frontiers | Frontiers in Environmental Science

TYPE Editorial
PUBLISHED 17 January 2023
DOI 10.3389/fenvs.2023.1127814

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Environmental Economics and Management, a section of the journal Frontiers in Environmental Science

RECEIVED 20 December 2022
ACCEPTED 09 January 2023
PUBLISHED 17 January 2023

CITATION
Fu J, Elshkaki A, Salvia M, Zhang X and Fan J (2023), Editorial: Toward carbon neutrality: Spatial planning and sustainable utilization of natural resource.
Front. Environ. Sci. 11:1127814.
doi: 10.3389/fenvs.2023.1127814

Editorial: Toward carbon neutrality: Spatial planning and sustainable utilization of natural resource

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KEYWORDS

carbon neutrality and emission peak, natural resources, geographic information system–GIS, renewable energy, mining, carbon emission (CE)

Editorial on the Research Topic
Toward carbon neutrality: Spatial planning and sustainable utilization of natural resource

Carbon peak and carbon neutralization are the new development strategies adopted by human society to cope with global warming. Territorial space and natural resources are the basic carrier and key medium of carbon peak and carbon neutrality achievement. The approaches and strategies for the sustainable utilization of natural resources and spatial planning to achieve carbon neutral are deemed to be worth investigating.

This Research Topic on "*Toward Carbon Neutrality: Spatial Planning and Sustainable Utilization of Natural Resource*" mainly focuses on the methods and strategies in achieving decarbonization by sustainable utilization of natural resources and spatial planning from the geography perspective. There are 45 authors and 11 papers that have contributed to this Research Topic.

Ye et al. employed the natural resources capitalization (NRC) as the ecological civilization policy to investigate whether the implementation of NRC has contributed to the carbon emissions reduction with a difference-in-differences (DID) method. The study showed that different variables of carbon emissions in four pilot cities can be effectively affected by the implementation of NRC. This research provides a timely and necessary study that the NRC policy could be a contributing factor to carbon emissions reduction.

The study by Zhao et al. presents that growing energy plants on marginal lands, not only helps to alleviate the energy crisis, but also reduces soil erosion and improves marginal soil quality without interfering with food production. The study assessed the potential of marginal land and analyzes the impact of environmental variables for Jerusalem artichoke (Helianthus tuberosus L.) in Shaanxi Province, China. The study shows that the dominant land type used for the growth of Jerusalem artichoke was moderately dense grassland.

Xinmin et al. investigated the relationship between energy use greenization, CO_2 emission, and economic growth in China. The analysis was carried out using Cobb–Douglas production function model and data from 2000 to 2018. Energy use greenization and CO_2 emissions were used either as dependent or independent variables and several factors were used as independent

variables to examine the causality of income including capital, labor, energy use, GDP, direct foreign investment, trade openness, oil prices, financial development, and urbanization. The study shows that energy use greenization reduces carbon dioxide emissions and promotes sustainable economic growth at the same time. The contribution rate of energy use greenization to economic growth shows an inverted U-shaped trend while carbon emissions have a relatively large contribution rate to green energy use and economic growth. The authors emphasized that China should maintain economic growth and employment stability in the process of energy use greenization and should promote the transformation of the traditional energy production industry (such as coal and oil industries) to mechanization and intelligence, transit from simple resource mining to deep processing, and eliminate the backward production capacity.

Li et al. constructed a carbon emission model for coal production enterprises. The main innovation of this study lies in the comprehensive analysis of the carbon emission sources of relevant enterprises from six aspects, including fuel combustion, torch burning, CH_4 and CO_2 dissipation, net purchased electricity and heat implication, coal gangue storage and utilization, and coal transportation. Moreover, the source–sink relationship method is proposed when the CH_4 and CO_2 dissipation is calculated.

Hou et al. analysed the lifecycle water footprint of the renewable energy industry in a typical arid region in north-western China. The water consumption of power generation enterprises was estimated based on current scenarios and three future scenarios. The study provides evidence on the significant pressure (in terms of high-water consumption) that the local renewable energy industry can exert on water resources in areas such as north-western China, which are plagued by long-term water scarcity. This leads to a limitation of the potential increase in installed solar energy capacity in this country, despite its rich solar energy resources, highlighting the need to adopt strategic planning to evaluate possible future upgrades in installed capacity.

Sun et al. explored the path of urban energy reform and low-carbon development for the industrial energy system in the city of Suzhou, which is an energy-dependent city in China that is dominated using coal for energy consumption mainly in the industrial sector. The authors have implemented a Long-term Energy Alternative Planning System (LEAP)-Suzhou model based on the LEAP model to explore the energy system optimization and emission reduction path of Suzhou city to 2050. The study shows that energy consumption is expected to be reduced by 37.9%, 37.4%, and 74.8%, respectively in the industrial structure optimization scenario, energy structure optimization scenario, and energy transformation optimization scenario by 2050 compared to the baseline scenario, which is expected to consume 259,954 million tons of standard coal and to emit 677.6 Mt of carbon emission by 2050.

The study by Mouzas et al. focuses on sustainable mobility and criteria that are broadly applicable to different urban environments. The proposes model is based on an index of intermodal walkability to rank the pedestrian mobility of a car-oriented urban environment. The index, based on an open-source geospatial analysis toolbox, is tested on a case study of the municipality of Nicosia (Cyprus). The study shows that pedestrian transportation can be ranked in terms of walkability from the point of private car delivery and that fossil fuel use and primary electricity generation can be reduced by focusing urban sustainable mobility planning on areas with negative scores on the proposed intermodal walkability index.

Sun et al. used the Tapio decoupling model to measure the relationship between China's economic development and mining carbon emissions from 2001 to 2018 and analyze the overall industry and its subdivisions. In addition, the authors identified the factors driving carbon emissions with the use of an improved Kaya identity and LMDI decomposition models. The study shows that all mining divisions, except oil and natural gas mining industries, have a strong decoupling and become stable with a continuous positive trend. In addition, the economic factor and energy intensity effects are the key factors in increasing and restraining carbon emissions, respectively.

The study by Yang et al. investigated the impacts of the low-carbon city pilot policy and fiscal pressure on carbon productivity based on data for 282 cities in China over the period 2005 to 2017. The staggered difference-in-differences (DID) model was used to identify the causal relationship among the low-carbon city pilot policy, fiscal pressure, and carbon productivity. The study shows that this pilot policy can significantly improve carbon productivity and that the improvement effect presents a dynamic and persistent feature.

The study by Xi et al. discusses the relevant evaluation principles and technical key points of constructing pumped storage power stations using abandoned mines (PSPSuM) in the Yellow River basin, and carries out feasibility assessment preliminarily from the perspective of multidisciplinary integration. The study shows that 91 PSPSuM can be built in this area, with a total installed capacity of 15,830 MW, comprehensively considering the aspects of spatial size, spatial structure, and space stability.

Lin et al. have built a simulation system of urban carbon emission based on system dynamics from four perspectives of population, economy, water resources and energy. It is aiming at building a method system for carbon peak path that is universally applicable to resource-based cities from a systematic perspective. The total carbon emissions of the whole industry in Taiyuan increased slightly every year from 2005 to 2021. The study shows that the comprehensive scenario had the best coordination benefit for the coupling system, which will reduce CO_2 by 17.14 million tons, water consumption by 158 million m^3, energy consumption by 5.58 million tons of standard coal and economic growth by 175.21 billion yuan in 2029.

Overall, the goal of this Research Topic has been achieved thanks to the contribution of the 45 authors. The Research Topic includes, but are not limited to: 1) the national space governance and carbon neutrality, especially in China and Cyprus. 2) assessments of natural resources for achieving carbon neutrality, especially in mining city. The editors think that this Research Topic will enrich the theory and technology and cases toward carbon neutrality.

Author contributions

JFu designed the whole editorial, summarized four articles and written the manuscript. AE concluded three articles and polished the

Editorial. MS summarized two articles, XZ and JFa summarized one article, respectively.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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