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Editorial

Climate Change Adaptation: The Role of Geospatial Data in Sustainable Infrastructures

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Climate change is a challenging reality, making adaptation at local, national and international levels a crucial need [1]. Against this background, this Special Issue demonstrates that the proper use of geospatial data can support the development of effective strategies/policies [2] and sustainable infrastructure to address climate change challenges [3]. Geospatial data can increase policy coherence by supporting the planning and implementation of climate adaptation projects. Their key role has been acknowledged by experts, policymakers and international organisations [4]. Currently, the Infrastructure for Spatial Data Information in Europe (INSPIRE) of the European Commission and the United Nations initiative on Global Geospatial Information Management (UN-GGIM) of the UN Department Statistics have established geospatial provisions to support community environmental policies and sustainable development goals.

The eight articles that are part of this Special Issue provide great examples of the role of geospatial data in addressing climate change challenges. They cover topics such as green infrastructure planning [5], groundwater regulation [6], urban heat islands mitigation [7], flood risks [8–11] and air pollution [12]. They also show the great potential that geospatial data have when combined with different data, methodologies and technologies, such as machine learning [6], satellite-driven data [7], web platforms using open data and open-source software [9], statistical and machine learning models for automated forecasting algorithms [12] and the development and use of models [10]. Moreover, the articles illustrate that open geospatial data applications are not limited to a specific geographical area, presenting cases from Africa, Asia, Europe and the Middle East.

The articles show that geospatial data provide valuable insights for making informed decisions to address different climate change challenges, predicting key future research areas. For example, the article "Towards Integrated Land Management: The Role of Green Infrastructure" demonstrates the importance of green infrastructure in supporting climate change mitigation strategies. The role of green and blue-green infrastructure when considering climate change adaptation has been promoted worldwide [13,14]. In the same context, the article "Climate Justice in the City: Mapping Heat-Related Risk for Climate Change Mitigation of the Urban and Peri-Urban Area of Padua (Italy)" shows how geospatial information systems and satellite-derived data are capable tools for investigating spatiotemporal urban heat islands, helping to define climate change policies, including the implementation of nature-based solutions [7].

The article "EU Net-Zero Policy Achievement Assessment in Selected Members through Automated Forecasting Algorithms" provides important insights regarding using geospatial data to evaluate air pollution production and related policies. This article focuses on nine Central and Eastern European countries and their efforts to reduce greenhouse gas emissions. The study assesses if the countries are on track to meet their pollution reduction targets set by the European Union. To do so, the researchers use seven different models in the nine countries, using a timescale from 2019 to 2050. The results show that

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most countries will not meet their pollution reduction targets without extra measures. The study concludes that combining statistical and geospatial data will help make better policy decisions and support sustainable development. Therefore, the authors recommend further research that continues their efforts to integrate aggregated statistical data and geospatial data, which complement and enhance each other [12].

Most of the articles in this Special Issue (five) focused on water-related challenges. Four of them studied flood issues specifically. The article "Assessing the Governance Context Support for Creating a Pluvial Flood Risk Map with Climate Change Scenarios: The Flemish Subnational Case" assesses the governance factors that affect geospatial data development and use. These types of assessments are important as they allow the identification of coordination bottlenecks when developing, sharing and using geospatial data by different users [15,16]. The researchers invite scholars to develop and apply governance assessment frameworks that increase our understanding of flood maps developed by subnational governments, including how they are adopted by medium- and small-sized cities to plan climate adaptation infrastructure, such as nature-based solutions and blue/green infrastructure. Continuing the topic of floods [11], the article "Hydrological Web Services for Operational Flood Risk Monitoring and Forecasting at Local Scale in Niger" explores a project in Niger called SLAPIS, where a platform was created to provide flood information. This platform uses open-source software and is designed to meet the specific needs of local people. The platform has been in use for 3 years and has been helpful for managing and predicting floods, including the extreme flood season in 2020. Furthermore, the study highlights the relevance of open data interoperability and wide collaboration among stakeholders alongside the empowerment of communities to achieve an integrated and sustainable water risk management strategy [9].

Similarly, the article "A Spatial Decision Support Approach for Flood Vulnerability Analysis in Urban Areas: A Case Study of Tehran" proposes the design and implementation of a spatial decision support tool for mapping flood vulnerability in Tehran under different risk scenarios. In the study, the authors take into account various factors, such as topography, demographics, land use and urban features. They also consider that different stakeholders can use its approach to plan and build climate adaptation projects, as well as proposing its applicability for use globally [8]. In the same vein, in the article "Torrential Flood Water Management: Rainwater Harvesting through Relation Based Dam Suitability Analysis and Quantification of Erosion Potential", the authors develop a technique called "relation-based dam suitability analysis", which includes several important factors, such as stream order, terrain roughness, slope, etc., when determining where to build a dam. The researchers argue that their method considers the increase in flash floods in Pakistan and can be used worldwide to identify appropriate areas for building dams, as well as estimating soil erosion to improve natural hazard management.

Finally, the article "Research into the Optimal Regulation of the Groundwater Table and Quality in the Southern Plain of Beijing Using Geographic Information Systems Data and Machine Learning Algorithms" discusses the sustainable use of groundwater in areas with issues related to water overuse and pollution. The authors combine geospatial data, machine learning, water resources technology and groundwater simulations to identify the best scenarios to regulate the groundwater table and quality in Beijing. The results indicate that adopting the optimal regimes reduced pollution, with the groundwater table rapidly recovering. These results can also be helpful in managing and regulating groundwater in other areas [6]. In this regard, it is important to mention that managing water scarcity and pollution is among the key challenges where policies and projects have had poor results worldwide [17,18].

As we can see, the eight articles demonstrate the potential of using geospatial data in addressing climate challenges in various application fields, such as land management, water management, risk management, renewable energy and urban development. They also provide effective insights regarding governance factors and emerging technologies and methodologies based on geospatial data, which can be employed worldwide to create sustainable policies and infrastructure to improve climate change adaptation. Hence, we invite scholars to contribute to geospatially oriented evidence-based decision making and sustainable policy/strategy development. Moreover, we encourage them to apply and enrich the different methodological approaches presented in this Special Issue.

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