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Development of Food Green Cities for Urban Sustainability

Centre for Science & Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre)

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SWARNIM WAGLÉ, PHD
Member of Federal Parliament, Nepal

डा. स्वर्णिम वाग्ले
सदस्य, संघीय संसद, नेपाल

Foreword

It is my pleasure to write a few words of appreciation for the book "Development of Food Green Cities for Urban Sustainability." With rapid urban expansion over the past two decades, the Nepali and South Asian cities have faced challenges related to pollution, open space, greenery, and food supply. This publication addresses these important issues in the chapters written by experts.

The book chapters analyze urban agriculture, forestry, solid waste management, roof-top gardens, public open spaces, and micro-economic activities for city residents. The authors also propose various theories and recommendations to improve urban activities in these areas. I find this book to be a useful reference for urban planners, policy makers, community leaders, and national leaders who wish to understand these topics in depth and influence policies to improve the quality of life.

As an economist, who is also an entrant into national politics in Nepal, I appreciate the many issues and challenges our urban population faces. Cities lack adequate infrastructure, are acutely short on public open spaces and parks, have limited greenery, and modest community activities. Further, the recent COVID pandemic showed that urban food supply could be disrupted any time, robbing the residents of the availability of affordable, healthy, and fresh food supply.

Promotion of urban agriculture can begin to make a dent on these challenges. Also, Nepali cities found out how the acute shortage of urban open spaces creates an unsafe and unhealthy situation for urban residents when Nepal experienced a major earthquake in 2015. The impacts of ongoing global warming are also creating serious problems in urban life such as extreme heat, flooding, water shortage, and increase in vector borne diseases. Programs to promote and expand urban forestry, agriculture, and parks and open spaces will help mitigate some impacts of climate change as the authors show.

I laud the editors and authors of this book for researching on, and publishing, emerging topics of policy salience tied with the collective aspirations of the people in Nepal, South Asia, and other developing countries.

Swarnim Wagle, *PhD*
Member of Federal Parliament,
Nepal

15th August, 2025

Preface

Cities in modern times have become the center stage of humanity's progress, prosperity, and resilience, as World Bank reports more than half of the world's population (57.7%) residing in the urban areas in 2024. At the same time, urgent challenges of explosion of population growth, climate change, environmental degradation, diminishing areas of arable land resulting food insecurity are becoming complex global issues along with the heightening promise of innovation and opportunity in multi-sectoral development around the world. As urbanization accelerates particularly in low- and middle-income countries, the question before us is whether cities can feed their ever-growing population, with sufficient supply chains of food, either grown locally in sustainable manner or through imports with a sustainable balance of trade.

This book, *Development of Food Green Cities for Urban Sustainability*, was conceived as a partial response to that critical question from the context of supplemental food production in urban and peri-urban areas that are not typically allocated for agriculture. It builds on the momentum of the International Workshop on Food Green Cities held in April 2022, jointly organized by the Nepal Academy of Science and Technology (NAST) and the Centre for Science and Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre). The workshop emphasized that sustainable urban futures depend on knowledge exchange, inclusive planning, and the integration of ecological wisdom into everyday practices. This volume carries forward those recommendations, translating them into a set of structured insights and practical strategies.

The chapters that follow are authored by expert scholars and practitioners who bring diverse perspectives of knowledge from Nepal, Asia, North America, and beyond. They collectively explore how the urban landscape often seen as a site of consumption and waste can be reimagined as a hub of food security, ecological resilience, and community well-being. Topics range from urban forestry, rooftop agriculture, composting, and waste utilization, to the preservation of open spaces, rainwater harvesting, and innovative green infrastructure. Each contribution demonstrates that Food Green Cities are not a utopian vision but a replicable, actionable pathway toward climate-smart and socially inclusive urban development.

What emerges from this interdisciplinary effort is a clear message: the health of cities and the health of people are inseparable. Urban forestry cools overheated neighborhoods and purifies the air; composting reduces landfill burdens while nourishing rooftop gardens; public open spaces foster biodiversity and strengthen mental well-being; and rainwater harvesting mitigates both droughts and floods. Together, these strategies create feedback loops that enable cities to be more self-reliant, equitable, and resilient in the face of uncertainty.

This book is particularly timely for cities of the Global South, where rapid urbanization often collides with resource scarcity. Yet, the lessons here are equally relevant to the Global North, where climate stresses, rising inequalities, and food supply vulnerabilities are intensifying. By drawing from both advanced practices and grassroots innovations, the volume bridges global divides and underscores the universality of green urban strategies.

We hope that the insights offered here will inspire policymakers, urban planners, academics, and community leaders to rethink the future of cities not just as centers of commerce and concrete, but as regenerative spaces that feed people, sustain ecosystems, and nurture human potential. The challenges we face are daunting, but the solutions are within reach. If pursued with foresight, collaboration, and determination, the development of food green cities can become one of the most hopeful transformations of our time for complementing the food supply chains for feeding urban population, while they become self-serving for alleviating afore-mentioned challenges of population growth, climate change, environmental degradation and diminishing areas of arable land.

We earnestly hope that this volume will be a reference book for academic researchers, faculty and students alike, policy makers, development practitioners, and even the leaders in corporate sectors who would be engaged in various aspects of development of green cities, especially in the Global South.

As the book is divided into chapters that are authored by various experts of diverse fields, who were invited to submit their chapters, with no particular prior-design of the book contents, other than the focus on a topic-relevant workshop held in Kathmandu, we do not claim it to be a comprehensive treatise on the subject matter, but hopefully it covers major areas of the relevant issues pertaining to the development of food green cities. Regrettably, any deficiency in the book contents is either an oversight or inability of the editorial team who might have missed inviting experts to author the potential chapters in any lacking of topical contents. Because of our proximity of contacts with the authors in South Asia, especially Nepal, the country-wise distribution of the chapters may have been skewed to the region, which we accept as a limitation of the book contents.

Ambika P. Adhikari
Keshav Bhattarai
Drona Prakash Rasali
Sunil Babu Shrestha

Introduction

The development of food green cities represents a vital strategy for advancing urban sustainability. By integrating urban agriculture, green infrastructure and sustainable food systems into urban planning, these initiatives promote local food security, reduce carbon footprints and enhance urban resilience. Food green cities not only reconnect people with nature but also transform urban spaces into productive, livable and climate-smart environment.

The concept of food green cities emphasizes the integration of food production within urban environment to create self-sustaining and resilient communities. It focuses on transforming rooftops, vacant plots and community spaces into productive green zones that contribute to local food systems. By promoting urban farming, vertical gardens and green infrastructure, food green cities help reduce food miles (how far the food has travelled before reaching the consumer), manage waste efficiently and improve urban air quality. These initiatives also enhance biodiversity and mitigate the impacts of climate change through increased vegetation cover.

Ultimately, food green cities foster social inclusion and community engagement while strengthening urban sustainability. They redefine cities as spaces that not only consume but also produce - nurturing both people and the planet. Promoting food green cities also help in general improvement in health of city dwellers.

Considering the importance of the subject, the *Centre for Science and Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre), New Delhi*, India [an Inter-governmental Organization] has published this book titled *"Development of Food Green Cities for Urban Sustainability"*. The edited volume comprises 15 comprehensive chapters, contributed by researchers, academicians and practitioners from various developing countries. Collectively, these chapters provide a multidimensional perspective on the evolving concept of *Food Green Cities*, addressing themes such as *urban agriculture, rooftop gardening, waste management, composting, climate change adaptation, sustainable food systems, urban forestry, digital innovations and ethno-botanical applications* for better urban health and resilience. The volume begins with an introductory chapter that offers an overview and a brief summary of all chapters included in the book. Additionally, a Prologue has been written by the Editors, providing context and highlighting the significance of the theme in advancing urban sustainability and food security and Nepal's efforts towards creating food green cities.

This book aims to advance understanding and practice in developing sustainable, self-reliant and climate-resilient urban ecosystems. It is a valuable reference for policymakers, urban planners, researchers and practitioners working towards achieving the goals of urban sustainability and food security in the developing world.

We express our sincere gratitude to our editorial team: Dr. Sunil Babu Shrestha, Academician, Nepal Academy of Science and Technology (NAST), Nepal; Dr. Ambika P. Adhikari, Distinguished Adjunct Fellow, Institute for Integrated Development Studies (IIDS), Nepal; Dr. Keshav Bhattarai, Professor, University of Central Missouri, USA and Dr. Drona P. Rasali, Adjunct Professor, University of British Columbia, Canada, for sparing their valuable time for technical editing of the papers published in this book.

I also express my deep gratitude to Dr. Swarnim Wagle, Member of Federal Parliament, Nepal, for graciously contributing the "Foreword" to this publication.

I will take this moment to express my sincere thanks to Mr. Madhusudan Bandyopadhyay, Senior Adviser, NAM S&T Centre, for his kind advice and guidance in various stages of planning and execution of this book project. Further, I am also thankful to Ms. Jasmeet Kaur Baweja, Senior Programme Officer, NAM S&T Centre for her significant contributions in coordinating this book project.

I also acknowledge the support received from the entire team of the NAM S&T Centre, particularly Mr. Pankaj Buttan, Data Processing Manager; Mr. Rahul Kumra, Assistant Administrative Officer; Mr. Sunil Kumar, Accounts Manager and Mr. Jayakumaran, Public Relations Manager for their support in bringing out this publication.

I am also thankful to Mr. Jagdish Singh, Editorial Assistant, Allied Publishers Pvt. Ltd. for his significant efforts in bringing out this valuable publication.

Amitava Bandopadhyay, Ph.D.
Director General
NAM S&T Centre, New Delhi

Prologue

Background for the Publication of the Book

Following the COVID-19 pandemic, food security and self-reliance for urban residents have become increasingly important considerations for planners and policymakers. Urban farming has emerged as a strategic policy instrument for local governments worldwide, to enhance food security while promoting environmental quality and public health through effective phytosanitation practices. To support stakeholders, particularly in non-aligned movement member countries, a variety of policies and practices is presented in this book.

The impetus for this publication originated from a virtual workshop held in April 2022, jointly organized by the Nepal Academy of Science and Technology (NAST) and the Centre for Science & Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre). The international workshop, titled "Development of Food Green Cities for Urban Sustainability," served as a platform for generating ideas and fostering discussions that directly inspired the creation of book.

The workshop aimed to explore the concept of the "Food Green City" and covered a broad range of topics, including urban farming, energy-efficient technologies, food security, socio-economic development, traditional and modern technologies, entrepreneurship, and employment generation. Participants engaged in discussions on themes such as urban agriculture, solid waste management, global climate change, and urban planning strategies, framed by the principle that "small farmers can cool the planet," as articulated at the landmark 1992 Rio de Janeiro Earth Summit. Conference participants also addressed the pressing challenges of food self-sufficiency that have intensified in the aftermath of the Covid-19 pandemic. Experts from nine countries presented their research and findings, contributing to a rich exchange of knowledge, which eventually crystalized as the topics for this book.

Food Green City Principles

The concept of the "Food Green City" was developed in 2004 as part of a doctoral research dissertation of Shrestha, S.B. at Osaka Sangyo University, Japan. It refers to a planned approach for achieving sustainable urban development that integrates agriculture into urban planning, maintains edible and supportive landscapes, ensures food security and self-reliance, and generates supplemental income for the urban residents.

According to Shrestha, S.B. (2011), the following principles summarize the objectives of the "Food Green City":

- Abundant food green spaces
- Mixed land use (adjacent residential and commercial uses)
- Optimal utilization of spatial resources
- Public–private partnerships
- Walkable environments
- Adoption of energy-efficient and environmentally friendly technologies
- Community participation and local resource utilization
- Minimization of waste production and use of organic waste as compost
- Promotion of food security and self-sufficiency

Nepal's Efforts Towards Creating Food Green Cities

Nepal has progressively embraced the Food Green City concept through various policies, strategies, and institutional initiatives. Some significant documents, strategies, and initiatives are listed below.

- **National Urban Development Strategy (NUDS), 2017** found that urban agriculture was largely excluded from land-use planning and recommended integrating farming into urban management to promote the production of vegetables, fruits, and cereals to enhance food security.
- **Fourteenth National Plan, 2016–2017 (2073 B.S.)** called for the promotion of Food Green Cities with an emphasis on conserving agricultural land, ensuring urban greenery, and strengthening food security. It proposed developing two Food Green Cities by the end of the plan period.
- **Government Policy and Budget, 2021/22** included specific provisions for developing Food Green Cities, such as expanding urban tree planting, promoting kitchen gardening, balcony farming, and planter cultivation, and encouraging fruit tree planting by private, cooperative, and community organizations on public land, rights-of-way, and riverbanks.
- As a part of **NAST Initiatives,** The Nepal Academy of Science and Technology (NAST) has entered into Memoranda of Understanding (MoUs) with 15 municipalities to advance the Food Green City program. These partnerships focus on knowledge and technology exchange for the production, processing, storage, and marketing of nutritious and medicinal plants. They also emphasize educating students and residents on modern soilless systems such as hydroponics and aquaponics.
- **Nepal's National Report to UN Habitat III, 2016 (MoUD)** highlighted the need for an urban spatial framework that promotes efficient land use, compactness, mixed uses, and higher densities through infill and planned extensions.
- **Sixteenth National Plan, 2024 of National Planning Commission (NPC)** recommended a spatial planning system for sustainable and resilient urban

infrastructure, emphasizing urban agriculture, riverbank beautification, and the protection of open spaces for farming use.

- **National Urban Policy, 2024 of Ministry of Urban Development (MoUD)** aims to strengthen urban–rural linkages, protect agricultural land, improve storage and infrastructure for agricultural products, and formally define the Food Green City concept.
- **Bagmati Province Second Periodic Plan, 2024 of Bagmati Province Planning and Policy Commission (BPPC)** promotes urban agriculture by utilizing wastelands and formally launching Food Green City programs.

Book Publisher, Editors, and Authors

The NAM S&T Centre, New Delhi, initiated the publication of **Development of Food Green Cities for Urban Sustainability**. At its request, Dr. Sunil Babu Shrestha, Academician at NAST, took the lead as Corresponding Editor. He is joined by three Co-editors:

- Dr. Ambika P. Adhikari, Distinguished Adjunct Fellow, Institute for Integrated Development Studies (IIDS), Nepal
- Dr. Keshav Bhattarai, Professor, University of Central Missouri, USA
- Dr. Drona P. Rasali, Adjunct Professor, University of British Columbia, Canada

The editors have called upon researchers, academics, and practitioners from Nepal, India, Sri Lanka, Togo, and Mauritius, as well as members of the Nepali diaspora in the USA, Canada, Japan, and Australia, to contribute chapters to this book. The authors represent a diverse array of expertise, including scientists, academics, policymakers, administrators, field workers, and activists in the fields of urban planning, agriculture, food sciences, biology, health sciences, rural development, economics, and poverty alleviation. This book serves as a valuable resource for academics, planners, policymakers, and students seeking to discuss and develop effective policies aimed at achieving self-reliance, efficiency, and sustainability in the rapidly expanding urban areas of South Asia and other developing regions

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Contents

This book is a synthesis of innovative concepts, practices, and policies aimed at transforming cities into ecologically sustainable, environmentally sound, and climate-resilient food systems. It brings together interdisciplinary perspectives that address the critical nexus between urbanization, food systems, environmental quality, and sustainable development. The volume presents a compelling vision for how cities—particularly in the Global South—can achieve this transformation through the integration of urban planning with urban forestry, urban agriculture, composting, and green infrastructure.

This volume, published as the key outcome of the International Workshop that was organized jointly by the Nepal Academy of Science and Technology (NAST) and the Centre for Science and Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre), showcase research and policy contributions from interdisciplinary scholars and practitioners representing Nepal and other developing nations, including their diaspora academics.

The book explores concepts of urban forestry, green infrastructure, composting, rooftop agriculture, and ethnobotanical urban design to advance the "Food Green City" model—where cities evolve as self-reliant, regenerative ecosystems. Drawing on evidence-based research, policy perspectives, and comparative analyses of cities across continents, it presents replicable models that link environmental regeneration with social inclusion and economic opportunity. By aligning urban planning, environmental management, and community participation, the volume demonstrates how local innovation and policy integration can transform urban challenges into pathways for sustainable and equitable growth.

Intended for researchers, graduate students, urban planners, environmental scientists, and policymakers, this book offers both theoretical foundations and applied knowledge. It serves as a valuable reference for those engaged in designing and implementing urban sustainability strategies that bridge science, technology, and community engagement in the context of global climate challenges.

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