there is public funding available through the plan Nagoya seems to be leaning toward more private investment and initiation. For example, ノリタケ株式会社 (Noritake Kabushiki-gaisha) more regularly referred to as Noritake is one of the largest glass and ceramics company out of Japan. As a commemoration for the 100th anniversary of Noritake, in 2001, the company redeveloped the former factory grounds into a lush urban green space as a commitment to social and environmental stewardship. Like the modern comprehensiveness of the Master Green Plan, Noritake created a multifaceted location, with public green space, recreational locations like shops, a museum, and even a center to learn how the manufacturing process occurs when making porcelain. They even signed an agreement with the city to turn the Garden into a temporary evacuation site in the event of a large-scale disaster that may displace large amounts of people.

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The same location saw new development in 2021, with an AEON Mall (a chain of malls found across Japan) opened October 2021. This was a collaboration between AEON and Noritake. It is now a bustling commercial hub that maintains the historical industrial heritage of the original site, while also adding large and inviting green urban space that is accessible to a large area. At a surface level with short term observability, it appears that the incentives from both previous plans and programs, as well as the newer initiatives from the Green Master plan have already started to influence development in Nagoya. Outside of maintaining existing and building new developments, the Green Master plan puts a large emphasis education, health, and welfare of its citizens.

Population Demographics

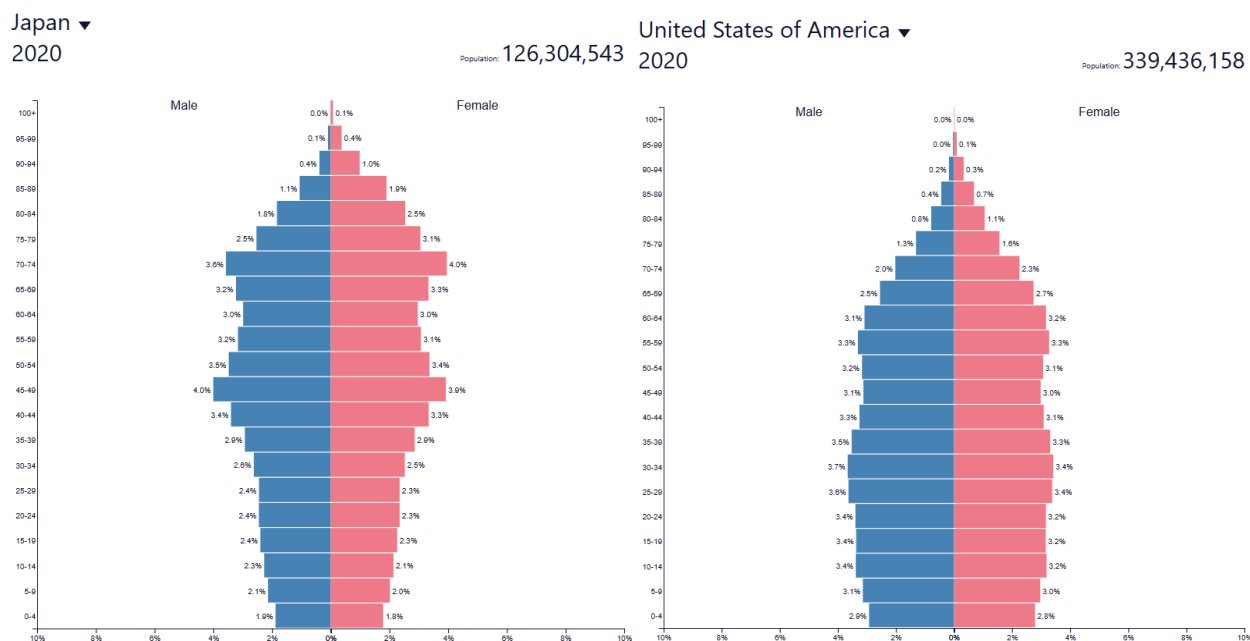


Figure 7 & 8 – PopulationPyramid.net Population Pyramid of Japan and US (2020)

The Green Master Plan recognizes the unique demographic challenges facing Nagoya and Japan as a whole, as evident by Figure 7. Japan's aging population is distinctly pronounced, with approximately twenty-nine percent of its citizens aged sixty-five and older, compared to just sixteen percent in the United States as seen in Figure 8. This demographic imbalance necessitates policies that cater to the well-being of older citizens while also fostering an environment conducive to family life and childrearing. Through initiatives tied to 8K such as K3 (vitality), K5 (Childcare and Education), and K6 (Health and Welfare), the plan aims to promote a healthier, more active lifestyle for its aging population by integrating accessible green spaces, encouraging community interaction, and ensuring adequate healthcare and recreational facilities [5 pp. 131].

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Programs under K4 (Exchange) and K5 are designed to reinvigorate younger generations through family-friendly spaces and community networks. These programs intend to better support childrearing, looking to addressing Japan's declining birth rate [5 pp. 131]. By tackling these dual objectives, the Green Master Plan seeks to achieve a balanced and thriving urban society. While the Green Master Plan addresses the unique challenges posed by Japan's aging population and declining birth rate, it is valuable to look at how similar urban sustainability initiatives are implemented in other parts of the world.

For instance, the Green Cincinnati Plan (GCP) serves as a local counterpart in the United States. The GCP 2023 is a strategic framework to guide Cincinnati's sustainability efforts. It is a recent addition, being adopted by Cincinnati City Council on April 19, 2023 [7]. While the GCP outlines comprehensive goals and strategies for sustainability, equity, and resilience, it functions primarily as a policy roadmap rather than enforceable legislation. Rather than having direct, enforceable legislation, the plan relies on the commitment of city departments, community partners, and residents to voluntarily adopt and promote, without direct incentives, the recommended practices [7]. With the recent adoption of GCP 2023, it will be interesting to observe future developments in Nagoya and Cincinnati.

The GCP 2023 looks more at environmental stability, equitability, and sustainability, while focusing less on specific greening practices like the Green Master Plan 2030. Both plans put the environment at the core, but the GCP seems to favor the environment over directly affecting the people of the city. The long-term commitment to the guiding practices of the GCP may be unstable if the public doesn't feel as involved and the plan is perceived as token effort to appease the worries of climate change.

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Personal Observations in Nagoya

During my time in Nagoya and Japan as a whole, I had the opportunity to experience the city's urban environment firsthand. These experiences provided valuable context for understanding the practical implementation of the Green Master Plan. One particularly striking observation was the widespread integration of green infrastructure, such as rooftop gardens and tree-lined streets, even in dense urban areas like Sakae. Local parks, such as Hisaya Ōdōri Park, were heavily utilized by residents of all ages, reflecting the plan's emphasis on creating inclusive green spaces. While certain areas, particularly those in the Minato Ward, suffered from heavy areas of industrial sites, there are still surprisingly attractive and unique green spaces peppered into the urban fabric. Noritake Garden and AEON Mall was an amazing feat of industrial heritage preservation that coupled commercial, educational, and green space very well, and was one of the first places visited due to proximity to where I was staying.

With Nagoya being in Aichi Prefecture, as mentioned when looking at key geographical features that surround and support green networks in Nagoya, the ability to easily and conveniently travel to areas outside of the city that had a plethora of green space. Areas like Gifu to the north and Nagakute to the east. Gifu with rolling hills and mountains, accessible by numerous trails and a cable car, whose crests offer views. Nagakute, with eastern forests, parks, and attractions, with two universities nearby. East of Gifu, there is Inuyama, with Lake Iruka, surrounded by mountains like Owarifuji and Hongu. All these locations could easily be visited as part of a relaxing day trip. However, this was only possible due to the proficient, convenient, and inexpensive public transportation available in Japan. Be it train, bus, or subway there were always multiple forms of transportation to get to a location.

The efficient and accessible public transportation was the most significant aspect I came to appreciate during my time in Nagoya. Upon leaving, its absence became notably apparent, underscoring the critical role such infrastructure plays in fostering connectivity and convenience in daily life. Something of which Cincinnati seems to have stepped up in importance, with record numbers in ridership, financial stability when compared to similar metro systems, as well as a brand-new BRT system in development. All of which is being enveloped in public engagement, through public meetings and surveys, one of which I attended and was informed of the Metro's performance.

But the biggest difference I saw between Japan and the US, was community involvement. Walking around a park to see a team of, presumed, volunteers gathering to coordinate the daily tasks for cleaning up trash, trimming overgrown foliage, edge pathways, planting new flowers, clean shelters, etc., was just shocking. Most of them were older, while showing an obvious passion for horticulture and attention to detail. I don't think I've seen anything similar outside of perhaps the Krohn Conservatory here in Cincinnati.

Conclusion

This analysis of the Nagoya City Green Master Plan 2030 and its comparison to the Green Cincinnati Plan highlights the importance of combining green infrastructure into urban planning to address environmental, social, and economic challenges. Nagoya's approach, centered around the innovative 8K framework, emphasizes the multifaceted role of green spaces in improving urban vitality, supporting demographic needs, and promoting sustainability. By incorporating both hard and soft measures, Nagoya's plan seeks to balance ecological conservation with community engagement, demonstrating a commitment to creating a more livable and resilient city.

In comparison, Cincinnati's Green Cincinnati Plan focuses on sustainability through community-centered strategies and reducing carbon emissions. While the plans share common goals, such as improving urban livability and addressing climate change, they reflect the unique cultural, demographic, and policy contexts to their respective regions. Nagoya's plan stands out for its specific response to Japan's aging population and declining birth rate, while Cincinnati's plan underscores equity and reducing systemic environmental impacts.

The broader implications of these findings suggest that cities worldwide can learn from Nagoya's and Cincinnati's efforts to integrate green and green space development into urban planning. These plans demonstrate the necessity of tailoring strategies to local demographic and environmental challenges while aligning with global sustainability goals, such as the UN SDGs. They also underscore the value of community engagement and cross-sector collaboration in ensuring the long-term success of green initiatives.

Further research could explore the long-term outcomes of these plans, including their measurable impacts on public health, biodiversity, and urban resilience. Additionally, investigating how these frameworks can be adapted to smaller cities or regions with limited resources would provide valuable insights for future policymaking. As cities continue to grapple with climate change and urbanization, the lessons from Nagoya and Cincinnati offer a roadmap for creating sustainable, equitable, and thriving urban environments.

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