Kousik Das Malakar · Supriya Roy

Mapping Geospatial Citizenship
The Power of Participatory GIS

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Preface

In the era of artificial intelligence, rapid technical breakthroughs, and increased recognition of the importance of geographical information, the convergence of geospatial technology and citizenship has emerged as a critical topic of research. But the challenge is, how can we connect local communities and indigenous people to the geospatial world? Based on this context, this book developed the idea of "Mapping Geospatial Citizenship," employing the power of the Participatory Geographic Information System (PGIS). First and foremost, we must understand what PGIS is and how it relates to social science research. And the answer is that PGIS is a powerful tool for incorporating local people's voices into the GIS systems. This is important in social science research because it provides powerful approaches for exploring, investigating, collecting, and comprehending various socio-spatial phenomena in our socio-ecological systems. And it facilitates research into complex spatial relationships, community dynamics, resource dynamics, and the consequences of policies and actions on local communities.

The book *Mapping Geospatial Citizenship: The Power of Participatory GIS* addresses the transformative potential of PGIS in empowering communities and amplifying their voices by employing geospatial technologies. It consolidates prominent contributions from a range of social science disciplines, including but not limited to anthropology, archaeology, area studies, communication studies, development studies, environmental studies, geography, health studies, media studies, political science, religious studies, rural studies, social policy, social work, socio-ecological studies, sociology, and urban studies. The book emphasizes disciplinary principles, (re)evaluates policy management practices, explores the potential scope for future research, and presents insightful arguments regarding the application of PGIS and community integration. Essentially, the book is dedicated to illustrating four key points:

- Incorporating community perspectives into Geographic Information Systems (GIS).
- Real-world case studies and field narratives on citizens' voice mapping.

- Explains how geospatial thinking can be used to reflect community participation and management.
- It sets itself apart by integrating varied viewpoints from the social sciences and GIScience into its coverage.

The book has been divided into ten interrelated and critical aspect-based chapters connected by three conjunction parts. Part I, *Fundamentals of Geospatial Citizenship and Participatory GIS*, is divided into six chapters. Chapter 1 provides an overview of the introductory section of geospatial citizenship, which will assist us in understanding the concepts, approaches, and dimensions of geospatial citizenship and integrate us to create a mental map on the role of GIS in citizen participation and empowerment, as well as participatory decision-making and collaborative decision-making in the face of the climate crisis in an exploration of space, society, environments, development, and sustainability. Chapter 2 delves into PGIS concepts and techniques, including traditional GIS challenges, community participation and data collection methods, participatory mapping tools and technologies, policy planning, and implementing PGIS approaches for social and spatial justice, among others. Chapter 3 digs into the multiple applications of participatory GIS, including socio-ecological techniques to mapping. In this context, we focus special attention on natural resource management and justice, climate disaster risk reduction and resilience building, urban planning and design, health and social justice, and climate migration policy planning.

Chapter 4 addresses the geographies and socio-spatial ecologies of a societal area using participatory GIS. This journey began with a grasp of the concept of societal spaces, which included geographies and socio-spatial ecologies. Furthermore, it explores community identity, empowering local communities using participatory GIS, and the future of participatory spatial planning. Chapter 5 presents an overview of community cartography in participatory GIS. In this chapter, we go over the concept and approaches of community cartography, participatory mapping techniques, and steps for empowering communities through community cartography, challenges, innovations, planning, socio-spatial justice, and future directions of community cartography. And Chap. 6 declares that GIS is for everyone and discusses the challenges of today's GIS, democratizing PGIS, and the application opportunities of open-source GIS, free tools, web-based GIS, mobile GIS, and crowd-sourced mapping, as well as the promotion of PGIS literacy and future directions.

Part II of the book, *Voices Mapping of Coastal Communities: Field Narratives, Case Studies, and Best Practices of Participatory GIS*, connects the three chapters. Chapter 7 discusses the significance and scope of voices mapping in coastal communities around the coastal World. The importance and scope of community voice mapping for sustainability were primarily emphasized here, as well as the collection of scientific information from global coasts, especially coastal Bengal in India. Chapter 8 reveals a unique and outstanding set of field narratives from the coastal Medinipur and Sundarbans as part of the field inquiry for voices mapping of coastal people. In this regard, we look into human-mangrove conflicts, man-environment

linkages, socio-ecological transformation, difficulties and conservation, sustainable thinking in the traditional maritime fishing community, and the extent of climate gap management among climate migrants. Chapter 9 focuses on in-depth case studies and best practices for using PGIS to map coastal community voices in the coastal region of Bengal, India. Therefore, the primary focuses were on mapping indigenous technical knowledge for fish catching, mapping social vulnerability to climate, participatory mapping of fishing grounds, natural resource management using participatory GIS, and modeling vegetation ecologies in relation to climate change. The book's final part delves more into disciplinary principles and social science research scopes as a power of PGIS. In this regard, more than 35 social science fields evaluate and summarize integration facts with PGIS in social science research.

This book highlighted some noteworthy thinking regarding contemporary concerns such as crisis, spatial justice, policy planning, sustainability, and the scope of further research, which is thoroughly discussed and concluded, and each chapter provided some preliminary and enlightening arguments in support of specific points in order to continue thinking about community participation, empowerment, and spatial justice through the GIS systems.

In closing, this book advances scientific knowledge based on participatory GIS among scientists, professionals, researchers, planners, students, and laypeople, while also providing a deeper understanding of community engagement as a geospatial citizen in a social setting. It also encourages various social stakeholders to participate in decision-making and helps planners and authorities build appropriate plans for a region's long-term management and development. As an outcome, it is recommended for everyone interested in geospatial technologies' potential to promote community engagement, social justice, and sustainable development. It provides a roadmap and additional research materials for leveraging the potential of PGIS to transform our perspectives on and engagement with communities, fostering more inclusive and equitable societies. In this context, we, the authors, would like to highlight the following lines:

> *The creativity that transforms obstacles into possibilities is found in the intricate tapestry of society, where socio-spatial justice, crisis response, and community participation are woven together. Here, participatory GIS acts as a collective map, guiding us through a terrain marked by empowerment and inclusivity.*

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Acknowledgment

Contents

About the Authors

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Supriya Roy is a GIS analyst and socio-environmental geographer. She holds a master's degree in social science geography from the Department of Geography, Institute of Humanities & Social Sciences, Visva-Bharati University, Santiniketan, and a double bachelor's degree in social science geography from the University of Gour Banga and Vidyasagar College of Education, West Bengal (India). In her field of research, she has participated in more than 100 workshops/seminars/conferences/webinars and has contributed research articles to both national and international journals. She has been awarded multiple certifications from NIDM (New Delhi) and IIRS (Dehradun) for her active participation in research and the acquisition of knowledge and research ideas. Her research interests encompass a diverse range of topics, including coastal indigenous communities, anthropo-environmental conflicts, climate justice, climate migration, society and politics, participatory policy planning, and the applications of geographic information science.

Abbreviation

C.D. Block	Community Development Block
CC	Climate Change
CC-GIS	Community Cartography with GIS
CC-Tech	Community Cartography Technologies
Cit-GIS	Citizen GIS
C-Map	Community Mapping
EO	Earth Observation
FGDs	Focus Group Discussions
FGs	Fishing Grounds
GC	Geospatial Citizenship
GIS	Geographic Information System
GIScience	Geographic Information Science
GPS	Global Position System
ICT	Information and Communication Technology
ITK	Indigenous Technical Knowledge
NDVI	Normalized Difference Vegetation Index
NGOs	Non-governmental Organizations
OGC	Open Geospatial Consortium
P-GeoTech	Participatory Geospatial Technology
PGIS	Participatory Geographic Information System
PGM	Participatory Geospatial Mapping
PPGIS	Public Participatory Geographic Information System
RS	Remote Sensing
SES	Socio-ecological Systems
SET	Socio-ecological Transformation
TMFC	Traditional Marine Fishing Community
TMFS	Traditional Marine Fishing Society
UNESCO	United Nations Educational, Scientific and Cultural Organization
VGI	Volunteered Geographic Information

Part I
Fundamentals of Geospatial Citizenship and Participatory GIS

Chapter 1
Introduction to Geospatial Citizenship

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> *Geospatial citizenship is about empowering individuals and communities to become stewards of their own landscapes.*
>
> Michael F. Goodchild

Abstract The chapter "Introduction to Geospatial Citizenship" provides an in-depth discussion of the concept, various viewpoints, and significance of geospatial citizenship in our increasingly interconnected world. It explores the connections between geography, technology, and civic engagement, highlighting the importance of spatial literacy and appropriate geospatial data use. The chapter first defines geospatial citizenship as people's active participation and responsible engagement in understanding, using, and contributing to the geospatial environment before delving into its characteristics. It emphasizes how geospatial technology improves our understanding of the environment, simplifies decision-making, and promotes long-term growth. In this sense, the author(s) emphasizes the rapid advancement of geospatial technologies such as global positioning systems (GPS), geographic information systems (GIS), and remote sensing. These breakthroughs have radically altered how we collect, process, and comprehend geospatial data, allowing us to make educated decisions about a wide range of issues, including urban planning, environmental management, and disaster response. Moreover, the chapter delves into collaborative decision-making in the geospatial realm, stressing the importance of developing critical thinking and spatial reasoning skills at both individual and community levels. It explores the role of geospatial citizenship in enhancing civic engagement, underscoring how geospatial technologies empower people to influence policies, advocate for their rights, and impact their surroundings. Emphasizing the transformative potential of geospatial citizenship for an inclusive and sustainable society, the chapter concludes by highlighting the need for geospatial literacy, responsible data usage, and active participation for the benefit of local communities and the planet.

Keywords Geospatial environment · Geospatial citizenship · Participatory decision-making · Community participation and empowerment · Geographic information systems

In today's fast-expanding digital world, understanding geospatial citizenship is critical. This chapter examines the core ideas of geospatial citizenship, highlighting its importance in today's society. Geospatial citizenship is fundamentally about engaging with geospatial technology and data in a responsible and informed manner. This chapter lays the groundwork for a thorough examination of the geospatial landscape by instilling civic duty and encouraging the ethical use of location-based information. So, we go on a journey to become responsible geospatial citizens, covering topics such as the importance of spatial awareness and ethical issues in geospatial applications.

Key Points of the Chapter
- Concept and relation between GIS and population.
- Various dimensions of geospatial citizenship and relations with PGIS.
- Thinking about participatory decision-making and empowerment.

1.1   Geospatial Citizenship: Concept and Approaches

1.1.1   Concept

Geospatial citizenship refers to the reasonable and ethical use of geospatial technology and data in an increasingly interconnected society. It includes understanding how location-based information is gathered, used, and shared, as well as the ramifications for individuals, groups, and society as a whole. Geospatial citizenship promotes educated decision-making, environmental stewardship, and social responsibility using geospatial tools such as geographic information systems (GIS) and global positioning systems. It emphasizes the significance of privacy, data security, and equal access to geospatial resources for everyone's benefit. Figure 1.1 depicts the visual representation of the key elements and relationships in geospatial citizenship. As well, we may recall the following:

- Geospatial citizenship involves responsibly using geospatial technology and data and recognizing the rights and responsibilities of individuals and communities in spatial information usage.
- It highlights the significance of spatial literacy, ethical geospatial data use, and active participation in decision-making with geographic information.
- Geospatial citizens understand the socioeconomic, environmental, and governance implications of location-based data and advocate for fair access and ethical behaviours.
- The idea encourages people to actively shape their spatial environment, whether by reporting issues in their area or participating in mitigation activities.
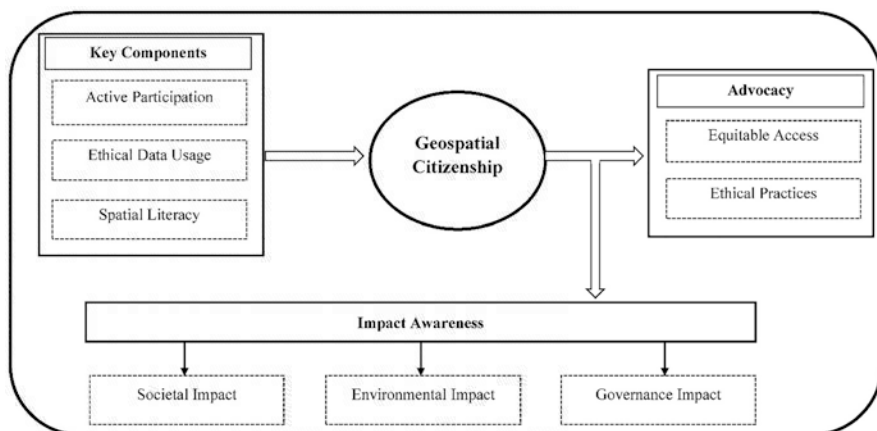
Fig. 1.1 Geospatial citizenship: essential components and connections. (Made by author(s))

1.1.2   Approaches

- *Community participation*: Community participation entails including residents in local geospatial projects and decision-making processes, which fosters a sense of ownership and responsibility for their geographical surrounds.
- *Educational engagement*: Encouraging people to gain geospatial literacy through formal and informal education. This includes teaching the fundamentals of geographic information, spatial reasoning, and responsible data use.
- *Environmental stewardship*: Environmental stewardship entails using geospatial technologies to monitor and resolve environmental issues, empowering citizens to make sustainable decisions and engage in conservation initiatives.
- *Advocacy for access*: Ensuring fair access to geospatial tools and information, bridging the digital divide, and encouraging social inclusion.
- *Ethical awareness*: Promoting ethical considerations in geographic data collection, analysis, and distribution, including privacy, security, and prejudice.
- *Data privacy advocacy*: Educating people about the importance of personal location data privacy and campaigning for open data regulations and practices.
- *Technological innovation*: Encouraging the development and adoption of geospatial technologies that benefit society and adhere to ethical norms.
- *Global citizenship*: Global citizenship entails encouraging a larger perspective on geospatial concerns, acknowledging the interconnection of global challenges, and instilling a sense of duty beyond national borders.

These approaches help to produce responsible and active geospatial citizens who use location-based information to benefit themselves and their communities.

1.1.3   Participatory GIS and Geospatial Citizenship

Participatory GIS (PGIS) and geospatial citizenship are two interconnected concepts that have the potential to transform how societies interact with spatial information, make decisions, and address a variety of challenges, including those related to the environment, urban planning, and social justice. So we need to first understand what PGIS genuinely is.

PGIS is primarily an approach that actively incorporates communities and stakeholders in the spatial data collection, analysis, and decision-making processes. It enables individuals and communities to use geographic information technologies (GIS, GPS, and remote sensing) to address issues specific to their local context. PGIS incorporates local knowledge and skills, making it an effective tool for comprehending complicated spatial challenges and developing context-specific solutions. It frequently encourages collaboration among community members, researchers, government institutions, and nongovernmental organizations (NGOs), thereby encouraging inclusive and democratic decision-making. PGIS can help with a variety of challenges, including land use management, disaster management, resource distribution, urban planning, and environmental conservation.

Relationship between PGIS and geospatial citizenship:

- Participatory GIS (PGIS) puts geospatial citizenship ideals into practice. It contains the idea that individuals and communities should have agency and a voice in the gathering, use, and application of geographical data to address local issues.
- Geospatial citizenship establishes an ethical and responsible framework under which PGIS operates. It assures that participatory geospatial activities protect privacy, adhere to data ethics, and encourage inclusivity and openness.
- PGIS promotes geospatial citizenship by providing individuals and communities with the tools and skills necessary to actively participate in geographical decision-making processes.
- Geospatial citizenship, in turn, encourages the adoption and responsible use of PGIS as a tool for democratizing access to geographic information and promoting more fair and sustainable solutions to societal concerns.

In summary, participatory GIS and geospatial citizenship are two interconnected concepts that enable individuals and communities to actively engage with spatial data and contribute to more inclusive, ethical, and informed decision-making processes. Together, they have the ability to effect beneficial change in a variety of fields, including environmental protection, social justice, and urban planning.

1.2   Dimensions of Geospatial Citizenship: A Legal and Ethical Viewpoint

The following (Fig. 1.2) are the several dimensions of geospatial citizenship: