



ELSEVIER

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Urban Climate

journal homepage: www.elsevier.com/locate/uclim

Influences and pathways of urban form and lifestyle on carbon emission reduction

Yu-Sheng Shen^{a,b,c}, Ying-Chen Lin^{d,*}, Wee Cheah^e, Jianyi Lin^{a,b,c}, Lilai Xu^f, Yanmin Li^g

^a Key Lab of Urban Environment and Health, Institute of Urban Environment, Chinese Academy of Sciences, Xiamen, China

^b Xiamen Key Lab of Urban Metabolism, Institute of Urban Environment, Chinese Academy of Sciences, Xiamen, China

^c University of Chinese Academy of Sciences, Beijing, China

^d Department of Urban Planning and Spatial Information, Feng Chia University, Taichung, Taiwan

^e Institute of Ocean and Earth Sciences, Universiti Malaya, Kuala Lumpur, Malaysia

^f Institute for Disaster Management and Reconstruction, Sichuan University-The Hong Kong Polytechnic University, Chengdu, China

^g School of Geomatics, Anhui University of Science and Technology, Huainan, China

ARTICLE INFO

Keywords:

Landscape metrics
Sustainable urban planning
Low-carbon city
Built environment
Household expenditure
Carbon dioxide

ABSTRACT

Urban areas experience high carbon emissions, impeding sustainable development, and causing global environmental changes. Low-carbon planning and lifestyle have the co-benefit of reducing carbon emissions and mediating environmental threats. However, the relationship among carbon emissions, urban form, and lifestyle remains unclear, limiting low-carbon urban and societal development. Thus, the objective of this study was to simultaneously clarify the direct and indirect influences and pathways of lifestyle (i.e., expenditures on diet, housing, transport, and entertainment) and urban form characteristics (i.e., dispersion, patch area, fragmentation, and aggregation of building patches) on carbon emissions, and identify vital factors for mitigating carbon emissions. Moreover, a partial least squares model was established and analyzed using urban-scale data from 352 townships in Taiwan, which was used at novel spatial scales. The empirical results demonstrate that maximizing the building patch area and minimizing the dispersion, fragmentation, and aggregation of building patches can reduce carbon emissions. Furthermore, minimizing expenditures on diet, housing, transport, and entertainment would have a similar effect. The findings established that proper policies for lifestyle and urban form can reduce carbon emissions and serve as useful strategies for developing low-carbon societies and cities.

1. Introduction

Global environmental changes are primarily caused by accumulative greenhouse gas (GHG) emissions, which affect human well-being and natural ecosystems, further impeding sustainable development (IPCC, 2021). To mitigate global warming, research on decarbonization and carbon neutralization has received considerable attention in the last decade (Barthelmie et al., 2008; Holden et al., 2018; Birge and Berger, 2019; Li et al., 2019a; Duan et al., 2021; Dillman et al., 2021; Koide et al., 2021; Song et al., 2021).

* Corresponding author: Department of Urban Planning and Spatial Information, Feng Chia University, No. 100, Wenhua Rd., Xitun Dist., Taichung City 407802, Taiwan.

E-mail address: yingchen0915@gmail.com (Y.-C. Lin).

<https://doi.org/10.1016/j.uclim.2022.101325>

Received 20 July 2022; Received in revised form 16 September 2022; Accepted 9 October 2022

Available online 21 October 2022

2212-0955/© 2022 Elsevier B.V. All rights reserved.