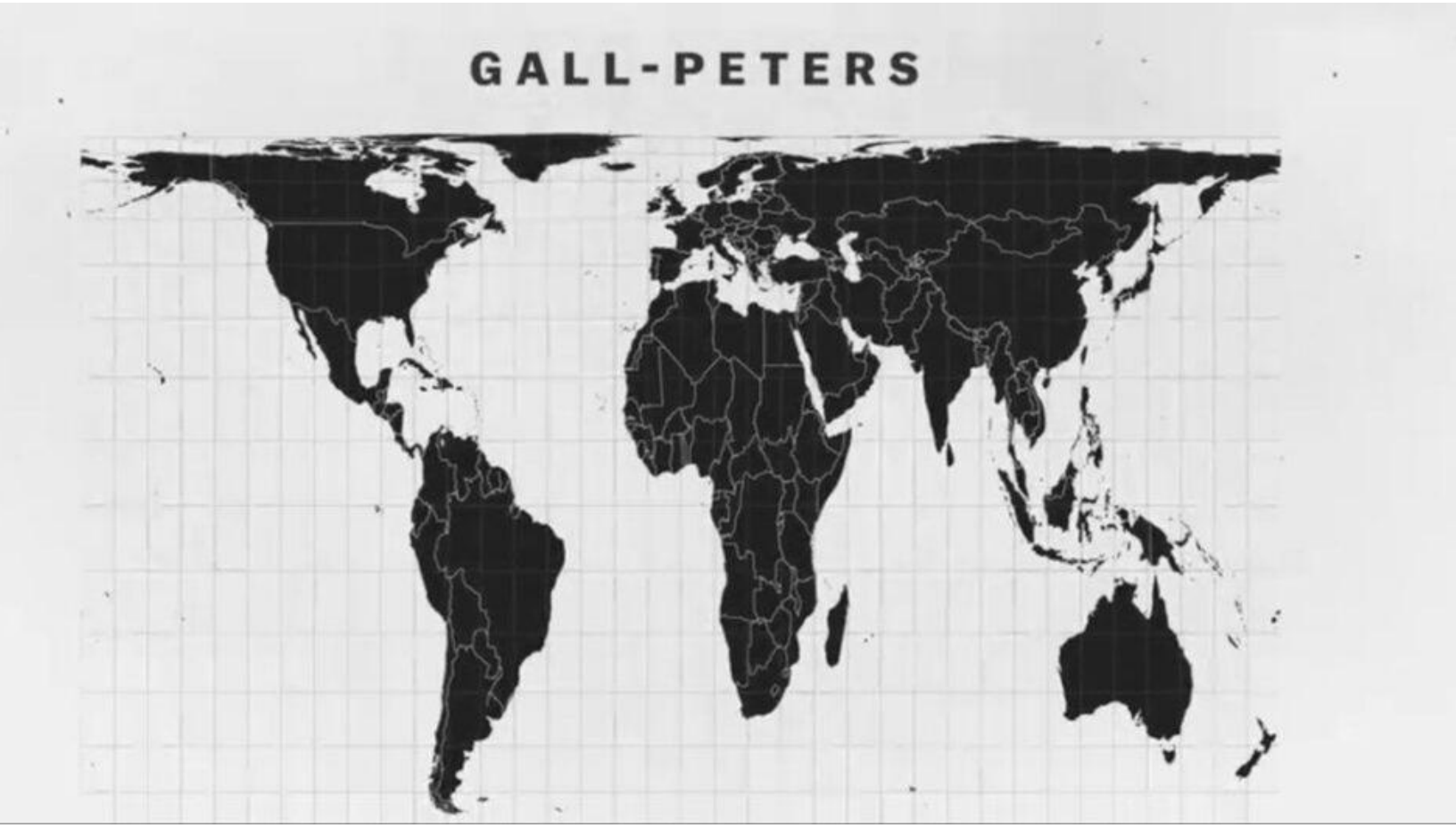
Università degli Studi di Palermo

Centro di Sostenibilità e Transizione Ecologica

IL RUOLO DEL MAPPING NELLE POLITICHE DI GENERE TERRITORIALI

THE ROLE OF CROWD-MAPPING IN TERRITORIAL GENDER POLICIES

Valeria Rossi, PhD Student in Transizione Ecologica at **Centro di sostenibilità e transizione ecologica (CSTE)** UniPA



TUTORS

PROF. NICOLA GULLO **SGD 16**

CO-TUTORS:

PROF.SSA GIUSEPPINA D'ADDELFIO **SDG 4**

PROF. DANIELE RONSIVALLE **SDG 11**

Read me carefully, follow me closely, doubt me not.
It says, I am the earth in the palm of your hand. Without me, you are alone and lost. And indeed you are.

Were all the maps in this world destroyed and vanished under the direction of some malevolent hand, each man would be blind again, each city be made a stranger to the next, each landmark become a meaningless signpost pointing to nothing.

Beryl Markham, 1987.

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Chapter summary

1. Environmental justice and human dignity: participation and bottom-up governance

Theoretical Frameworks. After illustrating how the concept of environmental justice could be described in some very popular publications which try to link the concept of Justice with that of the Capability Approach (according to Sen and Nussbaum), or, similarly, those connected with the Ecofeminism movement and the feminist approach, the settings, inconsistencies, and biased nature of the tech boom will be highlighted. It will be illustrated how some scholars argue that the process of digitizing everyday life does not occur in an undefined or unclaimed territory. Despite the novelty of the technology, its concepts, standards, and methods are an extension of prior social and material paternalistic frameworks.

2. Chapter 2 - Ecofeminism: Women, Nature, and Climate Justice

After describing how the feminist scholars working in nongovernmental organizations and UN have highlighted the vulnerability of women to climate disasters, this chapter claims that feminist approaches facilitate the process of knowledge development by establishing relationships, so creating opportunities for other forms of knowledge to be recognized and incorporated into the techno-scientific framework that now encompasses climate change.

2.5 Feminist Cartography

It explores feminist cartography, emphasizing how traditional mapping practices often reinforce gender biases. It highlights the need for inclusive spatial representations that reflect diverse women's experiences and perspectives. By challenging dominant narratives, this chapter advocates for collaborative mapping approaches that empower marginalized voices in the creation of equitable urban spaces.

3. Open geo-data systems

Analytical and interpretative phase of the method (feminist cartography, PGIS, case studies). The chapter will give an overview of recent publications that has given rise to what has been called a postmodern period in which geographic information is produced. It will be discussed how the literature on the more fundamental challenges brought up by this new resource, also known as volunteer geographic information, and, more importantly, how it has just recently begun to take shape thanks to a number of volunteers' contributions. This chapter will continue illustrating how digital transformation of cities has not only experienced quantitative growth but also a profound qualitative transformation, notably known as the reality of "smart cities", where citizens, either voluntarily or not, become digital sensors. It will be investigated, also with the support of figures and statistics, the context of digital humanitarianism and civil society activism through gelocalisation tools where traditional humanitarian organizations and other actors delegate tasks connected to the collection, production, processing, dissemination, and mapping of humanitarian data to a vast, unlimited number of non-specialists frequently volunteers. After an overview

of the open-geodata and open sources conditions for participatory mapping, it will be discussed how qualitative GIS, a paradigm that combines qualitative and quantitative methodologies, seeks to integrate many sources of information to provide a comprehensive understanding of how spatially recognized qualities or processes can be elucidated in conjunction with social and political aspects. At the same time Participatory Geographic Information Systems (PGIS) are influenced by certain biases and constraints. Gender has frequently been neglected in PGIS mapping, especially in the context of rangeland studies.

4. The networks that are changing territorial planning

Regulatory framework. Chapter 4 examines the regulatory frameworks that shape the application of PGIS, assessing how international, European, national, and regional provisions enable participatory mapping. The chapter highlights where laws support public participation, transparency, and access to spatial information, identifying opportunities for PGIS to enhance democratic decision-making. After outlining these premises, it analyzes concrete experiences and the integration of PPGIS (Public Participation GIS) into different legal contexts, with a specific focus on Italy, several of its regions, and selected international cases.

5. Evidence from Three Case Studies in Morocco

Experimental and applied part

Introduction: interpretation of applicative - experimental context of OpenStreetMap refers to the practical applications of OpenStreetMap analized in the case study in order to to understand its effectiveness, challenges, and potential in various fields.

5.1 Morocco

Case study 1. Introduction: examining Marrakech, a "ville sans bidonville," this research investigates how creatively and resiliently informal communities could be developed.

Case study 2 - Humanitarian mapping in post-emergency scenarios

Case study 3 - Mapping the climate change in the Draa Valley region

6. Mapping Disputes: Political Carto-Vandalism in OpenStreetMap

Maps, as participative tools, are open to biases: in OpenStreetMap, "tag wars" are political carto-vandalism manifestations. In this way, maps turn out to be a battleground of ideologies and territorial claim. OpenStreetMap (OSM) has experienced "editing wars" perpetrated in a random or programmed manner, in a reiteration of changesets.

INTRODUCTION

This research project is rooted in a long-standing network of relationships cultivated over more than twenty years of work in international cooperation across several African countries, primarily through collaborations with NGOs. This professional background has profoundly shaped both my perspective and my methodological approach. It would have been impossible for me to conceive a research project detached from activism, fieldwork, and the daily realities of the most vulnerable communities.

In Morocco, the study draws on the experience and commitment of human rights activists and local actors with whom I have collaborated over time. Thanks to this network of trust and shared engagement, I was able to explore in depth the social and territorial dynamics that form the core of this thesis, approaching them not only as an academic endeavour but as a continuation of a broader ethical and professional journey.

Research question

The research that has been carried out in recent months intends to respond to a series of research questions, sorted by importance and priority. The participation of all members of a community in decision-making processes is prioritized in projects fostering gender equality. This means that supporting initiatives that advance equal rights and giving local communities access to resources and training in order to promote female participation in land management policies and the preservation of ecosystems and biodiversity are similar to empowering mappers.

The **main question** that drives all the work is the following:

- Does promoting participatory mapping improve and make gender concerns easier to understand?

Secondary questions, subordinate to the previous one, are:
- Does Crowd-mapping aim to rethink the way communities live and coexist, work and produce to reduce environmental impact?
- Does it encourage the decision-making process of the interest groups through female participation?
- Does it facilitate the process of risk reduction during humanitarian emergencies?
- How should these crowd-mapping be more legitimate?

Research Framework

Objectives

To answer the following questions mentioned above, it is appropriate to outline the main objective research: **This research aims to investigate how participatory and feminist mapping practices — supported by open-source geospatial technologies — can promote gender-sensitive territorial governance and contribute to environmental and social justice.** Indeed, it focuses on **open geodata, which is freely available on open source geographic data collection systems**, the most popular of which is OSM (Open Street Maps). OSM's conceptual assumption is founded on the fundamental idea that data gathering activities related to the knowledge of a territory must be open, ensuring the ability of people and volunteer mappers to control and collaborate in the process. As a result of bottom-up pressures brought on by movements within civil society, individuals, organizations, and businesses are now participating in both virtual and non-virtual forms of collaboration. Utilizing the capabilities of modern information technologies, web 2.0, and digital media, geodata are described by volunteer mappers in an open and free format (open content) without constraints for reuse, reprocessing, and integration.

To do this, however, it was appropriate to outline the intermediate objectives that are intended achieve over the three years, such as:

- ✓ investigating how crowd-mappers evolve from mere data consumers to conscious and active agents in territorial governance and decision-making processes;
- ✓ exploring whether fostering responsibility among mapmakers supports initiatives promoting equal rights, gender inclusion, and participatory justice;
- ✓ analysing how participatory mapping (PGIS) can be institutionally and ethically integrated into policy frameworks to ensure transparency, inclusivity, and data quality.

Research methods

The research methodology is structured into three main phases designed to achieve the stated objectives:

Analytical Phase

a. Review of scientific literature on research methodologies relevant to the topic;
b. Critical analysis of the state of the art regarding field investigation methods and

documentation of existing projects and policies related to participatory mapping, gender, and environmental justice.

Interpretive–Explanatory Phase
a. Definition of a matrix of criteria for case study selection;
b. Combined analysis of quantitative approaches (geographical and structural analyses through OpenStreetMap/HOTOSM data) and qualitative approaches (interviews, project analysis, participatory observations, and calls to action on digital platforms);
c. Contribution to crowd-mapping experimentation, including training activities, creation of a working group, establishment of a virtual mapping environment, and definition of mapping objectives and tasks;
d. Field mapping and contextual analysis of the focus areas — Morocco (Sidi Youssef Ben Ali, Marrakech).

Propositional–Inductive Phase
Definition of possible guidelines and policy recommendations derived from the research findings (e.g., involvement of local actors in women's empowerment processes, participatory mapping and community roles).

Phases	Description
Analytical phase	Chapters 1–2 (theoretical study and literature on justice, ecofeminism, capabilities approach, PGIS)
Interpretive-explanatory phase	Chapters 3–4 (methodological and comparative analysis of PGIS cases and tools; regulatory analysis; comparison between qualitative and quantitative approaches)
Crowd-mapping experimentation	Chapter 5 (workshops in Marrakech, post-earthquake mapping, Draa Valley, women's involvement, use of OSM and QGIS)
Propositional-inductive phase	Conclusions (ethical guidelines, data governance, empowerment and inclusion)

* All chapters of the index were tutored by tutors and co-tutors. Chapter 1, titled "Environmental justice and human dignity: participation and bottom-up governance," was supervised by Professor D'Addelfio and Professor Gullo. Chapter 2, titled "Women empowerment and climate change," was supervised by

Professor D'Addelfio. Chapter 3, titled "Open geo-data systems," and chapter 4, titled "The networks that are changing territorial planning," were supervised by both Prof. Gullo and Prof. Ronsivalle .

In quell'impero, l'Arte della Cartografia raggiunse una tale Perfezione che la mappa di una sola provincia occupava tutta una Città e la mappa dell'Impero tutta una Provincia. Col tempo codeste Mappe Smisurate non soddisfecero e i Collegi dei Cartografi eressero una mappa dell'Impero che uguagliava in grandezza l'Impero e coincideva puntualmente con esso. Meno Dedite allo studio della cartografia, le Generazioni Successive compresero che quella vasta Mappa era inutile e non senza Empietà la abbandonarono all'Inclemenze del Sole e degl'Inverni. Nei deserti dell'Ovest rimangono lacere rovine della mappa, abitate da Animali e Mendichi; in tutto il paese non è altra reliquia delle Discipline Geografiche. (Suarez Miranda, Viaggi di uomini prudenti, libro quarto, cap. XLV, Lérida, 1658)

Da Jeorge Luis Borges, L'artefice Ed. Mondadori i Meridiani vol. 1

Chapter 1 - Environmental justice and human dignity: participation and bottom-up governance

Abstract: After illustrating how the concept of environmental justice could be described in some very popular publications which try to link the concept of Justice with that of the Capability Approach (according to Sen and Nussbaum), or, similarly, those connected with the Ecofeminism movement and the feminist approach, the settings, inconsistencies, and biased nature of the tech boom will be highlighted. It will be illustrated how some scholars argue that the process of digitizing everyday life does not occur in an undefined or unclaimed territory: despite the novelty of the technology, its concepts, standards, and methods are an extension of prior social and material paternalistic frameworks.

keywords: capability approach, ICT4D, environmental justice, climate change vulnerability, HDI.

Introduction

Amartya Sen, who was awarded by the Nobel Prize in Economics i n 1998, has made an influential work which has deeply shaped development studies, with his Capability Approach (CA) theory[1], a cornerstone of the United Nations Development Program (UNDP)[2]. The CA emphasizes the importance of expanding individual capabilities as a means to achieve social justice and enhance human well-being. The Capability Approach offers a valuable lens through

[1] The Capability Approach (CA) is a groundbreaking work that emphasizes the need to ovecome economic development traditional measures, such as Gross Domestic Product (GDP), to pass to another focus on what individuals can *do* and *be*— that is, their "capabilities" (Sen, 1999). This new approach consider justice in a broader sense: not only confined to resource allocation but taking into consideration freedoms and opportunities that individuals can undertake to achieve their well-being. For example, access to education or healthcare is not merely about the provision of services but about enabling individuals to develop the skills and health necessary to lead fulfilling lives. Sen's focus on agency and choice aligns with a participatory model of justice, which is essential for inclusive policy-making.

[2] The capability approach developed by Amartya Sen has had a great impact on the formation of the UNDP's Human Development Index (HDI) where the emphasis has been made on the multiple and interrelated aspects of human well-being instead of the sole emphasis on economic growth. The HDI includes life expectancy, education and income as the main indicators, which is in accordance with Sen's idea of enhancing people's capabilities. Despite these, the HDI and other similar indices like the Gender Development Index have been criticized for not being able to capture the systematic inequalities and the variation in people's experiences.

which to evaluate these injustices, positing that true justice extends beyond mere resource allocation to encompass individuals' capabilities to achieve well-being. Sen and Nussbaum argue that justice must consider individual capabilities, whose fulfillment is the conditions necessary for self-realisation[3]. From this perspective, even the access to resourses such as water and clean air and green spaces are a sort of integration to the individuals' capabilities to lead fulfilling lives. In her theory of justice, the philosopher Martha Nussbaum challenges Kant's view that morality and human dignity are separate from the natural world, rejecting the notion that non-human entities, particularly animals, lack inherent dignity. **Nussbaum introduces the idea of a threshold** at which an individual's capacities grant them dignity, connecting dignity not solely to species but to the range of capabilities that reflect one's potential to live a flourishing life. This approach is consistent with the critique of the Human Development Reports, particularly the Gender Development Index (GDI) from the UNDP, calling for improvement of these measures. Nussbaum extends the argument for a richer conception of dignity that respects the plurality of values, and thus calls for towards a what shift she calls neo-Aristotelian liberalism. In this way, capabilities are redefined as the central political ends, which makes it necessary to reconsider social institutions, including the family, in terms of political justice and thus expand the definition of dignity to include the needs and rights of all people. The concept of environmental justice has emerged as a significant theme in the contemporary discourse on social equality, environmentalism, and human rights. In this chapter, we look into the relationship between environmental justice and the Capability Approach by Sen and Nussbaum as well as the principles of Ecofeminism and Feminist Theory. Through an analysis of these concepts it is possible to determine what kind of participatory governance is required in order to address issues of environmental justice and improvement of human dignity.

1 .1 Climate change and human rights

The international debate on the link between human rights and climate change has developed over time, finding a significant moment in Resolution No. 23 adopted unanimously by the United Nations Human Rights Council[4].

[3] Nussbaum builds on Sen's approach by outlining ten central human capabilities which are necessary for human beings to live a dignified life. Some of them are physical health, education and, personal dignity and others (Nussbaum, 2000). According to Nussbaum, justice must ensure the minimum level (threshold level) of these capabilities for every person as justice is not possible without it. Her criticism of the traditional approaches to justice, including Kant, is especially important for the inclusion of non-human objects and the environment, which indicates a shift in the paradigm of ethics and justice (Nussbaum, 2006).

[4] United Nations Human Rights Council. (2008). *Human rights and climate change* (Resolution 7/23). United Nations. https://www.right-docs.org/doc/a-hrc-res-7-23

This resolution highlights the need to respect the specificities and adaptation capacities of communities living in individual states, recognizing the importance of coordinating climate change responses with the needs of social and economic development. In this sense, the right to development is reaffirmed as an integral part of the rights potentially threatened by climate change. The resolution also links climate change to specific issues such as food security, community participation in decision-making processes, and respect for international human rights and environmental governance obligations. This act is particularly relevant because it articulates state obligations in relation to the nexus between human rights and climate change, making it clear that the protection of fundamental rights cannot be separated from climate action.
To reinforce this perspective, several special procedures of the United Nations have integrated the climate issue into their mandates[5]. Each of these mandates has addressed the vulnerabilities related to climate change in their reports and recommendations, thus contributing to the construction of a multidimensional and integrated approach.
The very right to life is today seriously threatened by the impacts of climate change. Various risk profiles are linked to this right. One of the most serious involves extreme climate events such as floods, fires, and storms, which are among the primary causes of increased deaths associated with climate phenomena. In addition to sudden events, there are also slow-onset phenomena such as drought or soil salinisation. These significantly impact the availability of food and potable water, contributing to malnutrition and threatening the survival of entire populations. Particularly at risk are communities living within one hundred meters of the coast, especially in low-lying coastal areas, which are increasingly affected by frequent and intense climate impacts.
Another growing danger, which also concerns Europe, is represented by heatwaves, which have a direct impact on mortality. It is estimated that, between 1998 and 2008 alone, tens of thousands of people died in Europe due to extreme heat events, deaths that are directly attributable to climate change[6]. These are deaths that would not have occurred without global warming.
According to the World Economic Forum and other international organizations, these effects will disproportionately affect the most vulnerable countries, worsening already existing global inequalities[7].

[5] These include: the Special Rapporteur on extreme poverty, the Rapporteurs on internally displaced persons, the Rapporteur on the right to safe drinking water and sanitation, the Rapporteurs on adequate housing, food, health, and the rights of migrants. The Human Rights Council and its special rapporteurs are an essential point of reference for understanding how climate is redefining the global human rights agenda.

[6] The World Health Organization (WHO) has published a comprehensive report titled *Climate Change and Human Health: Risks and Responses*, which estimates that climate change was responsible for approximately 150,000 deaths globally in the year 2000. This report highlights the significant health impacts of climate change, including increased mortality due to heatwaves, and emphasizes the need for urgent action to mitigate these effects. In addition, a study published in Environmental Health examined the impact of heatwaves on mortality in nine European cities between 1990 and 2004, revealing a significant increase in deaths during extreme heat events (Ishigam et al., 2008).

World Health Organization. (2003). Climate change and human health: Risks and responses. Geneva: World Health Organization. Retrieved from https://apps.who.int/iris/handle/10665/42742

[7] World Economic Forum. (2023, January). *The climate crisis disproportionately hits the poor. How can we protect them?* Retrieved from https://www.weforum.org/stories/2023/01/climate-crisis-poor-davos2023/

One of the most authoritative reports in this area, the Global Climate Risk Index published by Germanwatch, estimated that between 2000 and 2019, over 480,000 people lost their lives due to more than 11,000 extreme weather events, including floods, inundations, and heatwaves[8].
Agricultural production still heavily depends on weather patterns, particularly on rainfall. This vulnerability is directly tied to climate variability, which is increasingly impacting agricultural economies.
According to a post-disaster assessment developed by FAO for the decade 2003–2013, in 48 developing countries, 25% of all economic losses caused by natural disasters directly affected the agricultural sector[9]. The damage also extended to livestock and fisheries, threatening the survival of entire production systems and affecting animal health and productivity.
In sub-Saharan Africa, for example, drought has had devastating effects. Fisheries are also in crisis: one in four marine species is currently threatened, and fish stocks are shifting, with serious consequences for the food security of coastal populations.
These effects also intersect with gender issues. Women, often responsible for caregiving (children, elderly, the sick), are disproportionately affected. Recent data show that women are 14 times more likely to die during climate-related disasters than men. This link between climate and gender inequality is now central to a broad literature and many international initiatives, which emphasize how income and education heavily influence climate vulnerability.
In addition to women, children, migrants, and Indigenous peoples are particularly vulnerable. The latter are especially noted by the United Nations for their role in environmental stewardship: Indigenous territories account for 22% of the Earth's surface and host 80% of the planet's biodiversity[10].
However, the impacts of climate change threaten not only the rights to life, health, food, water, and housing, but also fundamental cultural rights, such as those tied to identity, territory, and the customs and traditions of Indigenous communities. Climate change thus poses a direct threat to the survival of traditional cultures.
Finally, it is important to note that, although they represent a small portion of the global population, Indigenous peoples constitute 15% of those living in extreme poverty. A striking example of the intersection between climate crisis and cultural and economic vulnerability is represented by Amazonian deforestation, which compromises both biodiversity and the survival of its native populations.

[8] Germanwatch 2021. https://www.germanwatch.org/en/19777

[9] FAO. (2015, May). *The impact of natural hazards and disasters on agriculture and food security and nutrition.* Food and Agriculture Organization of the United Nations. https://openknowledge.fao.org/server/api/core/bitstreams/a9b93dc0-9b13-4644-96d0-fd8879e66007/content

Ishigami, A., Hajat, S., Kovats, R.S. et al. An ecological time-series study of heat-related mortality in three European cities. Environ Health 7, 5 (2008). https://doi.org/10.1186/1476-069X-7-5

[10] United Nations Department of Economic and Social Affairs. (2021, Maech). State of the World's Indigenous Peoples. Retrieved May 9, 2025, from https://www.un.org/en/desa/state-world%E2%80%99s-indigenous-peoples

1.2 Human dignity and the Capability Approach

Environmental justice advocates for the fair distribution of environmental benefits and burdens, emphasizing that marginalized communities often bear the brunt of environmental degradation. Reconsidering human dignity, Nussbaum's work challenges traditional philosophical paradigms by introducing a more inclusive and nuanced understanding of justice that accounts for various forms of dignity and capability. Instead, she argues that dignity has to be defined in relation to human beings' lives and societies. According to Martha Nussbaum, the society should move towards the neo-Aristotelian liberalism in which capabilities are identified as the political aim, which means that she tries to analyze the issue of families in the context of political justice. This way, she rejects the Kantian approach that makes a distinction between human being and the natural world, and thus denies that non-human beings have worth in themselves[11]. According to Nussbaum, accepting a more complex definition of dignity that includes non-human beings may help to promote a better political theory, which takes into account a variety of abilities, which are intrinsic to life, as primary criteria of ethical evaluation. Kant, however, refuses to acknowledge that animality can by itself have a claim to dignity and this forms the basis of Kant's ethical thought, where human interests are given the highest importance. As such, Nussbaum questions the Kantian notion of dignity being exclusive of humans by stating that such a view restricts moral consideration to a specific type of human being, one that excludes other life forms. To her theory she introduces the concept of a threshold of dignity, a concept which postulates that dignity is not an intrinsic attribute but rather capability achieved. This threshold provides a yardstick of human worthiness meaning that dignity is not a static concept as it depends on the culture that one belongs to; different societies and cultures have their own way of defining and respect dignity differently. This approach include non-human entities into the moral agency thus creating a broader notion of justice: it promotes a non-elitist and non ethno-centric approach to justice as it involves recognition of different conceptions of dignity. Thus, the new paradigm of neo-Aristotelian liberalism implies the changes in political systems, where people's capabilities will become the main value to be pursued by the government. This approach calls for a change of mind set when it comes to family structures, it calls for a change in the perception of the political justice system regarding the part that is played by people in their families[12]. It recognizes that justice cannot be de-contextualised from the diverse environments and circumstances that could shape people's lives and capabilities.

[11] Kantian ethics often associates dignity exclusively with rationality and autonomy, thereby excluding non-human entities from moral consideration. Nussbaum's critique highlights how this exclusion limits the scope of justice, arguing for an interconnected view that values all sentient beings and their capacity to flourish (Nussbaum, 2006).
[12] The reevaluation of family structures through Nussbaum's framework reveals how deeply embedded power dynamics within families can perpetuate inequalities. By incorporating family roles into political justice, this approach ensures that policies address both private and public dimensions of oppression, especially those affecting women and children (Nussbaum, 1999).

1.2.1 Reconsidering the Human Development Index

The existing Human Development Reports and the GDI have been criticized for not capturing the comprehensive notion of human capability and dignity. The current measures do not capture the to real gender life and experiences social of inequalities. We should therefore not only take into consideration the economic aspects but also the social, cultural and emotional aspects of a person's wellbeing. The analysis of existing Human Development concepts also highlights the relevance of capability to climate justice. Such measures can often prove inadequate in properly assessing the effects of climate change on human dignity. For instance, an index that is based on the economic parameters does not take into account the social and psychological aspects of climate risk. It should also take into account the factors such as environmental stability, social justice of resilience communities to ensure that the climate change policies being implemented are in the right direction to improve the human capabilities (Nussbaum, 2000).

1.3 The feminist revival in justice theories

Feminist philosophy has perhaps experienced a revival of the theories of justice and has thus contributed new questions to reflection in the fields of morality, law, and politics. The works of feminist scholars contribute to the formation of an extended notion of justice that takes into consideration structural oppression of women and other oppressed groups. By incorporating these understandings, it is possible to expand the conceptions of justice in a way that encompasses all people's experiences and thus bring about a better and healthier society. In conclusion, Nussbaum's work calls us to imagine justice in a new way that respects the many forms of human dignity and capabilities, and underlines the necessity of an inclusive approach in our political and ethical reasoning. This change is significant as it does not only impact the way we perceive justice but also influences the way we organize our societies and form our institutions in a way that respects the dignity of every person. The previous section on environmental justice and human dignity raises many connections with the concept of climate justice, which is a relatively new idea.[13] Climate justice advocates for equitable distribution of the burdens and benefits of climate change and recognizes the moral imperative to address the needs and rights of the most vulnerable populations who are disproportionately affected by environmental degradation. Nussbaum's idea that dignity is not merely an inherent trait but something that individuals can achieve through their capabilities resonates deeply with the struggles faced by communities affected by climate change. The majority of these communities are also

[13] Nussbaum defines human capabilities as ''what people are actually able to do and to be—in a way informed by an intuitive idea of a life that is worthy of the dignity of the human being'' (Nussbaum 2000).

socially and economically excluded and politically excluded from the system and thus, their basic needs like access to water, food and shelter are threatened by changes in the environment. This erosion of capabilities not only disrobs them of their dignity but also stresses the necessity of a climate justice approach that places human dignity at its forefront. Revision of theories of justice with the help of the feminist philosophy is useful for the construction of climate justice discourse. Feminist approaches stress on the links between the social and the environmental, and therefore, point out how climate change affects women and other oppressed groups. Thus, climate justice movements can benefit from these insights as they work towards the elimination of oppression and the establishment of policies that take into consideration the needs of a new approach.

Ecofeminists' claim that oppression of women and nature is due to the patriarchal system of thinking that entails domination and control. Through recognizing the bond between the ecological and the social justice, Ecofeminism underlines the necessity of the approach that engages the voices of the subaltern, and women in particular, in the discourse on environment. Feminist theories also stress on the notion of inclusiveness and intersectionality where they call for a more collective and decentralized approach to environmentalism by involving multiple agents in the management of environmental issues. The second aspect, encompassing the implications of the patriarchal structure on ecological as well as gender concerns, will be discussed in detail in the next chapter (Chapter 2). In few words, it can be said that the notions of environmental justice and human dignity, as defined by Nussbaum, are key constituents of climate justice concepts. Thus, stressing up on the human capabilities, accepting various types of dignity, and calling for the participation approach, it is possible to redefine the sound past concept of injustice but also the moral heralds responsibilities a of new climate era change. Thus, Martha Nussbaum's idea of interspecific justice can be seen to expand the notion of climate justice by focusing on the moral responsibilities that are due to non-human life and the environment. In her list of fundamental capabilities, Nussbaum speaks of the ability to live in relationship with animals and plants with compassion and interest. This is in line with the principles of climate justice which presupposes the equality of all life and the integrated approach to

ecosystems. In addition, her focus on the management of the environment—politically and materially—underlines the significance of ownership of land and other assets[14]. From this perspective, rights become real opportunities for individuals to be agents of sustainability[15]. Martha Nussbaum's idea of 'having control over one's environment' is closely associated with the notion of ownership and power in relation to material assets, which is in line with her ideas on justice and human capabilities. Other basic needs in life which are related to the physical environment include access to land, water and energy which is not only necessary for the physical survival but also for the ability to make choices and be involved in decision-making processes that determine one's life. This material element of "control" highlights the relationship between human worth and the proper use of natural resources. Without equitable access, many communities—particularly those marginalized by socio-economic or environmental injustices—are deprived of the opportunity to achieve well-being and agency, central tenets of Nussbaum's capabilities approach. The interplay between property rights and self-definition is critical, as equitable resource distribution empowers communities to address climate change effectively while ensuring the dignity of all beings. In this context, both interspecific justice and climate justice advocate for a holistic understanding of well-being that respects the rights of both human and non-human entities, fostering a more sustainable and just future for all. Martha Nussbaum's approach to animal justice (2022) is not only philosophically profound but also deeply personal. She wrote the book "Justice for animals" in memory of her daughter, Rachel Nussbaum Wichert, a dedicated animal rights lawyer with a focus on marine mammals, who worked for the NGO Friends of Animals. Rachel's commitment to advocating for the rights and well-being of cetaceans helped shape Nussbaum's own passion for animal justice and deepened her appreciation for the complex lives of non-human beings.

This personal connection adds an emotional dimension to Nussbaum's ethical arguments, bridging the scientific and moral realms in her vision of justice for animals. Inspired by her daughter's work, Nussbaum underscores the urgent need to address the ethical treatment of animals within an interconnected world, linking animal justice closely with climate justice and a post-Kantian, holistic view of human-nature interdependence. In this way, the book

[14] In her list of central human capabilities, Martha Nussbaum identifies "control over one's environment" as the tenth capability, emphasizing its critical role in human dignity and flourishing. This capability encompasses two dimensions: political control, which refers to meaningful participation in political decisions that affect one's life, and material control, which involves access to and the ability to utilize material resources, such as property, land, and natural assets. Nussbaum argues that this capability is crucial in order for people to be able to exercise choice and freedom in their lives and thereby determine their personal and collective fate. Environmental justice is crucial as it emphasizes the requirement of equal opportunity for all groups in terms of access to resources which are usually in short supply and often contaminated by environmental pollution.

[15] The concept of power as propounded by Nussbaum is evident in property rights and environmental justice. Scholars has viewed the issues of land and resource access as critical in enabling communities manage sustainable practices and effects of climate change while preserving their dignity and autonomy (Schlosberg & Collins, 2014).

resonates as a tribute to Rachel's advocacy and as a call for a moral framework that honours the dignity and interdependent well-being of all life on Earth. Nussbaum's view challenges traditional Kantian ethics, which traditionally grants moral consideration exclusively to rational beings, thus excluding animals from the domain of justice. Instead, Nussbaum's approach is consistent with a post-Kantian reconstruction of the ethical domain in which animals as sentient entities have a right to dignity and flourishing and it is the responsibility of humans to safeguard it. This expansion of ethical concern represents a change towards acknowledging the interdependence of life, suggesting that the happiness of humans is inextricably associated with the happiness of animals and the environment as well. This approach ties into the principles of climate justice, which similarly calls for moral consideration of those affected by climate change, particularly marginalized human and non-human communities. Both frameworks advocate for addressing historical injustices and the exploitation of vulnerable populations—animals in the case of Nussbaum's animal justice and marginalized human populations in climate justice. Both fields also emphasize the interconnected impacts of human actions on ecological balance and the well-being of non-human entities, arguing for systemic changes to prevent harm and promote sustainability across ecosystems. By endorsing a holistic, inclusive approach, Nussbaum's vision converges with climate justice by acknowledging that ethical responsibilities should not be confined to intra-human relations but should instead extend compassionately and justly to all life forms. This change is consistent with a new ethical vision where justice does not only take into account the rights of people but also the rights of the environment and all the creatures in it, and where nature is seen as a system of beings that have the right to exist and develop. This approach is in line with the post-Kantian ecological ethics that emphasizes the need to appreciate nature's intrinsic value and promote the dignity of the natural world without clear distinction between teleological and deontological rights of humans and other beings. According to Nussbaum, the justice system should embrace environmental ethics and animal rights simultaneously, which is in line with the overall aim of promoting sustainability and equality.

1.3.1 Climate change and the Threshold Concept and Vulnerability

This concept of a threshold level for dignity, that has been introduced by Nussbaum, seems to acquire particularly relevance with regard to climate justice. It becomes clear that most vulnerable populations often fall below this threshold, because of their exposition to risks from climate impacts. More importantly, recognising varying degrees of vulnerability experienced by different communities gives us a picture of a more nuanced understanding of environmental justice. When designing climate adaptation and mitigation strategies, policymakers must account for these disparities to ensure that efforts are efficiently and stategically allocated[16]. This threshold is quite meaningful when used in the context of

[16] As evidenced by Schlosberg & Collins (2014) policymakers must prioritize equity in the design of climate adaptation and mitigation strategies. Recognizing the disparities faced by vulnerable populations—such as those with limited economic resources or political power—is essential for creating fair and effective climate

climate justic. Groups that are most impacted by climate change hampers their ability to access basic needs, social stability and safety of life and property which compromises their dignity and quality of life. Understanding these disparities is essential for policymakers, who must ensure that climate adaptation and mitigation strategies do not only address environmental concerns but also promote fairness and equity by prioritizing those most affected by climate change. In Nussbaum's capability approach, the threshold concept is central because it represents the minimum level of capability that every person should have in order to live a life of dignity. Climate change has a potential of violating all these areas thus making life below the minimum requirement for human dignity. For instance, floods and other natural disasters caused by severe weather conditions may destroy properties, displaces people and affect the supply of water and food. Coastal regions are threatened by rising sea levels, which in turn results to loss of property and source of income while pollution especially in urban areas puts the health of residents at risk. In the context of the current challenges, the cumulative impact of climate change does not only threaten lives but also hinders people's ability to improve their lives and exercise their agency, thus violating Nussbaum's dignity threshold. The idea of the threshold of dignity can be well understood when used in relation to vulnerability especially with an emphasis on gender. Women, particularly in the vulnerable, rural and indigenous societies, are often impacted most by the changes in climate. Their vulnerability is increased due to various social, economic and cultural factors that define their access to resources and opportunities for adaptation. A gender perspective in climate justice not only emphasizes the need for gender equality but also ensures that climate responses are comprehensive and effective for those who are impacted most by environmental changes.

Women in vulnerable regions often bear the brunt of climate change impacts, as they are frequently responsible for managing essential resources like water, food, and family well-being. During extreme weather events, such as droughts, floods, or hurricanes, women's resource management roles intensify, often increasing their unpaid labour and exposing them to greater risks. Women's access to land, education, and social networks that could aid in recovery is often limited, creating a compounded vulnerability that requires tailored responses.

In many communities, women are underrepresented in political decision-making processes and institutions responsible for climate response strategies. This highly compromises women's consideration of needs and perspective within adaptation and mitigation strategies, thus rising the distance between climate policy and the concrete harm women experience in affected areas. A **gender-sensitive approach to climate policy** is not only essential for equity but also enhances the overall effectiveness of climate interventions. Applying Nussbaum's concept of the threshold of dignity underscores the fact that many women, especially those in economically disadvantaged or rural areas, live below the

policies. By targeting those most affected by climate change, these strategies can ensure that the most marginalized communities receive the support they need to adapt to and mitigate environmental challenges, ultimately promoting social justice and resilience.

minimum level of well-being needed for a dignified life. Women, as traditional stewards of natural resources and family welfare, are essential to community resilience. However, if they lack access to resources, education, or institutional support to cope with and adapt to climate change, their ability to support community resilience is significantly compromised. In the context of climate justice, supporting women's capabilities not only secures their right to a dignified life but also strengthens the adaptive capacity of the entire community. **Adaptation strategies that account for the specific needs of women**—such as training in sustainable agriculture, access to financial resources, and tools for resilience—empower women to more effectively address environmental challenges, resulting in improved community outcomes[17]. Integrating a gender perspective into climate policies means moving beyond merely including women in decision-making processes to recognizing the additional vulnerabilities they face due to structural inequalities. Research shows that when women actively participate in environmental and climate decision-making, policies are more comprehensive and sustainable (....). An inclusive approach that encourages female leadership in adaptation and mitigation initiatives helps develop strategies that reflect the actual needs of all community members, making climate interventions more impactful. A notable example is the use of microfinance programs and revolving funds that support women in rural areas. These tools improve women's access to resilient agricultural technologies, water management resources, and community-led climate initiatives, such as fuel-efficient stoves. Additionally, creating networks of women leaders at the local level increases awareness and collaboration around sustainability and climate change, encouraging the adoption of innovative practices. There is double perspective, though: women are agents of change in spite of their vulnerability to climate change. In affected areas, innovative mitigation solutions come from women, and they are sustainable, too. For instance they advise to diversify crops as a solution to reduce dependence on limited resources or introducing water conservation techniques. These practices are deeply rooted in their local ecological knowledge and their role as resource managers. A climate justice approach that values women's contributions not only strengthens community resilience but also promotes a more equitable and sustainable development model. Supporting women as leaders and innovators in the context of climate justice requires interventions that dismantle social and institutional barriers, providing them with resources, training, and representation.

Incorporating a gender perspective into climate justice offers a more comprehensive and fair approach to addressing climate change. Overcoming gender inequalities and strengthening women's capabilities are essential not only to ensure individual dignity but

[17] Integrating gender-responsive approaches into climate adaptation strategies can significantly enhance community resilience. Providing women with training in sustainable agricultural practices, access to financial resources, and tools for resilience addresses the unique challenges they face as primary caregivers and resource managers. Such strategies not only empower women but also improve overall community outcomes by leveraging their critical roles in environmental stewardship and social cohesion (Dankelman, 2010; Alston, 2014).

also to enhance community resilience in a lasting way. Women, particularly in the most impacted communities, need tools and opportunities to face climate change effectively, contributing to adaptation and mitigation solutions that respect diversity and promote equity. Upholding a threshold of dignity, as proposed by Nussbaum, means ensuring that no woman, and indeed no person, is "left behind" [18]in climate responses. Climate justice policies must therefore integrate a gender perspective and acknowledge that climate change impacts people unevenly. To achieve true equity, we must listen to and include the voices of those who are most vulnerable, yet also among the most resilient and innovative facing global challenges.

1.3.2 A New Neo-Aristotelian Liberalism and Climate Action

From the previous discussion, it has been suggested that a new neo-Aristotelian liberalism should be advocated for where human capabilities are key aims of the political process. This perspective raises questions on how societies are structured in the presence of climate change and requires a change in the approach of leadership to make sure that all voices are considered. Climate justice is in line with this view because it is a perspective that demands that those who are least responsible for causing climate change, the poor and the vulnerable, should be given top priority in both adaptation and mitigation measures. Continuing with the idea put forward by Amartya Sen, capability refers to the concept of space in which comparisons in respect of standard of living can be done (this was later expanded to form the Human Development Index), Martha Nussbaum develops on these ideas to propose that capabilities together with the threshold level can help in the formulation of sound constitutional principles that would promote justice and equality in the face of climate change. In Nussbaum's framework the threshold level of capabilities serves as a important benchmark. It marks the level of capabilities that every person should have in order to live a dignified human life. This idea is quite helpful in the discussions on climate justice especially because climate change affects negatively the affected communities in a very unfair manner. Since they have limited resources and capabilities to adapt, such thresholds must be identified and addressed for a just climate response. A new neo-Aristotelian liberalism also takes into account that human capabilities are linked and that these capabilities have to be developed while taking ecological sustainability into consideration. This approach also criticizes the traditional liberalism that is characterized

[18] The principle of "leaving no one behind," embedded in the United Nations' 2030 Agenda for Sustainable Development, calls for addressing the needs of the most vulnerable and marginalized communities in climate adaptation and mitigation efforts. This approach emphasizes that the benefits of climate action must be equitably distributed, ensuring that the populations most at risk from climate change—often the poorest and most disenfranchised—receive the necessary support to build resilience and thrive. Policymakers must design strategies that reflect this commitment, ensuring that no community is overlooked or excluded from the benefits of climate action (United Nations, 2015; Schlosberg & Collins, 2014).

by individualism by promoting the solutions that are based on community while at the same time embracing the social, economic and environmental systems. Thus transforming the focus from individual rights to the collective capabilities, societies are able to formulate better and more suitable strategies for climate change adaptation. The messages that Martha Nussbaum and Amartya Sen give are political and they call for a strong framework that will enhance human capabilities and social justice in the policy process[19]. Their theories dispute the standard definitions of development, including the Gross Domestic Product, which does not capture the essential aspects of human life and the real feelings of people in society. Nussbaum's approach is political because it requires the alteration of the structure of societies in as far as the distribution and provision of resources, the formulation of policies and the interaction with social groups that are oppressed. Through the concept of capability, Nussbaum forces the policy makers to rethink the people who are given a chance to speak and those who are considered worthy of attention in the policy making process. Likewise, the works of Sen raise the issues of the role of reason and democracy in dealing with the problems of social justice. This is the reason why Sen states that capability approach should be the central aspect of development as it embodies the principles of inclusion and engagement. According to Sen, people should not be treated as helpless victims in need of rescue, but accordingly to both authors they have the potential to determine their political structures and their own future. This political view is very relevant when analyzing contemporary issues, including climate change, poverty, and inequality. Nussbaum and Sen's approach based on justice and human dignity provides a perspective that goes beyond the economic discourse, and puts a responsibility on societies to look at the moral when making policies. Also, their emphasis on the integrated nature of capabilities highlight the fact that people's welfare is closely linked to the welfare of others. This connection strengthens the notion that responding to social injustice cannot only be considered as a moral responsibility but as a political one as well. In a world where inequalities are increasing because of systems and structures, focusing on capabilities can help promote fairness and harmony.

[19] Martha Nussbaum and Amartya Sen's ideas are fundamentally tied to politics because they delve into the ethical and practical aspects of justice, focusing on human capabilities and dignity. Their work highlights the need to tackle systemic inequalities and confront the political structures that restrict individual freedoms and opportunities. Nussbaum's approach to capabilities stands out as particularly political since it pushes for significant changes in how societies distribute resources, shape policies, and interact with marginalized groups. By placing capabilities at the heart of justice, she urges decision-makers to pay closer attention to whose voices are included and whose needs are prioritized (Nussbaum, 2006; Sen, 1999). Similarly, Sen emphasizes the role of public dialogue and democratic participation in reducing social inequalities, advocating for a more inclusive and engaging path to development. Both thinkers argue that the fairness of social systems and political institutions should be judged based on how well they expand human capabilities. This perspective becomes especially vital when grappling with major global issues like climate change, poverty, and inequality.

1.4 Bridging capabilities and technology

The link between social justice and human capabilities is not exclusive to development studies, it is also evident in other fields such as the rapidly growing field of Information and Communication Technology (ICT). Incorporating technology into environmental governance provides an excellent potential to improve the participation as well as decision-making. However, it also creates challenges and shortcomings that need to be addressed. The tech revolution is one of the most popular narratives of the modern world as a source of solving different issues, including environmental issues. However, there are some scholars who are highlighting that the process of digitization of life is happening in a way that reinforces existing inequalities.

Despite its promise of innovation, technology frequently reproduces and even amplifies existing social and material inequalities. This perpetuates a paternalistic approach where marginalized communities' perspectives are either ignored or superficially acknowledged.

Sen (2009) has highlighted the transformative potential of mobile phones in expanding human capabilities on a global scale. He stated that the mobile technologies increase the accessibility of information and services as well as increase the mobility of individuals through the use of communication, learning and working tools. This expansion of capabilities is in consonance with the concepts of climate justice and interspecies justice by Martha Nussbaum. Both of these are concerned with equality regarding resources and chances, which show that the improvement of one's people is linked with the conservation of the environment. Going with this, William Birdsall (2011, p.94), proposes that there should be what he calls "CA and ICT communities' close collaborative dialogue". He also stresses the need for discussing how the ICT applications can be developed and used in a manner that would help to enhance certain human capabilities and thus promote the inclusion and justice with regard to both people and planets[20]. This collaboration is important as integrating ICT into development plans can help to enhance the participation in management governance of and environmental issues including climate justice. Through the use of technology, people can have their voices heard, resources can be mobilized, and people can push for the adoption of sustainable measures that respect the rights of people as well as those of other living creatures. In the same manner, such collaboration can also assist in the formation of policies that incorporate the aspects of people's capabilities that have been marginalized and make sure that these capabilities are not only identified but also strengthened in the context of climate change. For instance, providing the communities with the necessary technology can help them be part and parcel in decision making processes and also enable them to address the issue of property rights which according to Nussbaum is a critical aspect of human capability to define oneself and act.

The application of the capability approach as a conceptual tool for analyzing the impacts of Information and Communication Technology (ICT) policies and programs in the

[20] Academics (Jha, 2020) argue that "close collaborative dialogue is essential between ICT and human capabilities, says Birdsall (2011), to explore the process of contributing to expanding human capabilities and talks beyond the traditional approach of communication freedoms."

developing world and especially at the sub-national level is current and ongoing. Nevertheless, a major issue in the analysis of ICT4D is how basic necessities like connectivity or hardware is connected with specific results well-defined or steps towards attaining the desired developmental goals. To this end, there is need to develop new measures that will help to establish the relationship between enhanced ICT resources and improvements in human capabilities as well as improvements in human development and environmental conservation.[21]. Donna Vaughan's (2011) study proposes that the capability approach provides a solid analytical tool for analyzing the link between resources, capabilities and well-being. As Vaughan explains, applying this approach in policy and program design, especially in a strategic and context specific manner, can greatly improve community development practice. Her research, done on Indigenous communities in Cape York, Australia and rural villages in Sri Lanka shows that the success of ICT4D initiatives is a function of acknowledging and leveraging on the capabilities and needs of the target communities. The community driven approach is more effective than the one that is based on a on-size-fits-all approach since the initiatives are in line with the community's strengths and goals.

An approach based on the concept of capability allows policy makers and practitioners to create programs which are relevant and appropriate for the communities in question, and thus ensure that the participation is sustained and the results are effective. In this manner, this approach connects the general guidelines of the capability approach with the real-life conditions of various societies, which shows the necessity of the contextual application of the development projects. Vaughan's analysis establishes a connection between the resource endowment, capability, functioning, and well-being that is important for the communities' buy-in and thus, sustainability of programs and social return on investment by sponsors.

According to Vaughan, skill and capability should not be interpreted in a way that would make them a universal concept that would apply to all the Indigenous people. Her case studies show how particular information bases of particular communities can be used in policy and program analysis (Sen, 2009, pp. 232-233). For example, the differences in the Indigenous Australian communities, which are ranged from completely urban to extremely remote, cannot be approached with a one-size-fits-all strategy as they have different cultural, geographical and social characteristics.

In all the case studies, the people from the concerned community discuss their experiences with the ICT4D programs, and rank the importance of ICT for their well-being. These reflections show that communities have different definitions of well-being and the understanding of the human beings' capabilities that define them, which provide a

[21] According to Jha (2020), while access to ICT infrastructure is often viewed as a vital resource, it does not automatically lead to enhanced capabilities or sustainable development outcomes. This gap highlights the need to focus not only on ensuring access but also on how technology can be effectively utilized to empower individuals and communities, thereby creating tangible pathways toward achieving development goals.

foundation for identifying the freedoms or skills that are most important for that context. Every ICT4D program is evaluated semiquantitatively to look at how well the program enhances the links between resources, capabilities, functionings and well-being.

The analysis of the application of capabilities and well-being dimensions in the context of Indigenous communities is based on Sen's (1999) and Nussbaum's (2000) approaches. It underlines the importance of focusing on context relevant capabilities rather than a set of prescribed capabilities that are deemed necessary and important for all contexts. The analysis of the cases from Cape York and Sri Lanka shows how the cultural, economic and environmental conditions of the particular approaches locality to influence people's development concepts policy of and well-being programs. which

According supports to the Vaughan, stochastic the nature current of poverty, the frameworks are inadequate, especially in the case of Indigenous Australians, as the government measures do not take into account the Indigenous' perceptions of well-being. She identifies three major frameworks of Indigenous well-being: (1) Government policy oriented focus on the social and economic well-being, (2) Rights-based approach focusing on cultural integrity and self-determination and (3) Traditions-based approach emphasizing on culture of Indigenous people. Through the application of these three lenses on ICT4D programs, Vaughan develops a feedback mechanism that ensures that the well-being of the community and climate justice are integrated with sustainable development to ensure are that those policies that that embrace are the indigenous formulated people's perspective as well as ensure the sustainability of the programs[22].

Here the author stresses the importance of the distinction between individual and collective capabilities in the context of Indigenous ICT programs. Even though Nussbaum and Sen focus more on individual capabilities like empowerment and resources, some communities have to take a collective approach. This approach recognises the shared benefits and community based resources which are important in many Indigenous societies. It is important to identify this distinction in order to design the ICT initiatives that would help to empower individuals and improve the quality of their communities in the context of Indigenous cultures.

The study also establishes that to be sustainable, such programs must be in line with the local vision and culture. A capability approach puts the emphasis on translating the access to technology into functionings that are meaningful for the society and as defined by the community. Programmes that directly affect such capabilities of the community are more

[22] The three perspectives outlined by Vaughan (2011) illustrate the tensions between externally imposed frameworks of development and Indigenous communities' own understandings of well-being, emphasizing the necessity for policies that balance economic objectives with cultural and traditional values. Vaughan's categorization highlights the complexity of Indigenous well-being, suggesting that effective policy and program development must integrate the strengths of all three perspectives—governmental, rights-based, and tradition-based—while remaining sensitive to the unique needs and aspirations of each community.

likely to succeed hence calling upon the policy makers to ensure that conversion of ICT access into capabilities which are perceived to enhance wellbeing by the local population.
This framework can be extended to show how, specifically in the context of climate change and its effects on the vulnerable, including indigenous populations, such implications arise. Climate change enhances the conditions of vulnerability by affecting the conventional ways of living, source of income and natural environments of the indigenous people. To these communities, climate change is not just a threat to their existence but also means adaptation measures that are congruent with their culture, social structures and indigenous knowledge.
In this context, the ICT4D interventions that are based on the capability approach and are tailored to the specific context of the community can make a instance, big initiatives difference. Access to climate information, IPCC reports, or digital tools for natural resources planning and management can help indigenous peoples to combat climate change effects and to preserve their cultures. But such programs cannot be limited to providing the basic technology equipment. Rather, they should encourage collective action for the environment and community cohesiveness.

This adoption of the capability approach for ICT programs could result into better and more sustainable climate change adaptation strategies. Through focusing on capabilities that are relevant in the context of Indigenous societies including governance, knowledge on the environment and management of resources, ICT interventions can enable sustainable development that addresses and enhances the needs and values of the vulnerable groups. Not only does this increase the climate change adaptation but also enhances social justice and cultural conservation in the face of the changing environment.

Conclusions

Accordingly to the aforementioned approach, it is possible to see how the combination of the Capability Approach, ICT, climate justice, and interspecific justice could give us some answers. If we take into consideration the role of technology in expanding human capabilities we can easily understand how technology can bring about environmental justice and enhance human dignity. But this is still not sufficient, since we have to adopt the the paradigm of participatory and bottom-up governance if we really want to incorporate the voices of the oppressed, and make environmental decisions and policies more relevant to the people's desires and goals. The Capability Approach, Ecofeminism, and feminist theories, have led to the same conclusions and can be considered as a multidimensional approach to interface with an issue such as climate justice.

References

Alston, M. (2014). Gender mainstreaming and climate change. *Women's Studies International Forum*, 47 (Part B), 287–294. https://doi.org/10.1016/j.wsif.2013.01.016

Arora-Jonsson, S. (2011). Virtue and vulnerability: Discourses on women, gender and climate change. *Global Environmental Change, 21*(2), 744–751.

Bianchi, B. (2020). Genere, generazioni e cambiamento climatico. Temi e questioni per una rubrica. *DEP. Deportate, esuli, profughe*, 41-42, 243-253.

Birdsall, W. F. (2011). Human capabilities and information and communication technology: The communicative connection. *Ethics and Information Technology*, 13(2), 93–106. https://doi.org/10.1007/s10676-010-9253-8

Buechler, S. (2009). Gender, water, and climate change in Sonora, Mexico: Implications for policies and programmes on agricultural income generation. *Gender and Development*, 17(1), 15-29. https://doi.org/10.1080/13552070802696912.

Dankelman, I. (Ed.). (2010). *Gender and Climate Change: An Introduction* (1st ed.). Routledge. https://doi.org/10.4324/9781849775274

Eckstein, D., Künzel, V., & Schäfer, L. (2021). Global Climate Risk Index 2021: Who suffers most from extreme weather events? Weather-related loss events in 2019 and 2000–2019. https://www.germanwatch.org/en/19777

Giacomini, T., Turner, T. T., Isla, A., & Brownhill, L. (2018). Ecofeminism against Capitalism and for the Commons. *Capitalism, Nature, Socialism, 29*(1), 1-6.

Ishigami, A., Hajat, S., Kovats, R.S. et al. An ecological time-series study of heat-related mortality in three European cities. Environ Health 7, 5 (2008). https://doi.org/10.1186/1476-069X-7-5

Jha, A. (2020). ICT with open and distance learning for capability enhancement: Practices of higher education institutions of Nepal. *Journal of Training and Development*, 5, 60-70. https://doi.org/10.3126/jtd.v5i0.33895

Merchant, C. (1980). *The death of nature: Women, ecology, and the scientific revolution*. Harper & Row.

Mies, M., & Shiva, V. (1993). *Ecofeminism*. Zed Books.

Nagel, J. (2016). *Gender and climate change: Impacts, science, policy*. Routledge.

Nussbaum, M. (2022). *Justice for Animals: Our Collective Responsibility*. Simon & Schuster.

Nussbaum, M. (2000). Women's Capabilities and Social Justice. *Journal of Human Development*, 1(2), 219–247. https://doi.org/10.1080/713678045.

Nussbaum, M. (2000). *Diventare persone: Women and human development. The capability approach*. Il Mulino.

Nussbaum, M. (2000). *Giustizia sociale e dignità umana*. Il Mulino.

Oosterlaken, I., & van den Hoven, J. (2011). ICT and the capability approach. *Ethics and Information Technology, 13*(1), 65–67.

Plumwood, V. (1993). *Feminism and the mastery of nature*. Routledge.

Robinson, S. (2014). *Nesting: Body, habitation, mind* (p. 21). Pordenone: Safarà Editore

Schlosberg, D., & Collins, L. B. (2014). From environmental to climate justice: Climate change and the discourse of environmental justice. *WIREs Climate Change*, 5(3), 359–374. https://doi.org/10.1002/wcc.275

Sen, A. (2009). *The idea of justice*. Cambridge, MA: The Belknap Press of Harvard University Press.

SERVIR-Mekong. (2015). *Gender and GIS: Guidance Notes*. Asian Disaster Preparedness Center.

Shiva, V. (1988). *Staying alive: Women, ecology, and development*. Zed Books.

Sultana, F. (2014). Gendering climate change: Geographical insights. *The Professional Geographer, 66*(3), 372–381.

Virgilio, F., & Carbonari, M. (2022, June 23-24). Il Data Activism contro la violenza di genere. Uno studio esplorativo su pratiche partecipative, saperi ed iniziative "dal basso". *IV Convegno Società Scientifica*

Italiana di Sociologia, Cultura, Comunicazione, Università Federico II, Napoli. Intervento a convegno non pubblicato.

Vaughan, D. (2011). The importance of capabilities in the sustainability of information and communications technology programs: The case of remote Indigenous Australian communities. *Ethics and Information Technology, 13*(2), 131–150. https://doi.org/10.1007/s10676-011-9269-3

WEB REFERENCES

World Economic Forum. (2023, January). *The climate crisis disproportionately hits the poor. How can we protect them?* Retrieved from https://www.weforum.org/stories/2023/01/climate-crisis-poor-davos2023/

United Nations Human Rights Council. (2008). Human rights and climate change (Resolution 7/23). United Nations. Retrieved from https://www.right-docs.org/doc/a-hrc-res-7-23

Germanwatch 2021. https://www.germanwatch.org/en/19777

FAO. (2015, May). *The impact of natural hazards and disasters on agriculture and food security and nutrition*. Food and Agriculture Organization of the United Nations. https://openknowledge.fao.org/server/api/core/bitstreams/a9b93dc0-9b13-4644-96d0-fd8879e66007/content

United Nations Department of Economic and Social Affairs. (2021, Maech). State of the World's Indigenous Peoples. Retrieved May 9, 2025, from https://www.un.org/en/desa/state-world%E2%80%99s-indigenous-peoples

Chapter 2 - Ecofeminism: Women, Nature, and Climate Justice

Abstract: After outlining the principles of the ecofeminism movement, this chapter explores the connection between environmental degradation and gender injustice, arguing that both stem from patriarchal systems that favour domination. Women, particularly in indigenous and rural communities, are often the stewards of natural resources and possess essential knowledge for environmental sustainability. Women, as primary caregivers and food producers in many societies, are acutely affected by the impacts of climate change, such as droughts, floods, and changing weather patterns. These impacts threaten their ability to secure food, water, and fuel for their families, exacerbating existing gender inequalities. Yet, despite these challenges, women also possess valuable knowledge and skills related to natural resource management that are essential for building climate resilience.

Ecofeminism critiques unsustainable development practices that exacerbate social inequalities and advocates for a partnership ethic that recognizes the interconnection between human well-being and the health of ecosystems. By integrating feminist perspectives and technologies, more inclusive and sustainable solutions can be developed to address global challenges.

keywords: ecofeminism, ICT4D, gender gap, climate change vulnerability

Introduction

Besides the Capability Approach, Ecofeminism also it helps to understand the connection between the concept of human capability and environmental injustice. Ecofeminists claim that oppression of women and nature is an outcome of the patriarchy under the logic of control and domination. In light of the above, Ecofeminism helps to understand the connection between ecological and social justice and therefore the importance of an approach that engages the local population, especially women, in decision-making. Feminist theories also stress on the need for participation and inclusion, they promote a systemic approach which involves all the concerned agents in the discussion and solution to environmental issues.

Ecofeminism is aware of the fact that the subjugation of women as well as the subjugation of nature are interconnected. They are both a product of colonialism, capitalism and patriarchy. Women, especially the indigenous and rural women, are the custodians of natural resources and have a better understanding of the concept of sustainable environmental management since they are involved in agricultural activities, water management, and family food security. The concept of eco-feminism as understood by women is the continuation of historical colonization that led to the deterioration of ecological assets that are vital for life, economy, and the political freedom of indigenous

people. Therefore, ecofeminism involves the acknowledgment of women's contributions towards preservation of the environment and the struggle against degradation and gender inequality.

2.1 The Historical Roots of Ecofeminism

"The Death of Nature: Environmentalism and the Wrong of Women", a book published in 1980 has been recognized as one of the most important works that gave a significant push to ecofeminist theory. In her work Merchant demonstrated the historical connections between capitalism, colonialism, science, religion, and patriarchy, and how these systems have led to the erasure of women and nature[23]. This perspective is still highly relevant in today's world, where capitalist expansion remains focused on the maximization of short-term profits, often to the detriment of the environment and society. In the last part of the 20th century there was a significant increase in the rate of agrarian and environmental activism with women fighting for the environment. This period marked the rise of women-led movements, leading to the development of an ecofeminist discourse that combines environmentalism with feminism. Some of the contemporary scholars such as Vandana Shiva[24] focuses on the role of women, particularly from the developing nations, in the maintenance of the local food production systems and preservation of the indigenous farming knowledge against the genetically altered crops. These women go beyond, they are the custodians of cultural and ecological knowledge which is very important in changing the face of environmental management. Their actions not only helps in fighting for the conservation of the environment but also promotes a model of development which ought to embrace equity as well as the natural cycles. Through the lens of ecofeminism, the sustainability is seen as the integration of environment, economy, society, and people. It seeks to enhance the quality of life of everyone and simultaneously struggles against capitalism and the patriarchy. This is because it focuses on social justice and gender equality, thus promoting both the well-being of communities and a balance between people and the environment. Ecofeminism, as an academic theory and a social movement, contains many facets and presents various narratives. It challenges the consumption of resources under capitalism and advocates for women's self-determination. Also,

[23] According to Merchant, environmental knowledge processes are similarly devalued in industrial capitalism, as well as through the subjugation and commodification processes. The scientific revolution led to the development of an attitude toward nature that regarded it as an extended and versatile mechanism to be operated for profit. This technological approach to nature enabled the accelerated exploitation of natural resources, which had adverse effects on societies, especially women, who are closely associated with natural resources.

[24] Vandana Shiva, an Indian environmentalist and artist, aims to transform agriculture and food practices, address intellectual property, biodiversity, bioethics, and biotechnology, and is a leader of the International Forum on Globalisation.

ecofeminism is compatible with the feminist economics and political ecology, where the burden of care-work is valued as it works for community stability. This framework, which is sometimes referred to as 'popular' feminism, also stresses the focus on the common struggles for the protection of the communities. Some examples of indigenous women activists, such as Lorena Cabnal[25] from Indigenous Gondi people of Colombia and Lolita Chávez from Garifuna[26] community in Honduras, demonstrate this approach: supporting environmental protection, respecting Indigenous knowledge is equal to build a sustainable future for all.

2.1.2 Capitalism, Colonialism, and Environmental Destruction

The capitalist ethic of unchecked growth and resource extraction reflects a worldview that sees nature as a commodity to be exploited rather than a living system to be preserved. This ethic is rooted in the colonial histories of many regions, where indigenous lands were seized, and their natural resources extracted to fuel industrial and economic development (Bianchi, B. 2020). Such practices have not only led to the degradation of ecosystems but also displaced indigenous and rural communities, stripping them of their political self-determination and disrupting their traditional ecological knowledge.

For many indigenous women, the aggression against their lands and rights is seen as a continuation of colonial violence. This connection is crucial within the framework of climate justice, which acknowledges that the communities least responsible for environmental degradation are often those most severely affected by its consequences. Women in these communities, whose lives and livelihoods are inextricably linked to the land, face heightened vulnerability to climate change as they contend with the loss of biodiversity, soil depletion, water scarcity, and extreme weather events.

Ecofeminism critiques the dominant development paradigms that prioritize economic growth over ecological and social well-being. Unsustainable development practices—such

[25] Lorena Cabnal (1973), a Guatemalan feminist and healer, co-founded the community-territorial feminist movement and the Red de Sanadoras Ancestrales del Feminismo Comunitario. Born during the Guatemalan Civil War, she grew up in a context of violence and violence. She began her activism against transgenics, free trade agreements, landowner dispossessions, and mining. Cabnal believes in territorial community feminism, calling for healing to defend territories and ancestral memories. Her network includes ancestral midwives, timekeepers, healers, and herbalists, creating a diverse healing path.

[26] Aura Lolita Chavez Ixcaquic is a human rights advocate in Guatemala, affiliated with the Council of Ki'che Peoples (CPK) and the Ki'che community. The CPK advocates for the preservation of natural resources and human rights fighting mining, forestry, hydropower, and agricultural sectors. Lolita endured genocidal campaigns during the Guatemalan civil war and received death threats. In 2017, she was selected as one of the three contenders for the Sakharov Human Rights Prize by the European Parliament. In 2018, she was awarded the Ignacio Ellacuría Award by the Basque government.

as deforestation, mining, and industrial agriculture—deplete the natural resources that women, particularly in rural areas, depend on for their livelihoods. These practices not only undermine environmental sustainability but also exacerbate existing social inequalities, pushing marginalized communities further into poverty and food insecurity.

For example, large-scale agricultural projects often result in the displacement of smallholder farmers, many of whom are women. These women, who play critical roles in maintaining food security, are often left without land, water, or resources, forcing them into precarious living conditions. Similarly, extractive industries, such as mining and oil drilling, degrade the environment and disrupt local ecosystems, further marginalizing those who depend on the land for their survival.

The intersection of ecofeminism and climate justice highlights how women, especially in vulnerable communities, are on the frontlines of both environmental degradation and the fight for climate resilience. **Climate justice** seeks to address the disproportionate impact of climate change on marginalized groups and to ensure that these groups have the resources and agency to adapt to and mitigate its effects.

2.1.2 A Call for a New Ethic of Partnership

In response to these challenges, ecofeminists advocate for a new ethic of partnership that acknowledges the interconnectedness of human and environmental well-being (Plumwood, 1993)[27]. This ethic also opposes the dominant patriarchal and capitalist approaches towards relationships and aims at establishing collaboration, respect and stewardship of people and planet. In this way, it is possible to understand that the concept of sustainable living is interconnected with social justice and equality, and therefore, the latter should be considered as the primary factor that defines the former. This concept is in conformity with the Rio Declaration on Environment and Development adopted in 1992 which emphasised on the 'need for a global partnership to conserve, protect and restore the earth's ecosystems. "The Rio Declaration also stressed on the importance of the involvement of all the stakeholders and especially the affected communities in the decision making processes with regard to environmental issues.[28] The contribution of women's insights, which are often suppressed in the processes of formation of global and local policies in the fields of environmental governance, is essential for formation of policies stimulating the effective use of resources and protection of species. Thus, the roles of women as caretakers of the environment should be recognized in order to achieve more

[27] Val Plumwood is one of the main representatives of ecofeminism, and her work is based on the concept of interconnection and the need for the new ethic of partnership.

[28] The Rio Declaration on Environment and Development's Principle 10 which emphasises the need to incorporate all the stakeholders including the affected community to be part of the decision making process on environmental issues as the stakeholders are seen to be vital in the search for sustainable solutions.

equitable and effective climate policies. Due to the fact that the knowledge on environmental management, which includes farming, water conservation and biodiversity management, has not been properly captured by the modern approaches of environmental management, women's knowledge shaped by generations can be used to inform the climate adaptation and mitigation strategies that are not only solution oriented but also gender sensitive and empowering for women. The ecofeminism agenda goes further to prompt radical shifts in the perception of the society and its relation with women and the environment. The ecofeminist approach also argues that the issue of environmental degradation can't be disentangled from the issue of social inequity. Eco-feminism is a very powerful analytical framework that explains the workings of the very structures that have led to the subjugation of women and environmental degradation.

2.2 Gendered vulnerabilities in climate-related disasters

The number of feminists working in international organizations and UN agencies such as Gender, Environment, and Development (GED), United Nations Development Fund for Women (UNIFEM), Global Gender and Climate Alliance (GGCA) and other similar networks including GenderCC and GENANET has brought into focus the vulnerability of women in climate change disasters[29]. This vulnerability is gender specific which means that it is a social construction resulting from systemic inequalities that are prevalent across many cultures and societies. The ways and frequency of how women are impacted by climate change related disasters are still not well understood, and most of what is known is based on a few pilot studies with rather unreliable data (Arora-Johnson, 2011).
Despite this discontinuity of academic references, the enhanced susceptibility of women in disasters that are related to climate is an outcome of various social, economic and political studies[30]. This is because in most societies women are assigned roles that confine them to

[29] UN agencies, such as Gender, Environment, and Development (GED), the United Nations Development Fund for Women (UNIFEM), and the Global Gender and Climate Alliance (GGCA), have seen an increasing number of feminists, which has significantly raised awareness about the women's vulnerability during climate change disasters. These organizations and networks, including GenderCC and GENANET, have been paramount in highlighting the intersection of gender and environmental issues, so that they advocate for policies that could address this disproportionate impact, especially in developing countries.

[30] Bianchi (2020) reports "La dimensione della vulnerabilità femminile si basa tuttora su alcuni casi di studio, e i dati non sempre sono attendibili (Arora Johnson 2011, p. 747). Lorena Aguilar, che dal 2002 è alla guida del Global Gender Office (GGO), ha valutato che il rischio delle donne di incontrare la morte a causa di disastri ecologici è 14 volte superiore a quello degli uomini. Nel ciclone che nel 1991 in Bangladesh ha ucciso 140.000 persone, il 91% delle vittime furono donne (Aguilar 2007, p. 2); nel caso dello tsunami a Sumatra il 75%. Confinate nelle loro case, le donne più difficilmente ricevono i messaggi di allarme; il timore di aggressioni sessuali le trattengono dall'abbandonare le loro abitazioni e dal recarsi ai rifugi; le responsabilità verso bambini e anziani impediscono o rallentano la fuga. Alle donne, inoltre, mancano quelle abilità che possono salvare la vita e che al contrario vengono colti vate negli uomini, come nuotare e arrampicarsi sugli alberi. La gravidanza è un'altra condizione che limita mobilità; nel caso di eventi estremi

the domestic dwellings hence they are not well informed or able to access early warning systems or important information regarding the on set of disasters. For instance, in most societies, women are mainly responsible for children and elderly people, which may delay or hinder their evacuation during the disaster. This is because, other factors such as the fear of sexual violence also discourage women and girls from seeking sheltering, either because they perceive the environment as unsafe or because there may be little privacy for women and girls. Also, women are also denied access to other important assets which include firewood, water, and even information concerning disasters. Women are usually assigned the role of collecting water, firewood or other necessities which becomes difficult and time consuming during natural disasters. Pregnant women are also at high risk of being affected during natural disasters due to mobility constraints. Likewise, girls are also affected worsened by lack of food, and other needs, as well as discrimination in the search and rescue operations. These gendered vulnerabilities are evident in different disasters that occur and are especially acute in societies where women are oppressed. Post-disaster sexual and gender-based violence is high with reports of sexual assault especially in emergency settlements, refugee camps, and temporary shelters where overcrowding and poor security compromises women's safety (Bianchi, 2020). This also increases the strain on women as they are expected to take care of other people's needs in the face of adversity which further puts their health and lives at risk. For example, women who are travelling long distances in order to seek for water or food during the disasters are exposed to higher risks of getting injured, sick or even getting assaulted. In addition, these responsibilities have adverse effects on the women's health since they are subjected to unsafe environments, physical fatigue, and hunger. Also, they are overburdened and feel overwhelmed, physically and psychologically, as they are exposed to danger, fatigue, and deprivation. Nevertheless, women are usually excluded from the decision-making structures that guide the post-disaster recovery and reconstruction planning and activities.
There is still a scarcity of empirical evidence that supports the commonly made assertions regarding women's vulnerability in climate disasters. Arora-Johnson (2011) notes that the current understanding of the problem is based on individual case studies that do not capture all the facets of the problem[31]. The analysis of Cutter published in 1995, highlighted that the conventional approaches to disaster management may sideline the

le prime vittime sono le donne gravide. Le bambine sono discriminate nella distribuzione del cibo e nelle operazioni di soccorso; ne è un esempio quel padre che durante il ciclone del 1991 in Bangladesh, non potendo salvare tutti i suoi figli, abbandonò la ragazza perché il figlio maschio 'poteva garantire la discendenza della famiglia' (Neumaye-Plümper 2007, p. 11). "

[31] For example, the research done by the London School of Economics showed that from 1981 to 2002 natural disasters resulted in increased female mortality and females died at a younger age than males. This shows that gendered impact of disasters is higher in the countries which has Social, Political and Economic inequalities.

requirements of women and children, thus exposing them to high levels of risk[32]. The UN, WHO and UNHCR have also recently concluded that gender inequalities in disaster impacts have not changed in the last two decades.

The "drought brides" a concept discussed in the UNICEF's 2022 report, represents the association between adverse weather and socially unacceptable practices[33]. This shows that there is still a need for policies that consider climate change, poverty, and gender inequality in order to support living wages and protect the futures of young girls. Drought situations also exposes girls and women to higher risks of sexual violence especially when they have to travel long distances in search of water. Some girls travel 6 to 12 miles a day in search of water and sometimes they have to move through areas which are considered unsafe and may expose the girls to sexual violence among other forms of violence.

These situations demonstrate that climate change can aggravate the existing threats and reinforce the gender inequality as women and children are obliged to survive in adverse environments. The interconnection of climate change, poverty, and gender discrimination increase the threats to women, whose role is to respond to and environmental shelter.

2.2.1 Bridging the Eco-Gender Gap: Gender Differences in Environmental Concern and Policy

Quantitative studies analyzing individual differences in environmental concern—which includes apprehension about the quality of natural resources such as air, water, soil, and biodiversity—have consistently revealed an eco-gender gap[34]. Women are more likely than men to exhibit pro-environmental attitudes, though the reasons behind this disparity remain unclear. A notable impact is the lack of women in decision-making position in the sphere of environmental policy and governance. However, women are more likely to participate in

[32] Susan L. Cutter's (1995) paper on women and children as the ''the forgotten victims" of climate and environmental changes is still relevant today.

[33] One of the most striking examples of how climate change intensifies gender inequality is the case of child marriage in Kenya due to drought and famine. Economic difficulties have made some parents sell their daughters, which has led to another practice of marriage where girls become wives at a very tender age due to lack of food and water; this is the drought brides (Nagel, 2016). In Kenya, fourteen out of the twenty three drought affected counties has FGM rates of between 85 percent and 98 percent, and the drought compound the economic and social burden on families. In this context early marriage is also seen as a means of reducing the number of dependants by selling the daughters in exchange for a bride price.

[34] The eco-gender gap is significant to consider because it shows how gender factors affect actions environmental (Echavarren, attitudes J. and 2023). This gap is important in order to understand genders. In addition, it is essential to consider the importance of enhancing environmental policies and education programs to promote sustainability initiatives. By acknowledging the eco-gender gap, policymakers can address the differences between men and women in terms of their engagement with environmental concerns. This recognition allows for the formulation of more effective and equitable strategies, ensuring the involvement of both men and women in climate action and environmental protection.

pro-environmental behaviors, for instance, reducing waste or switching off lights. But the negative impacts of patriarchate-based industries, for instance in construction and resource exploitation, seem to overshadow these positive efforts. To close this eco-gap, female participants should be provided with an equal opportunity to participate in decision making, resources and protection from the climate change risks that are specific to women. The case of Berta Cáceres[35], an indigenous and environmental activist from Honduras, shows how gender, climate change and human rights are interconnected.

Numerous feminist studies have explored how climate change exacerbates gender disparities, revealing that the social construction of vulnerability, responsibility, and risk is profoundly shaped by gender. However, despite mounting evidence of these disparities, climate policies, strategies, and action plans frequently fail to address gender-specific vulnerabilities in a meaningful way. The policymakers also forget or choose not to recognize the fact that men and women have different perceptions as well as approaches to climate change disasters, thus creating policies that do not take into consideration the needs of women and thus the policies that are being made are not effective in protecting women or empowering them in any way. For instance, disaster response activities are normally based on broad strategies like providing food and shelter and reconstructing structures without special attention to women and children. Consequently, women are usually stranded in unsafe situations with no way to access basic necessities or assistance. In order to address this, there is a requirement to develop gender sensitive climate policies which recognise the real lives of women and girls living in areas affected by climate change.

A growing number of feminist scholars and activists are also analyzing and demanding climate-inclusive adaptation plans. They state that, in order to create more sustainable and adaptive societies, it is essential to address the root causes of gender disparity. Some organizations, such as WEDO, OXFAM, and GGCA, have been most active in this regard, advocating for policies that address the needs of women and recognize them as key players in environmental management.

For instance, measures that enhance women's capacity in education, access to resources, and leadership preparedness positions can help improve management. It is therefore important that women are involved in the process of planning and decision-making on disasters, relief supplies, and climate change adaptation to develop better solutions. This approach not only ensures that women’s voices are heard but also acknowledges the vital contributions women make to sustaining their communities and managing natural resources. While the gendered impacts of climate change have been increasingly acknowledged, much work remains to be done to address the disparities faced by women during climate-related disasters. Women, especially those in marginalized communities, face vulnerabilities because society is not equal. This inequity must change to develop

[35] Cáceres was killed in 2016 for opposing a dam project which would have impacted the rivers that are considered as sacred by the indigenous people. Her slaying led to an international outcry and demonstrations and exposed the risks faced by women who are at the helm of environmental activism.

stronger and more equitable societies. Gender-specific climate policies that consider the needs and assets of women are crucial in minimizing the impacts of climate change on women. Moreover, such policies ensure that adaptation and mitigation measures being implemented are truly equitable.

Feminists engaged in climate-related activism, especially those affiliated with NGOs and UN bodies, have long been concerned with how climate change disproportionately affects women and marginalized groups. In 2002, OXFAM addressed these concerns by dedicating a special issue of *Gender and Development* to climate change, emphasizing that technical solutions alone were insufficient to address the broader social and political dimensions of climate issues[36]. The connection between gender and poverty is central to the argument that women—particularly those in vulnerable and impoverished communities—must have access to essential resources such as land, property rights, and information. These are necessary steps toward enhancing their resilience to climate change. Furthermore, the processes of ensuring these rights can also assist in changing the power relations and provide ways through which women can be involved in the climate change adaptation and mitigation plans. Although climate change has the propensity to worsen the gender inequality and has adverse effects on women and children, it is also viewed as a way of changing the gender balance[37]. This understanding can be used to come up with new climate technologies as well as adaptation measures thus allowing communities to reconstitute themselves in a more sustainable manner.

Some of the most visible organizations include Women's Earth and Climate Action Network (WECAN)[38] that was established in 2013. These networks organize women from different vantage points to interface with the structures that lead to environmental unsustainability and gender discrimination and to advocate for the alterations that have to be made in order to bring about environmental and social justice. These examples evidence the fact that women's leadership, and their participation in the processes of climate change mitigation and adaptation are not only essential for the achievement of gender equality, but are also essential for the change that has to be structural change. Thus, the involvement of women and the consideration of their experience and expertise will help to make climate policies and actions more comprehensive, more successful, and more durable, and will positively impact all societies and environments. Women have played a pivotal role in the struggles for the protection of forests, seeds, and against the industrial agriculture model

[36] The journal highlighted that women's involvement in national and international negotiations, particularly regarding sustainable energy practices, is critical. Such participation ensures that gender considerations are integrated into climate action, especially in areas related to poverty reduction, resource access, and land rights.

[37] Some of the scholars including Margaret Alston and others have highlighted the possibility of the 'radical adaptation' as well as the 'innovative adaptation' that shifts the power dynamics in favor of women. Alston, who has done her research on gender and climate change in countries such as Bangladesh, has pointed out that women's knowledge and local knowledge are important (Alston 2017).

[38] WECAN is an international organization of women's activists from 54 countries who fight for the protection of the environment and the effects of climate change. The network promotes women's political, social, and environmental activism with focus on climate justice as the central goal. WECAN is one of the examples of how women are coming together to address the problem of environmental degradation on the global level.

that is based on the use of fossil fuels and chemicals that are detrimental for the environment and contribute to climate change.

Feminist activism in these areas is deeply connected to the belief that environmental degradation—through deforestation, extractivism, and industrial agriculture—disconnects women from their livelihoods, disrupts community relationships, and denies ethical and spiritual ties with nature. As scholars like Giacomini (2016-2017) argue, these practices undermine the values of indigenous spirituality and knowledge, which are founded on a sense of responsibility toward the delicate balance of ecosystems. Women, especially from indigenous communities, embody this stewardship and act as defenders of environmental integrity.

source: https://www.wecaninternational.org/

2.3 Gender and Climate Justice: A Critical Intersection

It is thus important to understand the gender-climate justice relationship in order to appreciate how women are affected by risks in environmental disasters. These challenges cannot be attributed solely to the physical effects of climate change, as they are reinforced by enduring social and historical inequalities. Factors such as patriarchal systems, colonial heritage, and economic inequality exacerbate the impact of climate change on women, limiting their ability to cope and sustain themselves.

For example, women's contributions as managers of natural resources are often overlooked in climate change discourse, which in turn worsens their situation. Integrating women's perspectives into climate discussions and decisions enhances societies' ability to adapt to changing environments and discover more sustainable solutions. For years, feminist movements in the Global South, alongside NGOs and global organizations such as the United Nations, have worked to ensure that these concerns are central to the climate justice discourse.

Women's struggles against the exploitation of land and resources are often seen as extensions of historical colonization, which has eroded the ecological conditions that sustain indigenous life, economy, and self-determination. Indigenous women, in particular, understand the ongoing environmental destruction as another form of colonization—an aggression that continues to marginalize their communities and deny their cultural and spiritual connections to the land. These women, standing at the forefront of environmental defense **become the defenders of land and culture**, since they advocate for the protection of natural resources not only as a matter of survival but also as an ethical imperative grounded in their spiritual traditions and community values.

Ecofeminism is a theoretical framework which, on the one hand, can help to explain how both women and nature are oppressed, claiming that the subjugation of nature is in some way connected to the subjugation of women and other subordinate groups. In line with this, ecofeminists discuss the links between ecological decline and gender discrimination, and therefore, demand changes in the current governance systems to integrate many more people, and more importantly women, in decision-making. This is because this approach is not only crucial in solving environmental issues but also the issues that are brought up by climate change and its social impacts.

The feminist theory and the notion of intersectionality support the ecofeminism idea and call for the polices and governance systems that recognize the multiple forms of oppression faced by women especially those in the affected communities by environmental changes. These frameworks also stress on the need to enable women and to recognize them as important guardians of the environment and sustainable practices. The conversation on climate justice and human dignity with an emphasis on gender demonstrates the importance of adopting an inclusive strategy for dealing with the problem. Thus, it is possible to create the climate policies that will help to solve the problems of climate change and inequality of people's rights by recognizing the role of women, especially indigenous women, as the key players in the protection of the environment. In this manner, this approach helps to create a more just and sustainable future in which every person and every living organism is treated with due respect and dignity in the context of climate change.

Therefore, climate justice cannot be achieved by only relying on technological solutions, but rather, it has to include the perspectives and strategies of those who are most impacted by climate change. This vision, based on feminist and indigenous paradigms, is the basis for the solutions that do not only respond to the effects of climate change but to the need for the coexistence of all life in a healthy planet.

2.4 Ecofeminism, Technology, and Climate Justice

The integration of Ecofeminism and feminist perspectives with the Capability Approach and Information and Communication Technology for Development (ICT4D) initiatives, addressing both environmental and social injustices (particularly within marginalized and

indigenous communities) reveals a multi-layered framework. By combining these perspectives, we can better understand how gender, technology, and development intersect, and how this intersection can be leveraged to foster more inclusive and sustainable solutions to global challenges like environmental degradation and gender inequality.
Both **Ecofeminism** and the **Capability Approach** intersect with ICT4D in ways that highlight the necessity of integrating gender and environmental justice into technological development. Ecofeminism draws attention to how technological advances, particularly those tied to industrial agriculture and resource extraction, can further marginalize women and indigenous peoples by disconnecting them from their livelihoods and traditional knowledge. This dynamic is in line with the patterns of colonialism and patriarchal domination which still today continues to oppress and exploit both nature and the marginalized. However, technology can also offer tools for resistance and empowerment, especially when used in a way that focuses on the needs of those who are most impacted by environmental problems. For instance, ICT platforms can help women get information on how to adopt better and more sustainable agricultural practices and climate adaptation as well as environmental governance so that they can take the lead in the fight against climate change and for community resilience. The Women's Earth and Climate Action Network (WECAN) is one of the real-life examples of how technology can be used to support women's agenda for the climate justice and protection of the indigenous territories. Such form of feminism integration with technology presents how the ICT can contribute to the formation of the radical adaptation and unique approaches to handle the challenges of climate change in conformity to Hanson and Alston's gender-transformative approach to climate change (Hanson & Alston, 2018).

2.5 Feminist cartography

Digital platforms serve as potent tools for disseminating experiences that contribute to propagate various forms of feminist political and social activism, such as the #Nìunamenos, #Metoo[39], and #YesAllWomen movements[40] (Carbonari, 2022). Since data activism is a form of grassroots activism and civic engagement that uses big data to bring about social

[39] "Movimento contro il femminicidio e la violenza sulle donne nato in Argentina nel marzo 2015, la cui denominazione ricalca i versi della poetessa messicana vittima di femminicidio S. Chávez Ni una mujer menos, ni una muerta más (Né una donna in meno, né una morta in più). Estesosi rapidamente come mobilitazione globale in altri Paesi sudamericani, quali il Messico, il Perù e il Cile, fino a raggiungere la Polonia, dove nel 2016 grazie alle proteste di piazza è stata bloccata una proposta di legge per vietare le interruzioni di gravidanza in caso di gravi malformazioni del feto, e gli Stati Uniti, in cui esso ha dato impulso al movimento di denuncia di molestie e abusi sessuali #MeToo. […] In italia il movimento Nonunadimeno, attivamente impegnato a difesa delle donne vittime di violenze fisiche, psicologiche e simboliche, ha fatto propri gli stimoli provenienti dal collettivo argentino", fonte Enciclopedia Treccani.

[40] A Twitter hashtag and social media movement, #YesAll Women lets people post cases of sexism and violence against women.

change, it is easy to assume that it aims to benefit politically marginalised groups and challenge dominant power structures. Data activism contributes to the creation of alternative ideas and goals, where data is used for emancipatory purposes. Specifically, the proactive data activism approach has established itself as the leading force behind the growing concept of 'digital humanitarianism' (Meier, 2015), a concept that will be further developed in chapter 4.

The concept of gender mainstreaming, which involves integrating a gender perspective into all policies and programs to promote gender equality, can be applied to GIS research and systems. There are examples of how GIS applications can be used to spatially visualize and analyze gender data.

The utilisation of data infrastructure, including open source software, crowdsourced open geodata, and interactive mapping tools, enabled the execution of emergency and rescue operations (Gutiérrez, 2018; Meier, 2015). Data can be organised in relation to initiatives against gender-based violence that promote data activism. Internationally, there are several apps, initiatives, and tools that address the issue of sexual violence. These include Safecity, which is the largest online forum for reporting cases of sexual violence; the Índice nacional de violencia machista developed by the #Nìunamenos movement; Hollaback, an online blog that provides support to victims and allows them to report cases of violence; and HarassMap[41], an Egyptian project that aims to combat the social acceptance of gender-based violence in the country. These innovative tools facilitated various activities, including collaborative planning with victims in online groups that safeguard their anonymity, as well as the development of 'violence maps' using participatory mapping techniques. These newly developed tools have facilitated various activities, including collaborative planning with victims in online groups that ensure anonymity, as well as the generation of 'violence maps' using participatory mapping techniques.

Pirani (2019) examines the emotional engagement of users with three categories of thematic maps that depict data on female genital mutilation/cutting (FGM/C) in relation to the United Nations Sustainable Development Goals. The research centers on examining users' emotional reactions prior to and following their engagement with maps, and underscores the significance of acknowledging emotion as a valid type of information. The thematic maps under consideration are the choropleth map, the cartogram, and the map with repeating icons. The research findings suggest that the maps have definitely elicited emotional reactions in the majority of users. Nevertheless, certain users perceived the maps as impartial and objective, despite the delicate subject matter being discussed. Moreover, it has been noted that female participants displayed a stronger emotional engagement in comparison to male participants. Regarding qualitative evaluations, the coropleth maò was deemed the most comprehensible map, however the least captivating and stimulating. The

[41] Founded in 2010 in Egypt, HarassMap is an independent, volunteer-based project aiming at combating societal tolerance of sexual harassment. It lets users anonymously document harassment events using a digital platform, geolocalised on an interactive map to draw attention to regions at danger.
HarassMap also promotes awareness-raising campaigns, provides training in schools and universities, and collaborates with institutions and corporations to implement zero-tolerance policies towards sexual harassment, in addition to mapping. https://harassmap.org/en

cartogram, albeit not evoking a significant emotional response, necessitated careful scrutiny from the users. The map with recurring icons has garnered the highest level of user engagement, despite receiving some criticism over its impartiality and the challenge it poses in terms of geographical comprehension. In summary, the research findings emphasise the importance of investigating how cartographic decisions, familiarity with different types of maps, and subjective and geographical distance can impact users' emotional engagement and perception of the addressed concerns. Ultimately, Pirani proposes that forthcoming investigations should delve into the ways in which maps can elicit empathy and emotions, particularly when addressing delicate topics like FGM/C. Additionally, it advocates exploring how cartography might serve as a means to emotionally involve users in intricate subjects.

To give another example of feminist cartography we should take into consideration the document "Investigating gender differences in OpenStreetMap (OSM) activities in Malawi: a small case-study" by Zoe Gardner and Peter Mooney, presented at the AGILE 2018 conference in Lund, Sweden. It examines gender disparities in mapping activities on OSM in Malawi and aims to understand the impact of participation biases on the quality of volunteered geographic data (VGI).

The data was collected using an online survey of OSM users and by analysing the changes made to the OSM database for Malawi. The results demonstrate that men contribute more significantly to the quantity and quality of data compared to women, with a greater focus on geometric accuracy and tagging. Although women increasingly participate in humanitarian mapping initiatives, they are less likely to add tags in categories not required by these activities.

The study highlights that local gender-based editing patterns reflect worldwide trends and suggests that increasing female participation in targeted mapping activities could serve as a model for recruiting women in OSM. However, special barriers to female participation, such as lack of knowledge, skills, and time, must be taken into account.

In Malawi, the higher male participation in tagging work, linked to the ability to acquire and interpret data in remote contexts, highlights a gender inequality in access to digital and technical skills. This indicates a disparity in the level of engagement between male and female contributors, with men taking on more tagging activities. Tagging is crucial for adding semantic information to map features, suggesting that men may be more involved in enriching the map data[42].

[42] Malawi Rank: Male users generally have higher ranks, indicating more significant contributions to OSM in Malawi. The table lists 10 female and 10 male users, comparing their contributions. Total Objects Edited: Male users have edited more objects overall, with the top male user editing 39,691 objects compared to the top female user with 1,627. Total Changesets: Male users also lead in the number of changesets, with the highest being 935 for a male user, while the highest for a female user is 122. Total Creates: Male users have created more nodes and ways. For instance, one male user created 3,555 total elements, while the highest for a female user is 1,562. Total Mapping Days: Male users have more mapping days, with the top male user having 127 days compared to the top female user with 18 days.

This situation reflects how women, despite being a key resource for local communities, are often excluded from technology training due to structural barriers such as educational inequality, traditional division of roles and lack of access to resources.
From a feminist perspective, this phenomenon emphasises the urgency of promoting digital empowerment programmes specifically aimed at women, so that they can acquire the same technical and interpretative skills and participate actively and equally in data management and analysis processes. Reducing the gender digital divide is not only a matter of social justice, but also a prerequisite for building more inclusive, resilient communities that are better able to respond to local challenges.
The research also shows interesting results regarding participation in digital humanitarianism initiatives such as those launched by HotOSM[43]: the prescriptive process, i.e. the targeted assignment of mapping tasks, influences the tagging results for both genders. Men and women show higher levels of tagging in the categories of HOT tasks that have been prescribed to them. The prescriptive nature of Humanitarian OSM tasks which are structured and provide clear instructions may influence the mapping behaviors of both genders. This way of working influences the behaviour of both men and women: everyone follows the given rules, instead of acting according to a personal approach.Thus, one cannot see what would be natural preferences or spontaneous ways of mapping, because everyone adapts to the prescribed task. When mapping tasks are too structured and rigid, men and women behave as 'doers' of instructions, and not as mappers free to choose. Consequently, it is difficult to understand how they would really behave if they had freedom of choice.

Considering the importance of understanding the factors influencing gender participation in VGI, its potential impact on data quality, it isi paramount to develop further research in different contexts that could provide a more comprehensive understanding of gender differences in OSM activities, and, more specifically of humanitarian OSM activities.

Kwan (2002), when exploring the compatibility between GIS methods and feminist epistemologies, critiques GIS for its affinity with positivist scientific practices and visualization technologies, which can marginalize feminist perspectives.
However, she argues that GIS can be reinvented as a tool for feminist geographic research, respecting feminist epistemologies and politics. Kwan examines feminist critiques of science and vision, which view GIS as a masculine and objectifying technology. She proposes "re-visualizing" GIS to better represent gendered spaces and experiences, encouraging more reflexive and contextualized visualization. By suggesting that GIS can be used to connect geographic context with women's daily lives, support feminist activism, and build qualitative cartographic narratives, the author suggests strategies to overcome the limitations of GIS in its current form, such as integrating qualitative data and practicing

[43] HOT Tasking Manager (Humanitarian OpenStreetMap Team) is a non-profit organisation founded by the OpenStreetMap community that deals with humanitarian mapping. It was founded in 2010 in the aftermath of the earthquake in Haiti. https://tasks.hotosm.org/

reflexivity. Kwan concludes that GIS can be a site to deconstruct the distinction between quantitative and qualitative methods in geography and to create GIS practices informed by feminist epistemologies.
The author's view calls for critical engagement with GIS to reimagine it as a feminist practice capable of participating in transformative challenges to dominant views. Kwan emphasizes the importance of recognizing and addressing the limitations of GIS, the power relations it entails, the difficulty of practicing reflexivity, and the ethical or moral implications of the knowledge produced.

If we ask what role can GIS could play in feminist geographic research, it is useful investigate and understand women's experiences in specific geographic contexts. There are different ways in which GIS can be employed in feminist geographic research:

1. Connecting geographic context and women's daily lives: GIS allows the linking of women's daily trajectories, including the places of their activities and travel routes, to the geographic context in which they move. This enables a more context-sensitive analysis compared to conventional methods.

2.Supporting feminist activism: In urban planning and policymaking, GIS can support feminist activist groups by helping them understand and communicate local issues through GIS-based maps and analysis. This can strengthen activism and challenge traditional power dynamics.

3. Constructing qualitative narratives: By incorporating qualitative data such as digital photos, voice recordings, and videos, GIS can be used to create cartographic narratives that tell the stories and experiences of women. This approach can account for the complexity of women's lives and provide richer, more contextualized perspectives.

4. Revealing gender biases in conventional quantitative methods: GIS can be used to identify and correct gender biases in traditional quantitative methods, which may not accurately reflect women's experiences.

5. Representing gendered spaces and bodies: Although GIS has limitations in representing gendered spaces and bodies, it can be expanded to better represent the complexities of feminist corporeality and spatiality.

GIS can be a powerful tool in feminist geographic research, enabling the visualization and analysis of gendered spatial dynamics, supporting feminist causes, and providing deeper insights into women's experiences. However, it is important that GIS practices are informed by a feminist perspective, addressing the critiques and limitations of GIS while working to overcome them.[Re-envisioning GIS as a Method in Feminist Geographic Research by Mei-Po Kwan involves organizing the main concepts and the relationships between them into a visual structure.]

Applying feminist epistemologies means reconciling with them from a perspective that can develop critical GIS practices and feminist applications of GIS. It is important that GIS relates to the geographical context, reconnecting with women's everyday lives. In other words, a qualitative cartographic narrative that is able to identify gender biases in quantitative methods must be started again. To do this, the author suggests starting from a deconstruction of the distinction between quantitative and qualitative methods in geography in order to realise GIS practices informed by feminist epistemologies and address the ethical and moral implications of the knowledge produced.

Consistent with scholarly developments in the literature, international organisations are engaging in the discourse. The document "Gender and GIS: Guidance Notes" (2015) was produced for the United States Agency for International Development/Regional Development Mission for Asia (USAID/RDMA) and focuses on integrating gender issues into the development of Geographic Information System (GIS) applications for environmental management, climate change adaptation, and disaster risk reduction[44].

Written by Bernadette P. Resurrección and Karlee Johnson, both from the Stockholm Environment Institute (SEI), the document provides step-by-step guidance for GIS application developers on how to integrate gender concerns into GIS application production. The document explains the concept of gender, clarifying that it does not only refer to biological sex but also to the social roles and expectations associated with women and men. It emphasizes that both women and men can be affected by their gender roles and that gender equality does not imply uniformity but equal opportunities and rights.

The key steps for developing gender-sensitive GIS applications include gender analysis, the collection of gender-disaggregated data, and the georeferencing of data[45].

GIS applications that integrate gender information can influence policy decisions, raise awareness of gender-blind policy practices, and empower communities to minimize gender-unequal risks and address global challenges such as environmental degradation, climate change, and increasing disaster risk.

2.5.1 The sense of cities for women

Personal welfare, health, and quality of life are becoming more significant than traditionally private and domestic issues as the worldview shifts towards a more communal,

[44] The introduction outlines the goals of the SERVIR-Mekong program, which aims to enhance climate change adaptation and landscape management in the Lower Mekong subregion through geospatial analysis. https://wrd.unwomen.org/practice/resources/gender-and-gis-guidance-notes

[45] The document provides sample parameters and indicators to guide data collection and analysis. Moreover the document is supported by a series of figures, tables, and references that further illustrate the concepts and practices discussed.

societal, and planetary approach. Since architecture has historically been a male-dominated field, architects and urban designers are in greater demand for their ideas and vision.If we are to immerse the theory and practice of architecture in the larger background of our experience of embodied minds, of bodies profoundly rooted in space and time, we

> "must abandon the separation of body and mind that has dominated our ways of thinking architecture, of thinking ourselves and the world". (Robinson, 2014 as cited in Granata 2023)

The horizontal, invisible, relational element that sustains society even during emergencies can be exposed by the feminine capital of society. We need to shift from an economic perspective to an ecological one, emphasising the shared goods that are essential to our collective future. The Great Blindness, written by Amitav Ghosh in 2016, emphasises the importance of recomposing the body and mind as well as the wellbeing of the planet, its inhabitants, and its fauna.

Building upon previous feminist urban critique, the chapter of Carina Listerbon (2023) within the interesting book "Digital (in)justice in the smart city" examines the insights that smart city policies might provide about current urban realities and social relationships. By investigating the foundational assumptions and perceptions of daily existence that are influenced by gender, this chapter endeavors to unveil the power dynamics that are generated or perpetuated when technology companies participate in urban planning and introduce digital infrastructure. The inclusion of feminist theory aims to illuminate inquiries regarding the generation of urban knowledge, portrayal, and tangible results. It seeks to examine who is included in the discussion and the nature of the conversations taking place and whose perception of reality is being materialized through the implementation of the smart city. Although modern technology has alleviated certain domestic tasks, it has also given rise to new responsibilities and requirements. In order to emphasize the significance of social justice, it is crucial to highlight the settings, inconsistencies, and biased nature of the tech boom, with a specific focus on a feminist perspective. The process of digitizing everyday life does not occur in an undefined or unclaimed territory. Despite the novelty of the technology, its concepts, standards, and methods are an extension of prior social and material frameworks. Women have different experiences in cities, creating their own mental maps and figuring out which routes to take. Women construct their mental maps differently, because their experience is different. On their routes they know which points are most crowded and illuminated and therefore safest, they know which routes are accessible for pushchairs and which points are most convenient for parking, they know which green spaces are for children and which are dangerous for children.

Leslie Kern, essayist, associate professor of geography and the environment and director of the programme on women and gender studies at Canada's Mount Allison University, with her book The Feminist City, Claiming Space in a Man-Made World describes from the very title the emancipation of women primarily as a struggle for space in a world designed by men.

Leslie Kern's book explores the principles of feminist geography, which emerged in the 1970s and 1980s. It argues that space is not neutral and is influenced by inequalities, powers, and hierarchies. Feminist geography criticizes the traditional separation of public and private spaces, focusing on the body as the first territory where power manifests. It also emphasizes intersectionality, recognizing that being a woman and poor or a woman and migrant changes the way one experiences the city. The book encourages the idea of fairer cities and territories, where diversity is valued and celebrated.
It is interesting to note how the focus on diverse users of the city has transformed over time into a culture of de-suetude and de-construction of the practices and uses of the city for all, to the point of actually becoming an urbanism of diversity. It was the trigger to start rethinking cities for inhabitants of all ages, with different mobility, creating green areas, with shade and water, for ethnic origins, for different identities and genders, as the association Sex & the City APS does[46].

The counterpoint to the discussion on creative cities has been the emergence of urban inequalities that specifically impact women, youth, elderly individuals, migrants, and single parents. These inequalities manifest in higher living expenses, limited housing options, increased costs of social reproduction, and reduced opportunities for democratic participation[47]. This can poses a risk of further perpetuating these patterns of exclusion. Smart cities, characterized by a technocratic approach to urban development, run the risk of perpetuating and strengthening current power dynamics (Listerborn, 2023). Feminist urban critique specifically emphasizes the historical inequities associated with technology in terms of production, access, practice, and implementation.
The persistent gender inequality in cities is a global issue. Although legislative progress has been made, discriminatory practices and mindsets against women remain widespread. The importance of critical spatial thinking could be a tool for women's empowerment and the creation of safer, more inclusive urban spaces (Carvalho, 2021). The author - by selecting collaborative mapping actions through bibliographic research and scientific research platforms within four urban intervention projects - explores how critical spatial thinking can be applied to promote women's rights and their participation in urban planning. The mapping actions involved interviews and data collection from women who participated in the projects. This allowed for the gathering of direct information about their experiences and perceptions of urban spaces. The mapping platforms enabled the

[46] An organisation dedicated to social promotion. Through the creation of theoretical and practical projects, public interactions, and research initiatives, it focusses on observing and changing cities from a gender perspective. By giving public administrations the tools they need to create environments that support everyone's well-being, the organisation seeks to incorporate gender considerations into urban planning. The development of a gender-specific atlas that maps cities from the viewpoint of women and their desires is one of its most important projects. Another essential component of these initiatives is collaborative mapping, like the *Milan Gender Atlas*. Through tools such as HER WALKS and HER MAPS, the association organises exploratory walks and participatory data collection, directly involving citizens in the detection of the criticalities and potentials of urban spaces.
[47] Giovanni Vecchio, professor at the Instituto de Estudios Urbanos y Territoriales of the Pontificia Universidad Católica de Chile, talks about the right to mobility and accessibility as a condition of citizenship and as one of the main capacities theorised by Sen and categorised by Nussbaum (Granata, 2023).

visualization of collected data, highlighting areas where women felt safe or unsafe, and zones where they had been victims of aggression or violence. The mapping process encouraged participants to critically reflect on their experiences and the conditions of the places they inhabit, fostering greater awareness of social and spatial inequities. The collected data were analyzed to identify trends and patterns, and their implications for women's empowerment and the design of inclusive cities were discussed.
The research showed how collaborative mapping can be a powerful tool to visualize and share women's experiences, highlighting social and spatial inequities. These projects also showed how critical spatial thinking can stimulate collective action and build critical spatial awareness.

It is legitimate to question how Henri Lefebvre and David Harvey's "right to the city" is connected to promoting critical spatial thinking for women. The concept of the "right to the city" by Henri Lefebvre and David Harvey is closely connected to promoting critical spatial thinking for women, as both approaches emphasize the importance of active participation and social justice in the design and use of urban spaces. Lefebvre and Harvey's right to the city is connected to promoting critical spatial thinking for women through active participation, social justice, empowerment, active citizenship, and recognition of diversity—all key elements for creating inclusive and resilient cities[48].

Conclusions

In this chapter Ecofeminism, the Capability Approach and ICT4D have been discussed to understand how these concepts can help in understanding the overall problem of environmental and social injustice.

[48] Here's how the right to the city relates to the promotion of critical spatial thinking for women:
Active Participation: Lefebvre and Harvey emphasize the right of all citizens to actively participate in urban life, including the design and management of public spaces. Critical spatial thinking promotes this active participation by encouraging women to critically reflect on their experiences and contribute to designing more inclusive and safer urban spaces.
Social Justice: The right to the city requires social justice and equity in the distribution of urban spaces and resources. Critical spatial thinking helps identify and challenge social and spatial inequities, such as gender discrimination, that limit women's access to opportunities and safety.
Women's Empowerment: Critical spatial thinking is essential for women's empowerment, enabling them to recognize and challenge the limitations imposed by patriarchal society. This process of critical reflection on their spatial experiences can lead to collective action and the creation of more inclusive urban spaces.
Active Citizenship: The right to the city emphasizes the importance of active citizenship, where all members of society have the right to participate in public life and influence decisions that affect them. Critical spatial thinking promotes this active citizenship by encouraging women to voice their opinions and participate in urban planning processes.
Recognition of Diversity: Lefebvre and Harvey highlight the need to consider the diversity of citizens in the design of urban spaces. Critical spatial thinking helps recognize the diverse experiences and needs of women, leading to urban design that reflects a plurality of voices and identities.

The use of ICT in development strategies must be appropriate and relevant to the context of the communities and the needs of the communities especially the women and other minorities such as the indigenous people.

In this way, it becomes easier to see how technology can be used in a way that it could support enhanced democratic governance, increased adaptive capacity and reduced inequalities, at the same time as recognising how technology can reinforce inequality. In the end, the discussed theoretical models based on feminist approaches, Ecofeminism, and the Capability Approach can be considered as a valuable theoretical lens that can help to achieve the goals of climate justice, gender equality, and sustainable development, as well as to make sure that technological changes meet the needs of people and protect the environment.

Considering the need to promote critical spatial thinking it is crucial for demystify gender stereotypes, leading to active citizenship and participation in designing an inclusive city. Critical spatial thinking is essential for women's empowerment and for understanding the existing limitations in their environment.

The ecological transition cannot fail to consider the processes of urban regeneration that arise in the African peripheries. Urban regeneration in African peripheries is a common process, with major projects aiming to create new opportunities and resources. Natural leaders channel neighborhood resources, designing common spaces, and prioritizing collective good over individual interests, fostering a more sustainable transition. They contribute to define a new concept of “urban justice”.

The strength of a city lies not only in its structures but in the richness of its human connections. As Elena Granata beautifully states, "La biodiversità delle provenienze, delle competenze, delle cerchie di partenza, dei generi consente di moltiplicare la forza dei legami deboli, infinitamente più numerosi. Cosí accade in natura, cosí accade nelle città" (Granata, 2023).

This observation emphasizes how diversity—of origins, skills, backgrounds, and genders—enhances the network of so-called "weak ties" that are crucial for social resilience and innovation. Just as ecosystems thrive through biodiversity, cities flourish through the multitude of subtle, spontaneous, and diverse relationships that weave their social fabric. Recognizing and nurturing this complexity is essential for building more vibrant, adaptable, and inclusive urban spaces.

References

Alston, M. (2017). *Women and climate change in Bangladesh*. Routledge. https://doi.org/10.4324/9781315139306

Arora-Jonsson, S. (2011). Virtue and vulnerability: Discourses on women, gender and climate change. *Global Environmental Change, 21*(2), 744–751.

Bianchi, B. (2020). Genere, generazioni e cambiamento climatico. Temi e questioni per una rubrica. *DEP. Deportate, esuli, profughe, 41-42*, 243-253.

Bluecher, S., & Hansons, A. M. (2017). *A political ecology of women, water and global environmental change*. Routledge.

Bouchouba, J. (2014). The Moudawana Syndrome: Gender Trouble in Contemporary Morocco. *Research in African Literatures, 45*(1), 24–38.

Buechler, S. (2009). Gender, Water, and Climate Change in Sonora, Mexico: Implications for Policies and Programmes on Agricultural Income Generation. *Gender and Development, 17*(1), March 2009.

Carvalho, I. C. (2021). Critical Spatial Thinking in Women's Resilience for An Inclusive City. *Journal of Advanced Research in Social Sciences, 4*(1), 32-40. https://doi.org/10.33422/jarss.v4i1.688

Cutter, S. L. (1995). The forgotten casualties: Women, children, and environmental change. *Global Environmental Change, 5*(3), 181-194. https://doi.org/10.1016/0959-3780(95)00046-Q

Echavarren, J. (2023). The gender gap in environmental concern: Support for an ecofeminist perspective and the role of gender egalitarian attitudes. *Sex Roles, 89*(1), 1-14. https://doi.org/10.1007/s11199-023-01397-3

Gardner, Z., & Mooney, P. (2018). Investigating gender differences in OpenStreetMap activities in Malawi: A small case-study. *AGILE 2018 - Lund, June 12-15, 2018.*

Giacomini, T. (2016–2017). Ecofeminism and System Change. Women on the Frontlines of the Struggles against Fossil Capitalism and for Solar Commons. *Canadian Woman Studies/Les cahiers de la femme, 31*(1-2), 95-100.

Giacomini, T., Turner, T. T., Isla, A., & Brownhill, L. (2018). Ecofeminism against Capitalism and for the Commons. *Capitalism, Nature, Socialism, 29*(1), 1-6.

Granata, E. (2023). Il senso delle donne per la città: Curiosità, ingegno, apertura. Passaggi Einaudi.

Gutiérrez, M. (2018). Crowdsourcing and Mapping Data for Humanitarianism. In: Data Activism and Social Change. Palgrave Studies in Communication for Social Change. Palgrave Pivot, Cham. https://doi.org/10.1007/978-3-319-78319-2_4

Hanafi, L. (2012). Moudawana And Women's Rights In Morocco: Balancing National And International Law. *ILSA Journal of International & Comparative Law, 18*(2), Article 10.

Hanson, A.-M., & Alston, M. (2018). Gender and climate change: Expanding feminist engagements with ICT for adaptation and innovation. *Journal of Feminist Geography, 25*(3), 123-138.

Harvey, David (2008): "The Right to the City", New Left Review.

Ilse Oosterlaken, & van den Hoven, J. (2011). ICT and the capability approach. *Ethics and Information Technology, 13*, 65–67.

Kern. L. *La città femminista. La lotta per lo spazio in un mondo disegnato da uomini.* Roma: Treccani Libri, 2021

Kwan, M.-P. (2002). Feminist Visualization: Re-envisioning GIS as a Method in Feminist Geographic Research. *Annals of the American Association of Geographers, 92*(4), 645–661. https://doi.org/10.1111/1467-8306.00309

Lambrou, Y., & Piana, G. (2006). *Gender: The Missing Component of the Response to Climate Change*. Rome: FAO, Gender and Population Division, Sustainable Development Department.

Lévy, J., & Lussault, J. (Eds.). (2000). *Logiques de l'espace, esprit des lieux. Géographies à Cerisy.* Paris: Belin.

Listerborn, C. (2023). Who is telling the smart city story? Feminist diffractions of smart cities. In *Digital (in)justice in the smart city* (pp. 39–52).

Merchant, C. (1980). *The death of nature: Women, ecology, and the scientific revolution*. Harper & Row.

Mies, M., & Shiva, V. (1993). *Ecofeminism*. Zed Books.

Nagel, J. (2016). *Gender and climate change: Impacts, science, policy*. Routledge.

Nussbaum, M. C. (2000). *Women and human development: The capabilities approach*. Cambridge University Press.

Nussbaum, M. C. (2000). *Diventare persone*. Il Mulino.

Nussbaum, M. C. (2006). *Frontiers of justice: Disability, nationality, species membership*. Harvard University Press.

Oxfam. (2002). Gender and development: Special issue on climate change. *Gender and Development, 10*(2).

Pirani, N., Ricker, B., & Kraak, M.-J. (2019). Feminist cartography and the United Nations Sustainable Development Goal on gender equality: Emotional responses to three thematic maps. *The Canadian Geographer / Le Géographe canadien, 64*(4), 460-471.

Plumwood, V. (1993). *Feminism and the mastery of nature*. Routledge.

Robinson, S. (2014). *Nesting: Body, habitation, mind* (p. 21). Pordenone: Safarà Editore.

Sen, A. (1999). *Development as freedom*. Oxford University Press.

SERVIR-Mekong. (2015). *Gender and GIS: Guidance Notes*. Asian Disaster Preparedness Center.

Shiva, V. (1988). *Staying alive: Women, ecology, and development*. Zed Books.

Sultana, F. (2014). Gendering climate change: Geographical insights. *The Professional Geographer, 66*(3), 372–381.

Virgilio, F., & Carbonari, M. (2022, June 23-24). Il Data Activism contro la violenza di genere. Uno studio esplorativo su pratiche partecipative, saperi ed iniziative "dal basso". *IV Convegno Società Scientifica Italiana di Sociologia, Cultura, Comunicazione, Università Federico II, Napoli.* Intervento a convegno non pubblicato.

Winner, L. (1986). *The whale and the reactor: A search for limits in an age of high technology*. University of Chicago Press.

WEB REFERENCES

UNICEF. (2022, June 28). *Child marriage on the rise in Horn of Africa as drought crisis intensifies*. https://www.unicef.org/press-releases/child-marriage-rise-horn-africa-drought-crisis-intensifies

WECAN: Women's Earth and Climate Action Network. Retrieved October 19, 2024, from https://www.wecaninternational.org

https://harassmap.org/en

Chapter 3 - Open geo-data systems

Abstract: This chapter analyses open geodata systems and highlights the role of participatory cartography, Participatory GIS (PGIS) and crowdsourcing in transforming land representation and management processes. Maps are not seen merely as technical tools, but as social and political constructs capable of influencing power dynamics and territorialisation. The adoption of participatory methodologies has implications for planning, natural resource management and urban governance. However, ethical issues arise in relation to intellectual property, the risk of exclusion and the quality of bottom-up data. A specific section is dedicated to digital humanitarianism, where crowd-mapping and geoweb support the response to natural disasters. Finally, the impact of open geo-data on smart cities is discussed, between opportunities for inclusion and risks of new inequalities.

keywords: Open geo-data; Participatory cartography; Participatory GIS (PGIS); Volunteered Geographic Information (VGI); Critical cartography; Digital humanitarianism; Crowdsourcing; Geo-web; Smart cities; Spatial justice

Introduction

3.1 Participatory Cartography

“The ideal of collective intelligence implies the technical, economic, legal and human enhancement of intelligence distributed everywhere, in order to trigger a positive dynamic’ (Lévy 1994, 35-6) that can be translated into a collective project of new humanism, capable of opening up new forms of distributed democracy in real time (Lévy 1994, 74-5 as cited in Sanna Venere, Capineri, Salerno, & Teobaldi, 2025). Close to Levy's concept of collective intelligence is that of connective intelligence: De Kerckhove considers connective intelligence to be a form of organisation within collective intelligence, its “practical” part. Connective intelligence is therefore a cognitive process enhanced by technology, in which connection becomes the infrastructure that allows ideas, experiences and competencies to be linked in real time. One example above all of these productive possibilities found at the intersection between technology and social cooperation is undoubtedly represented by Wikipedia. The famous collaborative encyclopaedia is, in fact, a system in which the connection between individuals and digital technologies gives rise to a form of dynamic collective knowledge that enhances and modifies individual and collective cognition: the platform acts as a network connecting the minds of users from all over the world, amplifying the process of knowledge production and exchange.
This distributed knowledge functions both as an external memory and a cognitive tool, in which the platform acts as a network connecting the minds of users from all over the world, amplifying the process of knowledge production and exchange. This distributed knowledge

serves both as an external memory and a cognitive tool, in which individuals not only access information, but also actively contribute to its construction.

As highlighted by Casti (2013), while discussing of participatory cartography, we have to take into account the importance of reflexivity and choreography in the mapping process. Starting from the critiques of John Brian Harley (1989) to the positivist approach of modern cartography, we should advocate for an ethical framework in mapping practices[49]. According to the hermeneutic approach, the map is not a simple object, but a representation of the world, linked to power dynamics. Among the main studies there are Franco Farinelli's *I segni del mondo* and Denis Wood's *The Power of Maps* (1992), followed by Nancy Peluso's analysis of Counter-Mapping (1995), aimed at overturning power dynamics and giving voice to minorities on natural resource rights[50]. New analyses called *post-representational cartography* have been created to move the theory beyond Harley's approach. These studies look at maps from an ontological point of view since they are responsible for sending a message (Fernandez, 2014).

Another theoretical reference is also represented by critical cartography perspective, which challenges traditional topographic representations and emphasizes the social and cultural values of territories. This line of research first looked at the link between GIS and participation (Weiner, Harris, 1998) and then critiqued the deterministic nature of GIS and its potential to reinforce power dynamics, particularly in marginalized communities. According to this perspective the emergence of Volunteered Geographic Information (VGI) or crowdsourced geographic knowledge, (Goodchild, 2013) is noted as a means to enhance individual contributions to geographic knowledge. Since it made some of GIS's most elementary features accessible to the general population, Goodchild called the Google Earth phenomena the "democratization of GIS" (Goodchild, 2007). Similarly the increase

[49] In his volume which is part of The History of Cartography series, a publishing project that explores the history of maps as cultural artefacts across different traditions and historical periods. The project was conceived by J.B. Harley and David Woodward in 1977 and has resulted in the publication of six volumes, with the third volume devoted to cartography in the European Renaissance and the sixth to cartography in the 20th century. The project was funded by organisations such as the National Endowment for the Humanities and the National Science Foundation, among others.
With “History of Cartography”, Harley breaks with traditional topography by also including non-Euclidean representations. He criticises GIS and new technologies for their return to determinism and positivism, and for their anti-democratic nature due to unequal access to data and their potential to reinforce configurations of power and control over excluded communities.

[50] Within the broad participatory mapping toolbox, counter-mapping is the map-makingprocess whereby local communities construct their own maps to bolster the legitimacy of customary claims to land and resources (Peluso, 1995). These maps are considered as substitutes for the ones utilised by the government, industry, and other rival external organisations. They serve as a tool within a more comprehensive advocacy approach. They represent the assertions of communities, which frequently diverge from the government's conception of who possesses rights to specific land areas. The information is shared and presented as it is. Counter-maps have been employed in many instances globally, especially in regions with significant indigenous populations and land disputes, to delineate and assert control over customary territory that has been taken over by the government.

in social media use and Web 2.0 in addition to the significantly lower cost of web-enabled technologies are crucial to this process of "democratization" for consumers (Anderson, 2006; 2009). This phenomena, which can be characterized as the dissolution of the conventional distinctions between expert and non-expert, is known as neogeography (Turner, 2006). VGI is strongly tied to the idea of crowd-sourcing, which has come to have two rather different meanings (Howe, 2008)[51].

However, a unified theoretical discourse on participatory cartography remains rare, with recent studies exploring the semiotic aspects of mapping, such as the approach provided by cartographic semiosis (2013), which completely fits within the scope of post-representational mapping (Burini, 2016).
According to Elwood (2008), cited by Azong and Mutanga (2021), PGIS has the potential to include or exclude individuals and places, as well as to empower or weaken them. Through the use of customized, demand-driven, user-friendly, and integrated geospatial applications, PGIS practices aim to create empowerment processes for communities. Rambaldi et al. (2006) assert that PGIS incorporates a range of tools and techniques to encourage stakeholder participation in creating and managing geographic information. Moreover, it utilizes data specific to certain landscapes to support broad decision-making processes, fostering effective communication and community advocacy. Compared to other participatory approaches, the PGIS process of obtaining local information is more efficient and can enhance youth empowerment, resilience building for post-emergency scenarios, disaster risk management, and environmental awareness.
Local community participation in community development and environmental planning is necessary due to the global focus on involvement in decision-making for natural resource management. Kienberger (2014) discusses the use of participatory mapping techniques and PGIS (particularly photo mapping) to create community maps. In the context of disaster hazard assessment and risk reduction, this methodology is linked to high-level spatial analysis, as the methods used can promote empowerment and advocacy processes.
Attention to these issues began in the 1960s, with the recognition of the rights of inhabitants and minorities, the reflections of Lefebvre (1968) and the dramatic events of 1973 linked to the “Years of Lead” (Cassese, 1975). In the same period Kevin Lynch, with The Image of the City (1960), proposes a method of analysis based on direct observation and the construction of sketches and mental maps to interpret urban perception. Since the

[51] The two meanings referred to are those that have emerged in the literature (especially from Goodchild, 2007; Haklay, 2013;): 1. Crowdsourcing as a voluntary “bottom-up” contribution. Here, the value lies in widespread participation and in the fact that local and everyday knowledge enriches traditional databases; 2. Crowdsourcing as “outsourcing to the crowd”, in its most recent and critical sense, the crowd becomes a distributed workforce that performs, free of charge or at low cost, tasks that were previously performed by professionals or institutional bodies. In this sense, crowdsourcing can be seen as a form of cognitive exploitation or “mining” of data and voluntary work, where platforms (often commercial) gain a great economic advantage.

1990s, academic debate has focused on spatial justice[52], finding a reference point in Italy in the school of De Matteis.
At the end of the 1980s, Harley and Woodward's History of Cartography gave rise to a tradition of studies on indigenous maps characterised by a terminological "babel": Aboriginal, traditional, indigenous, native (Lewis, 1998), autochthonous (Iturralde, 2009) and "ethnic" cartography (Chapin, 2001). According to Burini (2016), these terms apparently do not take into account the process of territorialisation, i.e. the construction of a territory according to its own social logic, articulated in naming, reification and structuring, whether self-centred or allocentric (Turco, 1986).
As stated by Casti (2015), three phases of cartographic production can be distinguished: traditional cartography, an expression of local knowledge; "on-demand" cartography, developed to learn about "other" territories in mercantile and colonial contexts; and participatory cartography, aimed at local development and cooperation, which is the phase that interests my research. Since traditional cartography clearly uses topological structures and non-Euclidean representations, and therefore has a social relevance to the subjects represented (Woodward & Lewis, 1998), and shows historical continuity, from rock engravings to rural African villages, we can say that these maps have distinctive characteristics. These characteristics, which highlight their political and social dimension, are highlighted in concepts such as map-the-counter-encounter (Harley, 1989) and Basset's solicited maps (1998). Since the 1980s, methodologies such as RRA (Rapid Rural Appraisal), which evolved into PRA (Participatory Rural Appraisal) and then PLA (Participatory Learning and Action), have emphasised the participatory paradigm in cooperation projects, highlighting the role of communities in defining their own objectives. On the other hand, from the perspective of academia, the application of these approaches has been investigated: researchers and operators from international organisations have highlighted that, in order to be truly participatory, collaborative systems require methodological as well as technical support in order to reveal the social significance of places. Scholars dispute that the misuse of community maps can reduce them to tools for justifying cooperation interventions, thus distorting their intrinsic value, rather than true means of local empowerment[53].

3.1.1 PGIS, Participatory GIS

The concept of public participation geographic information systems (PPGIS), as Jankowski (2011) highlights, «might empower different groups of the public, including marginalized

[52] Université Paris Ouest, portal www.jssj.org, 2009.

[53] Towards the end of the 1980s, at the Institute of Development Studies (IDS) at the University of Sussex and the International Institute for Environment and Development (IIED) in London, through the publication of the journal RRA Notes (Rapid Rural Appraisal), a number of studies conducted in British academia sought to systematise the practices that had been implemented up to that point in the use of participatory methodology (Burini, 2016).

communities» (as cited in Picone & Piccolo, 2014, p. 347). Other scholars have referred to similar forms of GIS as "Bottom-Up GIS" (Talen, 2000), "Community Integrated GIS" (Harris, Weiner, Warner, & Levin, 1995), "Participatory Cartography" (Burini, 2016), among other terms. Despite the distinctions among these types of digital cartography (Casti, 2013, p. 142), Picone (2015) suggests that "all these terms share the same roots and are thus nearly interchangeable."

PGIS is a method and technology used to collect, analyse, visualize, and share land use information inclusively for participatory planning. When GIS/PGIS maps reflect perceptions of the world (or parts of it), the "qualitative" aspect of GIS can derive from data gathered using qualitative research techniques such as ethnographic interviews, focus groups, participant or active observation, brainstorming sessions, etc. (Picone, 2012). Additionally, mental maps serve as another significant source of qualitative data within GIS (Giannola, 2013). Qualitative GIS, a paradigm combining qualitative and quantitative methodologies, aims to integrate various information sources to provide a comprehensive understanding of how spatially recognized qualities or processes can be elucidated alongside social and political aspects.

Mental maps tend to recreate key spatial features according to the five main categories identified by Kevin Lynch for urban landscapes: paths, districts, nodes, landmarks, and edges (Lynch, 1960), which can be compared to OSM's "physical features": ways, areas/polygons, nodes, relations, labels.

Since the earliest cartographic representations, maps have played a central role in reducing the uncertainty of the unknown, recording conflicts and discoveries, and offering new ways of organising knowledge (Turchi, 2004). At the same time, they help to generate a sense of security and belonging, as pointed out by Kevin Lynch (1960), who highlighted the emotional function of environmental images.

Mental maps lie at the intersection of subjective perception and spatial representation, providing interpretative tools that are useful not only in geography, but also in psychology, education, urban planning, and cultural studies.

Traditional topographic maps are based on criteria of objectivity, scale and geometric accuracy. In contrast, mental maps are characterised by their dynamic, emotional and perceptive nature. They are not intended to replace cartography, but offer a complementary perspective on the relationship between individuals and space, which is useful for guiding everyday choices and strategic decisions.

Digital technologies (GIS, collaborative drawing apps, crowd-sourced data) are expanding the possibilities for use and analysis, bringing mental maps ever closer to participatory cartography.

As Kevin Lynch's analysis has shown, there is an intrinsic relationship between the perception of urban space and the way it is represented and planned. Building a mental atlas can also be considered a life-long commitment. It will not only help us orient ourselves in space, but will also develop a process of identity and values. It will help guide our daily and long-term decision-making process. Studied in behavioural geography (1970), mental maps represent a fertile field of study for understanding the relationship between

the individual, society and space. They not only translate perceptual and emotional experiences into visual representations, but also offer operational tools for sustainable and inclusive planning. In the context of smart cities and ecological transition, their value is set to grow, strengthening the link between geography, participation and innovation. As highlighted in an article in National Geographic[54], mental maps of the world are often inaccurate due to geographical misunderstandings and distortions of scale, such as the improper displacement of continents or the effects of cartographic projections (e.g. Mercator versus Peters), errors from which even cartographers are not entirely immune. Mental maps reflect how space is perceived, not measured. It does not prioritise geometric precision, but rather emphasises what was memorable, significant, and usable to early 16th-century navigators. On the other hand, mental maps can be considered a precursor to GIS (Geographic Information System) design. In fact, before translating space into georeferenced and formalised data within digital platforms, individuals and communities develop subjective representations of space that form the cognitive basis for any subsequent mapping process.

3.1.2 The Geo-web 2.0 paradigm

The involvement of citizens to improve the quality and management of public services requires, as a prerequisite, the adoption of the Web 2.0 paradigm, which enables online communication and resource sharing. It follows that it is essential for public administration portals to equip themselves with tools that encourage participation, promoting direct interaction between the administration and citizens.

In this scenario, the geo-web, based on geographical and cartographic content and applications, plays an important role. In the Web 1.0 phase, it was limited to informational and consultative use, with users only able to view the available data. With Web 2.0, however, the geo-web takes on a participatory character, offering opportunities for 'interaction and active contribution to the creation of content and tools' (Roche, 2010). The subsequent evolution of Web 3.0 opens up new perspectives: thanks to the development of artificial intelligence and geo-spatial web technologies, it becomes possible to manage and query huge amounts of data automatically. In this vision, Web 3.0 is based precisely on the ability to combine AI with advanced information processing to support new participatory models (Burini, 2016).

The most interesting aspect concerns the interactivity of collaborative mapping systems in Web 2.0, i.e. the possibility for users to contribute to the definition of maps. Burini (2016) reports that there are two main types: open and semi-open systems. Semi-open systems include Google Maps, Google Earth and cartographic mashups, i.e. online maps that combine multiple sources of information via APIs (Application Programming Interfaces)

[54] Mason, B. (2018, November 16). *Why your mental map of the world is (probably) wrong*. National Geographic Education. Retrieved from https://education.nationalgeographic.org/resource/why-your-mental-map-world-probably-wrong/

and languages such as XML (Extensible Markup Language), without necessarily requiring a searchable online database. These tools allow, for example, the display of statistical and demographic data linked to survey areas, as demonstrated by the emergence of platforms such as Pinterest, Instagram and Wikipedia, which have generated multimedia mashups that associate photos and videos with heterogeneous data. In both cases, the type of openness of the information produced by users is defined by the system operators.

The second type is represented by open interactive systems, which allow users to modify any cartographic information, such as road networks or buildings, already produced by other users. OpenStreetMap (OSM) (2007, Roche 2010) is an example of a collective and continuous construction system. Wiki systems represent the highest level available for voluntary management of geographic information, as they make both the data entered and the map creation process transparent, with details on actions, dates, changes and authors.

Finally, a further distinction between cartographic systems concerns the objective of the operation, whether individual or collective. In the literature, there are few contributions that interpret the interactivity of such systems.

Cartographic mashups integrate data from heterogeneous sources (institutional, community, open data, contributions from residents, real-time sensors) through web mapping platforms, transforming maps into interactive environments capable of superimposing and comparing different levels of information (mobility, services, risks, social perceptions, cultural and economic flows). These tools contribute to the recovery of spatial capital, understood as the set of territorial resources that can be mobilised thanks to urban location (accessibility, social and infrastructural connections, use of public spaces). Cartographic mashups can contribute to the recovery of spatial capital by mapping spatial inequalities, highlighting urban areas penalised by a lack of services, efficient transport or quality public spaces, with the aim of designing rebalancing policies. Through bottom-up contributions (using reports, emotional maps, daily routes), citizens can make their experience of urban space visible and, in doing so, contribute to more inclusive planning that takes into account abandoned spaces, fragmented cycle paths and little-known green areas. The coexistence of institutional datasets (urban planning, demographic statistics, traffic flows) with participatory maps helps to fill the information gaps that hinder a real understanding of the available spatial capital.

The tools for achieving this are sustainable mobility maps (official cycle paths, user GPS tracks and critical points reported by citizens), collaborative atlases and real-time maps. Cartographic mashups are strategies for activating the spatial potential of the city, promoting spatial justice, inclusion and urban resilience.

With the spread of digital technologies and Web 2.0, critical GIS was born, transforming cartography from traditional production to a collaborative process. In 2004, at Carleton University in Ottawa, Fraser Taylor began studying cybercartography, based on interactive atlases powered by users. These tools offer empowerment and new forms of representation, even if the limitation of two-dimensionality (Google Maps) remains compared to three-dimensional solutions that are closer to the perception of places.

In Italy, the Diathesis laboratory at the University of Bergamo[55] develops projects for participation and urban governance, adapting methodologies and strategies developed in African environmental protection (Casti 2006; Burini 2006). Participation thus becomes a process of recovering spatial capital as a heritage of territorial knowledge and experience (Levi, 2003). The concept goes hand in hand with that of territorial capital, understood as a set of fixed and specific assets linked to a territory. The Diathesis laboratory developed the SIGAP (Integrated Strategy for Governance and Participatory Action) methodology. This is divided into four phases: Knowledge: collection and dissemination of basic data (statistical, bibliographic, documentary) through web mapping / Consultation: design of tools to involve residents, through accessible, responsive, user-friendly and transparent cartographic mashups / Concertation: discussion between the parties to respond to questions and critical issues that have emerged / Active participation: final decision based on consultation, with digital systems that display summary documents and capitalise on experience. The original phases of SIGAP (knowledge, design, consultation, capitalisation, decision support) are then adapted to urban governance, in line with Lynch's approach: participatory processes must be preceded by an analysis of territorial dynamics and the strategies of the actors involved.

3.1.3 Ethics for PGIS

The International Convention for the Safeguarding of Intangible Cultural Heritage[56], which advocates for the documentation of intangible heritage, presents significant ethical concerns for individuals engaged in the process of geo-referencing people's knowledge and values.

Within this framework, the trajectory towards achieving exemplary PGIS practices is marked by significant obstacles; in particular, these highlight pressing challenges and overarching concerns regarding empowerment. To address these issues, a guide imagined by Rambaldi et al. (2006) aims to offer comprehensive recommendations for making ethical decisions, without however claiming to cover every possible scenario.

[55] The Diathesis Laboratory at the University of Bergamo is a research centre founded in 2004 by Professor Emanuela Casti. Specialising in the study of cartographic systems from a theoretical and applied perspective, the laboratory focuses on cartographic innovation, spatial representation and participatory methodologies. Starting in 2022, the laboratory has been renovated and reorganised, giving rise to the Imago Mundi Lab project, which integrates new collaborations and develops national and international research projects.

[56] The UNESCO Convention for the Safeguarding of Intangible Cultural Heritage (2003, effective 2006) aims to protect living cultural practices, expressions, knowledge, and skills, emphasizing community participation (UNESCO, 2003). It establishes representative and urgent safeguarding lists to recognize and preserve cultural elements (UNESCO, 2025). Italy ratified the convention in 2007 and actively promotes intangible heritage nationally and internationally (UNESCO, 2025).

In the same direction, the "Mapping for Change Conference" (IIRR, 2006)[57] highlighted the importance of practical ethics and the development of a code of good practice for Participatory Geographic Information Systems (PGIS). The conference held in Nairobi in September 2005 addressed ethical concerns linked to Participatory Geographic Information Systems (PGIS). These problems were shared online and discussed extensively among practitioners through the Open Forum on PGIS and Technologies.

The PGIS combines community development and geospatial technologies to provide opportunities for disadvantaged communities. According to Rambaldi et all (2006) Participatory GIS refers to the provision of GIS tools and technologies to disadvantaged societal groups in order to enhance their ability to generate, manage, analyze, and communicate geographic information. Through the use of customized, demand-driven, user-friendly, and integrated geospatial technology applications, the practice of GIS aims to empower communities.

In addition, the practice of Intellectual Property Rights could safeguard traditional knowledge and wisdom against external use. In this regard, cartographers employ a visual language consisting of symbols (points, lines, polygons, and volumes), their variations (shade, orientation, shadow value, shape, size, and texture), and interpretive keys (legends) printed on maps to convey geographic information. Moreover, the three-dimensional landscape elevation models exhibit additional enhancements. It is therefore vital that every detail of the map is represented with a common symbol in order to facilitate its interpretation, especially when a map is used as a basis for discourse.

Within this perspective, the development, georeferencing, and visualization of Indigenous Geographic Knowledge (IGK) assist communities in engaging in peer-to-peer conversations and ensuring that authorities take into account specific issues and concerns. Significantly, the CGA-based (Cartographic Grounded Approach, Casti 2013, Burini 2016) maps are also employed in contrasting contexts, such as in counter-mapping initiatives where indigenous communities seek to regain a certain level of control over ancestral lands and resources by utilizing participatory mapping methodologies. In this way, mapping makes people aware of pressing issues and returns one's own energy to the community.

Ultimately, the practice of participatory GIS assumes that geographic information systems and technologies are made accessible to disadvantaged groups in society in order to

[57] The Mapping for Change: International Conference on Spatial Information Management and Communication took place in Nairobi, Kenya, from 7–10 September 2005. It was organized by the International Institute for Environment and Development (IIED) together with partners including CTA (Technical Centre for Agricultural and Rural Cooperation) and other international and regional institutions. The conference brought together more than 150 participants from over 40 countries, including researchers, practitioners, community leaders, NGOs, and policy makers. Its aim was to explore how participatory mapping, GIS, and spatial information technologies can support community empowerment, local resource management, conflict resolution, and advocacy. The proceedings were later published as PLA 54: Mapping for Change – Practice, Technologies and Communication (IIED, April 2006), edited by Giacomo Rambaldi and colleagues (Rambaldi et al, 2006c). This volume documented methodologies, lessons learned, and policy implications from the event.

enhance their abilities to generate, manage, and utilize their own geographic data, as well as externally produced geographic information.

In concrete terms, the PGIS typically cover the following topics: the distribution of resources (occupation and use of land, water resources, habitats); the use, control, and access to resources (hunting, fishing, agriculture, grazing, mining, gathering and harvesting from nature, etc.); places of historical, cultural, and religious significance, ancestral lands, and sacred sites; indigenous names; cosmologies, creation myths, and origin stories, etc.; perception of risks (such as landslides, floods, malaria). The diverse geographical viewpoints of women, the elderly, youth, and children are of particular interest. At a deeper level, CGA may diverge from scientific knowledge on a cognitive level.

mental maps can incorporate overlapping areas, with blurred or many boundaries, and locations that are unknown or have limited access. PGIS applications might be used to legitimize decisions that have already been made by other parties.

However, critical research shows that the new socio-technical processes of collaborative mapping frequently promote or reproduce patterns of exclusion, particularly in terms of relative data density between the Global South and North (Herfort, B., Lautenbach, S., Porto de Albuquerque, J., et al. 2023). Regardless of these findings, Herfort et al. believe it is vital to recognise the growing amount of geodata contributions from locations outside of OSM's traditional European core. This increase in geodata generation in OSM is linked to a diversity of OSM players and socio-technical activities. While OSM has frequently been represented as a crowd-sourced initiative with thousands of individual craft mappers, the examination of OSM metadata reveals that new institutional actors are emerging. These innovations have resulted not just in new collaborative efforts, but also in disputes between local mapping communities and institutional players. According to Herfort et al. (2023), these processes can be interpreted in two ways. First, the spread of mapping operations can be understood as a decolonising process, in which quantitative disparities in data density between the Global North and South are somewhat decreased and new groups of local mappers are empowered to contribute spatial knowledge. Second, these changes can be viewed as colonisation processes. The involvement of large commercial actors in OSM raises concerns that the project (and its local mappers) will be used as a new method of data extraction, and that new and diverse voices in the OSM community will be marginalised. However, this ostensibly obvious distinction should not hide the fact that colonising and decolonising processes interact in intricate ways.

This discussion takes place within broader debates about inequalities in the production of geographic knowledge in OSM, as well as the critical work that has highlighted the social, political, and economic dimensions of VGI and, importantly, the discussion of the political economy of VGI and the geoweb (Leszczynski, 2012).

Finally, there is a danger that the emerging multiplicity of mapping practices and the growing polyphony of diverse mapping communities in OSM will be suppressed in favour of modernist and universalistic, economically exploitable epistemologies.[58]

3.1.4 Crowdsourcing and Data Quality in Geoinformation

The rising expenses of mapping have contributed to a shift in government funding priorities, resulting in a decrease in mapping activities (Goodchild, Fu, & Rich, 2007).
However, nowadays there are the conditions for rapid dissemination of information since volunteers are armed with digital cameras, GPS, digital maps, and a variety of other technologies. By contrast official agencies that manage information are frequently inadequately funded, lacking in resources, and compelled to wait till information can be validated. It is evident that civilization has entered a new period in which geographic information will not only be consumed by all, but will also be created by all, or at least by a dense and dispersed network of observers. This creates a completely new vision for Digital Earth, one that involves a dense network of intelligent observers who are distributed throughout the planet and have the ability to gather specific types of geographic data that large-scale acquisition systems such as remote sensing and other large-scale acquisition systems are unable to gather. Institutions and protocols will be required to guarantee that the outcome is trustworthy and beneficial. Many contributions establish a categorization based on the features of the information, activities, and scopes of the projects by giving actual examples of Volunteer Geographic Information (VGI). After discussing the connections between categories and VGI quality, Bordogna (2016) analyzes methods for enhancing the quality of volunteered information depending on when it is evaluated (ex ante, ex post, or both in terms of information generation). However, due to the complexity and frequent impossibility of evaluating the quality of each VGI item, many researchers are dubious about the usability of VGI in the scientific arena.
OpenStreetMap works with the contribution of a hierarchy of volunteers with established guidelines that are suited for crowd-sourcing review geo-referred entries. In order to define specific measures to enhance the quality of the geographic information, scholars provide overviews of numerous scientific programs where volunteers' geographic contributions are pledged.

Scholars attempted a classification of volunteer mappers which include the beginner, the enthusiastic amateur, the experienced amateur, the expert professional, and the informed authority (Bordogna et all, 2016). The volunteer known as the beginner lacks formal training in the study's subject. Nevertheless, he or she is willing, able, and interested in participating in the project. He or she is capable of performing relatively straightforward activities that call for either automatic or manual processes, giving prompt feedback, and

[58] For a wider decolonialist critique of the nexus of universalistic, Western, and modernistic epistemologies with colonialism, capitalism, and neo-colonialism, see Mouton & Burns, 2021; Radcliffe, 2017.

entering remarks about the surrounding situation (images, coordinates, firsthand knowledge of local phenomena, etc.). He or she typically behaves independently and impulsively, driven either by generosity, curiosity, or a competitive attitude, or to feel satisfied by seeing his or her entries on a public, highly visible platform. We can refer to individuals who, after finding a topic or scientific field of interest, start learning more about it through research and experimentation as interested amateurs. They occasionally gain from a particular training that the project's supporters provide. In comparison to those of the beginners, these volunteers' contributions are frequently richer and more thorough, less marred by formal flaws, yet they could still be technically inaccurate. The enthusiastic amateur, who is typically employed for simple or automated chores, frequently becomes involved in more difficult operations and can begin collaborating with other volunteers with whom he or she comes into touch or take part in genuine data collection campaigns. These volunteers are more trustworthy than beginners, and their ongoing commitment to the project over time is their most valuable asset. Volunteers are capable of making important contributions in the form of both original data and information as well as comments, revisions, verifications, and evaluations of the work done by other volunteers. Their intentions may include the desire to impart knowledge, satisfaction in demonstrating their skill to a large audience, which helps them build their name and gain respect, the desire to integrate into the community, and the expectation of making a positive impact on society.
Finally, It is important to keep in mind that a promising and realistic user viewpoint on VGI quality includes assessing the quality in respect to expectations, or by attempting to match the quality of the information delivered with the quality level selected by each user for her/his specific purpose.

3.2 - Digital humanitarianism

In the wake of natural disasters, the speed and precision with which humanitarian organizations respond can significantly impact the survival and recovery of affected populations. Earthquakes, in particular, pose a formidable challenge due to their sudden onset and the widespread destruction they cause. Efficiently directing aid and resources to the most critical areas becomes paramount. The case-study described in chapter 5.2 explores how humanitarian organizations can enhance their disaster response efforts through the use of digital tools and geoweb technologies, with a specific focus on crowd-mapping.
With regard to the concept of crowdsourcing, It refers to an analysis that highlights the evolution of American geography and the emerging role of user-generated geographic information (Elwood et al. 2013). However, the use of the term “sensor” by scholars reflects the technocratic nature of the discourse and considerations regarding the reconfiguration of the role of the cartographer, neglecting the social and territorial implications of this change.

Although the areas most commonly considered in VGI are the monitoring of natural phenomena, ornithology, meteorology and astronomy, in recent years other forms oriented towards the production of information useful for urban governance have emerged (Haklay, 2013). The protagonists of this co-production can be both the inhabitants who directly experience the event and provide useful information for rescue or intervention operations, and those who, despite being in another part of the world, are IT experts capable of translating the collected data into maps. This perspective is linked to Michel Lussault's reflections in L'homme spatial (2007, p. 19), in which the author emphasises the spatial importance of crises, environmental disasters or socio-political movements, which can transform individuals into spatial operators, i.e. entities capable of acting on and modifying geographical space. From this perspective, cartography itself can be understood as a symbolic operator that intervenes in processes of territorial transformation. The literature on crisis mapping highlights the technical aspects that have determined its success (Goodchild, 2010), the applications currently available and the challenges still open regarding published data: privacy and security, intellectual property, quality and reliability (Goodchild, Li, 2012). Reflecting on crisis mapping allows us to understand its potential in representing space, considering the semiotic field in which it is situated.

The concept of digital humanitarianism has gained popularity in recent years, driven by advancements in technology and the increasing availability of real-time data. By leveraging the collective intelligence and contributions of volunteers around the world, crowd-mapping platforms enable the rapid collection and dissemination of geospatial information. This approach not only improves situational awareness but also aids in the coordination and deployment of resources where they are most needed.

A poignant example of this is the September 2023 earthquake in the Moroccan High Atlas. The devastation left in its wake highlighted the urgent need for a coordinated and efficient response. The ruins left in the wake of an earthquake serve as poignant reminders of the irreparable loss experienced, both in terms of human loss and natural landscapes and cultural heritage. Humanitarian maps have emerged as powerful tools that can contribute significantly to the preservation and restoration of both natural and cultural assets in the aftermath of such disasters.

In the context of natural disasters like earthquakes, humanitarian maps provide crucial information about the affected areas, including the extent of damage, the location of critical infrastructure, and the distribution of resources. By accurately mapping these details, humanitarian organizations can prioritize their response efforts, directing aid and resources to where they are most needed. Essentially, while the ruins left behind by earthquakes may symbolize loss, the use of humanitarian maps offers hope for redemption.

The case study described in chapter 5.2 sets the stage for a deeper examination of how crowd-mapping and digital tools are revolutionizing humanitarian rescue operations, providing insights into the practical applications and benefits of these technologies in the field of disaster response.

The access to environmental information is a legitimate right that is protected by numerous national conventions, acts, and laws (see ch. 4.1).

The reasons why it became possible for the average user to reliably identify position without the specialized knowledge that was previously only available to skilled surveyors, was the accessibility of many internet services that could be accomplished by utilizing a straightforward Global Positioning System (GPS) or by locating destinations. Location may be determined using a variety of coordinate systems thanks to the GPS, which is accessible via a wide variety of consumer devices. Incorporating global positioning system (GPS) capabilities into cameras enables digital photos to be geotagged automatically. As already mentioned, Goodchild in 2007 calls this subset of user-generated content on the Internet ”volunteered geographic information” (VGI). Many innovative VGI tasks have arisen as a direct result of GPS technology, including the generation of maps by foot, bike, or car travel. Also, given the powerful synthesis of science and public participation, citizen science expands research capacity and engages the public in the resolution of environmental and scientific concerns.
Within the context of digital humanitarianism, as demonstrated by web-map services and communities like Ushahidi or the Humanitarian OpenStreetMapTeam (HOTOSM), traditional humanitarian organizations delegate tasks connected to the collection, production, processing, dissemination, and mapping of humanitarian data to a vast, unlimited number of non-specialists volunteers.

People, by giving actual examples of Volunteer Geographic Information (VGI), contribute to OpenStreetMap and publish their maps, which is particularly beneficial in remote regions that Google has not yet covered and which experienced catastrophic events related to natural disasters.
The first example of a voluntary humanitarian mapping experience occurred after the earthquake in Haiti in 2010 when relief operations led by humanitarian organizations benefited from the contributions of volunteer mappers through a crowd-mapping process.
The crowdsourcing principle implies, among other things, that information that is of interest to a large number of people will be more accurate than information that is only of interest to a small number. This is supported by the concept of "the wisdom of crowds."
The literature on the more fundamental challenges brought up by this new resource, also known as volunteer geographic information, has just recently begun to take shape thanks to a number of recent publications giving rise to what has been called a post-modern period in which geographic information is produced (Goodchild et al., 2007).
This trend, often called "digital humanitarianism," is located at the intersection of new socio-technical practices, new epistemologies, and new institutional relationships (Burns 2014; Crawford and Finn, 2015). Conventional humanitarian organizations typically dismiss digital humanitarian data as unreliable or as being of a type that cannot contribute to existing methods of operation. Despite the substantial quantity of geographic literature opposing humanitarianism, geographers have not made significant contributions to a theorisation of digital humanitarianism (Burns, 2014).
The study of digital humanitarianism offers a unique opportunity for researchers to refine their understanding of the geoweb by applying existing knowledge to a new context.

3.3 Smart cities

The digital transformation of cities has not only experienced quantitative growth but also a profound qualitative transformation. The global telecommunications network according to De Masi (1998, as cited in Carta 2003, p 284) couldn't be neither seen nor represented, since it is multidimensional, it is spherical, and its structures are made of telecommunications networks that can be expanded and interconnected to infinity.
Carta and Ronsivalle (2016) state that cities have a rich sociocultural diversity that they may employ as the foundation for the development of new open and adaptable urban cultures, the activation of identity resources in branding design, and the creation of new circular economic values implemented by policies driven by intelligence accordingly to the idea of Governance.
Carlo Ratti in "La città di domani" speaking of "the space of flows" (Castells M. 2007, as cited in Ratti 2017) as «la fusione tra reti virtuali e spazio materiale […] dove la distanza non ha significato», believes that enabling citizen participation predicts vulnerability, less control, and the possibility of mistakes. On the other hand, the productive integration of top-down and bottom-up urban paradigms could help us build the city of tomorrow together by using the user-generated content (UGC) in an almost continual stream of content created by people. User-generated data is also referred to as crowdsourced data. Although similar to UGC, there are differences. In fact, crowdsourced data implies that the collection and production of data occurs voluntarily within the context of a project or with a specific objective; moreover, it is data collected in large quantities. The definition of UGC has been in use since the early 2000s, when the Organisation for Cooperation and Economic Development (OECD) mentioned 'user-generated content' in a 2007 report, describing it as content created voluntarily or incidentally through the use of a digital application by online users. While Volunteered Geographic Information refers to data voluntarily collected by citizen scientists or citizen sensors, according to Goodchild (2007), crowdsourcing refers to a mode of information production involving a large group of participants, not necessarily connected to each other, who may also use different means of collection (internet, social media, digital platforms, etc.).

Planning databases and GIS can become a key component of comprehensive multimedia information systems at the municipal and regional levels, and planners can assume the role of consultants for all parties involved in the development of the territory. For instance, promoting an area as a "interconnected GIS system" can encourage the emergence of virtual districts of local development (productive, touristic, and cultural): local telematic networks dedicated to small and medium-sized businesses with the goal of reviving the competitive advantages of our local system, promoting the integrated development of the territory through the connection of businesses to other poles of the regional system, or with the help of other means. City networks will be able to compete in the global market as a local system thanks to the idea of virtual districts, which will use two crucial competitive resources: spatial information and network connectivity.

In recent times and the notion of sensor networks os people as sensors has garnered considerable attention. The researchers from the Senseable CityLab1 mapped Spain using Flickr data (Ratti, 2017) to highlight how locals and visitors use their surroundings and to pinpoint the locations that are most interesting, almost like "magnetivisies. " Networks of sensors deployed over the landscape can help achieve the observational goals of Earth science as well as security and surveillance goals. Video surveillance networks in numerous large cities are often offered as an example. To draw attention to environmental issues, such as the effects of drought, user-generated photo data was employed.

People that contribute to OpenStreetMap draw routes and publish their maps, which is particularly beneficial in regions that Google has not yet covered. Residents can report issues that need to be corrected, such as potholes, downed trees, and damaged street signs, via a number of city applications.

"Data driven" systems strengthen smart cities. Most of these statistics are created by citizens, who perform most of the time without any awareness or informed consent, in routine transactions. Large-scale data sets can originate from several data sources, including social media, consumer websites, search engines, and intelligent smartphone apps, CCTV, credit card transactions, smart utility meters, etc (Viitanen & Kingston, 2014). Usually, they can be utilized by private companies and traded for profit, as well as controlled by authorities. Researchers and citizens equally can utilize them if they are accessible to everyone. While there are numerous unexplored opportunities for smart cities, it is important to consider the dangers to people's freedom and privacy. Paradoxically, the same networked technologies that present a potential for empowerment can be utilized for censorship and monitoring against freedoms of expression, or even worse, outright control. On one hand it appears that the "system" will certainly diminish personal choice and boost corporate power in the city on personal decisions and access to information: on the other hand the pressure on political leaders to provide answers for urban issues caused by postindustrial economy and climate change is getting bigger.

Many criticize the smart city for prioritizing technology innovation over citizenship and democracy. Smart city supporters now emphasize participation, fairness, and inclusion in urban digitalization. Redistributive justice inquires who benefits from smart city initiatives[59], and recognition justice asks which cultures and values smart city acts affirm (Rosol & Blue, 2022). However, citizenship in such projects is limited because individuals are expected to act as data points, entrepreneurs, and service users rather than early project developers. «Despite attempts to recast the smart city as ‘citizen-focused,’ smart urbanism remains rooted in pragmatic, instrumental, and paternalistic discourses and practices rather than those of social rights, political citizenship, and the common good» (Cardullo, 2018). Thus, the smart city reinforces authority and inequality rather than emancipating urban development. ICT can successfully distribute vast amounts of public information. Investigating urban agency, people' subjectivities, and collective capacities in the sharing

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city shows that the smart city needs ideological support to promote both technical and justice-oriented social transformation.
Smart cities emphasize technocratic city management and risk of reinforcing power relations. Even though smart technologies aim to assist all urban residents, they are typically gender biased. According to Strengers and Nicholls (2017), a feminist approach to design and technology encompasses social care, health care, and sociology that « such approaches could prove fruitful in deviating from the dominant tech-centric trajectory permeating the smart home, to develop more gender-inclusive visions of 'smart' domestic life.» As previously discussed in Chapter 2.5, feminist urban critique draws attention to the historical inequities that are associated with technology in terms of production, access, usages, and application.

Conclusions

The discussion has shown how cartography, once considered a neutral and technical activity, has progressively become a field where power relations, social justice, and community empowerment are at stake. From Harley's critique of modern cartography to the development of participatory and counter-mapping practices, other critical aspects of this discipline concern the identification of means to institutionalize the practice of PGIS within local planning and development agencies (if appropriate), as well as mechanisms to protect the privacy and intellectual property of holders of local knowledge and to promote control and access to data and information for those who have contributed to generating such data. Among practitioners, researchers, and activists, there is a general opinion that the practice of GIS is more advanced than the underlying theory of its applications (Rambaldi, 2006a). Furthermore, it has been firmly demonstrated that it is important to evaluate experiences (both failures and successes) and develop instructions and strategies to promote best practices in this area, ensuring that the reasoned adoption of the PGIS meets the expectations of different groups in developing countries.
Sanna Venere et al. (2025) suggest that since in the digital age, data has become a crucial resource for society, transforming the way governments, businesses and individuals interact, these data should be considered as commons, i.e. shared resources managed collectively for the common good. Considering data as commons implies a radical change in perspective: it means treating data not as a commodity to be exploited, but as a public good that requires collective governance. This is particularly evident in the context of Citizen Science, where data collected by citizens can serve a wide range of scientific, environmental, social and political purposes. Considering the data produced by Citizen Science as commons therefore represents a unique opportunity to democratise knowledge and promote a more equitable, inclusive and sustainable science, as well as to strengthen social ties.

Within this perspective, it is crucial to institutionalize practices of participatory mapping in local planning and governance frameworks, while safeguarding the privacy, intellectual property, and agency of those who contribute their knowledge. Future research and practice should therefore focus on developing reflexive methodologies, fostering inclusive participation, and promoting forms of spatial justice that recognize the plurality of voices and experiences inscribed in maps.

References

Anderson, C. (2006). *The long tail: Why the future of business is selling less of more*. Hyperion.

Anderson, C. (2009). *Free: The future of a radical price*. Hyperion.

Azong Cho M., Mutanga O. (2021). "Understanding participatory GIS application in rangeland use planning: a review of PGIS practice in Africa", *Journal of Land Use Science*, 16(2), 174-187.

Bassett, T. J. (1998). Indigenous mapmaking in intertropical Africa. In D. Woodward & G. M. Lewis (Eds.), *The History of Cartography* (Vol. 2, Book 3, pp. 24–48). Chicago: University of Chicago Press.

Bordogna, G., Carrara, P., Criscuolo, L., Pepe, M., & Rampini, A. (2016). On predicting and improving the quality of Volunteer Geographic Information projects. *International Journal of Digital Earth*, 9(2), 134–155. https://doi.org/10.1080/17538947.2014.976774

Burini, F. (2006). La cartografia partecipativa e la cooperazione ambientale in Africa. Il caso del villaggio di Bossia (Niger). *Bollettino della Società Geografica Italiana*, 11, 961–980.

Burini, F. (2016). *Cartografia partecipativa. Mapping per la governance ambientale e urbana*. Milano: FrancoAngeli. ISBN 9788891740878.

Burns, R. Rethinking big data in digital humanitarianism: practices, epistemologies, and social relations. *GeoJournal* 80, 477–490 (2015). https://doi.org/10.1007/s10708-014-9599-x

Cardullo, P. (2018, October 29). New paper published "Smart urbanism and smart citizenship" - The Programmable City. *The Programmable City*. https://progcity.maynoothuniversity.ie/author/pcardullo/

Carta, M. (2003), *Teorie della pianificazione: questioni, paradigmi e progetto*, Palermo, Palumbo Editore. ISBN 88-8020-519-6.

Carta, M., & Ronsivalle, D. (2016). *The fluid city paradigm: Waterfront regeneration as an urban renewal strategy*. Palermo: Springer.

Cassese, S. (1975). *I beni culturali da Bottai a Spadolini*. Rassegna degli Archivi di Stato, 1-3, 116–142.

Casti, E. (2006). Geografia e partecipazione: la strategia SIGAP nella riserva della biosfera transfrontaliera "W" (Africa Occidentale). *Bollettino della Società Geografica Italiana*, 12(11), 949–975.

Casti, E. (2013). *Cartografia critica. Tal topos alla chora*. Milano: Guerini.

Casti, E. (2015). *Reflexive Cartography. A Modern Perspective in Mapping*. Amsterdam, Oxford, Waltham: Elsevier.

Chapin, M., & Threlkeld, B. (2001). *Indigenous Landscapes: A Study in Ethnocartography*. Center for the Support of Native Lands. ISBN: 978-0840023285.

Crawford, K., Finn, M. (2015). The limits of crisis data: analytical and ethical challenges of using social and mobile data to understand disasters. *GeoJournal* 80, 491–502 . https://doi.org/10.1007/s10708-014-9597-z

Elwood S. (2008). "Volunteered geographic information: Future research directions motivated by critical, participatory, and feminist GIS", *GeoJournal*, 72(3–4), 173–183.

Elwood, S., Goodchild, M. F., & Sui, D. (2013). Prospects for VGI research and the emerging fourth paradigm. In D. Sui, S. Elwood, & M. F. Goodchild (Eds.), Crowdsourcing geographic knowledge: Volunteered geographic information (VGI) in theory and practice (pp. 361–375). New York: Springer. doi: https://link.springer.com/chapter/10.1007/978-94-007-4587-2_20

Farinelli, F. (1992). *I segni del mondo. Immagine cartografica e discorso geografico in età moderna*. Firenze: La Nuova Italia.

Fernández, M. E. (2014). A map is not a place. In *Memories of Underdevelopment: Art and the Decolonial Turn in Latin America, 1960–1985* (exhibition catalog, pp. 38–41). Austin: University of Texas Press.

Giannola E. (2013). "Processi innovativi di costruzione dell'immagine territoriale: ruolo culturale e contributo alla pianificazione". *IN FOLIO*, 30(30), 27-30.

Goodchild, Michael & Fu, Pinde & Rich, Paul. (2007). Sharing Geographic Information: An Assessment of the Geospatial One-Stop. *Annals of the Association of American Geographers*. 97. 250 - 266. 10.1111/j.1467-8306.2007.00534.x.

Goodchild M.F. (2007). Citizens as sensors: the world of volunteered geography. *GeoJournal* 69, 211–221. https://doi.org/10.1007/s10708-007-9111-y

Goodchild, M. F., & Glennon, J. A. (2010). Crowdsourcing geographic information for disaster response: A research frontier. *International Journal of Digital Earth*, 3(3), 231–241. https://doi.org/10.1080/17538941003759255

Goodchild, M. F., & Li, L. (2012). *Assuring the quality of volunteered geographic information. Spatial Statistics*, 1, 110–120. https://doi.org/10.1016/j.spasta.2012.03.002

Haklay, M. (2013). Citizen science and volunteered geographic information: Overview and typology of participation. In D. Sui, S. Elwood, & M. Goodchild (Eds.), *Crowdsourcing Geographic Knowledge: Volunteered Geographic Information (VGI) in Theory and Practice (*pp. 105–122). Dordrecht: Springer. https://doi.org/10.1007/978-94-007-4587-2_

Harley, J. B. (1989). Deconstructing the map. *Cartographica*, 26(2), 1–20.

Harley, J. B., & Woodward, D. (Eds.). (1987). *The History of Cartography, Volume 1: Cartography in Prehistoric, Ancient, and Medieval Europe and the Mediterranean.* Chicago: University of Chicago Press. ISBN: 0-226-31633-5.

Harris, T. M., Weiner, D., Warner, T. A., & Levin, R. (1995). *Pursuing social goals through participatory geographic information systems*. In J. Pickles (Ed.), Ground Truth: *The Social Implications of Geographic Information Systems* (pp. 196–222). New York: The Guilford Press.

Harris, T., & Weiner, D. (1998). Empowerment, marginalization and community integrated GIS. *Cartography and Geographic Information Systems*, 25(2), 67–76.

Herfort, B., Lautenbach, S., Porto de Albuquerque, J., et al. (2023). A spatio-temporal analysis investigating completeness and inequalities of global urban building data in OpenStreetMap. *Nature Communications*, 14, 3985. https://doi.org/10.1038/s41467-023-39698-6

Howe, J. (2008). *Crowdsourcing: Why the Power of the Crowd Is Driving the Future of Business*. New York: McGraw-Hill, pp. 401–408.

Iturralde-Vinent, M. (2009). *GeoCuba para todos: una cartografía partecipativa para la gestión del territorio*. La Habana: Editorial Academia.

Jankowski, P. (2011). Designing public participation geographic information systems. In T. Nyerges, H. Couclelis, & R. McMaster (Eds.), *The SAGE Handbook of GIS and Society* (pp. 347–360). London: SAGE. https://doi.org/10.4135/9781446201046.n18

Jeleński, T. (2018). Review practices of built heritage post-disaster reconstruction for resilient cities. *Buildings*, 8(4), 53. https://doi.org/10.3390/buildings8040053

Kienberger S. (2014) "Participatory mapping of flood hazard risk in Munamicua, District of Búzi, Mozambique", *Journal of Maps*, 10(2).

Lefebvre H. (1968). *La droit à la ville*. Antrhopos, Parigi

Lewis, G. M. (Ed.). (1998). *Cartographic Encounters: Perspectives on Native American Mapmaking and Map Use*. Chicago: University of Chicago Press.

Leszczynski, A. (2011). Situating the geoweb in political economy. *Progress in Human Geography*, 36(1), 72-89. https://doi.org/10.1177/0309132511411231

Listerborn, C. (2023). Who is telling the smart city story? Feminist diffractions of smart cities. In *Digital (in)justice in the smart city* (1st ed., pp. 39–52).

Lynch, K. (1960). *The Image of the City*. Cambridge, MA: MIT Press.

Lynch, K. (1980). *Good City Form.* Cambridge, MA: MIT Press.Peluso, N. L. (1995). Whose woods are these? Counter-mapping forest territories in Kalimantan, Indonesia. *Antipode*, 27(4), 383–406.

Lussault, M. (2007). *L'homme spatial : la construction sociale de l'espace humain*. Paris : Éditions du Seuil.

MacKinnon, D., Burns, R., & Fast, V. (2023). *Digital (in)justice in the smart city.* Toronto: University of Toronto Press.

Mouton, M., & Burns, R. (2021). (Digital) neo-colonialism in the smart city. *Regional Studies*, 55(12), 1890–1901. https://doi.org/10.1080/00343404.2021.1915974

Peluso, N. L. (1995). Whose woods are these? Counter-mapping forest territories in Kalimantan, Indonesia. *Antipode*, 27(4), 383–406. https://doi.org/10.1111/j.1467-8330.1995.tb00286.x

Picone, M. (2012). Scienze sociali e progetto di territorio. In F. Schilleci (a cura di), *Ambiente ed ecologia. Per una nuova visone del progetto territoriale* (pp. 119-135). Milano : FrancoAngeli.

Picone, M., & Piccolo, F. (2014). Ethical e-participation: Reasons for introducing a "qualitative turn" for PPGIS. *International Journal of E-Planning Research*, 3, 57–78. https://doi.org/10.4018/ijepr.2014100104

Radcliffe, S. A. (2017). Decolonising geographical knowledges. *Transactions of the Institute of British Geographers*, 42(3), 329–333. https://doi.org/10.1111/tran.12195

Rambaldi, G., Chambers, R., McCall, M., & Fox, J. (2006). Mapping for change: The emergence of a new practice. *Participatory Learning and Action*, 54(1), 13–19.

Rambaldi, G., Corbett, J., Olson, R., Muchemi, J., Kyem, P., Weiner, D., & Chambers, R. (Eds.). (2006). PLA 54: Mapping for change: Practice, technologies and communication. IIED. https://www.iied.org/14507iied

Ratti, C., & Claudel, M. (2017). *La città di domani: Sempre più smart, trasformata dai progressi della tecnologia e dalla diffusione delle reti.* Torino: Einaudi.

Roche, S. (2010). Leggere e scrivere la carta sull'onda del Geoweb. In S. Roche & G. Zamboni (Eds.), *Sfide cartografiche. Movimento, partecipazione, rischio*. Il lavoro editoirale/Università, Ancona (pp. 47–61).

Rosol, M., & Blue, G. (2022). From the smart city to urban justice in a digital age. *City*, 26(4), 684–705. https://doi.org/10.1080/13604813.2022.2079881

Strengers, Y., & Nicholls, L. (2017). Aesthetic pleasures and gendered tech-work in the 21st-century smart home. Media International Australia, 166(1), 70–80.
https://journals.sagepub.com/doi/10.1177/1329878X17737661

Sui, D., Goodchild, M., & Elwood, S. (2013). Volunteered geographic information, the exaflood, and the growing digital divide. In D. Sui, S. Elwood, & M. Goodchild (Eds.), *Crowdsourcing Geographic Knowledge* (pp. 1–14). Dordrecht: Springer. https://doi.org/10.1007/978-94-007-4587-2_1

Talen, E. (2000). Bottom-Up GIS: A New Tool for Individual and Group Expression in Participatory Planning. *Journal of the American Planning Association*, 66(3), 279–294. https://doi.org/10.1080/01944360008976107

Turchi, P. (2004). *Maps of the Imagination: The Writer as Cartographer*. Trinity University Press

Turco, A. (1986). *Geografie della complessità in Africa: interpretando il Senegal*. Milano: Unicopli. ISBN 88-400-0041-0.

Turner, A. (2006). *Introduction to Neogeography*. O'Reilly.

UNESCO. (2003). *Convention for the safeguarding of the intangible cultural heritage.* https://ich.unesco.org/en/convention

Viitanen, J., & Kingston, R. (2014). Smart cities and green growth: Outsourcing democratic and environmental resilience to the global technology sector. *Environment and Planning A: Economy and Space*, 46(4), 803–819. https://doi.org/10.1068/a46242

Wood, D. (1992). *The power of maps.* New York: Guilford Press.

Woodward, D., & Lewis, G. M. (Eds.). (1998). *Cartography in the Traditional African, American, Arctic, Australian, and Pacific Societies* (Vol. 2, Book 3). Chicago: University of Chicago Press. ISBN 978-0226907284.

WEB REFERENCES

Mason, B. (2018, November 16). *Why your mental map of the world is (probably) wrong*. National Geographic Education. Retrieved from https://education.nationalgeographic.org/resource/why-your-mental-map-world-probably-wrong/

Chapter 4 - The networks that are changing territorial planning

Abstract: Chapter 4 represents a key step in the progression of this study. After having introduced the conceptual and methodological foundations of PGIS, the analysis now turns to the regulatory framework within which participatory mapping practices may be situated. The aim is to investigate the extent to which existing legal provisions—at international, European, national and regional levels—can provide an enabling environment for the application of the PGIS method. Particular attention is devoted to identifying those aspects of the regulatory framework that not only recognize but also actively encourage public participation, transparency, and access to spatial information. By examining these legal contexts, the study seeks to highlight where PGIS can most effectively operate as a tool for strengthening participatory decision-making processes. After discussing the theoretical and regulatory premises, the chapter focuses on concrete experiences and on the analysis of how the PGIS has been integrated into the regulatory frameworks of different contexts, with a focus on Italy, some of its regions, and international examples.

*keywords: PPGIS, t*erritorial governance, urban planning, landscape and risk management

Introduction

Territorial governance is establishing itself as an approach to managing the complexity of territories through cooperation between public and private actors, with participation as its guiding principle. This chapter explores how participatory cartography, from a simple technical tool, can evolve into a governance device capable of integrating pluralistic knowledge and guiding the sustainable development of the territory. Through the analysis of various applications in Italy and abroad, ranging from urban planning to risk management, it highlights how the use of digital platforms and participatory methodologies (such as mind maps) is transforming the role of citizens from mere recipients to co-creators of the planning process.

4.1 PPGIS, Public Participation GIS

The issue of PGIS standardisation and participatory mapping lies at the intersection of planning theory, national and regional legislation, and European and international regulatory references.

The participatory model, which is based on the involvement of local communities in land management and decision-making processes, includes local administrations. Although the distinction between Public Participation GIS (PPGIS) and Participatory GIS (PGIS) concerns only the geographical context or methodological approach, it reflects deeper transformations in the way territorial planning is conceived.
PPGIS, developed in countries in the global North since the 1990s, was created with the aim of integrating citizen participation into institutional planning processes. Its primary function is to make decision-making processes more transparent and inclusive, especially in urban and metropolitan areas (Talen, 2000). From this perspective, GIS becomes a technical support for urban planning, transport and service management, while remaining anchored to a structured, top-down vision of spatial planning. Citizen-participants are involved in the decision-making process, but largely according to parameters established by public institutions.
PGIS, which developed in parallel in countries of the Global South in contexts of international cooperation and natural resource management (Rambaldi et al., 2006), introduces a different perspective: that of valuing local knowledge and forms of indigenous knowledge. Here, GIS is not only a technical representation tool, but becomes part of a community empowerment process aimed at strengthening the capacity of local populations to influence decisions affecting their territories. The result is a less rigid model of territorial planning, more attentive to social and cultural dimensions, which goes beyond the traditional planning logic based solely on quantitative data and forecasting models.
The conceptual shift from PPGIS to PGIS therefore marks an evolution from planning as an exercise in technical and administrative rationality towards an approach that integrates discursive practices, negotiations and bottom-up dynamics. This implies not only a change in methodologies (mental maps, participatory interviews, use of digital media), but also an epistemological rethinking: the territory is no longer seen as a neutral container of spatial data, but as the product of social, cultural and political relations. In this sense, participatory cartography acts as a bridge between structured planning models and new, more flexible and inclusive practices of territorial governance. Its potential is not limited to the collection of geographical information, but lies in its ability to generate collaborative processes, legitimise plural knowledge and redefine the very boundaries of public action.

In a political and administrative context influenced by globalisation, territorial governance is a means of organising and coordinating public and private actors, with flexible and voluntary participation, aimed at defining a shared vision of the territory and its development. It is implemented through contractual and negotiating instruments, such as inter-institutional cooperation (e.g. inter-municipal cooperation in France, agreements between municipalities in Italy) and public-private partnerships. In the 1980s, the World Bank introduced the principle of “good governance” for investments in developing countries, based on criteria of transparency, efficiency and democracy. The UN Summit in Rio de Janeiro (1992) reaffirmed participation as a cornerstone of sustainable development (principle no. 10 of the Rio Declaration) and Agenda 21 recommended participatory

environmental policies. Within the EU, the European Constitution (2004) and the Treaty of Lisbon (2009) enshrined the principle of participatory democracy in Article I-47; Regulation (EU) No 211/2011 governs European citizens' initiatives. In the environmental field, the Aalborg Charter (1994) promoted the local implementation of Agenda 21; the Aarhus Convention (1998) enshrined the right of citizens to access information, participate in decision-making processes and environmental justice; the SEA Directive (2001) regulated strategic environmental assessment; and the European Landscape Convention (2000) recognised the role of communities in the perception and planning of the landscape. The access to environmental information is a legitimate right that is protected by numerous national conventions, acts, and laws. The Aarhus Convention on access to information, public engagement, and the application of environmental justice, however, is unquestionably the text that enshrines the right to environmental information at the level of international law. The declaration was ratified by the Italian Republic with Law No. 108 of the 16th March 2001. The Aarhus Convention's response to promoting enhanced accountability of decision-makers is that public procedural rights could foster more familiarity with formal and informal democratic processes and a higher awareness of civic responsibility. However, an analysis of European policies shows that, despite favourable declarations of principle, participation takes two main forms: financial support and the promotion of information, the latter corresponding only to the initial phase of participatory processes.

4.1.1 Urban Planning as a Space for PGIS

In the previous chapter (section 3.3), we discussed mental maps as a primordial (and innate) mapping activity that helps us achieve full spatial awareness. During my experience at Al Akhawayn University in Ifrane (AUI) in Morocco (June-July 2025), within the framework of Prof. Eric Ross's Geography course, I held a workshop on cognitive mapping with 22 students, inspired by Kevin Lynch's theory. The assignment consisted of drawing a mental map of their campus, applying at least three of the five elements identified by Lynch (paths, edges, districts, nodes, landmarks) and using different colours to distinguish them. The aim was to represent not so much geometric precision as the personal and subjective experience of the campus spaces, through symbols, annotations and a legend that reflected individual perception. The results of this workshop were collected and attached as an anthological appendix to my thesis (Annex 1). I report on this brief experience as a fundamental part of my research journey to reconnect with the concept of participatory urban planning which, if participatory cartography is to be used as a bottom-up methodology, must in any case start from a relationship, an open space for discussion and a mental map. This is because mental maps represent a preliminary and interpretative phase: they provide the basis for understanding local perceptions and for building territorial information systems that are more closely aligned with people's lived experiences. It is no coincidence that, in participatory cartography and collaborative urban planning projects, mental map workshops are often used as an initial tool, from which to proceed to digitisation and

analysis using GIS. Indeed, there are numerous fields of application for mental maps: from urban planning and citizen perception to migration studies, from the analysis of risk zones and safety perception to transport and route representation.

The flexibility of urban planning provides fertile ground for the application of PGIS: this stems from its protean nature, i.e. its ability to adapt to multiple forms and contexts, and from its «multiplicity, from the need to be able to interact with contexts » (Carta, 2003). This multiplicity implies that planning must be flexible and open to dialogue with the cultural, social and environmental specificities of the place where it is applied. Planning is an interactive practice, capable of incorporating heterogeneous and often conflicting elements to respond to complex and constantly changing needs.

According to Carta (2003), the role of the planner is becoming increasingly central to urban planning processes, because residents feel the need to personally present their experiences and perceptions in urban planning processes. It is well known that Herbert Gans and Kevin Lynch began to use residents' predictions and interpretations as fundamental elements of analysis, paving the way for the recognition of tacit residential knowledge in design processes. In his manifesto book The Image of the City (1960), Lynch proposes a systematisation of observation, outlining for the first time the dimensions of the urban image in terms of routes, districts, nodes and signs of the cityscape[60]. His influence has been lasting, not only in the style of planners, but also in research and training in environmental psychology studies, thanks to the provision of a system capable of codifying the complex multiplicity of the sensitive elements of urban life. In Italy, the first theorisations and experiments in participatory planning date back to the 1950s, within Adriano Olivetti's community movement. In Sicily, in the early 1960s, a strong desire for liberation emerged, expressed through the need for bottom-up planning that was not only a response to the demand for participation, but also a need to enhance local resources, especially human resources. Planning thus became a democratic and non-violent response to the culture of violence and mafia oppression (Leone, 1995). The stated aim of these experiences of democratic planning in Sicily was, in fact, to train new experts – not only urban planners – capable of dialoguing and working with the population to transform the territories through “democratic, organic and non-violent” planning processes (Dolci, 1969).

The Guidelines of the Piano Territoriale Paesistico Regionale (PTPR) of the Regione Sicilia were approved with D.A. of 21/05/1999. The plan derives from legge 431/85, «la quale dispone che le Regioni sottopongano il loro territorio a specifica normativa d’uso e

[60] Actually, the main precursor of participatory planning is considered to be Patrick Geddes (1854-1932), who devoted much attention to the social aspect of planning. In fact, the origins of action research and participation in the urban sphere could easily be linked to the Chicago School and its participant observation methods (Parker, 2006 as cited in Picone).

valorizzazione ambientale, mediante la redazione di Piani Paesistici o di piani urbanistico territoriali con valenza paesistica»[61] (Picone, 2012).

Maurizio Carta, in his book Governare l'evoluzione (Carta, 2009), distinguishes between different levels of planning in which the participatory process can be incorporated as a cross-cutting tool. From this perspective, the PGIS is not only a technical support for the analytical phase, but also becomes a regulatory device capable of guiding the construction of shared rules, thus acting as a cornerstone of territorial governance. According to Carta (2009), the plan is above all a cultural and dynamic tool that serves to govern the evolution of the planning process. It is a powerful producer of knowledge, interpretation, and diagnosis of the territory and the settled community, a device capable of highlighting resources and opportunities, but also the risks of deception. The plan is not a neutral instrument: it is an agent of transformation, a tool that must guide political decisions and not simply serve them. The dual nature that fuels the urban planning regulatory framework in Italy, on the one hand, recognizes the essential nature of the conservation of cultural and environmental heritage based on Article 9 of the Constitution: cultural heritage, landscape, and environmental qualities are values and must form a system with all other components of development, acting creatively and becoming generators of images of the world and cultural codifiers. The most mature international experiences, such as the English one, show us the path of co-construction of a preliminary, collective, and participatory clarification of cultural and environmental values. Consider, for example, the Landscape Character Assessment experience and, more recently, the new French urban planning code, which integrates landscape into the planning process as a structural component of decision-making. Starting with the reorganization of intermediate local authorities, the Province has been given new responsibilities for programming, territorial planning, and landscape protection, as part of the creation of an essential strategic plan for the Mediterranean. This plan will guide the definition of convergence policies toward common development objectives for the Mediterranean region, based on the balanced and competitive use of local resources and the definition of a common territorial policy.

4.1.2 Community Involvement in Landscape and Risk Management

The concept of "landscape governance," referring to the shared and inclusive management of landscapes, also recognizes the plurality of values, knowledge, and interests of the various communities involved. This approach, which aims to develop long-term visions for the territory and offers a theoretical and practical framework that can be applied effectively in urban planning, integrating environmental, social, and economic aspects, could be aligned with strategic planning[62].

[61] Regione Siciliana – Assessorato dei Beni Culturali Ambientali e della Pubblica Istruzione, 1999, p. 8

[62] The concept of "landscape governance" stems from a scientific approach introduced by Noss (1983) with the aim of holistically addressing the conservation of regional diversity (Reed et al. 2020). Subsequently, Görg (2007) was the first to frame this approach as "landscape governance" (Ros-Tonen, Willemen, & McCall, 2021).

In Italy, to consider the concept of landscape heritage, we must reflect on the methods and tools for interpreting heritage used in regional landscape plans, developed following the approval of "Il codice dei beni culturali e del paesaggio" (2004)[63]. Specifically, the Code promotes the development of regional landscape plans, which include, in their statutory part, a process for identifying regional territorial heritage based on two main, synergistic methodologies: geographical-historical analysis and community involvement. The regional landscape plan is therefore a document that encompasses, on the one hand, a system of complex knowledge relating to the entire regional heritage, and, on the other, provides guidelines for territorial planning, directives, and usage requirements for the management of landscape assets. The Cultural Heritage Code, also in light of the European Landscape Convention[64], promotes a heritage-based and participatory approach to land management and planning tools for developing regional landscape plans, among which community maps stand out. Community maps, created within the context of Apulian eco-museums and developed in their regional landscape plan[65], have been adopted as a tool for raising awareness of place, through the participation of residents in the construction of rich representations of territorial and landscape heritage values. In Sicily, Regional Law 19/2020[66] on land management (Norme per il governo del territorio) explicitly regulates the use of mapping and geographic information systems, establishing that planning must make use of regional geographic databases, some of which are open and some of which are confidential, thus recognising the value of geographic data as a regulated public good[67].

[63] Italia, 2024. The Italian code was adopted with Legislative Decree no. 42 of January 22, 2004, implementing Article 10 of Law no. 137 of July 6, 2002. This code represents the fundamental legislation for the protection and enhancement of Italy's cultural and landscape heritage.

[64] Council of Europe. (2000). European Landscape Convention (ETS No. 176). Florence, 20 October 2000. Retrieved from https://www.coe.int/en/web/landscape

[65] The PPTR is the *piano paesaggistico regionale* of Puglia, regulated pursuant to Articles 135 and 143 of *D.lgs. 22 gennaio 2004, n. 42 – Codice dei beni culturali e del paesaggio*, as well as Article 1 of *Legge Regionale 7 ottobre 2009, n. 20 – Norme per la pianificazione paesaggistica*.

[66] In Sicily, the PTR is currently being developed and was introduced and regulated by Regional Law No. 19 of 13 August 2020. This law replaced previous urban planning legislation dating back to a 1978 law, indicating a long interval between the two legislative initiatives. The current PTR is a new planning tool, whereas in the past, land management in Sicily was previously managed through other plans. The text makes explicit reference to participation in Article 6. Article 6, entitled "Participation", of Sicilian Regional Law No. 19 of 13 August 2020 (which regulates the Regional Territorial Plan with landscape value, PTR), states: "Nell'ambito della formazione dei piani è garantita la partecipazione a tutti i soggetti pubblici e privati nonché alle associazioni e organizzazioni, siano essi persone fisiche o giuridiche, attraverso l'ascolto attivo delle esigenze, il dibattito pubblico sugli obiettivi generali, la più ampia pubblicità degli atti e dei documenti di pianificazione, la possibilità di presentare osservazioni e proposte di modifica, assicurando il tempestivo e adeguato esame delle relative deduzioni tramite l'accoglimento o il non accoglimento motivato delle stesse." (Art.6, comma 1).

[67] Art. 14, Legge Regionale 19/20 explicitly establishes the mandatory use of the SITR (Sistema Informativo Territoriale Regionale, an informatic and cartographic platform that collects, manages, and makes available the official geographic databases of the Regione Siciliana) in the drafting of the PTR, integrating the Plan with a regional geographic information base. It « promuove la formazione e l'aggiornamento di banche dati geografiche condivise anche a livello comunale, attraverso la ricerca, lo sviluppo e la divulgazione di

Other regions, such as Tuscany and Emilia-Romagna, have also introduced public participation tools into their regulations that involve the use of collaborative mapping techniques and digital platforms (Tuscany Region, 2007; Emilia-Romagna Region, 2010), see paragraph 4.2).

At European level, the INSPIRE Directive (2007/2/EC)[68] provided the legal and technical framework to ensure interoperability and sharing of spatial data between Member States, laying the foundations for open information systems that are also accessible to citizens and local communities. Although not originally conceived as a participatory tool, it has made it possible to use geographical data in a collaborative and transparent manner. Even more explicit is the European Landscape Convention (Council of Europe, 2000), signed in Florence, which recognises the landscape as a common good and establishes the need for citizen involvement in spatial planning and management processes (see paragraph 4.2).

With regard to civil protection planning, it should be noted that the 2018 Civil Protection Code and the subsequent 2021 Council of Ministers Directive on Plans strongly reiterate the importance of adopting an approach that actively involves the population, promoting the use of participatory techniques for the drafting and revision of civil protection plans.

The first significant experience in this regard was carried out in 2012, as part of a cross-border Interreg project in the municipality of Quiliano[69], a small town on the western Ligurian Riviera, in the province of Savona, with approximately 7,000 inhabitants, 38% of whom live in flood-prone areas. This area was hit by a major flood in 1992. On the twentieth anniversary of the event, the municipal emergency plan was revised through the participatory process “Prevenzione Comune”.
Another example comes from the Municipality of Livorno, which has launched the “Proattiviamoci” project, coordinated by the Socialab cooperative, aimed at promoting community participation and involvement in civil protection planning through activities to strengthen key figures in the local community. These key figures were identified in the district councils, decentralised participatory bodies established in 2023 by the Municipality of Livorno. In particular, the group of facilitators involved in the project is working in the most affected district councils by the floods.

metodologie unificate per garantire principi, concetti e linguaggi comuni, favorendo in tal modo l'integrazione tra i diversi sistemi di informazioni, sia allo stesso livello di pianificazione che tra livelli diversi» (Art. 14, comma 3c). Furthermore the SITR «garantisce l'accesso, da parte di chiunque, ai dati ufficiali del SITR e ne facilita la consultazione e la divulgazione attraverso la pubblicazione sul sito dell'Assessorato regionale del territorio e dell'ambiente» (Art. 14, comma 6f).

[68] This document provides the legal framework for the establishment of an Infrastructure for Spatial Information in the European Community, detailing the requirements for spatial data sets, metadata, and spatial data services.

[69] These two case studies (Quiliano and Livorno) are taken from Valentina De Santi's contribution from the University of Turin, entitled ‘Territorial planning and risk management: reflections based on the participatory process of the Livorno civil protection plan’, which was presented as part of the study seminars ‘Mappe ribelli. Cartografis per la pace’ organised by the Universities of Parma and Siena. The seminar took place on 28 and 29 May 2025 and addressed issues related to community participation and spatial planning.

Within this project, the contribution of the CIMA group[70] has been fundamental and has taken two directions: on the one hand, the integration of planning tools, and on the other, the strengthening of community involvement with the aim of structuring a participatory process of mapping exposures. This process is still in its early stages and has not yet been fully implemented, but it is taking shape with the ambition of involving both institutional actors and, thanks to the activation of local councils, a significant portion of the citizenry.
The first phase of the project involved conducting semi-structured interviews aimed at exploring the relationship between risk, civil protection and heritage through discussions with a number of technical and institutional actors involved in local government. Those interviewed included urban planning managers, representatives from the planning, management and implementation office, and managers from the municipal civil protection office. The main objective of the project was to experiment with ways of actively involving local communities in defining prevention and emergency management strategies. The participatory drafting of the plan involved, among other things, the construction of an updated risk scenario, also based on the indications that emerged from the participants in the process.
From the analysis of case studies presented during the 'Mappe Ribelli' seminar at the University of Siena, it appears that Liguria (where Quiliano is located) has an updated Regional Landscape Plan, which also enhances everyday landscapes and identities, not just the 'classic' ones. Furthermore, it supports public participation in decision-making processes, including through funds and calls for proposals. Tuscany is also very active in the field of participatory civil protection. It has promoted projects such as "Proattiviamoci!", cited by De Santi, funded by the Region to experiment with new approaches to risk, involving citizens in the development of emergency plans. Here, moreover, there is integration between spatial planning and risk management, in line with the Civil Protection Code.

4.2 From Principles to Practices: PGIS in Italy

Apart form the regional planning and risk management, in the Italian context civic participation finds its first legal basis in Article 3 of the Constitution, which entrusts the Republic with the task of «rimuovere gli ostacoli di ordine economico e sociale che, limitando di fatto la libertà e l'uguaglianza dei cittadini, impediscono il pieno sviluppo della persona umana e l'effettiva partecipazione di tutti i lavoratori all'organizzazione politica, economica e sociale del Paese». Another fundamental regulatory reference is the Consolidated Law on Local Authorities (Legislative Decree 267/2000), which identifies

[70] The **Fondazione CIMA** is a research organisation specialised in disaster risk mitigation. Its activities focus on the forecasting, prevention, and study of risks related to climate change, such as floods, wildfires, droughts, and biodiversity loss. Since 2018, the Fondazione has been recognised as an operational structure of the **Servizio Nazionale di Protezione Civile**, and it collaborates consistently with the **Dipartimento della Protezione Civile**.

municipalities and their territorial divisions (hamlets and neighbourhoods) as the privileged places for giving concrete form to participatory processes[71].

At the regional level, the main instruments through which the orientation towards participation is manifested are the statutes. To date, only two regions, Tuscany and Emilia-Romagna, have adopted comprehensive legislation on the subject: respectively with Regional Law No. 69 of 27 December 2007[72] and Regional Law No. 3 of 9 February 2010[73]. However, this law has been updated several times: in particular with Regional Law 46/2013 which established the Regional Authority for the guarantee and promotion of participation, strengthening the tools of participatory democracy. In Puglia, Regional Law No. 28/2017 was approved, establishing participation as a right and duty of Apulian citizens.

The Tuscan experience is particularly significant: the region has taken part in initiatives supported by the European Union to strengthen citizen involvement. In 2008, it joined the IDEAL-EU project, which was born out of cooperation with the French region of Poitou-Charentes and the Autonomous Community of Catalonia. The aim was to support the European Parliament's initiatives to raise awareness of climate change through a social networking platform that would enable the dissemination of thematic information and the preparation of deliberative debates. Thanks to this tool, citizens and stakeholders were able to "discuss, vote and make recommendations to policy makers".

The Emilia-Romagna Region, for its part, stands out for its innovative communication approach: the home page of the institutional portal features a special section dedicated to participation, accompanied by two major digital initiatives. The first is a channel called "Democracy", created to "inform, support and consult citizens"; the second is a regional observatory of participation, built on an interactive map (Google Maps), which allows users to view the territorial distribution of initiatives accompanied by detailed information sheets drawn up thanks to reports from the promoters themselves.

The Italian landscape has been the subject of in-depth analyses, including those conducted by the OECD (2002) and the Department of Public Administration of the Presidency of the Council of Ministers (Bobbio 2004, 2007, as cited in Burini 2018). These studies have led to the drafting of operational manuals aimed at providing administrators with tools and methodologies for undertaking participatory processes, divided into three main levels (Burini, 2018):

i. information and communication, through public relations offices, institutional websites, territorial information systems and periodical publications;

[71] In particular, Article 8, paragraph 1, establishes that «i comuni, anche su base di quartiere o di frazione, valorizzano le libere forme associative e promuovono organismi di partecipazione popolare all'amministrazione locale; i rapporti con tali forme associative sono disciplinati dallo statuto».

[72] Regione Toscana. (2007, 27 dicembre). This law establishes the "Rules for the Promotion of Participation in the Development of Regional and Local Policies," recognizing participation as a citizen's right and promoting forms and tools of democratic participation.

[73] Regione Emilia- Romagna (2010, 9 febbraio). According to Emilia-Romagna Regional Law No. 3/2010 (Emilia-Romagna Region, 2010), citizen participation is promoted as a fundamental right in the development of regional and local policies.

ii. consultation and inclusive planning, through tools such as listening, interviews, forums, social round tables, consultative committees, focus groups, neighbourhood walks, or Open Space Technology (OST), which is a model developed by the American anthropologist Owen, planning for real, programme agreements, territorial pacts and concerted policies for local development, integrated territorial projects, area contracts, and zone plans for social services;
iii. active participation, based on shared actions such as citizens' juries[74] and participatory budgeting[75].
This framework also includes e-participation, i.e. the participation of citizens in public administration activities through Information and Communication Technologies (ICT). It represents a qualifying element capable of strengthening inclusive decision-making processes (Rocca, 2010, as cited in Burini 2018) . The emergence of Web 2.0 has made it possible to take a further step in this direction, supported also by legal instruments. Particularly relevant in this regard is Legislative Decree No. 235 of 30 December 2010, which amended the Digital Administration Code, establishing "the right to use communication technologies with the administration and the right of citizens to participate in administrative proceedings", effectively recognising the importance of civic involvement in political and administrative processes. Legislative Decree No. 150 of 27 October 2009, which focuses on optimising public sector productivity and improving efficiency and transparency, is also a significant regulatory reference point.
Beyond the aforementioned regions, there are other Italian regions that have introduced norms and instruments on participation and participatory democracy, such as Umbria (with Legge regionale 14 febbraio 2010, n. 3: *Norme per la promozione e il sostegno della cittadinanza attiva e dei processi partecipativi*), which introduces instruments of public consultation and participation in regional and local decision-making processes; Lazio with Legge regionale 28 ottobre 2019, n. 10: *Disposizioni per la promozione dei processi partecipativi nei processi decisionali regionali e locali*, which aims to structure participation as an ordinary method of regional governance; and Sardegna with Legge regionale 20 settembre 2017, n. 5: *Norme sulla promozione della partecipazione popolare nella formazione delle politiche regionali e locali.* For an overview, please refer to Table 1.

[74] Citizens' juries were conceived by Ned Crosby in 1974 at the Jefferson Center in St. Paul (Minnesota).

[75] Participatory budgeting was introduced in Porto Alegre, Brazil, in the early 1990s. The latter is a genuine instrument of direct democracy, born out of the need to make citizens protagonists in decisions relating to the allocation of resources.

Region	Law / Reference	Year	Participation Description	Digital Tools / Platforms	Explicit mention of mapping / GIS
Lazio	Regional Law No. 10/2019	2019	Regulation of citizen participation in regional policies	Yes, digital platforms for consultations	No explicit mention
Puglia	Regional Law No. 28/2017	2017	Participation as a right and duty of Apulian citizens; tools for participatory democracy	Yes, emphasis on ICT and digital platforms for citizen engagement	No explicit mention
Tuscany	Regional Law No. 69/2007; Regional Law No. 46/2013	2007 / 2013	Promotion of participation in regional and local policies; recognition of participation as a right	Yes, through digital platforms for proposals and consultations	No explicit mention
Umbria	Regional Law No. 14/2010	2010	Promotion of citizen participation in policy-making processes	General reference to use of ICT	No explicit mention
Emilia-Romagna	Regional Law No. 3/2010	2010	Promotion of citizen participation as a fundamental right; support for participatory processes	Yes, creation of a regional Observatory on Participation and online platforms	No explicit mention
Sicily	No specific participation law; relies on statutes and territorial planning tools (e.g., PTPR Guidelines 1999)	—	Participation mainly embedded in planning and heritage protection processes	Limited to planning procedures	No explicit mention

Table 1- Comparative Table of Regional Participation Laws in Italy

As can be seen from Table 1, all laws refer to forms of civic participation and digital tools, but none explicitly mention participatory mapping or PGIS. It can therefore be deduced

that the use of participatory mapping in Italy is currently experimental or operational, promoted through online platforms, municipal WebGIS or university research projects, but not codified in law.
A comparison of regional regulatory frameworks shows that Tuscany and Emilia-Romagna are the most advanced regions in the use of digital platforms for territorial participation, which could integrate participatory mapping tools in the future.

Within the mentioned regulatory framework, some Regions have begun to recognize the value of the PGIS:

Emilia-Romagna Region: through the Regional Territorial Plan, it has promoted digital territorial participation projects that use GIS tools to involve citizens in urban planning decisions, even without specific legislation dedicated to PGIS[76]. There is a cultural and territorial WebGIS portal[77] of the Region, which allows citizens and professionals to view and report data on cultural and environmental heritage, actively contributing to the platform. The system allows the submission of reports that enrich the regional database. Furthermore, through the PartecipAzioni platform[78] (Regional Digital Citizenship), a Citizen Science project has been launched to survey natural springs: citizens fill out a dedicated online form, attaching data, observations, or photographs of the identified springs. For springs, the report is validated by regional technicians and then published in the dedicated WebGIS.

Lombardy Region has experimented with PGIS applications in participatory planning processes for the governance of natural resources and the management of hydrogeological risk, integrating digital platforms for the collection of territorial data by local communities[79].

The Liguria Region, thanks to the collaboration with Wikimedia Italia, CAI (Club Alpino Italiano) and FIE (Federazione Italiana Escursionismo), has created the participatory

[76]Regional Territorial Plan (PTR) and digital participatory tools, source: the official website of the Emilia-Romagna Region and the documentation on the PTR:https://territorio.regione.emilia-romagna.it
Here you can also find e-participation and GIS projects for territorial planning:
https://www.patrimonioculturale-er.it/webgis

[77] https://geoportale.regione.emilia-romagna.it/applicazioni-gis/regione-emilia-romagna

[78] https://partecipazione.regione.emilia-romagna.it/news/normali/news-2025/la-piattaforma-partecipazioni-apre-uno-spazio-al-censimento-delle-sorgenti

[79] In Lombardy, in addition to the active community of local mappers registered on OpenStreetMap (OSM), significant experiences of collaborative use of free maps by local authorities are emerging. One notable example is the Lombardy Ecomuseum Network, which in 2020 launched a course together with Wikimedia Italia dedicated to the use of free licenses and participatory landscape documentation through OSM. These experiences demonstrate how the Lombardy region is adopting bottom-up approaches for shared common maps, enhancing cultural heritage.

mapping of the regional trail network (Alta Via dei Monti Liguri) using OSM as a shared database[80].

Accessible Padua represents a significant example of integrating PGIS into participatory urban planning processes. Projects such as Map4Youth, aimed at mapping abandoned spaces using the Geocitizen platform, and PEBA (Piano per l'eliminazione delle barriere architettoniche), based on the use of OpenStreetMap and the active involvement of citizens and associations, demonstrate how GIS technologies can be effectively used at the municipal level to collect georeferenced data, promote inclusion, and guide urban policies. These cases highlight the potential of participatory GIS in strengthening collaborative governance and diversity-sensitive territorial planning.
In Italy, several local authorities have experimented with the use of OpenStreetMap as a participatory tool: Milan, through the AMAT Agency in collaboration with Wikimedia Italia, has launched an agreement (2022-2023) to update data on cycling, urban accessibility, and the road network, organizing mapathons with residents and schools to map pedestrian and cycling infrastructure. The Municipality of Chiavari has promoted a pilot project together with Wikimedia Italia and the CIMA Foundation (Centro Internazionale in Monitoraggio Ambientale) to map the territory for hydrogeological risk management purposes, involving volunteers and the Civil Protection Department. Finally, in Cilento, some local communities have used OSM to map and document unofficially surveyed hiking trails, promoting sharing and collective stewardship of the territory.
Despite these examples, PGIS in Italy is still, let's say, in a preliminary phase in regulatory terms. The lack of clear and standardized guidelines limits its systematic implementation in urban and regional planning.

4.2.1 International experiences

In other countries, the integration of PGIS into regulatory frameworks is more consolidated:

United States
The United States offers significant examples through the United States Geological Survey (USGS)[81] and the National Park Service (NPS)[82], which have developed guidelines and

[80] According to a collaboration agreement between Wikimedia Italia and AMAT for data entry into OpenStreetMap.

[81] The United States Geological Survey (USGS) is a scientific agency of the U.S. federal government that provides impartial, up-to-date information on the health of our ecosystems and environment and natural hazards and rescources. https://www.usgs.gov

[82] Founded in 1916, the National Park Service (NPS) is an agency of the United States Department of the Interior responsible for managing and protecting national parks, historic monuments, natural areas, and federal historic sites. https://www.nps.gov

citizen science programmes in which participatory mapping is institutionalised, especially in relation to park management and emergencies (National Park Service, 2019).
In accordance with this regulation framework, numerous states and cities have adopted guidelines and regulations[83] which involve the use of PGIS platforms to involve the community in urban development plans, environmental management and emergency plans[84]. For example, the city of Portland, Oregon, uses PGIS systems for collaborative mapping that supports neighborhood planning and green resource management.

Australia: public participation in land-use planning is regulated at the state and local levels[85], with some specific programs adopting PGIS to facilitate the involvement of indigenous peoples and rural communities in territorial decisions.

South Africa: PGIS has been a fundamental tool to encourage the participation of marginalized communities in urban development processes, integrating traditional knowledge with GIS techniques in plans for the improvement of informal settlements[86].

[83] US EPA – Public Participation Guide, a guide that defines principles and best practices for public engagement in environmental decision-making. While it doesn't explicitly mention PGIS, it promotes the use of digital tools to map environmental issues and facilitate community participation.

[84] In the United States, several local communities and civic tech companies are using OpenStreetMap as a PGIS platform for participatory and public service projects. In Louisville, Kentucky, the city made urban data public and collaborated with the Civic Data Alliance and local volunteers to update OSM with house numbers and building outlines. This support supported the development of the Nearby Explorer app for the blind. During the State of the Map US 2023, the YouthMappers project (USAID-West Virginia University) has been presented as an example of open GIS training and use: students and locally identified communities collaborate to address real territorial needs using OSM. Furthermore, city projects in cities such as Chicago and Phoenix demonstrate micro-GIS initiatives.-Mapping to map pedestrian infrastructure, sidewalks, and unregistered public spaces: involving OSM volunteers to improve urban navigability and accessibility.

[85]At state level, laws such as the Planning and Environment Act 1987 (Victoria) provide the legal basis for planning schemes. ANZLIC (Australia & New Zealand Spatial Information Council) is the government's platform for the dissemination of geospatial information, capable of integrating and supporting PGIS platforms such as the Park Life Project and government platforms for urban simulation and emergency response (*NSW Digital Twin & NJCOP*). These examples demonstrate how the use of participatory GIS is concretely promoted at a public and systemic level, even though there is no legislation dedicated exclusively to PGIS.

[86]In South Africa there are several examples of government projects promoting PGIS: *MobiSAMCitizen Engagement via App,*A collaboration between universities, civil society, and local government for the MobiSAM project, created to actively involve citizens in digitally reporting service disruptions. Although not focused on GIS-based territorial mapping, it represents a model of digital public participation applied to local government; *Koffiekraal – Water Access Mapping*- a government project to improve access to water in rural areas. It uses participatory techniques integrated with GIS: local people provide spatialized data on water services, which is then analyzed within a GIS system to guide planning interventions. *Rangeland Management Vulindlela*: Government and research-supported initiative for participatory rangeland management. Local communities contribute to mapping ecological knowledge through PGIS, strengthening shared environmental governance.

In *India*, PGIS finds practical application especially at the local and state government levels, in rural planning, resource management, local mapping and public participation activities.[87].

Experience and literature show that the use of the PGIS methodology improves the quality of territorial decisions, facilitated by the use of qualitative GIS that allows for the integration of local and technical knowledge. Furthermore, there is greater transparency and legitimacy in decision-making processes, thanks to the strengthening of Social capital and a sense of belonging in communities are fostered. To date, there are a few widespread or consolidated cases of PGIS explicitly framed and regulated by national or regional laws. PGIS experiences around the world are mostly promoted by pilot projects, non-governmental initiatives, or integrated into broader planning tools without a specific regulatory framework dedicated to PGIS. Urban and regional planning regulations tend to regulate more traditional tools (Master Plans, urban plans, official GIS systems), while digital and geospatial participation are only partially integrated. The process of integrating PGIS into regulatory frameworks remains at an early stage and presents several challenges, such as the possibility of standardizing regulations that are incomplete and currently lack specific guidelines, limiting the diffusion of PGIS as a standardized tool. Another challenge will be training to ensure the effective inclusion of all stakeholders, and data quality management: a uniform tool is needed that defines clear rules regarding data validity and its use in participatory processes.

[87] Among these, *Gram Manchitra* And *mActionSoft* enable local authorities to map and monitor development projects in villages; the platform *Yuktdhara*, within the framework of the program *NREGA*, supports participatory planning of rural projects using geospatial data. Other experiences include collaborative urban mapping in Malkapur (Maharashtra) and Cuttack (Odisha), natural resource surveying in mountainous villages in Uttarakhand, and a WebGIS for lake management promoted by the state of Karnataka

Conclusions

As Gullo points out (2022), clear regulations provide the basis for participation: just as laws on the recovery of confiscated assets establish procedures, responsibilities and operating methods, participatory mapping also requires a regulatory framework that defines who can participate, how data are collected and managed, and what rights citizens have over shared information. Analysing the role of cohesion policies and the PNRR, Gullo points out that funding programmes and public policies can either encourage or hinder participation. Similarly, I believe that the availability of funds, digital tools and regulatory guidelines can facilitate the adoption of PGIS as a tool for urban or territorial governance. Just as the recovery of confiscated assets, regulated by precise rules, shows that a solid regulatory framework promotes transparency and allows citizens to understand and influence processes, even in participatory mapping, similar regulations can ensure that the geographical data collected is reliable, accessible and usable for shared public decisions. Citing Gullo's article, we can see an example of how regulatory definition is an essential prerequisite for structuring participation, applicable not only to the management of confiscated assets, but also to the use of digital tools such as PGIS to involve communities and citizens in territorial planning. Another example comes from the Labsus 2021 Report[88], which can be cited as an experience of how institutional regulations and guidelines are fundamental to structuring civic participation. This also applies to participatory mapping projects, where citizens, communities and institutions interact through digital tools to plan and manage the territory.

In conclusion, it can be reasonably stated that participatory mapping, although it began as an innovative and often experimental practice, and although it has not yet found a precise regulatory place in recent decades, is often used as a cross-cutting support for territorial plans (Carta, 2009), as a methodology applicable within the framework of national and regional laws (Italy, 2004; Sicilian Region, 2020). Participatory mapping could also be used as an operational consequence of European legislation on transparency and access to data (EU, 2007; Council of Europe, 2000), and as an institutionalised practice in various sectors at international level (USA, India, Australia and South Africa).

[88] Cariani et al. (2022), in the 2021 Labsus Report on the shared administration of common goods, analyse common goods management practices in Italy and highlight the fundamental role of clear rules and institutional tools in enabling citizen participation.

References

Burini, F. (2016). *Participatory mapping: Mapping for environmental and urban governance*. Milan: FrancoAngeli.

Cariani, D. et all (2022), *Rapporto Labsus 2021 sull'aministrazione condivisa dei beni comuni*, Fondazione Compagnia San Paolo, in labsus.org.

Burns, R. Rethinking big data in digital humanitarianism: practices, epistemologies, and social relations. *GeoJournal* 80, 477–490 (2015). https://doi.org/10.1007/s10708-014-9599-x

Cardullo, P. (2018, October 29). New paper published "Smart urbanism and smart citizenship" - The Programmable City. *The Programmable City*. https://progcity.maynoothuniversity.ie/author/pcardullo/

Carta, M. (2003). *Teorie della pianificazione: Questioni, paradigmi e progetto*. Palermo: Palumbo.

Carta, M. (2009). *Governare l'evoluzione: Principi, metodi e progetti per una urbanistica in azione*. Milano: Franco Angeli.

Casti, E. (2013). *Cartografia critica. Tal topos alla chora*. Milano: Guerini.

Casti, E. (2015). *Reflexive Cartography. A Modern Perspective in Mapping*. Amsterdam, Oxford, Waltham: Elsevier.

Chapin, M., Lamb, Z., & Threlkeld, B. (2005). Mapping Indigenous lands. *Annual Review of Anthropology*, 34, 619–638. https://doi.org/10.1146/annurev.anthro.34.081804.120429

Cope, M., & Elwood, S. (Eds.). (2009). *Qualitative GIS: A mixed methods approach*. London, UK: SAGE Publications.

Crawford, K., Finn, M. (2015). The limits of crisis data: analytical and ethical challenges of using social and mobile data to understand disasters. *GeoJournal* 80, 491–502 . https://doi.org/10.1007/s10708-014-9597-z

Elwood S. (2008). "Volunteered geographic information: Future research directions motivated by critical, participatory, and feminist GIS", *GeoJournal*, 72(3–4), 173–183.Görg, C. (2007). Landscape governance: The "politics of scale" and the "natural" conditions of places. *Geoforum*, 38(5), 954-966.

Elwood S. (2008). "Volunteered geographic information: Future research directions motivated by critical, participatory, and feminist GIS", *GeoJournal*, 72(3–4), 173–183.

Elwood, S., Goodchild, M. F., & Sui, D. (2013). Prospects for VGI research and the emerging fourth paradigm. In D. Sui, S. Elwood, & M. F. Goodchild (Eds.), Crowdsourcing geographic knowledge: Volunteered geographic information (VGI) in theory and practice (pp. 361–375). New York: Springer. doi: https://link.springer.com/chapter/10.1007/978-94-007-4587-2_20

Goodchild, M. F., & Glennon, J. A. (2010). Crowdsourcing geographic information for disaster response: A research frontier. *International Journal of Digital Earth*, 3(3), 231–241. https://doi.org/10.1080/17538941003759255

Goodchild, M. F., & Li, L. (2012). *Assuring the quality of volunteered geographic information. Spatial Statistics*, 1, 110–120. https://doi.org/10.1016/j.spasta.2012.03.002

Haklay, M. (2013). Citizen science and volunteered geographic information: Overview and typology of participation. In D. Sui, S. Elwood, & M. Goodchild (Eds.), *Crowdsourcing Geographic Knowledge: Volunteered Geographic Information (VGI) in Theory and Practice (*pp. 105–122). Dordrecht: Springer. https://doi.org/10.1007/978-94-007-4587-2_

Gullo, N. (2022). Il recupero dei beni confiscati tra restyling normativo e opportunità delle politiche di coesione e di attuazione del PNRR. *Istituzioni del federalismo: Rivista di studi giuridici e politici, XLIII(*1), 71–97. Soveria Mannelli: Rubbettino. http://digital.casalini.it/10.1400/290132

McCall, M. K. (2003). Seeking good governance in participatory-GIS: A review of processes and governance dimensions in applying GIS to participatory spatial planning. *Habitat International*, 27(4), 549–573. https://doi.org/10.1016/S0197-3975(03)00005-5

Noss, R. F. (1983). A regional landscape approach to maintain diversity. *BioScience*, 33(11), 700–706. https://doi.org/10.2307/1309350

OECD (2002) Organizzazione per la cooperazione e lo sviluppo economico (OECD). (2002). *Measuring the non-observed economy: A handbook.* OECD Publishing. https://doi.org/10.1787/9789264175358-en

Picone, M. (2012). Scienze sociali e progetto di territorio. In F. Schilleci (a cura di), *Ambiente ed ecologia. Per una nuova visone del progetto territoriale* (pp. 119-135). Milano : FrancoAngeli.

Reed, J., Ickowitz, A., Chervier, C., Djoudi, H., Moombe, K., Ros-Tonen, M., Yanou, M., Yuliani, L., & Sunderland, T. (2020). Integrated landscape approaches in the tropics: A brief stock-take. *Land Use Policy*, 99, 104822. https://doi.org/10.1016/j.landusepol.2020.104822

WEB REFERENCES

Regione Emilia-Romagna. (2025, 21 gennaio). *La piattaforma PartecipAzioni apre uno spazio al censimento delle sorgenti*. https://partecipazione.regione.emilia-romagna.it/news/normali/news-2025/la-piattaforma-partecipazioni-apre-uno-spazio-al-censimento-delle-sorgenti

Australian Urban Research Infrastructure Network (AURIN). (n.d.). Tools and documentation for public participation with GIS. Retrieved from https://aurin.org.au

Portland Maps. (n.d.). *Interactive GIS platform for community participation.* https://www.portland.gov/bts/cgis/portlandmaps
Public Participation GIS (PPGIS). (n.d.). Principles and practices. https://ppgis.net

Regione Emilia-Romagna. (n.d.). *Piano Territoriale Regionale (PTR) e strumenti digitali partecipativ*i. https://territorio.regione.emilia-romagna.it

Regione Emilia-Romagna. (n.d.). *Applicazioni GIS* – Regione Emilia-Romagna. https://geoportale.regione.emilia-romagna.it/applicazioni-gis/regione-emilia-romagna

Segretariato Regionale per l'Emilia-Romagna del Ministero della Cultura. (n.d.). *WebGIS del Patrimonio culturale.* https://www.patrimonioculturale-er.it/webgis/

United States Geological Survey. (n.d.). *U.S. Geological Survey.* U.S. Department of the Interior**.** https://www.usgs.gov

National Park Service. (n.d.). *National Park Service*. U.S. Department of the Interior. https://www.nps.gov

De Santi, V. (2025, maggio 28-29). *Pianificazione territoriale e gestione del rischio: Riflessioni a partire dal percorso partecipato del piano di protezione civile di Livorno*. Seminario Mappe Ribelli, Università di Parma e Università di Siena. Retrieved from https://www.unisi.it/sites/default/files/allegatiparagrafo/MAPPE%20RIBELLI%20-%2028%20%26%2029%20maggio.pdf

LEGAL REFERENCES

United Nations Economic Commission for Europe (UNECE). (1998, 25 June). *Convention on access to information, public participation in decision-making and access to justice in environmental matters* (Aarhus Convention). Treaty Series No. 2161. United Nations. https://unece.org/environment-policy/public-participation/aarhus-convention/text

European Parliament & Council of the European Union. (2007). *Directive 2007/2/EC establishing an Infrastructure for Spatial Information in the European Community (INSPIRE).* Official Journal of the European Union, L 108, 1–14. https://eur-lex.europa.eu/eli/dir/2007/2/oj/eng

Council of Europe. (2000). *European Landscape Convention* (ETS No. 176). Florence, 20 October 2000. Retrieved from https://www.coe.int/en/web/landscape

Presidency of the Council of Ministers. (2021). *Direttiva del Presidente del Consiglio dei Ministri del 30 aprile 2021 – Indirizzi per la predisposizione dei piani di protezione civile ai diversi livelli territoriali.*

Official Gazette of the Italian Republic, General Series No. 160, 6 July 2021. Retrieved from https://www.protezionecivile.gov.it/it/normativa/direttiva-del-30-aprile-2021-0/

Italia. (2018). *Decreto legislativo 2 gennaio 2018, n. 1 – Codice della protezione civile*. Official Gazette of the Italian Republic, General Series No. 17, 22 January 2018. Retrieved from https://www.protezionecivile.gov.it/it/normativa/decreto-legislativo-n-1-del-2-gennaio-2018--codice-della-protezione-civile/

Italia. (2010). Decreto Legislativo 30 dicembre 2010, n. 235. *Modifiche ed integrazioni al decreto legislativo 7 marzo 2005, n. 82, recante Codice dell'amministrazione digitale, a norma dell'articolo 33 della legge 18 giugno 2009*, n. 69. Gazzetta Ufficiale, Serie Generale, n. 303. https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:decreto.legislativo:2010-12-30;235!vig=

Italia. (2009, 27 ottobre). Decreto Legislativo n. 150: *Attuazione della legge 4 marzo 2009, n. 15, in materia di ottimizzazione della produttività del lavoro pubblico e di efficienza e trasparenza delle pubbliche amministrazioni*. Gazzetta Ufficiale n. 254 del 31 ottobre 2009. https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:decreto.legislativo:2009-10-27;150

Italia. (2004). *Codice dei beni culturali e del paesaggio, ai sensi dell'articolo 10 della legge 6 luglio 2002, n. 137* (Decreto legislativo 22 gennaio 2004, n. 42). Gazzetta Ufficiale della Repubblica Italiana. https://www.gazzettaufficiale.it/dettaglio/codici/beniCulturali?utm

Italia. (2000). Decreto legislativo 18 agosto 2000, n. 267 – *Testo unico delle leggi sull'ordinamento degli enti locali.* Gazzetta Ufficiale della Repubblica Italiana, Serie Generale n. 227 del 28 settembre 2000. Estratto da https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:decreto.legislativo:2000-08-18;267=

Regione Siciliana. (2020). *Legge regionale 13 agosto 2020, n. 19: Norme per il governo del territorio.* Gazzetta Ufficiale della Regione Siciliana, 19 agosto 2020, n. 37. https://w3.ars.sicilia.it/lex/L_2020_019.htm

Regione Puglia. (2017, 13 luglio). *Legge regionale n. 28: Legge sulla partecipazione. Bollettino Ufficiale della Regione Puglia*. https://partecipazione.regione.puglia.it/pages/legge-partecipazione

Regione Toscana. (2013, 2 agosto). *Legge regionale n. 46: Disposizioni in materia di promozione della partecipazione alla elaborazione delle politiche regionali e locali e istituzione dell'Autorità regionale per la garanzia e la promozione della partecipazione*. Bollettino Ufficiale della Regione Toscana. https://www.gazzettaufficiale.it/eli/id/2013/10/12/13R00442/s3?utm

Regione Emilia-Romagna. (2010, 9 febbraio). *Legge regionale n. 3: Norme per la definizione, riordino e promozione delle procedure di consultazione e partecipazione alla elaborazione delle politiche regionali e locali*. Bollettino Ufficiale della Regione Emilia-Romagna. https://demetra.regione.emilia-romagna.it/al/monitor.php?urn=er%3Aassemblealegislativa%3Alegge%3A2010%3B03

Regione Toscana. (2007, 27 dicembre). *Legge Regionale n. 69: Norme sulla promozione della partecipazione alla elaborazione delle politiche regionali e locali*. Bollettino Ufficiale della Regione Toscana. https://raccoltanormativa.consiglio.regione.toscana.it/articolo?urndoc=urn%3Anir%3Aregione.toscana%3Alegge%3A2007-12-27%3B69

Regione Siciliana. (1999). *Linee Guida del Piano Territoriale Paesistico Regionale (PTPR)*. Decreto Assessoriale n. 6080 del 21 maggio 1999. Retrieved from https://www.regione.sicilia.it/beniculturali/dirbenicult/bca/ptpr/LineeGuida.pdf

Chapter 5- Evidence from Three Case Studies in Morocco

Abstract: In Morocco, Public Participation Geographic Information Systems (PGIS) reveal strong political and social potential across diverse contexts. Three case studies illustrate this: in Marrakech, participatory mapping amplified women's voices in the SYBA neighborhood; after the 2023 earthquake, the feminist group El Amane used grassroots data to guide humanitarian aid; and in the Draa Valley, local and satellite mapping addressed water scarcity and rural depopulation. Together, these experiences show PGIS as a tool for empowerment, crisis management, and inclusion of marginalized communities[89].

Keywords: *rural-urban migration, bidonvilles, urban fringes, African slums, PGIS*

INTRODUCTION

The Moroccan context offers a fertile ground for exploring the political and social potential of Public Participation Geographic Information Systems (PGIS). As a country marked by profound territorial, cultural, and socio-economic diversities, Morocco reveals how participatory mapping can become an instrument of empowerment for marginalized communities, particularly women, and a tool for addressing both structural and emergency challenges. By bridging local knowledge and technological tools, PGIS has supported initiatives ranging from urban peripheries to rural valleys, while also proving to be a valuable asset in humanitarian contexts.
The case study in Morocco is divided into three different experiences that demonstrate the political and social potential of PGIS:

[89] "Il diritto alla città" di Henri Lefebvre è un diritto collettivo. Se intendiamo questo diritto secondo il punto di vista lefebriano, la mappa, come atto creativo, contribuisce a fare della città un'opera d'arte che promuove la libertà e l'emancipazione dei suoi abitanti.

i. Marrakech: participatory mapping gave a voice to women's associations in the urban periphery of the Sidi Youssef Ben Ali (SYBA) neighbourhood, in relation to migration processes and the population of urban peripheries;
ii. Post-earthquake 2023: grassroots data collection supported the humanitarian response by the feminist association El Amane[90];
iii. Draa Valley: cartography integrated local knowledge and satellite data to address water stress and rural depopulation, valuing women's knowledge of water resources.

The first case study focuses on Marrakech, where participatory mapping enabled women's associations in the peripheral neighborhood of SYBA to articulate their perspectives on migration processes and the transformations of the urban margins. The second one highlights the aftermath of the 2023 earthquake, when grassroots data collection conducted by the feminist association El Amane played a critical role in coordinating humanitarian relief and ensuring that women's needs were not overlooked in the emergency response. The third one examines the Draa Valley, where participatory cartography combined traditional ecological knowledge with satellite imagery to address pressing issues of water scarcity and rural depopulation, showcasing the crucial role of women in managing and transmitting knowledge about water resources.

Taken together, these experiences demonstrate how PGIS can act simultaneously as (1) a political practice of recognition, as (2) a technical tool for managing crises and resources, and as (3) a social process that values voices often excluded from formal decision-making. Morocco thus becomes an emblematic case for understanding the broader potential of participatory mapping in contexts where vulnerability, resilience, and community agency intersect.

[90] El Amane association (Association El Amane pour la femme et l'enfant - AEDF) has as its objective: "the research and defense of women against all forms of violence and gender equality". Since its creation in 2003, the organization has engaged in a wide range of activities, including literacy classes for illiterate women at the Listening Centre, which serves as the organization's headquarters in Sidi Youssef Ben Ali, a very vulnerable area of Marrakech, and other advocacy activities for gender rights in Morocco, and the promotion of ecotourism. FDHM - Fonds pour les Droits Humains Mondiaux, Global Found for Women, Global Rights, Mamacash, and National Endowment for Democracy - NED are just a few of the significant collaborations that AEDF has built on both a national and international scale. AEDF also engages with the network for women's rights in North Africa.

5.1 The Planet of Slums, Emerging Urban Margins in Africa

Over the past decade, Africa has seen a significant increase in internal migration, especially from rural to urban areas. This internal migration is often driven by the search for employment and the need to abandon lands increasingly impoverished by environmental degradation, landgrabbing[91], the consequences of climate change, natural phenomena, as well as the dominance of industry over agriculture (Stocchiero, 2021).
The peripheries, where new settlements often emerge, should, according to Agenda 2030, be sustainable and guarantee access to safe and quality goods and services for all. However, despite the better opportunities and services offered by urban centers, migrants from rural areas to cities face difficulties: they cannot access the labor market due to lack of education and low levels of skills, and are therefore forced to work in the informal sector.
In October 2003, UN-Habitat published its first global report on urban poverty in which it was clear to everyone that urban poverty is a global problem.UN-Habitat (2018)[92] notes that today, 55% of the world's population lives in urban areas, a percentage that is expected to increase to 68% by 2050. In many African countries, a significant share of the urban population lives in slums. In some states, this percentage exceeds 50%, indicating high housing and infrastructure vulnerability: the highest percentages include South Sudan, the Central African Republic and Niger, where over 70-80% of the urban population lives in slums.
Mike Davis in his book "Planet of Slums" (2006), which was a visionary anticipation of what would happen in the urban peripheries of Africa, imagined a devastating inequality and urban instability. Davis shows how the economic exclusion of the urban proletariat corresponds to a confinement in the slums, which are perceived, according to a metaphor widespread among the Victorian middle class, as «just volcanoes waiting to erupt» (Davis, 2006, p. 201).
Following this metaphor we could say that the inhabitants of the slums in Africa constitute the new emerging social forces of today's society. The Asian urban peripheries are normative voids where « Darwin Beats Keynes», where congestion, inadequate or informal housing, poor water and sanitation and instability emerge (Schenk H., cited in Davis, 2006, p. 46). This expression should not be understood in an evolutionist or deterministic sense, but rather as a radical critique of the abandonment of redistributive policies and urban welfare within neoliberal economies.
In the peripheries of cities in developing countries, adjacent to agricultural lands, forests or deserts, there are complex kinship networks, property systems and ties to other members of

[91] In Africa,theand rural areas have become dependent on conventional production techniques or are exposed to the explosion of land grabbing by domestic and international firms following the emergence of large cities as administrative centers. Furthermore, in the current liberalized global market economy, major cities import basic goods from abroad at lower prices than domestic ones.
[92] The data used for this analysis were retrieved from the World Bank website (consulted in March 2025) which cites the UN-Habitat source of 2018.

the community. The urban poor are nomads «transients in a perpetual state of relocation» (Agbola, 1997, 51). Greenbelts are becoming ecological wastelands where natural disasters, polluting industry, frenetic traffic and crumbling infrastructure compound the problem (Davis, 2006).

Since the suspension of IMF structural adjustment programs, slums in Africa, Latin America, and South Asia have exploded (Walton, Shefner & Seddon, 2008). Food riots, violent protests, and general strikes have erupted in Morocco, Brazil, Haiti, Sudan, Turkey, Chile, Peru, Bolivia, and India. Since 1980, liberalization has turned cities into dumping grounds for unskilled, unprotected, and underpaid informal service workers, while urban and occupational marginalization has increased due to economic informality. This has exacerbated jihadist ideological nihilism in the suburbs of Istanbul, Cairo, Casablanca, and Paris.

The aim of this case study is to try to see the urban peripheries in Africa from a perspective that, while not neglecting the necessary considerations on the related critical issues, can give an inverted image of the peripheries: from areas of high vulnerability and marginalization to real urban laboratories, engines of change in Africa. If we consider the migratory phenomenon in terms of international connections and social networks, transnational migrant communities play a significant role in government policies and third sector initiatives. This is recognized by the term "transnationalism" (Caselli, 2009)[93], thanks to which all the actors and communities involved benefit and in which development strategies linked to the concept of co-development play an important role[94].

On the other hand, the demographic pressure on African urban peripheries increases the risk of catastrophic events for all those urban settlements that are in a precarious position from an environmental point of view: for example, cities built at sea level are at risk of massive flooding if, as seems likely, the sea level rises.

Migration is dramatically connected to urbanization. If we consider that creating inclusive, safe, resilient and sustainable human settlements is a Sustainable Development Goal (SDG)

[93] Caselli uses the results of a study to understand whether there are subjects that can be traced back to the model of the transnational migrant, which leads back to the widely debated concept of transnationalism.

[94] Since, when talking about sustainable urbanization, the connection between rural and urban areas is a crucial element to take into account, as well as population growth, employment opportunities, governance structures and migration patterns, the strategies to be undertaken should put the person, social groups and associations that cooperate and try to find a shared basis to improve social inclusion at the center of the strategies to be undertaken. Since migrants are the best placed to identify their needs, being those who know the reality and conditions of their countries best, it is no coincidence that development strategies have paid so much attention to co-development, which allows the coordination of the development strategies of the countries of origin with the migration policies of the countries of destination. In fact, the idea behind co-development is to combine immigration and development so that both the country of origin and the host country can benefit from the flow of immigrants.This is demonstrated by the outcome of EuropeAid's AENEAS programme (Cooperation with third countries) under the Migration & Asylum line – co-development between Italy and Morocco (2000–2010). This programme revealed serious shortcomings, calling into question co-development as a solution to migration problems. In my opinion, the causes of these critical issues could be attributed to the lack of attention to inclusion in the destination countries and the neglect of a rights-based approach. Furthermore, there was a lack of adequate financial support and guarantee instruments to ensure the sustainability of the projects.

11, we must take into account the living conditions of the population of several African countries that have moved circumferentially from rural areas to large cities.

5.1.1 Marrakech, Villes sans bidonvilles

The city of Marrakech is known as the "Red City" and stands out for its unique architecture that reflects the influence of different cultures such as the Almohads and West African traditions. Founded way back in 1062 and has undergone significant changes since the French colonization in 1912 that led to the expansion of the city outside its ancient walls. The structure of the city of Marrakech has transformed over time, becoming more and more complex over with the integration of traditional and innovative elements.
This has generated a variety of contexts aimed at housing of different social classes that blend together creating a unique socio-spatial diversity. After gaining independence in 1956, the urban fabric of Marrakech has gradually mixed, complicating the distinction between traditional and modern areas. Increased population growth, driven by migration from rural to urban areas has caused a housing crisis; approximately 50% of the population is concentrated in only 5% of the city territory, focusing mainly on the Medina and Sidi Youssef Ben Ali neighborhoods. This has led to the emergence of widespread informal settlements in the douar, which are often unrecognized by authorities and lack basic public infrastructure[95]. The urban landscape of Marrakech has been deeply influenced by locally rooted religious cultural traditions, and residential area planning emphasizes privacy and social coexistence, contributing to the creation of a unique urban form that contrasts sharply with Western urban planning principles (Ross, 2022). Streets in Islamic cities serve primarily as access points to homes, often creating narrow, enclosed spaces that prioritize family privacy over public interaction. Despite efforts to address the housing crisis, the proliferation of informal settlements continues, exacerbated by socio-economic disparities and ineffective public policies.
The douars, spontaneous settlements that arose around the city, reflect the cultural fusion that characterized the urbanization of Marrakech. Their informal development led to a hybrid architecture, combining Arab-Muslim elements with techniques and materials introduced by traders. The irregular layouts and the use of local resources highlight the need for functionality and adaptability, especially in response to the growing demand for housing (Mercatili et al. 2020).

[95] In Marrakech, derbs represent the urban neighbourhoods of the medina, as opposed to douars, which refer to typical rural settlements. However, the informal settlements that have sprung up in the suburbs are often referred to, significantly, as douars: a name that reflects the osmotic nature of these processes, typical of peri-urban areas, where the countryside and the city interpenetrate and transform each other. Peri-urban douars also refer to the informal nature of these settlements.

Figure 1 - « An aerial photograph shows bidonvilles side by side new homes in a peripherical area of Casablanca », (Mercatili et al., 2020).

During the colonial period, the influence of the French protectorate introduced new urban patterns, which also influenced the expansion of the douars. The absence of formal regulation favored a variety of architectural expressions, with a mix of traditional and modern elements, a testimony to the continuous cultural exchange.

A fundamental role in urban and cultural development was played by caravanserais, centers of hospitality for travelers and merchants. These spaces not only facilitated trade, but also promoted the spread of decorative elements typical of Islamic art, such as geometric patterns and calligraphy. The aesthetic and architectural influence of these places helped shape the visual identity of Marrakech and spread Islamic art throughout North Africa and the Middle East.

The *foundouk*, the caravanserai, constituted the first settlement of the medina, becoming a vital point for passing merchants. These places, despite being hotels, represented real centers of exchange and highly specialized trade (Nossov, 2013). The presence of a

network of foundouks revolutionized the spatial structure of the medina, which developed around these nerve centers during the early Middle Ages. Urban hybridism is a living component of the city of Marrakech even today. With the exodus of the inhabitants of the medina towards the suburbs, due to the real estate crisis, we might ask ourselves whether this corresponded to a transfer of identity, leaving the Medina in the hands of tourism and foreign investors, and the suburbs the destination of migratory movements from both the countryside and the city center.
The Moroccan government's approach to managing urbanization has been characterized by a lack of effective policies, focusing primarily on rural development and neglecting urban areas. The "Ville Sans Bidonville" (VSB) program, launched in 2004, aims to improve living conditions in slums and reduce their prevalence, but challenges remain due to inadequate infrastructure and the complexities of urban planning.
According to El Kahlaoui (2015) the program VSB has made great strides in improving housing conditions, but lack of coordination among various stakeholders and insufficient funding hinder its effectiveness.
A more integrated approach that encompasses social, economic, and infrastructural development is essential to address the complexities of urbanization in Marrakesh and the development of its douars. The population has grown from 209,000 in 1950 to over 1 million in 2024, and is projected to reach 1.26 million by 2035 (United Nations, 2024, as cited in World Population Review, 2024). This influx has created a high demand for housing, leading to the emergence of informal settlements known as douars.

The lack of planning and urban policies has allowed informal settlements to proliferate, as public authorities have failed to effectively manage rapid urbanization. The lack of services and infrastructure in these settlements and economic disparities have played a role in the development of douars. Laissez-faire policies adopted by the government have favored the wealthiest populations, allowing landowners to profit from them while the poorest segments of society have resorted to the creation of informal housing to meet their needs. The high cost of housing in the city has pushed many low-income families to seek refuge in these unregulated areas, whose informal nature leads to a lack of recognition by the authorities and, consequently, a state of abandonment and deterioration. Many of these areas lack basic services such as water, sewerage and electricity, which places the inhabitants in a further position of marginalization.

5.1.2 The Outskirts of Marrakesh: An Open-Air Frontier Laboratory

The state's ambiguous stance towards slums often oscillates between tolerance and prohibition, leading to a precarious existence for slum dwellers. On the one hand, authorities have avoided developing existing slums; on the other, they have moved residents to poorly equipped suburbs, creating new areas of social exclusion.
On the contrary, civil society organizations have developed more participatory and inclusive approaches, working directly with communities in urban peripheries. These interventions, based on the active involvement of residents and a specific focus on gender

issues, have proven more effective in responding to the real needs of the population. In particular, women, often the most affected by forced redevelopment processes, have assumed a key role in local development projects, helping to create solidarity networks and microeconomic initiatives for the sustenance of families.
The experience of Marrakech highlights how a participatory approach, based on dialogue with communities and women's empowerment, can represent a valid and sustainable alternative to policies imposed from above. While the VSB model has shown its limits, emerging practices in urban peripheries suggest the need for more inclusive and local-sensitive governance, capable of integrating the voices of civil society in urban planning.

As highlighted by researchers at the Polytechnic University of Milan, urban peripheries have the potential to become “urban laboratories” (Mercatili et al. 2020). In the slums of Marrakech, people get married in the street, inviting their neighbors. Due to the lack of public services, families clean their portion of public space in front of their homes; there are several activities dedicated to repair and recycling, such as community initiatives of mutual aid. The intensity of this city is linked to the porosity between public and private spaces, especially in the teeming peripheries.

Figure 2 - « Wajiha Ibrahim, "Slum Eradication Polices in Marrakech, Morocco. Assessing the semi-privatestate nexus of the Villes Sas Bidonvilles Program"; Master thesis in Urban and Regional Planning, University of Michigan (2016) », (Mercatili et al., 2020).[96]

Urban peripheries can become 'urban laboratories', spaces for experimenting with new models of development and social innovation. If the image of slums is associated with negative feelings, it has the potential to evolve. In responding to the problems of the peripheries on a daily basis, the inhabitants have found new solutions, inventing new forms of urban organization.

SYBA, the district of Sidi Youssef Ben Ali, Marrakesh

Marrakech has a population of 1,015,000 (General Population and Habitat Census 2024) and is the capital of the Marrakech-Safi region. The city's development is based on tourism, which is the main economic driver. The industrial sector is dominated by agri-food activities. However, the real estate market experienced a boom in 2000 and a downturn in 2008, leading to a decrease in the local population. The urban population is concentrated in the Medina and the Sidi Youssef Ben Ali neighborhood, which currently has about 108,000 residents(2024). The neighborhood, originally part of the Medina, has a unique mix of urban and rural characteristics. It was the site of the first recorded rural exodus,

[96] This image, interpreted as a mental map (if we wish to continue the exercise undertaken at the AUI University in Ifrane), depicts Marrakech not as a topographical map but as a symbolic construction: a city of red houses (the colour representing the “red city”) clustered around its identifying landmark (the Koutoubia), in which urban compactness and chromatic strength become collective memory and shared imagery.

caused by speculation and the rising cost of housing. Today it is the largest neighborhood after the Medina and is characterized by its different urban and rural aspects. This neighborhood is the main example of "Medina spillover," that is, the creation of small spontaneous villages known as douars all around the ancient city walls.

The image elaborated by researchers from the Polytechnic University of Milan (fig. 3) shows how the douar, informal and semi-urban settlements, have developed around the urban core of the city, responding to population growth and the economic dynamics of the region. The city-countryside osmosis typical of African peripheries is represented by mixed douar (circles with dotted outline) that represent transition zones between urban and rural, presenting hybrid characteristics, both at an architectural-constructive and cultural and social level.

Figure 3 - « Rural, urban and mixed douar in the city of Marrakech », (Mercatili et al., 2020).

In the district of Sidi Youssef Ben Ali, the high population density and the lack of social housing have led to an increase in shanty towns. The inhabitants find themselves managing their living conditions on their own, demonstrating strong resilience and developing mutual aid practices.

Urban resilience emerges as a crucial response to the inefficiencies of government policies. The inhabitants of slums, as demonstrated by the case of Sidi Moumen in Casablanca, where Bouchaib Mhamka founded an association that promotes sports, cultural and social activities, encouraging the inclusion of young people and countering the risk of radicalization. Bouchaib made a clear choice (Mhamka & Masto, 2008), distancing himself from the spectre of terrorism that comes from his neighborhood, Sidi Moumen, one of the most vulnerable in his city, to devote himself to civic activism and promote collective initiatives that aim to improve living conditions.

Similarly, the youth of SYBA live in precarious and uncomfortable conditions that expose them particularly to religious jihadist extremism, which finds in the suburbs a condition of weakness that favors their affiliation. The poverty rate detected by the HCP 2016 (Haut Commissariat au Plan) of the SYBA neighborhood is among the highest in the entire city of Marrakech and takes into account access to education, health services and housing.

Figure 4 - Aerial image of the arrondissement of Sidi Youssef Ben Ali, Marrakech, source. https://www.wikidata.org/

5.1.3 Mapping to SYBA

Following the Map & Jerry project (Choplin, Lozivit 2019), which allowed the mapping of a very vulnerable neighborhood on the outskirts of Benin, we wanted to propose a similar initiative on the outskirts of Marrakech. In collaboration with a Beninese FabLab and the OpenStreetMap Benin community, the Map & Jerry project aimed to map a neighborhood that is not present on any map and has a high crime rate, in order to create a map with the locals so that those who have no voice (and no map) could be heard and become visible. The study highlights the importance of democratizing access to digital technology for populations that are excluded from it due to a lack of both technical and financial resources. Collaborative mapping has become increasingly important in recent years, according to several international networks, including the influential Slum Dwellers International (or Shackdweler International, also known as SDI), which has internationally emphasized the importance of collaborative mapping and co-planning for the recognition of urban poor populations and for the construction of inclusive and sustainable cities.
The case study reported below was carried out as part of an activity abroad foreseen by the doctoral program in Ecological Transition at the CSTE of the University of Palermo.

Within a research path that concerns participatory mapping, the activity saw the realisation of workshops in collaboration with the association el Amane and the LERMA Center (Laboratoire des Etudes sur les Ressources, Mobilité et Attractivité) of the Cadi Ayyad University of Marrakech. The target group of the workshops were about twenty young people who follow the training in communication and manage and animate the Radio El Amane[97].

The first methodological act, as Prof. Guarrasi teaches us[98], was the inspection. It was decided to set up the workshops according to the defined target using a participatory methodology and impact on the new generations who are more inclined to use digital devices, applications and smartphone programs also with regard to geolocalization. The choice of the target group of very young students and volunteers of the Association is motivated by the fact that on their part there can be a better response in the digital mapping activities also taking into consideration the training path undertaken in the communication sector. In fact, most of the young volunteers are involved in the dissemination and information activities of Radio El Amane.

The methodology of the laboratories was redefined together with Prof. Augusto Gamuzza and Prof. Anna Maria Leonora, sociologists of the University of Catania. It was decided to prepare within the program, in addition to the moments of theory, some experiences of mapping one's own neighborhood.

[97] Radio El Amane is a social radio, created to defend women's rights by the El Amane association and known as a community radio in Marrakech; it is a type of radio station and podcast alternative to commercial radio stations and national public service. It is animated by a group of about 20 young people from the neighborhood. The age range of young people is from 18 to 22 years old. The female component is about 60%. Most of the young people are from the neighborhood of Sidi Youssef Ben Ali (SYBA).

[98] «Ogni luogo è un'entità ad alta complessità, perché è il risultato imprevedibile dell'azione – in un contesto di situazione dato – di esseri umani, che incorporano nel loro operato sostrati culturali multipli, derivati dalle rispettive biografie. […] Nell'interazione tra i soggetti questi distinti universi convergono perché la comunicazione possa aver luogo. Anche il sopralluogo è un evento: è qualcosa che accade quando uno almeno dei soggetti in interazione è riflessivo, cioè tende a tradurre in scrittura […] l'eco dell'evento. L'arte del sopralluogo produce, dunque, luoghi dotati di un particolare statuto, in cui intenzionalità nuove si sovrappongono a quelle costitutive del luogo stesso e aprono verso ulteriori universi di senso. » (Guarrasi, 2006, 60-61 as cited in De Spuches, 2021).

Figure 5 - Mappatura dei laboratori con gli studenti di Radio El Amane, settembre 2023

The smartphone tool used for GIS mapping was “Mapillary”, a service for sharing geolocalized photos in crowdsourcing mode, that is, with contributions from people.
In the preliminary phase of the laboratory, maps of some little-traveled routes were created.

The laboratory activity instead started from the definition of “node” in OpenStreetMap and its identification on a paper support representing their neighborhood. The kids divided into groups and drew the nodes of their neighborhood:

Lieux de mémoire (contes de fées, histoires de vie...)

Lieux des personages importants de votre ville

Lieux des organizations de votre ville

Lieux de temps libre / lieux de rencontre

We first illustrated the mapping tools in the field via smartphone (Mapillary and Osmond) and then decided to use Mapillary during the mapping “promenade”.
Since the proposed activity took place in a sensitive territorial context, where territorial survey and geolocalization activities can be perceived as potentially harmful to national security, it was necessary to inform the local authorities in advance and request the necessary authorizations for the initiative to be carried out. This made it possible to guarantee transparency on the project's purposes and ensure the regular performance of the activities in compliance with local regulations.
The walk in their neighborhood was done by three groups with a group leader (meeting nodes, memory nodes and education routes). My group decided to walk the education route, and to map the newest neighborhood called “Uarda”, which in Darija dialect means “rose”. Today it has become the neighborhood where the main educational buildings of various levels (essentially from primary to secondary) of formal and professional type, both government and private, are located. The mapping process through the street-view system was done in comparison with the other routes.

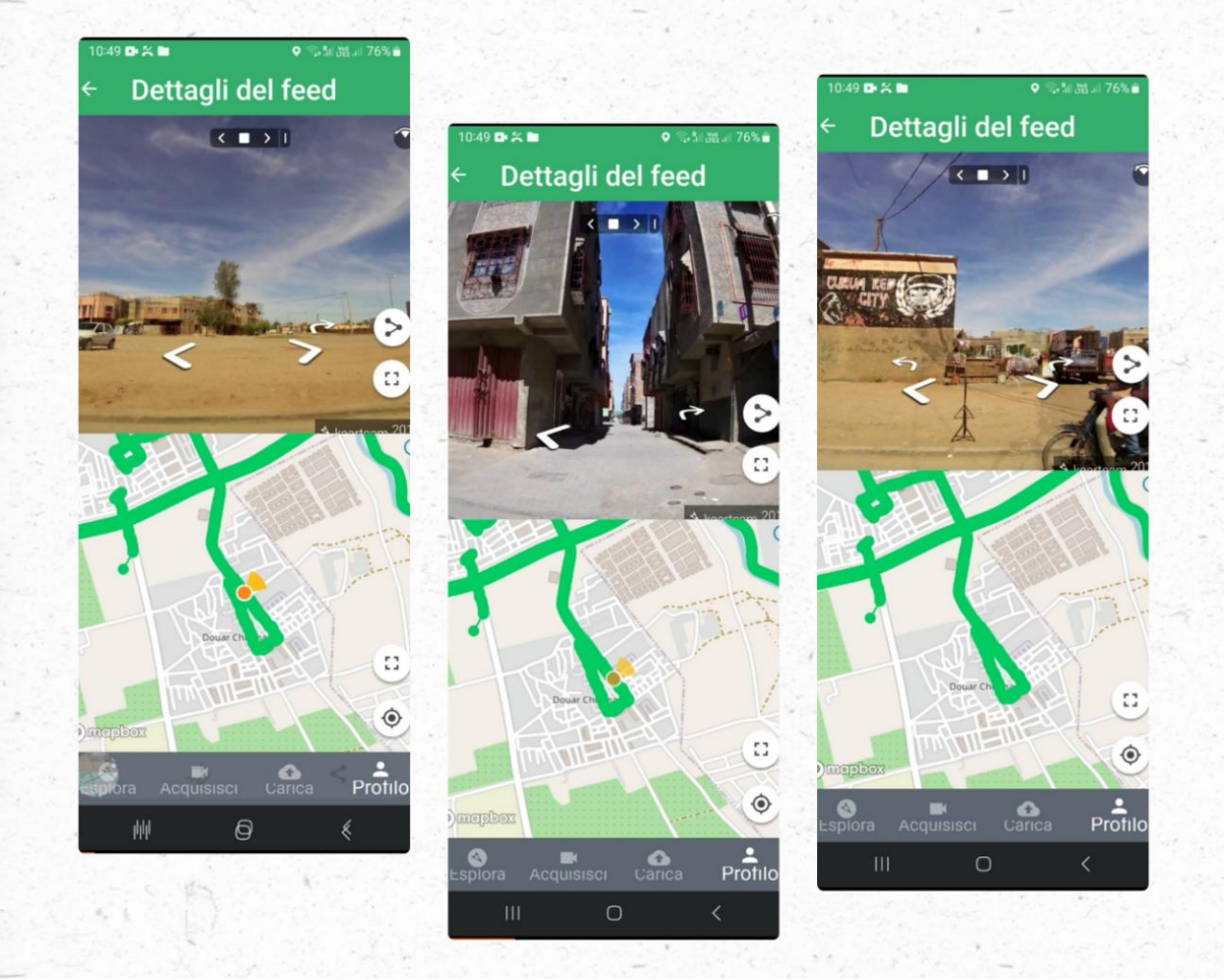

Figure 6 - Some screenshot taken from Mapillary during the walk at SYBA, September 2023

The mapping activity was not limited to the simple geographical recording of buildings and points of interest, but encouraged the children to reflect on how certain places have become symbolic for their community. The choice to trace the "nodes" in places of education, for example, highlights the importance of these spaces in the construction of collective identity. Schools, in fact, are not only places of formal learning, but also spaces for meeting, cultural exchange and socialization. In a neighborhood like "Uarda", which has seen a great change over the years, schools represent a central point of reference that helps define the perception of the neighborhood by its inhabitants. This identification is also partly the reflection of a very important government program of social reforms that have aimed, in the last twenty years, at strengthening educational policies and enhancing secondary education, particularly attentive to gender policies.

One of the main obstacles encountered while mapping with Mapillary was the limited storage capacity on participants' devices. The application requires a significant amount of image storage capacity. This hindered data collection and limited neighborhood coverage. A viable approach is to use a shared device, which would provide sufficient storage and equal access to the technology, thus simplifying the entire process.

The data obtained has significant potential to improve housing conditions. Geolocalized photos facilitate the identification of infrastructure problems, such as deteriorated roads or areas lacking services, and allow reporting community needs to authorities. In addition, mapping facilitates understanding of the use of public space and can contribute to the formalization of informal settlements, providing a solid basis for urban interventions.

In addition to the technological dimension, the experience has brought about a significant social stimulus. Participants have developed a better understanding of their community, using mapping as a means of emancipation and communication with institutions. Therefore, technology serves as a tool to improve democratic processes and support the "right to the city" (Lefebvre, 1968)[99].

Mapping through tools such as Mapillary and Osmond, combined with the mapping "promenade", offered the group an immersive and hands-on experience, which put them in direct contact with their environment and encouraged them to think critically about the connection between physical and social space. This process was not only a technical exercise in geographical recording, but an opportunity to explore the relationship between place and collective memory, between urban transformations and individual stories.

The emergence of informal settlements has evolved alongside residents' claims for housing rights amidst illegality (El Kahlaoui, S. 2015). Informal housing, known as 'el 'achwai', includes illegal construction and unregulated trade.

[99] "The right to the city" by Henri Lefebvre is a collective right. If we understand this right according to the Lefebrian point of view, the map, as a creative act, contributes to making the city a work of art that promotes the freedom and emancipation of its inhabitants.

The wave of informal housing developments across the country, and particularly in areas where residents have started building without official permission, has coincided with the demand for residents' rights to housing, under the slogan "andna el haq nssouknou" (we have the right to housing). With this phrase, residents argue that their right to housing is inalienable, and although no reference is made to civil rights, this demand is rooted in a broader social and moral demand for justice and dignity, reflecting a collective awareness of their marginalized status.

This phenomenon was particularly visible during the Arab Spring, when demands for housing rights emerged forcefully, as did the demand for social justice and dignity. In many of the demonstrations that characterized the social protests in Morocco, housing informality and the lack of affordable housing became one of the central issues. The protest movement denounced real estate speculation, corruption and the government's inefficiency in guaranteeing the right to housing.

Since the terrain of the African peripheries is teeming with disruptive social energies and forces, there is a way to channel them in a constructive sense and aimed at democratic emancipation: the analysis of the case of Marrakech highlights how ineffective government strategies can only be overcome through participatory and collaborative approaches. The resilience of slum dwellers, combined with civil society activism, offers a vision for building more inclusive, safe and sustainable cities. However, it is crucial that governments recognize the value of these bottom-up initiatives and adopt integrated policies that consider migration dynamics and the challenges of urbanization.

5.2 The role of crowd-mapping within humanitarian rescue operations

Case Study:Planning a humanitarian mapping intervention in a post-emergency context (Morocco 2023)[100]

This initiative's activities were agreed upon and developed in partnership with the El Amane association and the LERMA Centre (Laboratoire des Etudes sur les Ressources, Mobilité et Attractivité) at Marrakech's Cadi Ayyad University.
This study is part of a post-emergency project for earthquake victims in Morocco, which has been supported by Caritas in partnership with five Italian NGOs working in the region. The project's goal was to provide assistance and support to the communities affected by the earthquake that hit Morocco on September 8 and 9, 2023, so contributing to the rebuilding and improvement of the living conditions.
The 6.8-magnitude earthquake struck the Atlas Mountains, particularly the Marrakech-Safi region, the Souss Massa region, and the Beni Mellal-Khenifra region, severely testing the already fragile infrastructure and threatening the safety of the local population, especially in the most mountainous and remote areas. The earthquake was the most powerful in the last century in Morocco and the deadliest since 1960. The epicenter of the quake was located in Ighil, a commune in the Al-Haouz province in the High Atlas mountain range, an area about 75 km from Marrakech, which had never been hit by high-intensity seismic events in the past. The most affected areas are rural and isolated. Within this intervention, which includes various support actions (distribution of family kits, distribution of housing tents and school modules, socio-health interventions, and psychological support), a humanitarian mapping action was planned, supported by COPEOfficinaSociale (Social Research Center of the NGO CO.P.E. Cooperazione Paesi Emergenti). This action has been carried out with the help of a group of women from a community radio station focused on “open data activism” (Radio El Amane) that operates in an underprivileged neighborhood of Marrakech: Sidi Youssef Ben Ali.

[100] This chapter partially draws on and further develops ideas from an article I published (Rossi 2024), Ruins of redemption: The role of crowd-mapping within humanitarian rescue operations, Folio, 43 (June 2024), 137–145.

5.2.1 Humanitarian Mapping

As part of this project, a successful humanitarian mapping activity was conducted in collaboration with the mappers from the El Amane association[101]. This activity began almost immediately after the completion of overseas activities (September 2023) with a group of volunteer mappers, mainly women, and was realized through participation in the shared project of the HotTaskingManager Emergency Morocco. It later became part of a broader post-emergency project that involved many *douars*[102] spread across the territory. This transversal humanitarian mapping activity, carried out together with OfficinaSociale COPE, allowed for the collection of essential data on the situation on the ground, identifying immediate needs and critical points in the earthquake-affected areas. This activity was successfully coordinated by a professor from the LERMA Center at the University of Marrakech, whose role was crucial in ensuring the accuracy and relevance of the information collected.

The mapping group, consisting of six women[103] (one of whom was me) and one man[104], actively participated with three representatives in the mapathon activity held in January 2023. The Emerging Business Factory (EBF), known as "the entrepreneurial, creative, and digital hub of Marrakech Safi," launched a project for the monitoring, evaluation, and learning of relief interventions following the earthquake. Local, national, and international organizations were invited to support EBF's initiative to create an accessible and secure platform for earthquake response activities, providing data, information, and maps on what they do, where, when, why, and with/for whom. Using established methods and past experiences, the aim is to consolidate data and information on earthquake response through the Mapathons website, which uses the Tasking Manager. The mappers from the mapping group participated in the mapathon activity in Marrakech on January 23. The earthquake response mapathon in the High Atlas and the collaborative effort between the EBF and the

[101] This activity is closely related to the community mapping work described in section 5.1, as what was initially a collaborative project with LERMA and El Amane in the suburbs turned into a humanitarian mapping activity during the course of the project: in fact, during my period of activity abroad, while I was conducting workshops at EL Amane in Syba with the young people of Radio El Amane, the city was hit by an earthquake. Local associations, including El Amane, immediately took action to launch relief efforts and provide assistance. Our research group, consisting of myself for the CSTE and professors from the University of Catania, Augusto Gamuzza and Anna Maria Leonora, offered our support to the population in need, following the suggestion of local associations. Our activity thus transformed into humanitarian mapping, shifting our focus from the suburbs of Marrakech to the areas most affected by the earthquake, namely the provinces of El Haouz and Chichaoua.

[102] A small, traditional village or a group of rural dwellings consisting of dozens or sometimes even hundreds of houses.

[103] Chaimaa Aaglli, Manar Abissate, Aya Elhouri, Nadia Elmejjati, Rabab Naciri, Valeria Rossi and the Mapping Coordinator Halima Oulami, President of El Amane Association and researcher at LERMA.

[104] Miloud Ouchala, Professor from University of Marrakech, LERMA.

Global Diversity Foundation (GDF) focused on providing crucial support to mapping in response to the earthquake challenges in the High Atlas region.

5.2.2 Hot tasking manager OpenStreetMap

The team actively participated to the HOTOSM Project by mapping different polygons delimiting territorial areas hit by the earthquake. This project launched by the platform HOTOSM. The images (fig.7) present data related to the earthquake mapping project in Morocco, a part of an initiative by the Open Mapping Hub for West and Northern Africa, which shows significant progress toward project completion with 62.535 changesets validated created by 10.235 contributors.

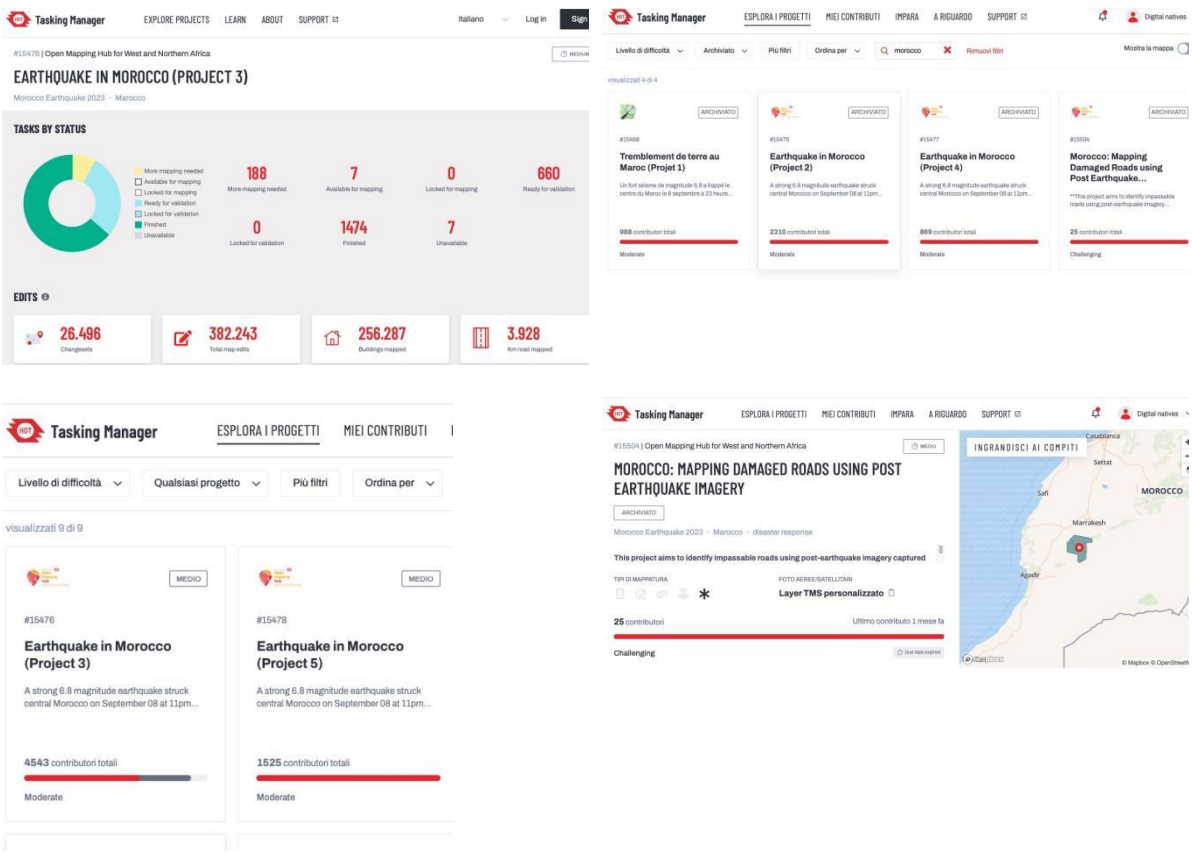

Figure 7 - Screenshots from the HOTSOM relating to Morocco Humanitarian project. Souce: https://www.hotosm.org/

As the screenshots from the HOTOSM website illustrate, some projects have been completed and archived, while others remain open. These projects have engaged a diverse group of contributors across five distinct initiatives, resulting in the collection of a significant amount of data. It is important to highlight that only one of these six projects has a higher skill requirement for contributors. This particular project titled “Mapping Damaged Roads Using Post Earthquake Imagery” has registered only 25 contributors,

which is relatively low compared to the other projects. This is probably due to the demand of contributors' higher skills. The specialized nature of the tasks involved likely accounts for the limited number of contributors. Despite this, the collective efforts across all projects have greatly enriched the available data, demonstrating the impactful collaboration facilitated by the HOTOSM platform.

> "Within 48 hours of mapping activities, 310 contributors around the world had contributed 32,450 buildings and 530 km of roads to OSM using pre-disaster imagery, providing the necessary base map to support decision-making. The outcome is a detailed base map of Morocco and data on road damages aimed at providing operationally useful data." Source: https://www.hotosm.org/

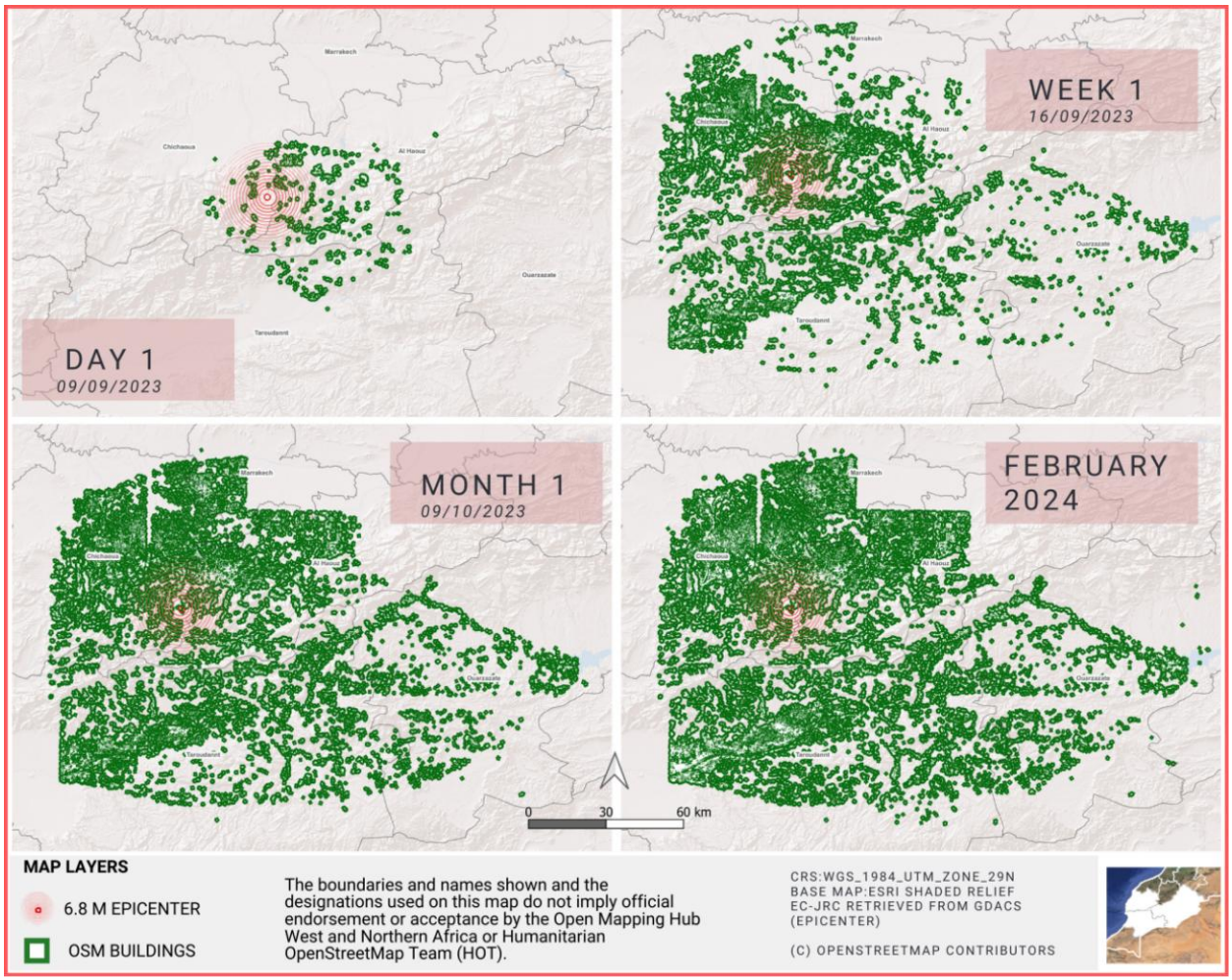

Figure 8 - MOROCCO EARTHQUAKE contributions from HOTOSM

Field visits

With concern to the field visit missions in the province of El Haouz and Chichaoua the established mapping team used the following tools and methods:
- Google Earth Pro: For printing maps and involving local residents in their distribution.
- OsmAnd and Mapillary: (Android for digital recording on smartphone devices).

- Google Earth Pro and ArcMap For comprehensive mapping.
- Web-GIS platforms like OSM or Missing Maps, Hot Tasking Manager, for data collection.
- Google Earth Pro, for printing for the focus groups with the community.

The integration with ArcMap was a key methodology adopted to improve location accuracy in OsmAnd. The primary aim of this integration was to overlay the mapped data obtained with their surveys onto existing digital maps.
The process began with scanning the printed maps from Google Earth Pro. The mapping team then used ArcMap to merge these scanned maps with the digital maps available in the software. This step allowed them to achieve an integrated representation of the mapped information.
Once merged, they integrated the field data into Excel spreadsheets. This allowed them to organize and manipulate the data more effectively, preparing it for seamless integration with digital maps. Subsequently, they converted the data from ArcMap's SHP format to OsmAnd's GPX format. This conversion was crucial to ensure a smooth and uninterrupted data transition between the two systems, enabling seamless integration. Finally, to ensure accurate geolocation of points of interest in the douars (1. territorial features such as water sources, wells, earthquake-damaged roads and 2. anthropic features such as places of worship, schools, small shops, solar energy supply, crops and cooperatives, and interest in forming a cooperative or association), the mappers relied on OsmAnd to automatically geolocate these entities based on the converted data. This approach provided additional assurance of the precision and reliability of the mapped information.
The humanitarian mapping process was conducted using participatory methodologies, actively involving local communities in the data collection and analysis. This inclusive approach ensured the representativeness of the collected information and fostered greater engagement from the directly affected individuals.
During the initial fieldwork phase, surveyors visit communities in their respective areas to collect comprehensive data and create sketch maps.
By transcribing data onto new maps in the second workshop, surveyors returned from the field with data regarding important geographical characteristics in their area.
During the second phase of fieldwork, surveyors revisited the communities to validate the data by cross-referencing the information on the draft maps, addressing enquiries, and completing any missing information. The villagers were provided with an opportunity to carefully examine the maps and engage in discussions regarding the concerns related to their territory.
The third workshop focus was the rectification and finalisation of maps. Surveyors collaborated with cartographers to integrate field-verified information and transformed the draft maps into their definitive versions. This time, compared to the experience at the AUI University in Ifrane (reported in paragraph 4.1.1 and Annex 1), the methodology did not start from a mental map drawn up together with the local community, but from a simple tool: a small-scale digital satellite map. As suggested by Rambaldi et al. (2006), the choice

of map scale is fundamental in participatory activities: maps with a scale greater than 1:10,000 allow users to confidently identify the location of their homes. Following this principle, we adopted a working scale of >1:10,000 for field data collection in order to improve the accuracy of georeferencing and facilitate the direct involvement of participants. Since women experience difficulty participating in mapping activities in the presence of men due to potential inhibitions, it was advantageous to segregate the genders and generate two distinct maps. By examining these disparities in priorities and the importance placed on specific areas and resources between men and women, we can frequently yield valuable insights[105]. Employing this strategy was paramount for a more comprehensive final depiction. Additionally, it fostered increased engagement from all individuals involved.

As a conclusion of this process, on March 24 five "future labs" were held in five different douars within the Commune of Assif El Mal (Imi Oussif, Ait Abaid, Tabonout, Tafroukht, Tloutimte), under the coordination of Professor Augusto Gamuzza from University of Catania (DISFOR).

The data collected in the initial mapped douars have been presented in a shared geoportal elaborated with ArcGis[106]. This activity provided a comprehensive overview of the needs and challenges faced by the communities affected by the earthquake. The collected data were used to inform the design and implementation of assistance and reconstruction initiatives, ensuring that resources were effectively and strategically directed to maximize the positive impact on the lives of the affected people.

The entire process developed by the mapping team was presented and published in a poster during the global OSM conference, State of the Map 2024 (with my contribution, annex 6). This document was subsequently prepared for "La 1ère Edition du Colloque International Hybride PHC Toubkal des Jeunes Chercheurs en Géographie", 21–22 April 2025, University of Marrakech / LERMA, for the presentation of a poster (with my contribution, annex 6).

[105] During the participatory mapping and focus group discussions the cross-cutting issue of gender inequalities was evident. In the 15 douars involved, women are traditionally responsible for collecting and managing water, with an increase of workload due to inefficient infrastructure. Similarly women's safety and health is affected by the lack of adequate sanitation facilitie. From an economic perspective, women have limited access to income-generating opportunities and they are mainly engaged in unpaid domestic and agricultural work. The existant women's cooperatives remain underfunded, lack dedicated spaces and face significant barriers to accessing markets. With regards to infrastructures, unsafe or damaged roads limit women's mobility and their access to schools, healthcare and markets. Women and children, who spend more time in the domestic sphere, experience a more dispropotiate burden from the emergengy, and they are more vulnerable to natural distasters.

The final project report (annex 2, Final Report) shows that the priority interventions identified by the communities include: improving road infrastructure with a focus on women's safety, rehabilitating housing with sensitivity to the needs of women, children and the elderly, and strengthening women's economic participation through support for cooperatives and access to resources.

[106] Geoportal availabe at the following link:

https://www.arcgis.com/apps/instant/portfolio/index.html?appid=ddf0601c4eb84adba9dde6a78ac6d6fc

Figure 9 - Some shots taken from March 2024 Mission on the field

5.2.3 From ruins to redemption

The devastation wrought by earthquakes is often painfully apparent in the crumbling remains of buildings and infrastructure, standing as stark reminders of the destruction that has been wrought upon a community (Jeleński, 2018). Maps could foster a sense of optimism and renewal amidst the widespread devastation: they embody the potential for transformation, turning the narrative from one of destruction to one of recovery and progress (Elżanowski & Enss, 2021).

Through the use of qualitative tools and analysis, this study aims to better understand the nature of the relationship between crowd-mapping and participatory design. In both remote and field mapping work, the localization of territorial reference locations takes into

account themes identified by the WEF nexus, such as access to food, energy, and water, as well as other territorial aspects seen as important by participants for the *douar*. Using this criterion, the mappers gathered about 200 nodes (points of interest). It's worth noting that the collected nodes addressed both the degree of post-emergency risk as a result of the earthquake's devastation and the possibility for local development that may allow for a new beginning, a rebirth from the ruins. The results of this data collection are illustrated in Annex 3, which is the final cartographic report of the project, supplementing the final report already mentioned (Annex 2).

The insights gained from this comprehensive mapping initiative underscore the critical role of crowd-mapping in disaster response and recovery. By integrating qualitative tools and participatory design, the project not only provided a detailed assessment of the immediate vulnerabilities but also identified key opportunities for sustainable development in the affected regions. The engagement of local communities in the mapping process ensured that the data collected was relevant and reflective of the ground realities, enhancing the accuracy and applicability of the information.

The nodes collected serve as a dual-purpose dataset, highlighting areas of urgent need while simultaneously pointing out resources and strengths that can be leveraged for future development. This dual focus on vulnerability and potential empowers local stakeholders and decision-makers with the knowledge to prioritize interventions effectively, ensuring that aid and resources are directed where they are most needed and can have the greatest impact.

Ultimately, this study demonstrates that crowd-mapping, when combined with participatory approaches and qualitative analysis, can be a powerful tool in the aftermath of disasters. It provides a blueprint for how communities can map their own recovery, transforming crisis situations into opportunities for growth and resilience. As we move forward, the lessons learned from this project can guide similar initiatives in other regions, fostering a global network of empowered, resilient communities.

5.3 Mapping the climate change - climate justice and drought in the oasian regions of Morocco

Climate change is affecting water availability, distribution, and quality globally, exacerbated by pre-existing inequalities. Water justice and climate change are interconnected, as water injustice creates vulnerability and entrenches these injustices. Solutions to climate change can impact water justice, with some solutions deepening existing injustices and others providing opportunities for positive action. Building unity between water justice and climate justice struggles can help understand local-global connections. However, scholars should avoid viewing climate change as the driver of water injustice, as it can naturalise water scarcity (Mills-Novoa et al, 2022).

In what follows on the issue of water as an economic resource, the 1968 European Water Charter[107] was the first legal instrument and the first international initiative to explicitly enunciate the right to water[108]. It proposed the idea of water as a common good shared among several states and clearly suggested the need to develop international cooperation.

The European Water Charter is a fundamental document adopted by the Council of Europe on 6 May 1968. This document establishes a set of guiding principles for the management, protection, and sustainable use of water resources in Europe. The Charter was born out of an awareness of the crucial importance of water for human life, the environment, and economic development. The principles of the Charter are still relevant today, emphasizing the need for responsible and sustainable use of water resources. The European Water Charter and the theory of limited sovereignty introduce a water management model based on equity, cooperation, and sustainability. These principles represent a significant step towards a more just and sustainable management of shared natural resources, recognizing the rights and duties of all states involved.

The European Water Charter has helped raise public and governmental awareness of the need to protect and manage water resources sustainably. Although it does not have the force of law, the Charter has influenced many national and European water-related laws and policies. It represents a moral and political commitment to sustainable water

[107] Council of Europe. (1968). European Water Charter. https://rm.coe.int/090000016809f1251

[108] For an analysis of the interconnections between water and climate justice, see: Boelens, R., Hoogesteger, J., & Swyngedouw, E. (2016).

management and has laid the foundations for further regulatory developments and international water agreements.

Linked to a strictly uncontrolled use of the resource water, an important international context emerges in the form of Agenda 21[109], an action programme adopted at the United Nations Conference on Environment and Development in Rio in 1992. This programme contains numerous proposals for the future of environmental protection, with particular emphasis on Chapter 18, dedicated to water issues. Agenda 21 emphasizes the need for sustainable management of water resources. Environmental law is structured into general principles, protective institutions, and special disciplines, providing a comprehensive legal framework for environmental protection. Water law is a special discipline regulating the use and protection of water resources, with international, European, and national regulations. Agenda 21 emphasizes the need to recognize water as a multidimensional and cross-sectoral resource. However, a complexity emerges in the economic approach to water: on the one hand, it aims to meet the water needs of all states to promote sustainable development; on the other hand, it proposes that consumers pay for the use of water.

This approach raises a crucial debate: water is qualified as a commodity or a service. This qualification inevitably entails the application of the rules of international economic law to water, presenting a number of challenges and issues. Water law encompasses all regulations governing the use, management, and protection of water resources. This area of environmental law aims to guarantee the quality and quantity of water resources, protecting both the aquatic environment and human interests related to water.

Legal Framework

International Legislation: Resolution A/RES/64/292, adopted by the UN General Assembly on 28 July 2010, officially recognises the human right to safe drinking water and sanitation as a fundamental right[110]. The United Nations Convention on the Law of International Watercourses and the Helsinki Convention on the Protection and Use of Transboundary Watercourses and International Lakes[111] establish principles and guidelines for cooperation between states in the management of transboundary water resources.

European Legislation: The EU Water Framework Directive (2000/60/EC) requires member states to achieve ecological and chemical 'good status' for inland, coastal, and groundwater within certain deadlines.

[109] United Nations. (1992). Agenda 21: Programme of action for sustainable development. United Nations Conference on Environment and Development. https://sustainabledevelopment.un.org/outcomedocuments/agenda21

[110] United Nations General Assembly. (2010). The human right to water and sanitation: Resolution adopted by the General Assembly on 28 July 2010. A/RES/64/292. https://digitallibrary.un.org/record/687002?v=pdf

[111] United Nations. (1997). Convention on the law of the non-navigational uses of international watercourses. United Nations. https://legal.un.org/ilc/texts/instruments/english/conventions/8_3_1997.pdf

Other relevant legislation includes the Groundwater Directive[112] and the Bathing Water Directive[113].

National Legislation: Each state makes its own laws about how to manage its water resources. These laws may include rules about how to get water, use it, and treat it, as well as rules about how to stop and control water pollution.

For some time now, the Water-Energy-Food (WEF)[114] Nexus has been spreading in international opinion and in the planning of development programmes, highlighting the interconnection between water, energy and food as a challenge for global development goals. The WEF nexus is a novel framework for action and thought that emphasises the interdependence of three vital resource components that are crucial to sustainability and resilience and have the potential to have a significant impact on people who live in vulnerable areas. Accordingly it is essential to recognise and take into account certain interdependencies.

1. The case of the Draa Valley, Morocco

Looking at national legislation, the focus is now on Morocco again, where I conducted a field study on water management during extreme drought, as part of the final project work for the course "Metodi Quantitativi E GIS Per Lo Studio Dei Fenomeni Migratori," held by Prof. Mauro Ferrante, which I attended during the second year of my PhD. The final project is included in Annex 4.

[112] European Unions. (2006). Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration. Official Journal of the European Union, L 372, 19-31. https://eur-lex.europa.eu/eli/dir/2006/118/oj/eng

[113] European Union. (2006). Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC. Official Journal of the European Union, L 64, 37-51. https://eur-lex.europa.eu/eli/dir/2006/7/oj/eng

[114] The concept of the Water-Energy-Food (WEF) Nexus has been developed over time, but one of the first official references is the World Economic Forum Report of 2011, which highlighted the interconnection between water, energy and food as a global challenge.However, the concept was already under discussion before:
2008: FAO began exploring the interactions between water, energy and food in its publications, i.e. The state of food and Agriculture 2008, https://openknowledge.fao.org/server/api/core/bitstreams/c739bfa7-defa-4786-b730-760d53b2fdba/content;
2011: The 2011 Bonn Conference (The Water, Energy and Food Security Nexus - Solutions for the Green Economy) made the term 'WEF Nexus' widely recognised, https://unfccc.int/conference/bonn-climate-change-conference-june-2011
World Economic Forum Report (2011): Identified the WEF Nexus as a key element in global resource security. https://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf
UNESCO Report (2012): Delved into the role of the Nexus in water resources management. https://unesdoc.unesco.org/ark:/48223/pf0000216472

With regard to rules for the implementation of the PNE (*Plan National de l'eau*)[115], the World Bank reports[116] that the body of legislation and regulations keeps being strengthened, notably with the adoption in August 2016 of a new Water Law (No. 36-15), which pursues the objectives of Law 10-95 and stipulates the rules for integrated, decentralised, and participatory water resources management, so guaranteeing the right of citizens to have access to water. Thanks to this great development and continuous water policy updating, Morocco should be able to schedule the activities to guarantee the water security of the nation even under drought conditions. However, an integrated process of adaptation of the water system, agricultural production, and consumption needs to be considered, starting with a bottom-up awareness of how to safeguard one's resources[117].

The geographical positioning of Morocco, at the extreme northwest of the African continent, contributes to a diverse climate, shifting from sub-humid conditions in the north to arid conditions in the south, leading to significant temporal and spatial variations in available water resources. Regional and local variables are making the Mediterranean climate more susceptible; the World Resources Institute projects hydric stress to be significant by 2040 (see fig. 10), which makes the region among the most noticeable "Hot-Spots" in future climate change forecasts (Giorgi, 2006).

The country is exposed to a high risk of disasters, including flooding, erosion, salinisation of river deltas and aquifers that sustain food security and livelihoods.

[115] Ministère de l'Équipement, du Transport, de la Logistique et de l'Eau. (n.d.). Plan national de l'approvisionnement en eau potable et d'assainissement en milieu rural (PNAEPI) 2020-2027. Retrieved from https://www.equipement.gov.ma/eau/Strategies-plans-programmes/Pages/PNAEPI-2020-2027.aspx

[116] World Bank. (2021, June 16). *Water security in Morocco: A growing challenge*. Arab Voices. Retrieved from https://blogs.worldbank.org/en/arabvoices/water-security-morocco

[117] Following the events of the Arab Spring in 2011, Morocco's constitutional change wanted to increase executive power and reduce centralising of authority. Still, the system remains bureaucratically hierarchical, and this influences internal migration increase and resource management. Notwithstanding the referendum-passed constitutional reform, this has hampered the government's policy adjustments in sectors like environment, security, economics, and migration.

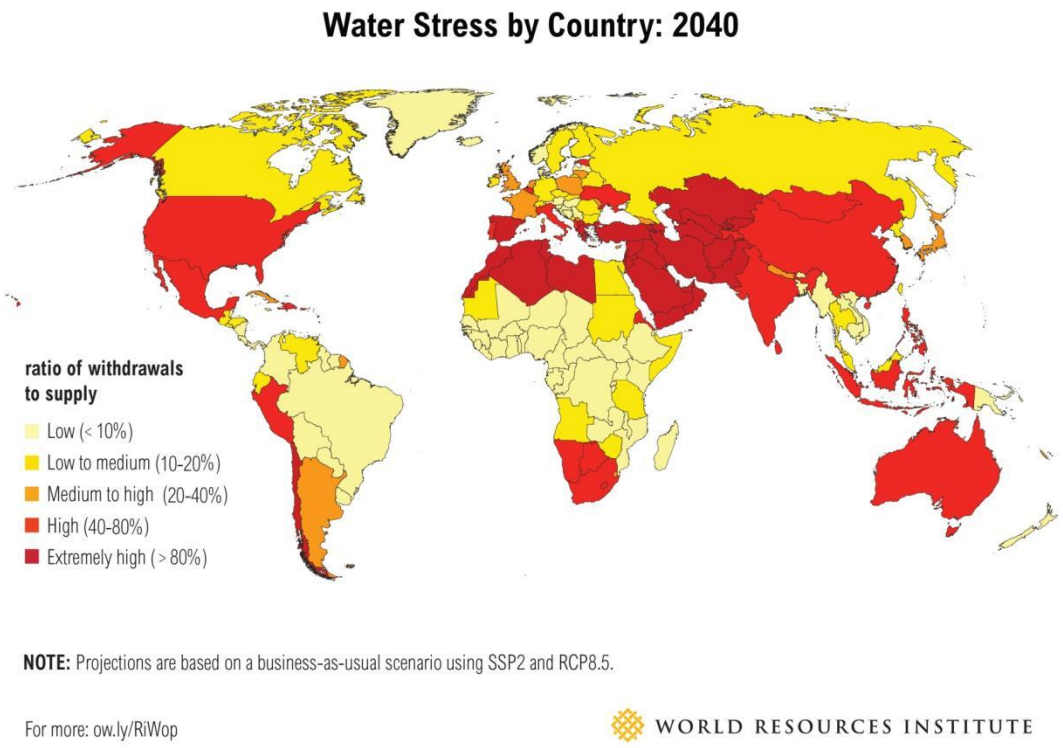

Figure 10 - Fig 1. World Water Stress by 2040 - Source: World Resouces Institute[118]

Climate justice demands a comprehensive examination of the differential vulnerabilities, the equitable distribution of climate change burdens, and the implementation of inclusive adaptation and mitigation strategies that prioritize the needs of the most marginalized communities within these oases. The Draa Valley in Morocco represents a crucial example of the intersection between climate change, environmental law, and climate justice. As a semi-arid region highly dependent on water resources for agriculture and livelihoods, the valley is particularly vulnerable to shifting climatic patterns, prolonged droughts, and increasing desertification[119].

Two-thirds of the oasis habitats in the country have been lost recently due to drought, water scarcity, and high temperatures; these areas no longer provide sustainable economic prospects for families and communities, thus compelling them to migrate to metropolitan centres in search of alternative livelihoods, so erasing the historical knowledge related to conventional water management practices (Bryce, 2016).

The legal framework governing water rights and land use in the Draa Valley reflects broader tensions between local communities, government policies, and international

[118] Luo, T., Young, R. S., & Reig, P. (2015, August 26). Ranking the world's most water-stressed countries in 2040. World Resources Institute. https://www.wri.org/insights/ranking-worlds-most-water-stressed-countries-2040

[119] "Desertification refers to land degradation in arid, semi-arid and dry subhumid areas resulting from various factors, including climatic variations and human activities (UNCCD, 2017)."
"Desertification and land degradation are very serious challenges. They lead to hunger and poverty, drive unemployment, forced migration and conflict, while increasing the risk of extreme weather related to climate change (FAO, 2020a)." https://www.undrr.org/understanding-disaster-risk/terminology/hips/en0014

environmental commitments. The European Water Charter and Agenda 21 emphasise sustainable water management, but in practice, limited regulatory enforcement and economic pressures have led to over-extraction of groundwater and inadequate access to clean water for rural populations. This situation raises significant climate justice concerns, as marginalised communities in the valley bear the brunt of resource depletion while lacking the institutional power to influence decision-making.

Moreover, climate migration is emerging as a serious challenge in the Draa Valley. As water scarcity intensifies, many families are forced to leave their ancestral lands, highlighting the urgent need for legal mechanisms that protect environmental refugees and ensure equitable adaptation strategies. Legal solutions should include stronger enforcement of water governance laws, recognition of community water rights, and increased international cooperation to address the valley's growing environmental vulnerabilities.

Oases, which provide fresh water in dry, arid locations, are under strain from climate change, leading to diminishing groundwater levels. These ecosystems, which are based on date palm farming, keep the land from drying out by blocking the sun's rays. Oases have historically been important for desert commerce and transportation routes, making them delicate and complex agrosystems that sustain agriculture under extreme climatic conditions and act as a barrier against desertification[120]. This makes the oasis forceful and flexible in response to climate change. These ecosystems are particular ecological landscapes, delicate and complex agrosystems that not only sustain agriculture under extreme climatic circumstances (Karmaoui, 2016).

Oases are important nodes in trade routes, changing social, cultural and commercial patterns. However, the worst drought in 40 years in 2022 peaks the situation[121] with social and economic consequences. Men's migration to cities often leads to increased responsibility for women in oasis communities. This enhances the function of women in oases from one restricted to traditional activities to more central and sustainable ones: women know ancient agricultural and nomadic-pastoral systems that have proven successful for generations due to their efficient management of soil and aquatic plants, constant human work, and handed-down knowledge.

The arid and semi-arid oasian ecosystems of Morocco, vital for biodiversity and human livelihoods, are disproportionately vulnerable to the escalating impacts of climate change, particularly the intensifying droughts that threaten the delicate ecological balance and socio-economic stability of these regions (Hachem et al., 2022; Ouassou et al., 2006). Morocco, like many nations in Africa, the Middle East and North Africa, has faced alternating periods of wet and dry conditions for many years, and it is still dealing with the repercussions of these events. Climate change significantly impacts the oasis regions of Morocco, particularly through increased drought frequency and severity. These changes threaten local agriculture, water resources, and livelihoods, exacerbating existing social inequalities. Vulnerable communities face displacement and loss of traditional ways of life,

[120] Based on an agricultural system focused on date palms, the oasis maintain the moisture required for orchards, vegetables and other crops by shielding the land from the sun's beams.

[121] European Investment Bank. (2023). *Morocco's water scarcity challenge: Sustainable solutions for a vital resource*. https://www.eib.org/en/stories/morocco-water-scarcity.

highlighting the urgent need for climate justice. Adaptation strategies, such as improved water management and sustainable agricultural practices, are essential to mitigate these effects. Addressing the intersection of climate change and social equity is crucial for fostering resilience in Morocco's oasis regions, ensuring that marginalized populations receive support and resources to adapt effectively.

In the Middle Draa Valley (VMD) in Morocco, accelerated economic and demographic development, coupled with rapid urbanisation and agricultural expansion (especially of unsustainable crops such as watermelon), are putting pressure on the region's water resources. This situation is particularly critical since the VMD, being an arid area, relies solely on the Draa River and the limited water resources provided by the Mansour Eddahbi Dam.

5.3.1 Background of an ancient oasis: The case of the Draa Valley, Morocco

The Draa Valley, located on the border with the Sahara in Morocco, is an area of great historical and environmental interest. This region, characterised by an ancient and lush oasis, has been a source of wealth for the caravan routes that crossed the desert. Climate change significantly impacts the oasis regions of Morocco, particularly through increased drought frequency and severity. This study aims to examine these effects through a detailed analysis of orographic and demographic resources, using GIS technologies and satellite data.

The VMD covers an area of 15,000 km² and is 200 km long. It is located west of the Upper Draa Valley and forms the border with Algeria. The topography of the region features significant variations in altitude, ranging from 1,020 meters to 375 meters above sea level. The Draa Valley is fed by the Draa Wadi, the longest wadi (intermittent river) in Morocco, formed by the confluence of its main tributaries, the Dadès and Ouarzazate rivers.

Surface water resources in the VMD come mainly from the Draa Wadi, which has become an intermittent river after the construction of the Mansour Eddahbi Dam upstream of the Draa Valley. This wadi serves as a vital source of surface water and recharges groundwater resources. The topography and climate of the region significantly influence the distribution of cultivated areas, urbanization, road construction and other land uses. The Draa Valley is characterized by a hot and arid climate, also influenced by its southern geographical location. Rainfall is rare, but when it occurs it can be very heavy, typical of desert and steppe climates. In the Draa Valley, oases cover approximately 26,000 hectares, distributed in six palm groves, and are characterized by layered vegetation management dominated by date palm. This type of management creates a warm and humid microclimate, favorable for diversified agricultural production.

Since the construction of the Mansour Eddahbi Dam in 1972, the number of motor pumps has increased steadily. In the Draa Valley, the reduction of surface water reserves has led to an increase in groundwater pumping; consequently, the energy production of the

Mansour Eddahbi dam is expected to decline due to the decrease in release waters. In addition to the risk of overexploitation, there is an increase in the salinity of the groundwater. In this valley, the river system is fed by releases from the Mansour Eddahbi dam. In parallel with the impact of drought, this dam is subject to the phenomenon of silting. In fact, the capacity of the dam experienced a reduction of about 25% in 1998.
Still in the Moroccan Oasis Biosphere Reserve, the Hassan Eddakhil dam in the Ziz Valley has also suffered the same silting problem. To make matters worse, farmers are turning to more profitable but long-term damaging crops, especially watermelon cultivation, which dramatically increases water demand. In fact, from 2012 to 2013, the cultivated area almost doubled (from 670 hectares in 2012 to 2,430 hectares in 2014). Indeed, it has been reported that some farmers in the Draa Valley have introduced unsustainable crops, such as henna and watermelons, which consume a lot of water and cause genetic erosion. These crops, although part of the cultural heritage, require large amounts of water, especially during the summer, worsening the situation of water resources.
The total irrigated area in the Draa Valley is about 26,000 hectares, dominated by palm trees, wheat, alfalfa and, in the last decade, watermelon cultivation. Regarding the distribution of water resources among the different sectors, 96.66% (Karmaoui, 2019) of the available water is used for agriculture, 2.70% for domestic use, 0.28% for tourism and 0.36% for economic activities. This shows that the agricultural sector is the largest consumer of water resources.
In the Drâa region, the main water management strategies adopted to cope with water scarcity and unpredictable weather conditions include irrigating fields in oases along the Drâa River and building artificial storage systems such as small dams to ensure a reliable supply of water for irrigation (Rössler, 2010).
A study on land use and land cover in southern Morocco (Linstädter et al. 2010), focusing on the management of unpredictable resources and extreme events, in particular, focuses on water as a highly unpredictable natural resource in arid environments and on the water and land management strategies adopted by locals. The paper highlights the importance of adaptive natural resource management and risk mitigation strategies for the resilience of the socio-ecological system in this highly unpredictable and vulnerable environment.
Suggesting the importance of oases along the Drâa River in the management of water and soil resources in the southern region of Morocco, it is further highlighted how oases act as natural reservoirs, enabling water conservation and management of water resources for irrigation and human consumption (Ait Lamqadem, 2018)[122].
The authors (Karmaoui et al. 2015) use the Environmental Vulnerability Index (EVI) to assess and summarize the collected data, noting that the region of the largest Moroccan oasis is characterized by high vulnerability to climate change and anthropogenic impacts. Taking into account the main indicators of environmental degradation in the Oasis Biosphere Reserve in Southern Morocco, the focus is on identifying common indicators that influence environmental vulnerability, with particular attention to water resources,

[122] The study's results indicated that only 16.63% of the sites were classified as least susceptible to desertification, while 50.34% were classified as highly and very highly sensitive areas.

desertification and biodiversity loss. The results (Karmaoui et al. 2015) show that the region is particularly vulnerable to heat waves, soil salinization and biodiversity reduction. In addition, human activity, such as intensive agriculture and tourism, exerts strong pressure on natural resources, contributing to the degradation of the oasis ecosystems.
Concerning the impact of tourism on poverty reduction of palm groves of M'hamid El Ghizlane, in Morocco, Khalifi, A., & al. (2012) highlighted that the decline of the traditional economy related to the oasis has pushed tourism to emerge as an economic alternative to generate income, create employment and slow the rural exodus. However, it is emphasised that the impact of tourism on poverty reduction is modest and that it has negative effects on the ecological environment and cultural heritage. The analysis also brings out the risk of negative transformations in the palm groves and the disappearance of traditional agricultural activities in favour of tourism. Furthermore, it points out the presence of external investments in the tourism sector, which, on the one hand, bring wealth, but on the other hand, lead to capital outflows and risks of exploitation of the local environment. Finally, it underscores the need for a sustainable approach to integrate tourism into local development plans and ensure a balance between the benefits of tourism and the preservation of the cultural and environmental identity of the area, using a holistic and sustainable approach to maximize the benefits and minimize the negative effects. In the M'hamid El Ghizlane area the main economic activities and sources of income are nursery agriculture and seasonal tourism. Nursery farming relies on irregular and insufficient water resources, coming from the runoff waters of the oued Drâa and from groundwater aquifers. However, the harsh climatic conditions and the limited availability of water constitute a significant challenge for agricultural activities.

5.3.2 Water resource management: the dams

According to an article (Ait Almouh, 2023, that appeared on TelQuel[123], the owners of the luxury villas surrounding the Ouarzazate golf course continue to draw water from the Mansour Eddahbi dam to irrigate their gardens, using clearly visible pipes. This happens despite the fact that the level of the reservoir has drastically decreased, similarly to all the reservoirs in Morocco. According to data provided by the Ministère de l'Equipement et de l'Eau on January 4, 2023, the filling level of the Mansour Eddahbi Dam was only 74.7 million cubic meters, compared to a total capacity of 445.3 million cubic meters, or less than 17%. This level is significantly lower than the overall national occupancy rate of 31.4%. Behind the evocative images of the crystalline water of the lake, reflecting the shadow of the surrounding cliffs, lie significant mud deposits. These are the result of soil erosion within the watersheds and pose a challenge to the treatment and drainage of drinking water intended for Ouarzazate. To address this problem, the authorities undertook

[123] TelQuel is a French-language Moroccan weekly magazine founded in 2001 by Ahmed Benchemsi. It is distinguished by its independent editorial line and its critical approach to political, economic and social issues in Morocco.

the construction of the Tiouine dam about a decade ago. With a total capacity of 270 million cubic meters, it is the main source of water supply for the city. The Mansour Eddahbi dam is not the only water reserve that is no longer fed by the Draa River. The Draa is mostly dry, except for a few areas, such as the Tizgui waterfalls. After floods, the wadi flows temporarily in some places, before drying out again for extended periods. Despite the irregularity of this wadi, another dam is under construction near the town of Agdz. This infrastructure is designed to provide drinking water to Zagora and the ksour124surrounding areas. Currently under completion, the reservoir will have a storage capacity of approximately 250 million cubic meters. In parallel, work continues on the water supply to Zagora, visible along the national road.

Although the project is not yet finished, the *Agence du Bassin des Fleuves Drâa et Oued Noun* (ABHDON) has already started to conduct controlled releases of water from the dam, as it did in late March 2022. These releases, although short-lived, have had a significantly positive impact on the wells in the region.

In the past, shortages of drinking water, particularly acute during the summer months, have triggered significant protests among residents of Zagora. A key moment in this context was the decision by the Ministries of Agriculture and Budget, at the end of September 2022, to suspend a significant number of subsidies for agricultural crops, especially watermelon. This measure was welcomed with relief by the local population, severely affected by water scarcity.

The government intervention is part of a broader attempt to correct some of the distortions generated by Morocco's Green Plan[125]. The Feija plain (*Plaine d'el Feïja*), located a few kilometres west of Zagora, has become, in about a decade, one of the main centres of watermelon cultivation. This agricultural transformation has led to an intensive use of local water resources. In fact, watermelon is a crop that requires large amounts of water, and the massive support for its production has further exacerbated the water crisis in the region.

The decision to suspend subsidies for these crops responds to the need to rebalance the allocation of water resources. The Green Plan, although aimed at promoting modernisation and agricultural expansion, has in some cases favoured crops that are not sustainable from a water perspective, especially in arid regions such as Zagora. The Feija plain, under the influence of these subsidies, has seen a proliferation of crops that have accentuated the

[124]Ksour (plural of ksar) are ancient fortified villages typical of North Africa, especially in the regions of Morocco, Algeria and Tunisia. The word ksar comes from the Arabic word رصق (qasr), meaning "castle" or "palace". These settlements are usually built with mud bricks, stone and wood, and feature architectural structures designed to defend the inhabitants from raids and the harsh climate of the desert. Ksour include houses, mosques, granaries, and communal spaces, all enclosed by walls that protect the village.
The distinctive feature of ksour is their function as both habitation and defense, which has allowed these communities to thrive in often hostile environments. Ksour are an important cultural and historical heritage, representing the resilience and ingenuity of local populations over the centuries.

[125] Morocco's Green Plan, known as "Plan Maroc Vert" (PMV), is an agricultural development program launched by the Moroccan government in 2008. This ambitious strategic plan aims to transform and modernize the country's agricultural sector, making it more competitive and sustainable.

competition for water between agriculture and the population's drinking needs. This dynamic has highlighted the contradictions of agricultural policies that, while aiming at economic growth, neglect the optimisation of natural resources, compromising long-term sustainability.
The suspension of subsidies for water-rich crops is a fundamental step towards a more sustainable management of water resources, reducing the impact of intensive agricultural practices and improving the availability of drinking water. The aim is to promote agriculture that is more compatible with local water availability, encouraging the cultivation of plants that are less demanding in terms of water consumption and better adapted to the environmental conditions of the region.
This integrated approach aims not only to ensure a more stable water supply for the residents of Zagora, but also to encourage an agricultural model that harmonises the needs of economic development with those of environmental sustainability. The reform of agricultural subsidies is therefore an important component of a broader strategy aimed at improving the balance between agricultural production and natural resource management. This is to make sure that the availability of drinking water is not sacrificed for economically profitable but ecologically unsustainable crops.

5.3.3 Data and Methods

The project work reveals significant environmental and demographic shifts in the Draa Valley. Cartographic representation, historical satellite image comparison, and demographic data analysis taken together show unambiguous patterns of depopulation in rural regions. More specifically, the identification of significant dams and local resident interviews point to a political approach that gives urban water supply first priority above rural demands, hence aggravating migratory trends, thus confirming the centralised structure of the country's political priorities.

A brief description of the methods used
First, I used QGIS software to create a map that included the following elements:

1. Administrative boundaries of the region: This data was downloaded from the Moroccan government website (https://www.data.gov.ma/) in shapefile format.
2. Orographic data: This data was also obtained from the government website and the OSM Tasking Manager and integrated into the map.
3. Demographics: Demographic data in shapefile and GPX format has been included, always coming from the government website.
4. Data taken in the field (PGIS) coming from community direct participation to create geo-data have been finally digitised and integrated into the map.

It is paramount to highlitht that point 3 and 4 were completed recurring both to crowd-sourcing mapping data (OSM and Hotosm) and on the field (primary geo-data finally

digitised and geo-referred in a digital map using QGIS with a gender focus. Without this contribution our maps would lack: 1. community engagement and 2. critical information.

Method	Description	Sources
Statistical Analysis	Use of quantitative models to interpret demographic data	https://www.hcp.ma/draa-tafilalet/Annuaires-Statistiques-Regionaux__r15.html February 2014
Quantitative Methods and GIS for Migration Studies	Integration of quantitative data and spatial analysis (geo-data), QGIS	https://data.humdata.org/dataset/hotosm_mar_populated_places (National Census February 2024) https://data.humdata.org/dataset/hotosm_mar_waterways https://data.gov.ma/data/fr/dataset/liste-des-barrages-dans-le-bassin-hydraulique-de-souss-massa
GIS (Geographic Information Systems)	Spatial mapping	Exported data from OSM and Google Earth Data collected on the ground (PGIS). paper map/women's community / satellite images March 2024 Sentinel Satellite Images data, https://dataspace.copernicus.eu/

Table 2 - Analytical Methods Used

The resulting map highlighted the presence of various agglomerations, including small douars[126] and the city of Zagora, along the entire valley crossed by the Draa river.

Comparative Analysis

Comparison of satellite images and demographic data revealed clear signs of depopulation in rural areas of the Draa Valley. The main findings can be summarized as follows:

- ✧ Reduction of Vegetation: Satellite images have shown a significant reduction in green areas, indicating a loss of vegetation due to prolonged drought and reduced water resources. Oases that were once lush and vital to local agriculture are now largely barren and degraded.
- ✧ Decrease in Rural Population: The demographic data for 2024 show a drastic decrease in the population in rural areas and an increase in urban areas served by artificial dams compared to 1994. A rather discontinuous demographic change is observed over the twenty-year period considered (1994, 2004 and 2014), a sign of a mobility that could be determined by ongoing climate change, in relation to the search for water sources.

[126]A "douar" is a term used in the Maghreb countries, such as Morocco, Algeria and Tunisia, to indicate a small village or rural settlement. These villages are generally inhabited by extended families or clans and are characterized by a traditional social organization.

The regions closest to the Sahara and the border with the Algerian desert are those that show a slower or negative rate of population growth (with the presence of municipalities that have practically depopulated). This demographic decline has been confirmed by satellite images, which show an increase in uncultivated lands and abandoned buildings.

March 2024 mission

This research also draws on additional data collected during my mission in March 2024 in Zagora province up to the end of the Draa Valley that ends at the village of M'hamid, which have been sponsorshiped by the CSTE (Centro di Sostenibilità e Transizione Ecologica) of Palermo University. Satellite imagery was used to physically document the locations and characteristics of water sources for a broader spatial analysis, which was discussed with a group of ten women who helped identify water sources in the desert region. The mapping exercise revealed a diverse network of 22 water sources scattered across the Draa Valley, including traditional wells, natural springs, and modern irrigation systems. Local women expressed concern about the increased frequency and severity of droughts in the region, which have led to diminished water resources and crop failure. The re-processing of these data into cartographic results is currently underway and partly processed in a research outcome.
Field surveys conducted through geo-localization have highlighted the visible impact of climate change on palm trees, which are struggling to survive in the face of prolonged periods of heat and drought.


Figure 11 - Fig 2 and 3.
The Draa dry river bed and dead palms from the oasis - Source: Author's shot.

In the context of the research conducted in the Draa Valley of Morocco, the women who participated in the mapping activity show a variety of ages and backgrounds, which contributes to a diverse and informative perspective. In particular, a generational distinction is evident among the participants, with older women having experienced the transition from nomadism to sedentarisation and possessing in-depth knowledge of water resources in the M'hamid Desert, while younger women benefit from both the experience

passed down from previous generations and their direct experience and familiarity with wells in the region.

For the research purpose, it was used the Google Earth "timelapse" , a tool which visualises the Earth's evolution over time through satellite images, and the European Union's Copernicus program, which uses geospatial data to monitor the planet. Copernicus Sentinel satellites provide essential data for monitoring the Earth's surface, seas, atmosphere and sea level.

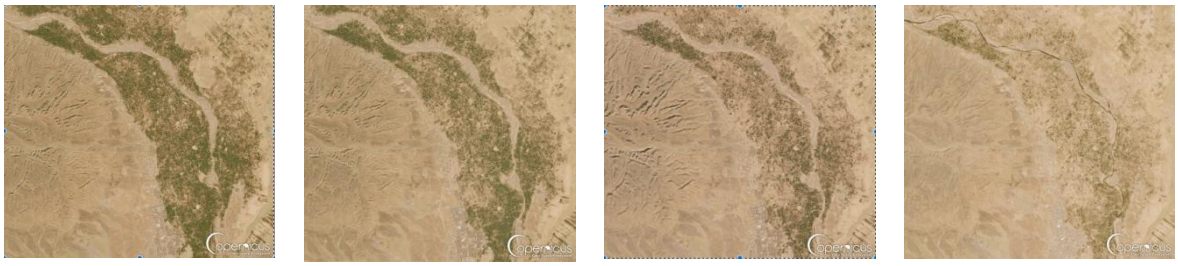

Figure 12 - Figure 4. Sentinel2 Timelapse, May 2021 - 2024, source: https://dataspace.copernicus.eu/

The Copernicus Land Monitoring Service (CLMS) offers global and local geographic data, high resolution and regularly updated, to support the sustainable management of land and natural resources. The use of Sentinel-2 data for global land mapping, marine litter detection and the development of tools such as the Landscape Evolution and Forecasting Toolbox (LEAF), transforms Sentinel-2 data into global maps for the sustainable management of natural resources.

Results

The difference in the comparative analysis of historical images reveals large variations in hydrographic and vegetative levels for the palm grove. Using the layers on QGIS, "Draa Valley Palmeraie 2009," "Draa Valley Palmeraie 2016," and "Draa Valley Palmeraie 2023," (fig. 13) shows significant changes in water resources and vegetation cover over the years considered. On the contrary, the comparative analysis of the agricultural area north of the palm grove, represented by the layers "Draa Valley Horticulture 2009" and "Draa Valley Horticulture 2021" does not show significant changes over time.

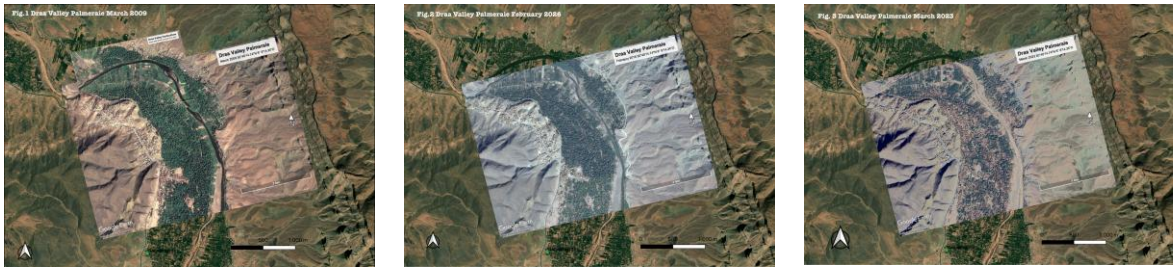

Figure 13 - Draa Valley Palmeraie - Source: Author's elaboration

The map created with QGIS clearly showed how the Draa Valley, once a lush oasis, is now significantly affected by the reduction of water resources. Georeferenced satellite images highlighted a progressive degradation of the natural environment and a decrease in cultivable areas.

The analysis of the date palm prairie highlights the dramatic impact of climate change on the hydrography and vegetation of the region. The 2009 layer shows a relatively lush and well-watered landscape, with a dense concentration of date palms. In 2016, a relative decline in vegetation cover is observed, correlating with reports of prolonged drought and reduced water availability. The 2023 layer shows a notable decline, illustrating an even drier and sparsely vegetated environment. These results suggest a continued degradation of the date palm ecosystem, caused by increasing climate stresses.

In contrast, the agricultural zone north of the palm groves shows remarkable stability in both hydrographic characteristics and vegetation during the same period. The 2009 and 2021 horticulture layers show consistent patterns of land use and cultivation, with no significant variations in vegetation density or water distribution. This stability could be attributed to various factors, including the implementation of effective water management practices, the use of drought-resistant crop varieties, or different socio-economic dynamics that protect this area from the most severe impacts of climate change.

The divergent trends observed in these two regions of the Draa Valley highlight the complexity of climate change impacts and the need for targeted adaptation strategies. Date palm prairies, being more vulnerable to hydrographic changes, require urgent interventions to restore and preserve their ecological balance. These findings underscore the importance of localized and data-driven approaches to climate adaptation and resource management, tailored to the specific vulnerabilities and strengths of each region within the Draa Valley.

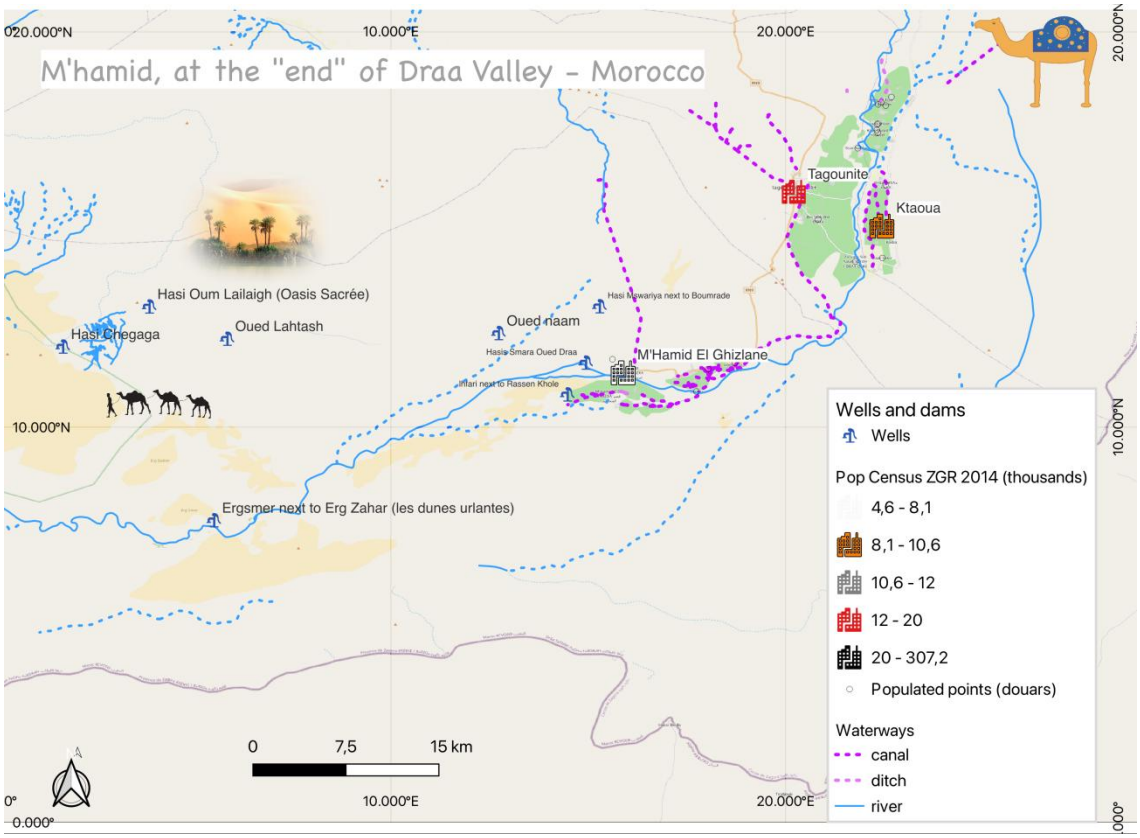

Figure 14 - M'hamid Waterways - Source: Author's elaboration

The map entitled 'M'hamid_waterways Morocco' (fig.14) provides detailed information on waterways, wells, settlements and oases in Zagora region, located in southern Morocco, in the Region of Drâa-Tafilalet.

The map aims to represent the water resources available in the M'hamid el Ghizlane village (also known as the "door of the desert") at the end of the Draa Valley in Morocco, with a focus on access to water for agricultural and domestic purposes. The target audience of this map could be researchers and specialists in water management and sustainable development, local administrators and NGOs, local communities interested in improving access to drinking water and irrigation efficiency, tourists, highlighting places of interest such as oases, dunes and caravan routes.

The map aims to highlight the importance of water resources in an area characterised by a desert climate, showing its use in relation to population distribution, with settlements concentrated along waterways and oases (coloured green). The message of the map is to emphasise environmental fragility and the need to manage water resources in order to prevent "the end" of Draa Valley, an oasis at risk of desertification.

The map shows the spatial distribution of water sources (wells, Draa river) and the use of water for irrigation according to the traditional systems typical of oases, which are irrigation channels (called *seguias* in the local dialect).

The wells present in the desert were digitised using satellite images and local maps. The latter were made with the help of a group of fifteen women from M'hamid who, during a mapping session in March 2024, helped to map about 22 wells, of which I have currently

managed to digitise 8. As far as the traditional irrigation channels (*seguias*) are concerned, I obtained the sources from OSM, which are tagged as "ditch" and "canals". Since OSM reports timely but not exhaustive data, it would be interesting to create a detailed map with the local community to identify the traditional irrigation canals (which are being replaced by cement ones). It seems that there isn't prove of the *kettaras* water system (creation of underground water channels for irrigation), which is present in many areas of Morocco (Faiz & Ruf, 2010).

The use of GIS for water management in M'hamid el Ghizlane provides a better understanding of water availability and distribution in a highly vulnerable arid environment. Despite some limitations in the available data, the combination of satellite imagery, vector data taken from the collaborative platform of OSM (geodata which are not available on Google Map with the same level of accuracy) and information collected on the field by using PGIS methods provides a detailed and useful map to improve water management in the region.

Field data collection should be done to better detail the irrigation system used for the oasis, with a focus on vernacular sustainable systems.

5.3.4 Demographic trends: drought and climate change dramatically affect migration flows

Demographic data confirmed a trend of depopulation of rural areas, associated with migratory processes towards other regions more favorable from the point of view of water resources.

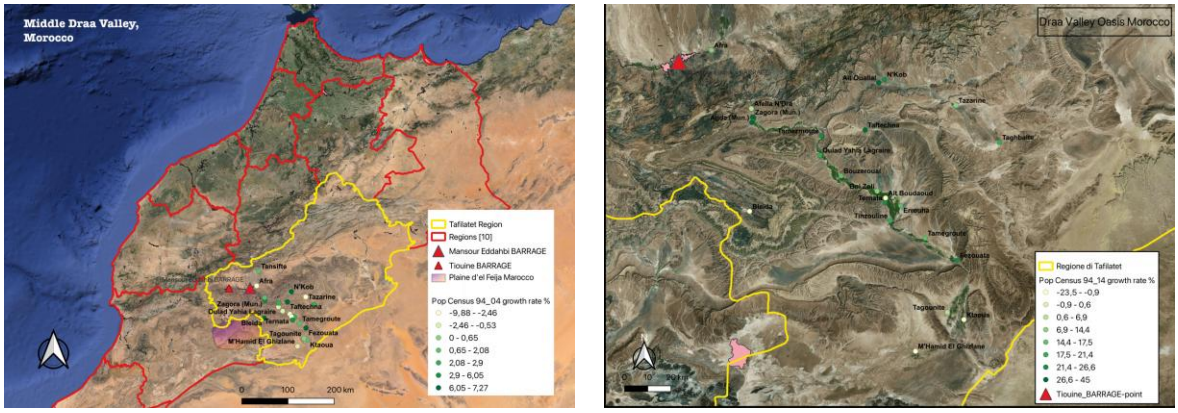

Figure 15 - The Draa Valley Demographic trends. Source: Author's elaboration

The graded mapping of the rate of population growth in the Draa Valley (fig.15) reveals a notable discontinuity in the processes of settlement and depopulation over the course of a few decades. This phenomenon highlights a population mobility that seems to be strongly influenced by the search for water sources and by changes in agricultural and pastoral practices.

By analysing demographic data through advanced GIS tools, it is possible to observe significant changes in population distribution. Some areas show an increase in population

density, while others record a drastic decrease, suggesting a continuous movement of people within the valley. These demographic shifts appear not to be random but to respond to specific needs related to survival and adaptation to changed environmental conditions.
If we analyze fig.15 which is a graduated map created with an excel file in which I aggregated all the data from the latest censuses (1994, 2004, 2014) and in which I subsequently manually inserted the geographic coordinates for acquisition on QGIS, we can observe the following:

- ✓ Most areas are shown in shades of green, indicating low to moderate positive population growth rates from 1994 to 2014. Some areas, particularly in the northwestern part of the region, are shown in shades of green, suggesting higher growth rates. This may indicate economic or social developments in those areas that attract population or encourage higher birth rates.
- ✓ Areas with negative growth rates, shown in yellow, suggest emigration, poor living conditions, or other factors that lead to population decline. The presence of the red triangle (Tiouine_BARRAGE-point) could be related to an infrastructure project that could affect population growth rates in its vicinity due to economic activity, job opportunities, or improved water management.

Trends show the population growth rates for specific locations in two decades, from 1994 to 2004 and from 2004 to 2014. Some notable observations include:

- ✓ there are both positive and negative growth rates, indicating that some areas have experienced population increases, while others have seen decreases;
- ✓ growth rates vary significantly between localities, with some areas showing substantial growth or decline. For example, the locality corresponding to "Ait Bouada" shows a significant decrease in population growth rate from -40.78 between 1994 and 2004 to -7.26 between 2004 and 2014.

Some areas show a reversal of the trend, such as "Tamazmout," which had a negative growth rate between 1994 and 2004 (-3.53) but a positive rate between 2004 and 2014 (22.01).
Table 1 highlights extreme oscillations between population growth rates in the decade 1994-2004 (which could be retrospectively compared with the new census of 2024, already published; however, it lacks small administrative nodes details yet), outlining a phenomenon of depopulation in some areas that deserves further investigation to understand the causes underlying such significant changes in the population. These extreme variations suggest that some specific factors, potentially linked to environmental, economic or social changes, are drastically influencing the demographic dynamics of the region.

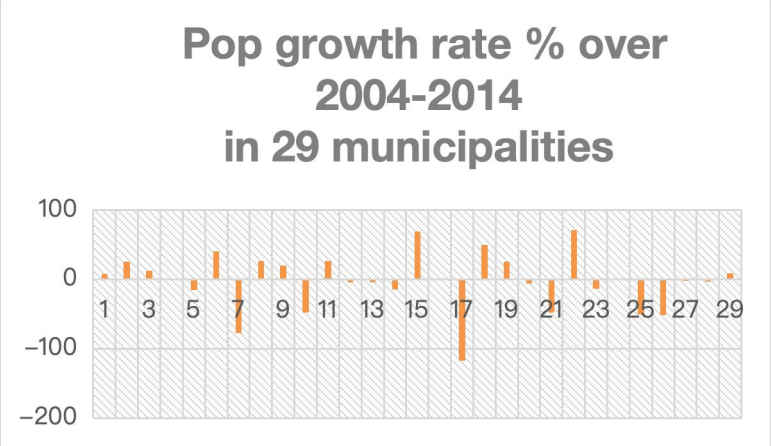

Table 1 - *Source: Author's elaboration*

5.3.5 Discussions: Environmental injustice and its impact on the most vulnerable populations

This study highlights how climate change and water management policies have a profound impact on the Draa Valley. The combination of orographic, demographic and satellite imagery data, combined with crowd-sourcing geo-data and communities' contributions, allowed for to document environmental and social changes in the region.

Increasing water scarcity, due to prolonged droughts and climate change and desertification, is forcing communities to move to areas where water is more easily accessible. This phenomenon is particularly evident in areas close to residual watercourses or artificial infrastructure such as dams. This often involves a shift from economies based on subsistence agriculture to more diversified livelihoods, which may include non-agricultural activities. Population mobility, driven by the search for water resources and the adaptation of agricultural and pastoral practices, requires an integrated and data-driven approach to ensure the sustainability and resilience of local communities in the face of future challenges.

Interviews provided a more complete picture of the challenges faced by local communities: five interviews were conducted from March 2024 until March 2025 (this is still an insufficient number to draw scientific conclusions, and I regret that I do not have more resources and research time to investigate further). They provided further insights into the political and social dynamics that influence water management in the region. It emerged that dams built along the Draa River have contributed to depriving rural communities of crucial water resources, exacerbating drought problems and further promoting depopulation. According to the interviews, water management policies in Morocco seem to be oriented to favour urban areas, which are often considered to be of greater economic and political importance. This approach can be interpreted as a strategy to support economic growth in cities and ensure their sustainable development. However, this focus on urban areas has significant consequences for rural communities, especially in regions such as the Draa Valley.

Rural areas, often described in interviews as "abandonés" (abandoned), are perceived as areas of less political interest. This term highlights the feeling of neglect and marginalization that many rural communities experience. Water resources, which are vital for the maintenance of oases and local agriculture, are then diverted to urban areas, leaving rural communities to face drought and aridity with limited means.

Recent national reports have also underlined the aggravation of the development gap between rural and urban regions as well as decentralised development that fits the local community based on project interviews. Based on figures from the High Commission for Planning (HCP), the coastal urban area—which includes Casablanca—makes around 58% of the GDP. By contrast, the weakest area, Draa-Tafilatet, with a GDP per capita of only 15,809 dirhams, well below the national average of 29,390 dirhams[127].

Migratory flows are therefore affecting rural regions, which are prone to geographical marginalisation in addition to economic exclusion, and small to medium-sized cities, which are sidelined by programs focused on bigger cities (Bogaert, 2021). Data from the HCP show that four-fifths of Morocco's population lives in rural regions, where poverty rates are three times greater than in metropolitan areas.

Within this context the water management policy has profound social and environmental implications, closely linked to the concept of climate justice. On the social side, water scarcity in rural areas has amplified inequalities, forcing many vulnerable communities to migrate to cities or abroad in search of more sustainable living conditions. Environmentally, the progressive reduction of water resources has accelerated the degradation of local ecosystems, resulting in a loss of biodiversity and increased desertification. These effects disproportionately affect already disadvantaged populations, highlighting how the water crisis is not only an environmental issue, but also a question of equity and rights.

The methodological approaches adopted have allowed to acquire initial data and information for an academic research that could be deepened with a focus on the environmental and social dynamics in the specified areas of interest. Collaboration with the communities involved is encouraged to ensure an ethical and culturally sensitive approach during all phases of the research and mapping process. The study contains potential for future research development through the expansion of the baseline of the investigation.

The aim of the research responds to the urgent need to develop water management strategies that take into account the needs of rural communities and promote environmental sustainability. Only through an integrated approach that considers climatic, social and political dynamics will it be possible to preserve the Draa Valley ecosystem and improve the living conditions of its populations.

[127] Haut-Commissariat au Plan. (2016). *Note d'information sur les comptes régionaux de la région de l'Oriental 2016*. Haut-Commissariat au Plan. Retrieved from https://www.hcp.ma/region-oriental/docs/comptesregionaux/NoteInfoCompteRegionalOriental2016FR.pdf

Conclusions

The study of section 5.1 concludes by highlighting how participatory mapping can be a factor of democratization and emancipation of local communities in the face of existing powers. From this perspective, the map is an instrument of emancipation for minorities or marginalized groups: it uses a new language of social protest, territorial negotiation and becomes a militant object to promote struggles, especially urban ones.

As we have seen in section 5.2 humanitarian maps represent a new narrative by offering a transformed perception of the environment as they serve as instruments for long-term recovery and resilience. This shift in geographic storytelling not only aids in immediate disaster response but also in the long-term development and strengthening of affected communities. The collected data demonstrate that, in a context of post-emergency disasters, communities—especially women—have highlighted the possibilities of redemption and recovery. From "ruins", there emerges a perception of rehabilitation through the geo-narrative provided by PGIS. This narrative not only portrays the immediate aftermath but also charts a course towards rebuilding and renewal, underscoring the transformative power of geographic information systems in fostering resilience and hope amidst the ruins.
Environmental law and climate justice are essential pillars in the fight against climate change. Legal frameworks must evolve to ensure equitable, effective, and enforceable climate policies. The intersection of law, science, and policy discussed in section 5.3 offers a pathway toward a more sustainable and just future.
The experience on the field highlights the importance of participatory geographic information systems (PGIS) in creating spatially explicit data necessary for effective water management and community engagement. The involvement of women in climate activism is emphasised as crucial for addressing water-related issues, safeguarding public health, and preserving local customs.

To mitigate this injustice, several policies could be implemented:

- ✓ Enhance Water Resources Management Reform: it is crucial to give strength to Governement national policies that ensure equitable access to water resources for all communities, including rural communities. This approach could include the creation of governance mechanisms and methods that involve local communities in the planning and management of water resources.
- ✓ Agricultural Sustainability: promote sustainable agricultural practices that require less water and are better adapted to local climatic conditions. This could include crop diversification and the adoption of more efficient irrigation techniques, among others, the traditional one such as the khettara systems. That could occur by strengthening and supporting intergenerational ties to guarantee the spread of regional knowledge and conventional farming methods.
- ✓ Support for Rural Communities: invest in development programmes that support rural communities in their transition to more diversified economies, reducing their dependence on traditional agriculture and improving employment opportunities, and

the need for migration to metropolitan hubs, therefore conserving the local ecology and cultural legacy.

- ✓ International Co-operation: Strengthen co-operation between countries in the region to manage transboundary water resources in an equitable and sustainable manner, following the principles set out in the European Water Charter.
- ✓ Encourage the sharing and study of ancestral knowledge so that it may be used in initiatives for climate change mitigation and adaptation.

Implementing these policies could help reduce inequalities and improve the living conditions of local populations in the Draa Valley.

References

Ait Almouh, H. (2023). *Along the Draa wadi, two dams and a dry valley*. Telquel, n. 1025, 6 January 2023.

Ait Lamqadem, A., Pradhan, B., Saber, H., & Rahimi, A. (2018). Desertification Sensitivity Analysis Using MEDALUS Model and GIS: A Case Study of the Oases of Middle Draa Valley, Morocco. *Sensors*, 18(7), 2230. https://doi.org/10.3390/s18072230

Agbola, T. (a cura di, 1997). *The Architecture of Fear: A Pilot Study of Planning Urban Design and Construction Reaction to Urban Violence in Lagos, Nigeria*. Ibadan: IFRA and African Builders.

Boelens, R., Hoogesteger, J., & Swyngedouw, E. (2016). Water justice in times of climate change: An overview. In R. Boelens, J. Hoogesteger, & E. Swyngedouw (Eds.), *Water justice: The politics of water governance* (pp. 1–24). Cambridge University Press.

Bogaert, K. (2018). Globalized Authoritarianism and the New Moroccan City. *MERIP*, 48(287), 6–10.

Bryce, E. (2016, November 7). A drive to save Saharan oases as climate change takes a toll: COP22. *Yale e360*. Retrieved from https://e360.yale.edu/features/a_drive_to_save_saharan_oases_as_climate_change_takes_a_toll_cop22br

Casaglia, A., & Giubilaro, C. (2020). Carte di frontiera. (Contro-)mappature del Mediterraneo a confronto. *Bollettino della Associazione Italiana di Cartografia*, 170, 49–61. https://doi.org/10.13137/2282-572X/

Caselli, M. (2009). Transnazionalismo. In V. Cesareo & G. Blangiardo (Eds.), *Indici di integrazione. Un'indagine empirica sulla realtà migratoria italiana* (pp. 109–122).

Chierichetti, Nicolò & Gardino, Maria & Mercatili, Greta. (2020). *URBAN FRINGES AS URBAN LABORATORIES - The inefficiency of Villes Sans Bidonvilles Program and the new vision of the Douars, in Marrakech*. 10.13140/RG.2.2.27581.49127

Choplin, A., & Lozivit, M. (2019). Mapping a slum: Learning from participatory mapping and digital innovation in Cotonou (Benin). *Cybergeo: European Journal of Geography*, (894).

Davis, M. (a cura di, 2006). *Planet of Slums*. London: Verso.

De Spuches, G. (2021). Per una didattica della geografia sociale: sopralluoghi ed esplorazioni urbane. *Geography Notebooks*, 4(2), 55-64. doi: https://doi.org/10.7358/gn-2021-002-spu1

Elkhalifi, A., Aït Moussa, A., & Bouaouinate, A. (2022). Tourisme et pauvreté au Drâa moyen. Cas de la palmeraie de M'hamid El Ghizlane (Province de Zagora, Maroc). *Revue d'Innovation et Dynamiques Territoriales,* 1.

El Kahlaoui, S. (2015). Revendiquer un droit en situation d'illégalité. In B. Dupret, Z. Rhani, A. Boutaleb, & J. Ferrié (Eds.), *Le Maroc au présent*. Casablanca: Centre Jacques-Berque.

Faiz, M., & Ruf, T. (2010). An Introduction to the Khettara in Morocco: Two Contrasting Cases. In *Water and Sustainability in Arid Regions* (pp. 189–204). https://doi.org/10.1007/978-90-481-2776-4_10

Giampaolo, M., & Ianni, A. (2021). La migrazione rurale-urbana in Africa. *Quaderni FOCSIV, I volti delle migrazioni* (n. 10).

Giorgi, F., & Lionello, P. (2008). Climate change projections for the Mediterranean region. *Global and Planetary Change*, 63(2–3), 90–104. https://doi.org/10.1016/j.gloplacha.2007.09.005

Guarrasi V. (2006), L'indagine sul terreno e l'arte del sopralluogo, in Marengo M., a cura di, *La dimensione locale. Esperienze (multidisciplinari) di ricerca e questioni metodologiche*, Aracne, Roma.

Hachem, A., El-Mostafa, M., Benbella, B., El Ouardi, H., & Mehdaoui, R. (2023). Characterization of climatic drought sequences in the Upper Moulouya Watershed, Morocco. *Ecological Engineering & Environmental Technology*, 2, 162–179.

Karmaoui, A. (2019). Drought and desertification in Moroccan Pre-Sahara, Draa valleys: exploring from the perspective of young people. *Geoenvironmental Disasters*, 6(2). https://doi.org/10.1186/s40677-019-0118-8

Karmaoui, A., Ifaadassan, I., Messouli, M., & Khebiza, M. Y. (2015). Characterization of Common Environmental Indicators of the Moroccan Oasean Biome. *Advances in Research*, 5(5), 1–15. https://doi.org/10.9734/AIR/2015/19369

Karmaoui, A., Ifaadassan, I., Babqiqi, A., Messouli, M., & Khebiza, M. Y. (2016). Analysis of the Water Supply-demand Relationship in the Middle Draa Valley, Morocco. *Journal of Scientific Research and Reports*, 9, 1–10. https://doi.org/10.9734/JSRR/2016/21536

Lefebvre, H. (1968). *Le droit à la ville*. Paris: Éditions Anthropos.

Linstädter, A., Baumann, G., Diekkrüger, B., & Fritzsche, P. (2010). Land use and land cover in Southern Morocco: Managing unpredictable resources and extreme events. In *Climate and Environmental Change in the Mediterranean Basin*. Springer.

Mhamka, B., & Masto, R. (2008). *La scelta di Said. Storia di un kamikaze*. Sperling & Kupfer.

Mills-Novoa, M., Boelens, R., & Hoogesteger, J. (2022). Climate change and water justice. In *Encyclopedia of Water: Science, Technology, and Society*. Elsevier. https://doi.org/10.1016/B978-0-323-99875-8.00014-8

Nossov, K. (2013). Protecting travel and trade: Seljuq fortified caravanserais in Anatolia. *Medieval Warfare*, 3(3), 22–27. https://www.jstor.org/stable/48578236

Ouassou, A., Amziane, T. H., & Lajouad, L. (n.d.). State of natural resources degradation in Morocco. In *Desertification in the Mediterranean region: A security issue* (pp. 251–268).

Pirani, N., Ricker, B., & Kraak, M.-J. (2019). Feminist cartography and gender equality. *The Canadian Geographer*, 64. https://doi.org/10.1111/cag.12575

Ross, E. (a cura di, 2022). *Sufi City: Urban Design and Archetypes in Touba* (Vol. 24). Rochester Studies in African History and the Diaspora. https://doi.org/10.1515/9781580466615

Rossi, V. (2024), Ruins of redemption: The role of crowd-mapping within humanitarian rescue operations, Folio, 43 (June 2024), 137–145.

Rössler, M., Kirscht, H., Rademacher-Schulz, C., Platt, S., Kemmerling, B., & Linstädter, A. (2010). Migration and resource management in the Drâa Valley, Southern Morocco, in P. Speth, M. Christoph, & B. Diekkrüger (Eds.), *Impacts of global change on the hydrological cycle in West and Northwest Africa* (pp. 584–597). Springer, 2011. ISBN: 978-3-642-12956-8.

Ros-Tonen, M. A. F., Willemen, L., & McCall, M. K. (2021). Spatial tools for integrated and inclusive landscape governance: Toward a new research agenda. *Environmental Management*, 68, 611–618. https://doi.org/10.1007/s00267-021-01547-x

Stocchiero, A. (a cura di, 2021). *Padroni della Terra 2021 / Land Lords 2021. Report on land grabbing*.

UN-Habitat. (2003). *The Challenge of Slums: Global Report on Human Settlements 2003*. London: Earthscan.

United Nations, Department of Economic and Social Affairs, Population Division. (2024). *World Population Prospects 2024*. UN DESA/POP/2024/DC/NO. 10.

Walton, J., Shefner, J., & Seddon, D. (2008). *Free markets & food riots: The politics of global adjustment*. https://doi.org/10.1002/9780470712962.ch4

WEB REFERENCES

Radio El Amane. Recuperato da: https://radiopublic.com/radio-el-amane-GKRz9Q
Recensement Général de la Population et de l'Habitat 2024. (2025). Haut Commissariat au Plan. Retrieved March 2025, from https://www.hcp.ma/
Slum Dwellers International. Retrieved from: https://sdinet.org/
World Bank. Population living in slums (% of urban population). Recuperato da: https://data.worldbank.org (last consulted: March 2025).
Slum Dwellers International. Recuperato da https://sdinet.org/
Radio El Amane. Retrieved from: https://radiopublic.com/radio-el-amane-GKRz9Q
World Bank. Population living in slums (% of urban population). Retrieved from:data.worldbank.org (last consulted: March 2025).
Recensement Général de la Population et de l'Habitat 2024, Haut Commissariat au plan https://www.hcp.ma/ (last consulted: March 2025).

Geoportal Humanitarian Mapping Project by Caritas (section 5.2.2)
https://www.arcgis.com/apps/instant/portfolio/index.html?appid=ddf0601c4eb84adba9dde6a78ac6d6fc

Chapter 6 - Mapping Disputes: Political Carto-Vandalism in OpenStreetMap

Abstract: In OpenStreetMap, "tag wars" are political carto-vandalism manifestations. In this way, maps turn out to be a battleground of ideologies and territorial claim. OpenStreetMap (OSM) has experienced "editing wars" perpetrated in a random or programmed manner, in a reiteration of changesets. As an example, the Israeli-Palestinian conflict region shows these disagreements, especially over how to name Jerusalem, since different contributors have different ideas about which names and language forms should be used. Similarly, Crimea has become a clash over place names dispute, where Ukrainian and Russian-speaking users, in turn, seek to assert sovereignty through toponyms that reflect their political narratives. The Western Sahara, which is occupied by Morocco and the Polisario Front, leads to cartographic arguments in OpenStreetMap because of the issues of sovereignty. OpenStreetMap often comes out to mirror broader geopolitical tensions, even though it is mostly perceived as a platform designed for collaborative and neutral mapping. This especially occurs when contributors impose competing perspectives on a shared digital space.
By using a qualitative analysis of historical data changes on OSM, this study explores if it is the collaborative model of OSM that influences its vulnerability to disputes, given the natural implications of its democratised structure in politically sensitive regions. The chapter examines how conflicting narratives could be negotiated by contributors because of the platform's decentralised framework. The role of OpenStreetMap's Data Working Group (DWG) in resolving disputes is also investigated, especially in its application of principles like the "on-the-ground rule" to maintain neutrality.

Keywords: 4-6 carto-vandalism, OpenStreetMap, tag-wars, Western Sahara, Palestine.

Introduction

In the 21st century, digital geographical data has become a cornerstone of geopolitics, influencing decision-making processes, security strategies, and economic policies. Geographic Information Systems (GIS), satellite imagery, and collaborative mapping platforms like OpenStreetMap (OSM) provide unprecedented insights into territorial dynamics, resource distribution, and population movements. In the modern political landscape, digital geospatial information proves to be a valuable asset for countries, corporations, and even humanitarian organisations owing to the intricacies of global interdependence.
Ethical and policy concerns araise from the growing reliance on digital geographical data, especially in regard to privacy, which is particularly threatened in authoritarian regimes where geospatial data may be weaponised (Kitchin 2014), as it has been pointed out by the critical cartography as far as the need to interrogate who controls and produces geographical data is investigated, since it can reinforce power imbalances (Harley 1989).
As for data governance, to regulate the use of digital geographical inputs, and ensure accountability and ethical standards, international frameworks are needed: organisations

like the United Nations are working towards such guidelines, but enforcement remains a challenge (Goodchild 2007).

Starting from colonial cartography and propaganda maps of the 20th century, such distortions were employed to overemphasise territorial possession, erase native peoples' identity, and demonstrate power. Across history, there has been what can be referred to as carto-vandalism which is a form of resistance against geographic expansionism. For example, in 1943, Mussolini's 'imperial maps' in Rome were vandalised with red paint, an act that was a physical assault on Fascism's territorialistic dogma (Minor, 1999). This act of vandalism was a manifestation of the overall discontent of the Italian public to the Fascist regime, especially after the downfall of Mussolini. Maps and acts of carto-vandalism have been the most effective ways to express protest since Mussolini's reign in Italy.

The red colour was incorporated into the imperial maps in a very dramatic and clear way to show the atrocities committed by the regime in the colonial arenas. This action showed that it was possible to protest in ways that were not only conventional and this act of resistance was possible even in oppressive societies. It was also an attempt to demystify power: altering the map revealed the underlying ideology, taking the mask off of the "empire" and showing how it was built. Moreover, there are other historical examples, including the defacement of maps: for example, during the American Revolutionary War, when the colonists retouched the British maps to state their ownership of certain territories (Stock 2016). Likewise, after the postcolonial period, the maps which used to define colonial boundaries have been attacked by different groups of people in an attempt to redefine themselves and their territory. These can be considered acts of carto-vandalism that could be considered as powerful statements against the narratives of expansionism and imperialism, and therefore a challenge to the legitimacy of the borders and the claims to ownership of territory that have been traced.

There has been a change in mapping practices that has transformed traditional expert-driven models into collaborative, crowdsourced maps (Ballatore 2014), exposing them to increased vulnerability to malicious actions. Given the open nature of platforms like OpenStreetMap, where anyone has the right to edit, maps become susceptible to carto-vandalism, risking the degradation of their digital artefacts.

Ballatore examines the similarities between physical and digital vandalism and the effectiveness of counter-strategies, highlighting how there is a high contribution to the disinhibition effect in online spaces that could be responsible for fostering deviant behaviour. What are the measures of mitigation that the community employs to combat carto-vandalism? The most common behaviours are policing and automated detection methods.

6.1 The power of Maps

The cultural roots of cartographic power are fundamentally anchored in the legacies of imperial exploration, resource exploitation, colonisation, and state control, which have influenced the strategic applications of maps, especially in conflicts. Maps have been "designed and used for centuries for highly strategic purposes such as planning and executing war" (Krupar 2015), therefore reflecting the geopolitical agendas of governments and their military plans. Maps, therefore embodied the geopolitical agendas of the states and their military strategies. The emergence of the concept of map power in the West was a result of pragmatic military needs, where maps became tools that determined the management of space and therefore the practice of war.

A map can seem a simple thing, yet the act of holding it, studying and discussing the contents illuminates how they operate as practical and rhetorical tools for control, as demonstrated in South Africa during apartheid

Figure 16 - Officials examine Johannesburg 'Native Townships' plan. Apartheid Museum Photograph[128]

The role of cartography should be thought of as a paradigm that expresses an idea, not an absolute truth. Just consider the dilemma between equivalent cartographic representations

[128] Source:https://www.theguardian.com/cities/2014/dec/02/architects-apartheid-picturing-place-johannesburg-map-planning

(which preserve areas but distort shapes) and conformal representations (which preserve angles but distort areas), emphasising that each choice represents an idea and a choice[129].

According to Krupar (2015), mapping is a powerful tool that has been used in the rise of modern geography, as it is a social justice issue since maps are tools of power that help in defining space in a way that enables oppression and control. Mapping has a rather paradoxical role in today's world, as it has always been closely associated with imperialism, extraction of resources, and state-building, which is the expression of certain strategic interests and not the accurate representation of reality. The construction of world maps is strongly influenced by how different cultures place themselves in relation to others, thus reflecting the "rule of ethnocentricity." This rule often leads historical societies to place their own territories at the centre of their cosmographies or world maps, which is evident in various cultures, from pre-Columbian North American Indians to ancient Babylonia, Greece, and mediaeval Islamic and Christian maps. Furthermore, the scientific Renaissance in Europe, while advancing cartographic techniques, also reinforced a myth of Europe's ideological centrality through projections like those of Mercator, which exemplify this ethnocentric bias[130]. The ideological implications of such centricity contribute to the geopolitical force and meaning of representations, codifying and legitimising the worldviews prevalent in different periods and places.

A map should be deconstructed and decoded to extract metadata, quantitative and qualitative information, especially when we talk about pre-geodetic cartography, so that it can be used and shared with related disciplines[131].

On the other hand, while maps often reinforce coercive dynamics, they can also serve as tools for social movements advocating for liberation and justice. There is, indeed, a double narrative of maps: the critique of traditional mapping practices and the use of mapping as a method of resistance[132]. Activist mapping subverts conventional discourses and aims at giving voice to the voiceless, by applying mapping in the struggle for social change in order to show how it is used in movements for social justice. Critical cartography has

[129] Conformal maps preserve local shapes but distort areas, making them suitable for navigation and topographic purposes (as in the Mercator projection). Equal-area maps, by contrast, maintain the correct proportions of surface area while distorting shapes, which makes them preferable for geographic or statistical analyses (such as the Gall-Peters projection).

[130] One significant example is the Galls-Peters Projection, which is a critique of the Eurocentric Mercator projection that is accused to inflate the size of regions based on their distance from the equator, thereby minimizing the significance of poorer nations.

[131] Pre-geodetic cartography is the type of cartographic representation created before the development and adoption of modern geodetic techniques. In practice, these are maps and charts created before precise instruments and methods were used to measure and represent the shape and size of the Earth with mathematical and geometric accuracy. These maps were often based on visual observations, approximate measurements, or historical sources and testimonies, and therefore may contain significant errors, distortions and inaccuracies compared to later geodetic maps. Participatory maps have similar characteristics.

[132] "Maps are active; they actively construct knowledge, they exercise power and they can be a powerful means of promoting social change." Jeremy W. Crampton and John Krygier, "An Introduction to Critical Cartography," 2006, (Krupar 2015).

become a discipline that analyses the values that underpin the maps and how the maps can lie and strengthen the oppression.

Counter-mapping initiatives allow communities to contest state narratives and assert their own spatial knowledge, often employing official mapping techniques to reclaim rights and resources. Krupar also highlights various activist mapping projects that challenge dominant representations and promote social change. These include immersive tours and alternative history trails that engage local communities and emphasise marginalised voices. He advocates for "map literacy" as a crucial educational tool to empower individuals and communities to navigate and reshape their spatial realities. Overall, we can say that mapping is a powerful act that can either reinforce existing power structures or serve as a means of resistance and social justice.

The evolution of mapping technologies has intensified the perception of maps as objective representations, which has significant implications for military strategy and operations. Contemporary information-technology mapping has fundamentally transformed military activity, demonstrating the intertwining of mapping practices with the exercise of power in warfare. The development of satellite imagery, remote sensing, and geographic information systems (GIS) has allowed for what appears to be a "value-neutral transcription of the environment," which has been utilised for strategic military purposes. Furthermore, these advancements have enabled the military to produce spatial knowledge that legitimises borders and makes resources visible, thereby facilitating domination and control. Additionally, the rise of grassroots mapping technologies has created tensions between expert and amateur mapping, which can influence military strategies by incorporating diverse perspectives and local knowledge. Overall, the integration of advanced mapping technologies into military operations underscores the critical role that maps play in shaping modern warfare.

The technologies associated with mapping can potentially be misused or abused by malicious actors in several ways. For instance, the aggregation of spatial data can raise regulatory concerns and social distress over privacy and access, leading to the pirating of populist knowledge for corporate purposes. Additionally, the reliance on commercial datasets and platforms for participatory GIS can undermine the democratic nature of community mapping, as it may prioritise private profits over open-source mapping and data sharing. Furthermore, the critical claims-making of non-professional mapmakers could be exploited by those with malicious intent, as mapping technologies become further embedded in accessible online tools, potentially leading to misinformation or manipulation of spatial narratives.

While Harley originally advocated for a professional cartographic ethics, which was centred around the paper-based topographic map as a democratic tool, modern digital cartography has shifted into more corporatised and militarised domains. Critiques of digital mapping suggest that democratised maps today face similar issues to those identified by Harley decades ago (Harley 1989)[133]. This shift raises ongoing ethical questions about who

[133] The essay "Deconstructing the Map" by J. B. Harley argues for a significant epistemological shift in the interpretation of cartography, suggesting that maps are not merely objective representations of reality but are

controls geographic knowledge production and how asymmetrical power structures affect the exchange and consumption of mapping information.

There is a growing critique of how contemporary mapping practices often overlook grassroots and counter-mapping efforts, which aim to create alternative, community-driven geographies. These counter-mapping projects—including artistic, activist, and grassroots interventions—seek to challenge mainstream, corporate mapping practices by promoting diverse and inclusive perspectives on space.

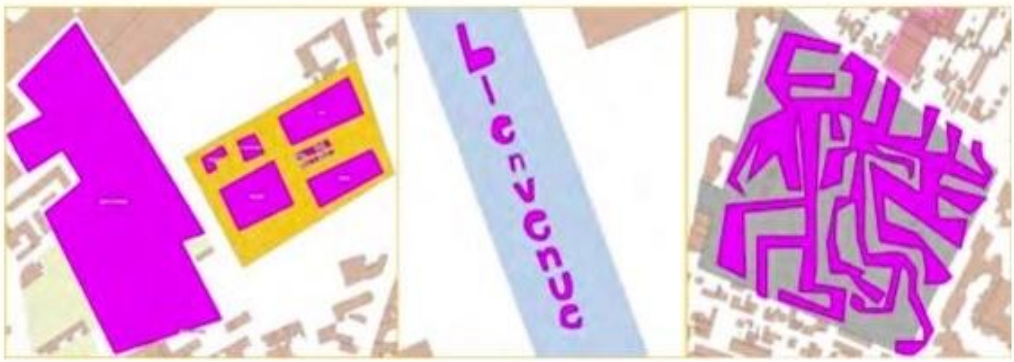

Figure 17 - Fantasy vandalism (left image) and artistic vandalism in Aubervilliers, France (Truong et al. 2018)

Ushahidi, an example of activist mapping, utilises the crowdsourcing paradigm to promote social activism and public accountability. This platform combines social activism, participatory journalism, and geospatial information. Ushahidi provides tools that allow local observers to send information using their mobile phones or the internet, creating a temporal and geospatial archive of events.

The context in which Ushahidi was born is emblematic, as it emerged as an initiative tied to a specific moment and the utilitarian use of mapping to record and monitor post-election violence in Kenya. During the unrest on the streets of Nairobi and other parts of Kenya, Ushahidi's crowdsourcing tools were used by thousands of individuals and millions of people to “raise voices, inform decisions, stop suffering, and influence change.” Ushahidi has been used by community leaders and neighbours to address their issues through local campaigns that have resulted in initiatives such as installing more streetlights, raising awareness through campaigns, organising women's walking groups, and improving city resources to protect women.

deeply embedded in social and cultural contexts. It provides examples of ethnocentricity in world maps and how social structures are embedded in cartographic representations, demonstrating that maps often serve to legitimise existing power relations.

6.2 Carto-vandalism

Maps serve as powerful representations of geographic realities, and the rise of online mapping practices has transformed traditional expert-driven models into collaborative, crowdsourced efforts (Ballatore 2014). As already mentioned, this shift has led to increased vulnerability to malicious actions, as the open nature of platforms like OpenStreetMap allows anyone to edit maps, making them susceptible to carto-vandalism.

As a matter of fact, OpenStreetMap (OSM) has experienced "editing wars" where users engage in repeated modifications of contentious areas, often tied to territorial disputes or politically sensitive regions. In these scenarios, some users have worked to restore deleted sections of the map while others—opposing those restorations—continued deleting them, creating a cycle of edits and reverts. These mapping disagreements aren't just about names; they also involve removing whole communities or religious sites that are important to culture, like monasteries, mosques, and historic landmarks, or changing boundaries and barriers. This practice reveals a tendency among parties in conflict to manipulate geographic data to support territorial claims, erase symbols of their adversaries' culture, or assert their presence on disputed lands.

In these contexts, due to their symbolic significance as platforms for political assertion, digital maps cease to be mere tools for navigation. Maps as instruments of power (Krupar, 2015) represent space in ways that facilitate domination and control, thus investigating the relationship between mapping, power, and social justice. The strengths and vulnerabilities of crowd-sourced geospatial data manifest themselves when geopolitical disputes manifest in virtual spaces.

In conflict zones and crisis-affected regions, the integrity of geographic data is crucial for humanitarian efforts, resource management, and accurate navigation. OpenStreetMap (OSM), as a prominent collaborative mapping platform, has become an essential tool for many organisations and individuals in these areas. However, it is also vulnerable to vandalism, particularly in politically sensitive contexts.

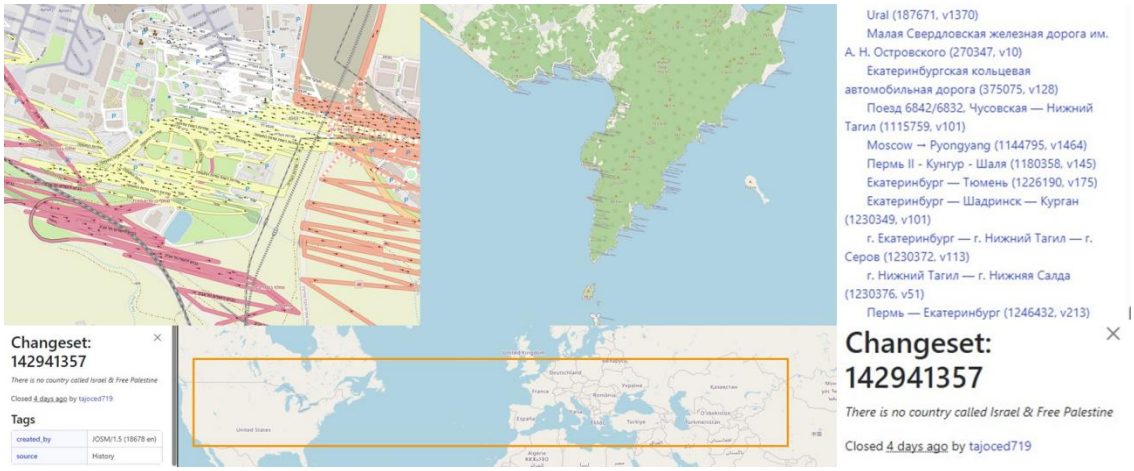

Figure 18 - - Examples of data distortion (left to right-top to bottom); infrastructure distortion in Israel, coastline distortion Türkiye, Ukrainian verbal attack in data tags, scale of oct23 vandalism, Palestinian tag used in OSM attacks (Kostanian 2023)

The case of Palestina

Acts of deliberate data vandalism, including deletion, manipulation, and the addition of spam tags come to light as primarily distortions in OpenStreetMap. Isolated individuals, identified as Palestinian or pro-Palestinian, have recently used multiple OSM accounts to intentionally disrupt data in Israel and the Mediterranean Sea through targeted acts of vandalism. The altered targets are key infrastructure data, including hospitals, schools, and emergency services, which are occasionally deleted or corrupted. These acts of vandalism, aiming at creating disruption and chaos, are often conducted on a large scale and indiscriminately. In addition to the primary forms of vandalism, a less frequent but notable type involves "tagging," where data is reclassified to include profanity or political statements. Between October and November 2023, there was a significant wave of politically motivated vandalism on OSM, and it coincided with the escalation of violence soon after Hamas' attacks on Israel[134]. This act of vandalism was perpetrated by newly registered users who altered, deleted, and distorted map data in Israel and surrounding regions, including Lebanon, Syria, Turkey, Cyprus, and Gaza. In some cases, these actions were accompanied by explicit political statements, such as “There is no country, Israel & Free Palestine.” The attempt was swiftly detected and countered by a vigilant community of Israeli OSM editors, who restored the missing information.

The attack was symptomatic of an emerging pattern of territorial disputes in digital mapping, whereby the virtual delineation of borders occurs in forms that mirror actual political conflicts. This episode underscores the difficulties encountered by open-source systems like as OSM, which depend on community contributions to preserve and enhance the integrity of their data.

The vandalism incident in OSM was not an isolated case. In late October 2023, Google Maps also became a target for cyber activists who manipulated the representation of the Rafah border crossing between Gaza and Egypt by inserting fake placenames containing anti-Israel messages. This attack occurred when Google disabled live traffic data in the region as a precaution during escalating military activities. These incidents bring a broader issue in the realm of Volunteered Geographical Information (VGI) platforms, where the manipulation of digital maps becomes a tool for political or ideological warfare, complicating their use for navigation, humanitarian relief, and operational purposes.

Traditional cartography should be analysed as a medium that historically reinforces singular and hegemonic worldviews (De Vet 2023). Often perceived as objective, traditional maps actually serve specific political and ideological agendas, shaping individuals' understanding and interaction with geographical spaces.

De Vet scrutinises the De Boeck Atlas, a Flemish educational system atlas that completely ignores Palestine. As she notes in her essay *The problem of cartography: From singular to plural mapping*, “maps are coded, flattened representations of a space, and coding means

[134] As reported in State of the Map 2024 Presentation by Marco Minghini and Yair Grinberger.

making choices, simplifying and discarding many layers of information" (de Vet, 2023, p. 23)[135]. In the atlas index, there is no reference to Palestine, neither as a geographiclocation nor as a state, while Israel is depicted without any acknowledgement of the Palestinian context. De Vet notes that this type of mapping represents an ideological choice that, intentionally or not, erases the Palestinian narrative. Moreover, occupied Palestinian territories like the West Bank are marked with smaller text than "Samaria and Judea." These terms reflect the Israeli narrative and imply that the West Bank is part of Israeli territory (de Vet, 2023, p. 24).

De Vet views the agreement as an example of how maps can reflect political intentions, legitimising colonial power and undermining the self-determination of indigenous populations, and she counters this with a countermapping narrative[136].

While OSM's decentralised and community-driven model has enabled rapid responses to data discrepancies, it also presents vulnerabilities to organised disruptions. The vandalism not only compromised the accuracy of OSM data but also raised questions about the ability of such platforms to remain neutral in politically charged environments. In response to the attacks, the reaction of the OSM Foundation's DWG was quick in banning the offending users and implementing measures such as rate limiting with the aim to prevent future large-scale disruptions. The Israeli OSM community made a rapid restoration of the map data, which further demonstrated the platform's resilience in facing such challenges.

[135] The essay describes how maps like those in the De Boeck Atlas, used in Flemish education, omit representations of places such as Palestine, thereby invisibilizing particular narratives and reinforcing political biases.

[136] The *Subjective Atlas of Palestine* (2007), edited by Annelys de Vet, is a counter-hegemonic cartographic project showcasing diverse perspectives from over 30 Palestinian artists and designers through visuals and graphics. Supported by ICCO's Department for Democratisation and Peacebuilding, it challenges traditional atlas narratives with a focus on localized subjectivity.

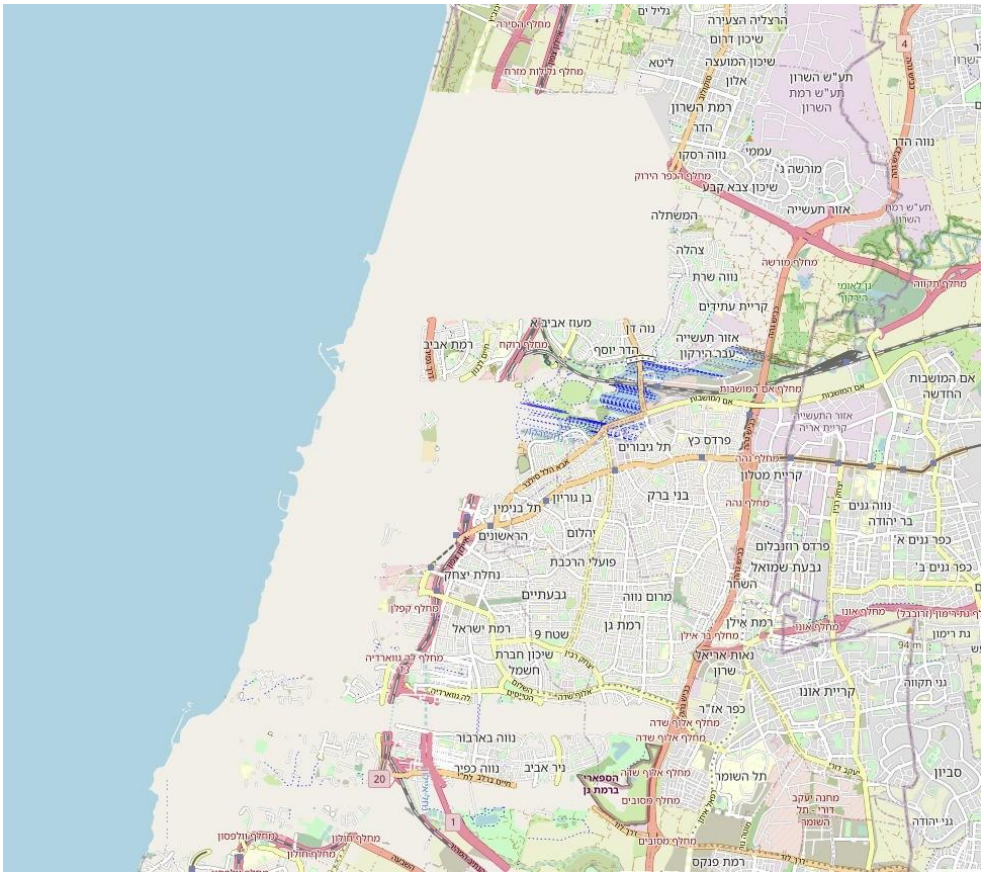

Figure 19 - Mass data deletion in central Israel, Tel-Aviv (Kostanian 2023).

The rapid implementation of rate limiting in OSM, while effective in curbing future attacks, illustrates the tension between decentralisation and governance in the platform. OSM's "do-ocracy" model[137]—where influence is based on contributions rather than formal authority—often leads to challenges in decision-making, especially in times of crisis. The 2023 OSM vandalism incident, in addition to the Google Maps attack, underscores the complex intersection of geopolitics and open-source cartography. While OSM's community-driven approach has proven effective in maintaining its integrity, it also exposes the platform to significant risks.

The case of Western Sahara

The territory disputed between Morocco and the Sahrawi Arab Democratic Republic (SADR)[138] has become a focal point for cartographic disputes within the OpenStreetMap

[137] "we believe strongly in 'do-ocracy' and want to be inclusive and welcome to participation and contributions from many. We do not want to force the hand of working groups or indeed the OSMF board when it comes to selecting their collaboration tools." OpenStreetMap Foundation Free and Open Source Software Policy (OSM FOSS Policy), https://osmfoundation.org/wiki/FOSS_Policy

[138] Western Sahara, a former Spanish colony, has remained unresolved decades after decolonization. Following Spain's withdrawal in 1975, Morocco claimed sovereignty over the territory, while the SADR, supported by the Polisario Front, declared independence. A 1991 ceasefire left much of the region under

(OSM) community. Political motivations, conflicting narratives, and complex territorial histories intertwine, making the cartographic representation of the region both technically challenging and socially sensitive. This case study examines how OSM's DWG addressed the Western Sahara dispute. By analysing specific edits, community interactions, and the application of the "on-the-ground rule" (which concerns the interpretation and application of rules based on the real, practical and concrete situation rather than on purely theoretical or formal criteria), the study seeks to understand the dynamics of resolving cartographic disputes on a global collaborative platform. This complex territorial configuration poses significant challenges for digital cartography, where clear and universally accepted boundaries are essential.

The DWG is responsible for managing disputes and ensuring that OSM data conforms to platform guidelines. In March 2016, complaints began to emerge about politically motivated edits by Moroccan mappers. These edits included removing the SADR area, labelling it as a "buffer zone" within an expanded Moroccan territory, and extending Morocco's borders to include areas under Spanish control, such as Ceuta and Melilla. To address the situation, the DWG implemented a systematic approach: engaging recent editors in the region to clarify intentions, encouraging broader discussions in the "International Boundaries" forum, identifying and addressing suspected "sock-puppet" accounts, and applying the "on-the-ground rule" to recognise the SADR as a national entity with an admin_level=2 status[139].

The "on-the-ground rule," a cornerstone of OSM's philosophy, dictates that features should be mapped based on their physical presence and local recognition rather than abstract political claims. However, its application in Western Sahara was not straightforward. The berm provides a clear physical demarcation between Moroccan-controlled areas and the buffer zone, but the eastern region's governance under the SADR complicates its classification, as its administrative structures are not universally recognised. Additionally, edits reflecting Moroccan sovereignty challenged the rule's intent, prioritising political narratives over observable realities. The berm, clearly visible in satellite imagery, serves as both a physical and symbolic line of separation. OSM contributors have attempted to map it accurately, yet some sections, particularly those in the south, do not precisely follow Moroccan fortifications. A forum example highlights how one section of the berm is "clipped" at the Mauritanian border, even though the fortifications extend further south. This discrepancy underscores the frequent mismatch between real-world boundaries and their digital representations, creating tensions between achieving accuracy and adhering to simplified mapping conventions.

In contrast to the berm, the boundary between Western Sahara and Mauritania is an abstract line, drawn during colonial times without reflecting local realities. Lacking clear

Moroccan control, with the Polisario managing a buffer zone to the east of the "berm," a fortified sand wall extending 2,700 kilometers, the longest existing berm.

[139] In OSM the value of admin_level=2 specifically refers to national-level boundaries, which typically represent the borders of a sovereign country.

references, OSM users have mapped it as a simple straight line, raising questions about its accuracy. Discussions in the forum suggest that this boundary doesn't get nearly as much attention as the berm. This shows a difference in mapping efforts that is caused by differences in how visible they are and how important they are politically.

Figure 20 - Moroccan Berm, UN Geospatial, January 2021[140]

The DWG's resolution involved recognising the SADR as a national entity (admin_level=2), informed by community input and historical context. Despite this, resistance persisted, with some users attempting to reverse the changes. Suspected sock-puppet accounts undermined the integrity of the debate, prompting the DWG to implement safeguards, such as requiring users to read explanatory messages before continuing to edit.

[140] https://www.un.org/geospatial/content/minurso-deployment-january-2021

This case highlights several lessons. Neutrality is particularly challenging in politically sensitive regions, as balancing local realities with global consensus is often fraught. The DWG's structured approach—combining engagement, investigation, and rule enforcement—was pivotal in resolving the dispute but underscored the need for additional resources to manage complex conflicts. Community contributions enriched the decision-making process, but the presence of sock-puppets revealed vulnerabilities in OSM's open model, necessitating more robust verification mechanisms.

The case of Crimea

The annexation of Crimea by Russia in 2014[141] and its subsequent geopolitical ramifications have stirred controversy across various domains, including cartography. OSM has become an integral part of the discussions about the representation of Crimea, encountering controversies over its territory mapping, particularly in light of its 2018 decision to designate Crimea as part of Russia. On November 14, 2018, the OSM DWG updated its guidelines for mapping Crimea. The peninsula's administrative boundaries were revised to reflect its *de facto* status as Russian-controlled territory. The OSM database officially assigned Crimea to Russia's administrative relations, acknowledging its disputed status. The decision was based on OSM's guiding principle to "represent the on-the-ground situation."

In its statement, the DWG emphasised that the change was not a political endorsement but a technical decision aimed at accurately reflecting the reality of control. The new guidelines read: "Crimea shall be part of the Russian administrative relation and not the Ukrainian one as long as Russia has on-the-ground control in Crimea. The boundaries of Crimea shall be indicated as disputed, except for water-based ones on the Black Sea or Sea of Azov where there is no dispute." (Shadra 2018).

Additionally, members of the Ukrainian community brought attention to OSM's inconsistent attitude. According to them, OSM's decision goes against its principle of following globally recognised boundaries, as the United Nations and other international organisations have recognised Crimea as Ukrainian territory.

The Ukrainian community also pointed out inconsistencies in OSM's approach. They noted that other disputed territories, such as North Cyprus and Transnistria, are mapped differently, with overlapping administrative boundaries representing claims from both sides.

One forum user stated: "This will make it impossible to create a correct political map using OSM data and will allow opponents to claim that OSM recognises Crimea's annexation."

[141] Crimea, a peninsula on the northern coast of the Black Sea, was annexed by Russia from Ukraine in 2014 in a move widely regarded as illegal by the international community. The United Nations and major geopolitical entities, including the EU, NATO, and the United States, continue to recognize Crimea as part of Ukraine. Despite this, Russia maintains de facto control over the region, complicating how it is represented on maps.

According to another commenter, aligning with Russia's de facto rule might discourage international organisations like the EU and UN from using OSM data.
As one contributor noted, “OSM only seeks to represent the on-the-ground situation. It has no bearing on whether the current situation is legal or not—it just is.” Proponents also highlighted practical considerations, such as ensuring that users planning trips to Crimea are not misled by inaccurate representations of control. The DWG's conclusion was founded on the claim that OSM should not take political positions but rather map reality.

Comparing Cases

Combating carto-vandalism on OpenStreetMap (OSM) requires an integrated approach that combines community engagement with advanced technological tools. Active participation from volunteers plays a fundamental role, as they regularly monitor map changes, especially in regions subject to political or historical disputes. These contributors use tools such as change logs and update notifications to identify potential acts of vandalism, such as data deletions or the insertion of politically provocative tags. When issues arise, volunteers initiate discussions on community forums to find a collective solution and ensure that modifications align with the “on-the-ground rule,” which prioritises physical reality over abstract claims.
Alongside human efforts, technology has become an indispensable ally in the fight against carto-vandalism. Tools like OSMPatrol are revolutionising how suspicious edits are detected. OSMPatrol, in particular, employs algorithms to analyse editing patterns on the platform, identifying anomalies that may signal malicious activities. For instance, the system can identify sudden increases in the rate of edits in high-risk areas, or point to new users who are making a number of changes, such as mass deletions or the insertion of irrelevant tags. These tools not only accelerate the detection process but also alleviate part of the workload for the community, allowing volunteers to focus on more complex cases.
However, the adoption of automated systems like OSMPatrol is not without challenges. One of the main issues is false positives: detection models, not yet fully capable of distinguishing between legitimate edits and acts of vandalism, may erroneously flag benign contributions, increasing the verification workload. Additionally, algorithms struggle to grasp the political, cultural, or historical context of edits, a crucial aspect in geopolitically sensitive regions. For this reason, human input remains irreplaceable, as experienced contributors can better interpret local nuances and ensure informed, fair decisions.
An effective solution must therefore rely on a hybrid approach. Technology, represented by tools like OSMPatrol, provides speed and large-scale analytical capabilities, while human involvement ensures respect for local specificities and an ethical assessment of cases. This collaboration between people and automated systems represents the future of managing open platforms like OSM, where protecting data integrity goes hand in hand with maintaining its collaborative and inclusive nature.
To make this system even more effective, investments will be necessary both in training volunteers and in developing more advanced technologies capable of minimising errors

and misunderstandings. OpenStreetMap, with its open and decentralised model, stands at a crossroads: strengthening governance and fostering integration between communities and technologies will be essential to maintaining its credibility and usefulness in an increasingly interconnected and politically complex landscape.

The table below delineates the primary distinctions among the three cases and the DWG's way to respond to carto-vandalism, facilitating a quick comprehension of the specific dynamics.

Aspect	Case of Palestine	Case of Western Sahara (SADR)	Case of Crimea
Type of DWG Intervention	Swift action to block users and implement rate-limiting measures to prevent further vandalism.	Systematic approach involving user clarification, forum discussions, and application of the "on-the-ground" rule.	Technical decision to include Crimea in Russian administrative relations based on de facto control.
Community Involvement	The Israeli local community quickly restored the vandalised data.	Intense involvement from both local and international contributors, though fake accounts complicated the process.	Protests and criticisms from the Ukrainian community, highlighting inconsistencies in the application of guidelines.
Applied Principle	Focused on protecting the platform's integrity, with no explicit strategy to balance opposing political narratives.	Applied the "on-the-ground" rule to recognise the SADR as a national entity (admin_level=2).	Applied the "on-the-ground" rule to reflect Russia's de facto control while marking the territory as "disputed."
Response to Controversy	Effective technical measures but lack of a clear stance on how to handle conflicting territorial narratives.	Structured response with processes to resolve disputes, but persistent manipulation attempts from politically motivated users.	Highly contested decision, with accusations of bias and concerns about OSM being perceived as endorsing annexation.
Challenges Encountered	Large-scale vandalism and difficulty in preventing the misuse of newly registered accounts.	Presence of fake accounts (sock-puppets) and challenges in balancing local realities with global narratives.	Criticism over inconsistency with other contested territories (e.g., Northern Cyprus) and risks of losing institutional trust.

Table 1 - Table 3 - Comparative analysis of DWG responses to territorial disputes on OpenStreetMap

As we can see, this table illustrates how the DWG handled difficult problems in each instance, tailoring its strategy to the particular situation. Similarities include the implementation of the "on-the-ground" principle for technical determinations and the influence of political forces on the platform.

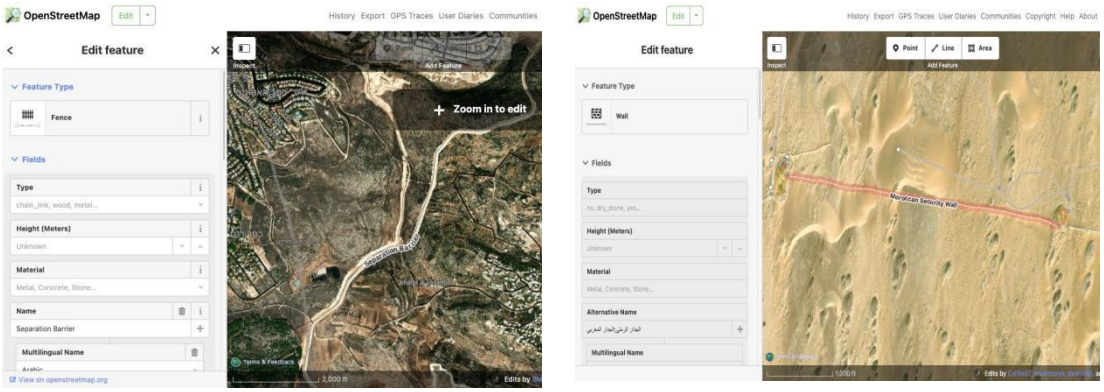

Figure 21 - Mapping the West Bank Wall and Moroccan “berm” in OSM

Both images (Fig.3) illustrate how OSM provides tools to accurately document and visualise physical structures in complex political contexts, while maintaining a detailed and technical approach. The West Bank Wall is classified as a "fence" in the OSM system. This choice of terminology may reflect a neutral approach, seeking to avoid more politically charged terms such as "wall"; in contrast, the Moroccan berm is classified as a "wall", although physically it may not be a traditional wall.

OSM's impartiality on international disputes is the very consequence of its open and crowd-oriented nature, which makes it an extraordinary tool for reading reality. The platform becomes a veritable and highly readable textbook of territorial dynamics and its inequalities.

While aiming to preserve OSM's image as a neutral platform, we can still assume that OSM is not an impartial application due to its participatory and democratic potential.

The nature of OSM’s global, open-source model, which relies on a single database visible to all users, makes it more exposed to disputes and debates compared to other, more strategically localised Web-GIS such as Google Maps which has features more focused on visualisation and basic interaction rather than advanced spatial analysis and employs a different approach by adapting its maps to regional audiences (Crimea appears as Russian territory for users in Russia but as Ukrainian territory for users elsewhere). Google Maps uses a variety of data points, notably the user's location, their device's cookies, and their search history, to give customised results. Given this, the user's geographical location and conditions can trigger the displayed political borders to change. As an example, whereas most people globally consider Crimea to be part of Ukraine, Russian users tend to regard it as part of Russia[142]. Google adjusts maps to align with regional perceptions and local regulations: this customisation process may make the results more biassed towards human perspectives and presumptions than facts and figures. Particularly in politically delicate

[142] Google's search engine is designed to provide personalized results tailored to individual users. This customization depends on various factors, including your physical location, browsing history, and stored cookies on the user’s device. This strategy enables Google to present results that they predict align with customers’ preferences or needs.

situations involving contested boundaries, the danger of disinformation is a real concern. Although the system's goal is to improve user experience, there is a danger that it may misrepresent geopolitical reality and reinforce certain narratives.

When compared to private online services like Google Maps, which put consumer delight and financial interests first, OpenStreetMap stands out due to its collaborative and democratic origins.
OpenStreetMap is a crowdsourced initiative, driven by a community of contributors who actively shape the representation of geographical and social realities, thus allowing for a plurality of perspectives.
In contrast, platforms like Google Maps are primarily driven by the needs of paying customers or business stakeholders or simple consumers, with the risk of treating complex geopolitical issues—such as disputed borders or politically sensitive territories—as market-driven preferences. This approach could mitigate social and geographical processes that are deeply rooted in transnational considerations that aren't in line with their larger cultural and historical contexts.
For example, choices on how to display problematic borders may be influenced by users' demographics or government contracts rather than reflecting the lived realities or contested narratives of those areas' residents.
The following table gives us a clearer idea of the different approaches of OSM and Google Map, two systems implying a different philosophy, fundamental to the management for conflict resolution.

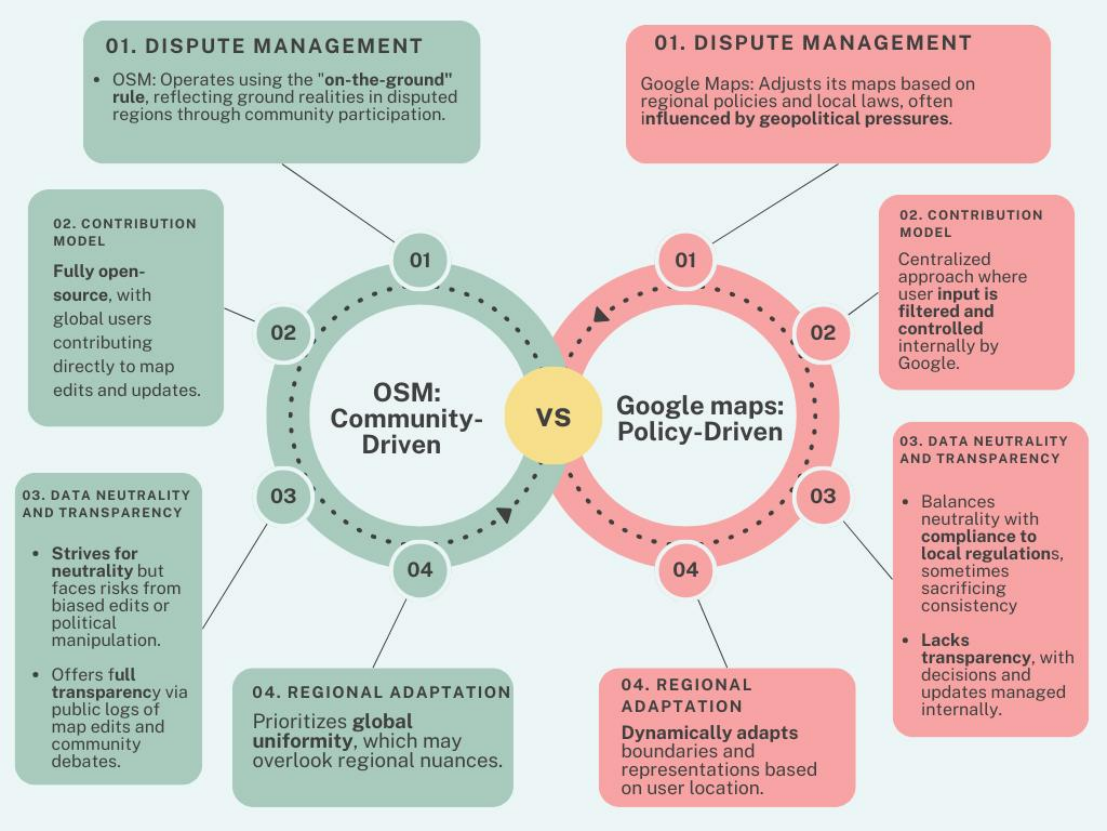

Table 4 - Comparing OSM and Google Maps: Community-Driven vs. Policy-Driven Approach

The social and political components of mapping, as reflected by OpenStreetMap's collaborative framework, help develop a sense of shared ownership over spatial representation. Conversely, the customer-oriented philosophy of platforms like Google Maps runs the risk to commodifying geographic data, often prioritising commercial viability over the nuanced and multifaceted nature of spatial relationships.
Similarly, the following radar diagram (fig.3) reveals the contrasting strengths and weaknesses of Google Maps and OpenStreetMap (OSM) across key areas.

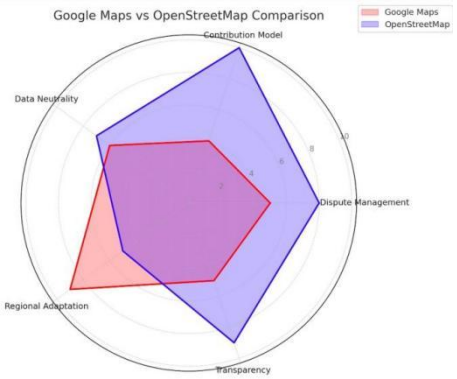

Table 5 - Comparative radar diagram OSM vs Google Map[143]

[143] I made a radar diagram that compares Google Maps with OpenStreetMap (OSM) in five areas: transparency, data neutrality, regional adaptation, contribution model, and dispute management.

Conclusions

Analysing carto-vandalism as a phenomenon that experiences politically motivated "editing wars" has revealed several key findings about cartographic disputes in OpenStreetMap (OSM). This has been proved by some examples, such as the labelling of Jerusalem, the representation of Crimea, and the Western Sahara dispute, where we can point out how OSM becomes a battleground for conflicting narratives that reflect broader geopolitical tensions. We have discovered the crucial role of the OSM DWG, which uses principles like the "on-the-ground rule" to manage disputes and maintain neutrality. It is clear that there is a high impact on humanitarian efforts and neutrality since manipulations of OSM raise questions about its reputation as a neutral platform. OSM's decentralised model is paramount in facing carto-vandalism in terms of community education, improved dispute resolution mechanisms, and technological safeguards against large-scale disruptions.

The consequences of carto-vandalism in conflict zones can also have social and economic implications. Digital maps are frequently used by humanitarian organisations to coordinate aid distribution and by researchers to monitor on-the-ground situations. Intentional inaccuracies and manipulations could restrict access to help or complicate the consideration of particular local requirements. Even within global communities that use these technologies to better comprehend the reality of conflict areas, constant map interference can contribute to polarised narratives, hence exacerbating tensions. Acts of carto-vandalism intentionally diminish the utility of geospatial artefacts for most users. In the context of OpenStreetMap, vandalism is characterised by a disregard for the community's consensus norms and includes actions such as copyright infringement, disruptive behaviour, and spamming. On OSM forums and projects' email lists, instances and suspected vandalism are discussed and addressed. Contributors may report suspected vandalism. Especially when acts reflect actual geopolitical tensions, political conflicts and territorial claims make their way into virtual areas over physical boundaries. This vandalism compromises OSM's goal to reflect "ground truth"[144] by introducing subjective and politically charged edits, therefore complicating the process of cooperative mapping. It also highlights the vulnerabilities of Volunteered Geographical Information (VGI) platforms to organised misuse. Open-source platforms like OSM face challenges due to cyber-carto-vandalism, which occasionally exploits collaborative editing for political or ideological purposes. The platform's reliance on community moderation underscores both

Dispute management: Google Maps (score: 5) adapts to local laws, while Open Street Map (8) relies on the "on-the-ground rule" to guarantee accuracy. Comparing the two **contribution models**, we find that OSM is completely open-source (10) whereas Google Maps (4) is limited and centralised. Google Maps (6) puts rules ahead of data **neutrality**, whereas Open Street Map (7) strives for impartial representation but is susceptible to manipulation. **Regional Adaptation**: While OSM (5) ensures uniformity on a global scale, Google Maps (9) makes regional adjustments to borders. With regard to **transparency**, OSM provides public change logs (9), whereas Google Maps is not transparent (5). Both systems bring out different trade-offs.

[144] The term "ground truth" is used in cartography and sometimes within the OpenStreetMap community, where it is referred to as "truth on the ground" or "TotG," signifying the collection of data on the ground.

its strengths—such as rapid responses to vandalism—and its vulnerabilities to acts of sabotage. It also raises broader questions about the intersection of geopolitics and open-data projects, as such events can disrupt not only the platform's data but also its trust and functionality.

It could be assumed that the democratisation of GIS—that is, the availability of geospatial data and mapping to a worldwide audience—is greatly facilitated by OSM's collaborative nature as a platform wherein users may freely modify and update maps. This transparency, however, also makes OSM particularly susceptible to disputes and controversy. The absence of centralized control means that debates about map accuracy, representation, and geopolitical narratives often spill over into public forums and platforms like Telegram, where contributors and stakeholders openly contest and negotiate the interpretation of geographical data.

The findings highlight the dual nature of OSM's openness: while it enables diverse voices to shape digital cartography, it also amplifies tensions over representation and power dynamics. These challenges require better governance management, community education, and also technical solutions that can help preserve the integrity of the platform without compromising the cooperative aspect. Recommendations for better management of future disputes include developing automated tools to detect suspicious behaviour, training contributors on OSM policies and the importance of neutrality, engaging local stakeholders for contextual understanding, and ensuring transparency in decision-making to build trust within the community. The collaborative process becomes particularly ambiguous if applied in disputed regions, such as the case of Western Sahara. Following the "on-the-ground rule" and engaging the community helped the DWG effectively handle a very delicate issue while preserving OSM's integrity. OSM's function as a worldwide mapping tool will progressively interact with geopolitical conflicts as it expands. To address these issues, we must strengthen governance, encourage community involvement, and utilise technology to ensure the platform remains open, impartial, and consistent. This paper highlights the careful balance between cooperation and conflict in digital mapping by showing how platforms like OSM could both be instruments and battlefields for geopolitical narratives.

Digital systems like OpenStreetMap or Google Maps show boundaries, which often acquire a validity that could influence public opinion and political choices. For instance, in areas like Crimea, where some maps depict Russia in control after the 2014 annexation, the portrayal supports particular territorial narratives that support one side of the conflict. This may change public opinion worldwide, complicate talks, and support assertions contradicting international law or other points of view. Maps are objective sources about data that policymakers often depend on to guide choices on diplomatic strategy, infrastructure projects, or budget distribution. Digital maps run the danger of entrenchment, while, if they show contentious borders as set or unequivocal, compromise becomes more difficult. Simultaneously, sites like OpenStreetMap that let people contribute may provide a forum for communication by letting many points of view be expressed, therefore promoting perhaps mutual understanding. Still, these renderings also run the danger of

manipulation and prejudice, particularly in politically sensitive regions where false or too simple images could skew public opinion and international debate. Therefore, the function of digital cartography goes far beyond mere technical mapping and becomes a major player in determining how conflicts are seen and settled.

Ethical standards and social awareness should guide the use of geographic data in humanitarian situations to address privacy, equality, and representation concerns. This will guarantee that, while respecting their dignity and rights, mapping projects really benefit impacted people. Criticality includes politically driven changes, data vandalism, and boundary conflicts that underline the need for alternative government structures that preserve the openness of the platform while fixing these weaknesses. A more productive alternative to improve accuracy and accountability in OSM mapping efforts would be to establish review committees or hybrid groups. Integrating community voices, respecting data governance frameworks, and using privacy-preserving technologies can contribute to the development of ethical and socially focused geographic systems, thus enriching the effectiveness of crisis response by avoiding misleading narratives.

We can briefly suggest with an "open answer" that some solution and mitigation measures could be undertaken: improved governance, with transparent decision-making and updated policies for disputed territories, can enhance credibility; partnerships with experts and organisations can provide valuable insights, while fostering map literacy and ethical awareness ensures responsible contributions; continuous reviews and feedback loops are vital for refining these efforts and maintaining OSM's reliability and neutrality.

References

Ballatore, A. (2014). Defacing the map: Cartographic vandalism in the digital commons. *The Cartographic Journal*, *51*(1), 1–25. https://doi.org/10.1179/1743277414Y.0000000085

Burini, F. (2010). *Per una cartografia partecipativa nel dialogo interculturale*. In E. Casti & J. Lévy (a cura di), Le sfide cartografiche. Movimento, partecipazione, rischio (pp. 186–198). Il Lavoro Editoriale/Università.

Casti, E. (2013). *Cartografia critica: Dal topos alla chora. Guerini Scientifica.* (v. capitolo 7, p. 141–142).

De Vet, A. (2023). *The problem of cartography: From singular to plural mapping*. TYPP, Sint Lucas School of Arts.

Giannola E. (2013). "Processi innovativi di costruzione dell'immagine territoriale: ruolo culturale e contributo alla pianificazione". *IN FOLIO*, 30(30), 27-30.

Goodchild, M. F. (2007). Citizens as sensors: The world of volunteered geography. *GeoJournal*, *69*, 211–221. https://doi.org/10.1007/s10708-007-9111-y

Haklay, M. (2010). How good is volunteered geographical information? A comparative study of OpenStreetMap and Ordnance Survey datasets. *Environment and planning B: Planning and design*, 37, 682--703.

Harley, J. B. (1989). *Deconstructing the map*. Ann Arbor, MI: MPublishing, University of Michigan Library. http://hdl.handle.net/2027/spo.4761530.0003.008

Harris, T., & Weiner, D. (1998). Empowerment, Marginalization, and "Community-integrated" GIS. *Cartography and Geographic Information Systems*, 25(2), 67–76. https://doi.org/10.1559/152304098782594580

Kent, A. (2017). Trust me, I'm a cartographer: Post-truth and the problem of acritical cartography. *The Cartographic Journal*, *47*(2), 77–79. https://doi.org/10.3138/carto.47.2.77

Kitchin, R. (2014). Big data. In *The data revolution: Big data, open data, data infrastructures & their consequences* (pp. 67–79). SAGE Publications Ltd. https://doi.org/10.4135/9781473909472

Krupar, S. (2015). Map power and map methodologies for social justice. *Georgetown Journal of International Affairs*, *16*(2), 91–101.

Jankowski P. (2011). Designing Public Participation Geographic Information Systems, in T. Nyerges, H. Couclelis, & R. McMaster (Eds.), *The SAGE Handbook of GIS and Society, London*: SAGE, 347–360. 10.4135/9781446201046.n18

Louis, R. P., Johnson, J. T., & Pramono, A. H. (2012). Introduction: Indigenous cartographies and counter-mapping. *Cartographica: The International Journal for Geographic Information and Geovisualization*, *47*(2), 77–81. https://doi.org/10.3138/carto.47.2.77

Markham, B. (1987). *West with the night*. North Point Press.

Minghini, M., & Grinberger, Y. (2024). What happens when VGI is threatened? A systems perspective analysis of the events behind the introduction of rate limiting in OpenStreetMap. Talk presented at *State of the Map 2024*, OpenStreetMap Foundation. https://2024.stateofthemap.org/sessions/FSYR9S/

Minor, H. H. (1999). Mapping Mussolini: Ritual and cartography in public art during the Second Roman Empire. *Imago Mundi*, 51(1), 147–162.

Picone M., Piccolo F. (2014). "Ethical E-Participation: Reasons for Introducing a 'Qualitative Turn' for PPGIS", *International Journal of E-Planning Research,* 3, 57–78. https://doi.org/10.4018/ijepr.2014100104

Robinson, A. H., Morrison, J. L., Muehrcke, P. C., Kimerling, A. J., & Guptill, S. C. (1995). *Elements of cartography* (6th ed.). Wiley.

Stock, P. (2016). America and the American Revolution in British geographical thought, c.1760–1830. *The English Historical Review*, *131*(553), 1–31. https://doi.org/10.1093/ehr/cew278

Strohmaier, A., & Krewani, A. (2021). *Media and mapping practices in the Middle East and North Africa: Producing space*. Amsterdam University Press. https://doi.org/10.2307/j.ctv1hw3z0w

Talen, E. (2000). Bottom-up GIS: A new tool for individual and group expression in participatory planning. *Journal of the American Planning Association*, 66(3), 279–294. https://doi.org/10.1080/01944360008976107

Truong, Q.-T., Touya, G., & De Runz, C. (2018). Towards vandalism detection in OpenStreetMap through a data-driven approach. In *LIPIcs – GIScience 2018* (No. 61). https://doi.org/10.4230/LIPIcs.GISCIENCE.2018.61

WEB REFERENCES

Kebir, Omer. "Anti-Israel Activists Attempt to 'Wipe Tel Aviv off the Map.'" *Calcalistech*, October 22, 2023. Retrieved from https://www.calcalistech.com/ctechnews/article/r1hyeammt.

O'Sullivan, D., & Kourdi, E. (2023, October 29). Fake placenames with anti-Israel messages flood Google Maps' depiction of the Rafah border crossing between Gaza and Egypt. CNN. Retrieved from https://edition.cnn.com/2023/10/24/tech/anti-israel-messages-google-maps-rafah-border-crossing/index.html.

Kostanian, G. (2023, October 29). Conflict in OSINT: OSM data abuse, vandalism and corruption in conflicted regions. LinkedIn Pulse. Retrieved from https://www.linkedin.com/pulse/conflict-osint-osm-data-abuse-vandalism-corruption-gevorg-kostanian-irpdf/.

Shandra, A. (2018, November 23). Open Street Map decides to mark Crimea as Russian territory. Euromaidan Press. Retrieved from https://euromaidanpress.com/2018/11/23/open-street-map-decides-to-mark-crimea-as-russian-territory/

Other sources: OSM community forums and Telegram discussions.

General Conclusions

Research answers

As stated at the beginning of this research, the work carried out over the past months was designed to address a series of research questions, organized by importance and priority (see pag. 9, *Introduction*). In this final section, I synthesize the findings to answer all the research questions that guided this study, reflecting on the results and insights gained over the course of the research.

The main question of this research study is:
Does promoting participatory mapping improve and make gender concerns easier to understand?

After debating this issue from different perspective we can say that promoting participatory mapping (PGIS) enhances understanding of gender concerns by making women's experiences, spatial perceptions, and local knowledge visible in governance processes traditionally dominated by institutional or male perspectives.
As the dissertation states, «participatory and feminist mapping represent a fundamental tool for addressing the challenges of climate and gender justice»: by combining the Capability Approach (Sen, Nussbaum), ecofeminism, and participatory GIS, the study shows how mapping practices «reconfigure spatial policies by including voices traditionally excluded from institutional processes».
For instance, in Marrakech, participatory mapping with Radio El Amane empowered young women to visualize issues related to migration, informal settlements, and urban inequality, transforming cartography into a form of social and political agency: «The mapping experience in Marrakech illustrates how civil society organizations can effectively engage communities, particularly through the empowerment of women in local development projects» (Ch. 5).
Thus, promoting participatory mapping does not only reveal gendered spatial inequalities, but it also helps communities and policymakers to see and understand how women interact with their environments—transforming gender from an abstract concern into a visible spatial and social reality.

As far as secondary questions are concerned:

1. Does Crowd-mapping aim to rethink how communities live, coexist, work, and produce to reduce environmental impact?

Yes. Crowd-mapping and PGIS challenge conventional top-down planning by rethinking coexistence and production through sustainable and inclusive territorial practices.
In the Draa Valley case, participatory mapping «integrated local knowledge and satellite data to address water stress and rural depopulation, valuing women's knowledge of water resources» (Ch. 5). This demonstrates a new ecological governance model where

community knowledge, especially women's, becomes central to managing environmental resources.
Moreover, the ecofeminist framework connects these practices with environmental ethics: «Ecofeminism criticizes unsustainable development practices and promotes a partnership ethics that recognizes the interconnection between human well-being and ecosystem health» (Ch. 2).
Hence, crowd-mapping rethinks coexistence by fostering co-responsibility, ecological awareness, and gender-sensitive sustainability.

2. Does it encourage the decision-making process of the interest groups through female participation?

Absolutely. The work highlights how participatory mapping can strengthen decision-making by including female voices and perspectives.
As Jankowski (2011) observes, «PGIS can empower different groups of the public, including marginalized communities» (Ch. 3). This empowerment is evident in examples like Padova Accessibile and Map4Youth, where women and associations collaborated to map urban accessibility and abandoned spaces, influencing local policies: «These projects show how GIS technologies can be effectively used at the municipal level to promote inclusion and guide urban policies» (Ch. 4).
Similarly, in M'hamid (Draa Valley), women directly participated in mapping 22 water sources, contributing to decision-making for sustainable resource management. This aligns with Nussbaum's concept of threshold for dignity: expanding women's capabilities enables full participation in civic life and governance.

3. Does it facilitate the process of risk reduction during humanitarian emergencies?

*Yes. T*he dissertation explicitly connects crowd-mapping to humanitarian response and risk reduction.
After the 2023 earthquake in Morocco, mapping activities shifted to humanitarian purposes: «Data collection from below supported the humanitarian response of the feminist association El Amane… using participatory methods to ensure local voices were included in the data collection process» (Ch. 5).
This demonstrates how participatory mapping provides rapid, community-driven spatial data that improves situational awareness, resource allocation, and coordination in emergencies. The text further links this to the concept of digital humanitarianism: «Data activism has become the driving force behind the growing concept of digital humanitarianism» (Ch. 3).

4. *How should these crowd-mapping processes be made more legitimate?*

To achieve legitimacy, the dissertation stresses the need for:
Clear legal frameworks: «The Italian context still lacks explicit guidelines on the use of geospatial technologies in participatory planning» (Ch. 4, Conclusions).
Data quality and governance protocols: «It is necessary to adopt transparent data governance, equitable access, and protection against misuse, including mechanisms of verification and validation».
Ethical and technical training: ensuring facilitators and participants understand not only the tools but also the ethical and political implications of mapping.

Bridging institutional and community knowledge: «Only through an alliance between technical expertise and local knowledge… will it be possible to build truly fair and inclusive territorial policies». (For instance, the Draa Valley PGIS project integrated women's local knowledge of 22 water sources with satellite imagery and QGIS analysis, directly informing vulnerability mapping and adaptation priorities).
Thus, legitimacy depends on normative recognition, ethical management of data, and institutional validation of community contributions.

Summary

Research Question	Key Findings	Supporting Examples
Does promoting participatory mapping improve and make gender concerns easier to understand?	Yes, by visualizing gendered inequalities and empowering marginalized voices.	Radio El Amane (Marrakech), Capability Approach framework
Does Crowd-mapping rethink coexistence and production to reduce environmental impact?	Yes, it links local and scientific knowledge to sustainable resource use.	Draa Valley mapping, ecofeminism ethics
Does it encourage decision-making through female participation?	Yes, women's mapping initiatives influence local governance.	Padova Accessibile, Map4Youth, M'hamid women's mapping
Does it facilitate risk reduction in humanitarian emergencies?	Yes, by producing rapid, community-driven spatial data.	Post-earthquake mapping in Morocco, digital humanitarianism
How can these processes become more legitimate?	Through legal frameworks, ethical data governance, and institutional recognition.	Ch. 4 & Conclusions – call for normative integration and data ethics

Uncovered areas of investigation

This experience taught me how important the local level is and how the territorial context in which the researcher-geographer operates defines his professional and personal identity. The study of social and territorial dynamics thus becomes part of my own transformative journey.
The proposed vision is that today the role of geographers is to interpret global challenges within real territorial laboratories, where they work by "getting their hands dirty", physically and socially entering the territories.

Although feminist geographies have made crucial contributions to the spatiality of oppression and resistance, they often remain disconnected from operational planning practices and public policy evaluation. This leaves a crucial area of investigation

uncovered: what tools, languages and forms of visibility can be activated to make gender a central axis in territorial policies through participatory cartographic practices?
This research area of work therefore should aim to fill this gap by proposing a critical and situated reading of mapping as a political-feminist device capable of producing visibility, agency and legitimacy for subaltern knowledge in the construction of local policies.
While not offering a definitive answer, my work aims to outline a solid theoretical framework from which to initiate critical reflection on mapping as a political-feminist tool, laying the foundations for future operational and practical explorations.
The critique of colonial power implicit in Western academic paradigms, which Linda Tuhiwai Smith courageously spoke about in the late 1990s[145], should start from a research approach that involves local communities, reconsidering the territory as a unit of meaning. Anthropology offers the concept of territorial patches: territorial areas through which it is possible to read global dynamics on a local scale (Wolfe, 1982). This approach is extremely stimulating, as it allows students and doctoral candidates to study the major issues of the contemporary world starting from a specific place, a limited landscape.
Recognising territorial patches as true units of meaning, capable of simplifying the complexity of the world, restoring the intertwining and mediation between human and non-human connections, on all scales.

It is emblematic that the first document attesting to the birth of Italian literature, with the first document written in ancient Italian, is a document that recognises a very ancient territorial identity linked to the Benedictines, who over time were able to maintain diplomatic autonomy between two great powers, the Kingdom of Naples and the Papal States: it is the land of San Benedetto, a territory that appears for the first time in a document from 960, the famous Placito Capuano.

If we take Franco Farinelli's idea in *I segni del mondo*, which identifies a sequence of epistemological paradigms in the history of geography[146], we could venture the hypothesis

[145] Linda Tuhiwai Smith is a Māori scholar and one of the leading voices in postcolonial studies and decolonial methodologies in research. Smith criticises the way in which Western academic research has historically treated indigenous peoples as objects of study, and proposes decolonial approaches based on indigenous epistemologies and priorities (1999). Similarly, participatory cartography in its approach to territorial realities should proceed to the decolonisation of knowledge and research practices; to the recovery of indigenous epistemologies, research as a tool for self-determination and social justice.

[146] Euclidean geography → space as extensio, a field measurable in geometric terms.
Geodetic geography → space as the Earth's surface to be represented and controlled through scientific instruments (modern cartography).
Digital geography → which, for Farinelli, marks the beginning of the end of the direct relationship between physical space and representation, because GIS and digital technologies produce maps that are no longer "mimetic" but operational, interactive and reticular.

of a subsequent sequence, which is the one we are beginning to experience by applying the "Metaphor of the cartographic metaverse":

The reasoning can work: from the Euclidean model to the digital model: cartography no longer describes an objective territory, but constructs real-time, multi-level, updatable and socially produced scenarios (think of OpenStreetMap or participatory maps).

The Earth's surface, now covered by thousands of invisible information networks, reflects this complexity. It is precisely in relation to this condition that David Russell (as cited in Farinelli, 1992, p. 78) spoke of the "dematerialisation of the geographical object", a phenomenon that affects the very function of the Atlas and its iconographic representation, , whose evolution has been well explained by Farinelli (1992).[147].

The metaverse could be considered as an epistemological leap: in analogy with the digital metaverse, a cartographic metaverse would not only be an environment of representation, but an experiential world in which different actors co-produce maps, live within the representation and dynamically modify its contents. No longer a map is conveived as a mirror of the territory, but a map as a lived, simulated and continuously reconfigured territory.

Reconnetting to Farinelli, we could state that if geodesy is the era of modern state domination (cadastral, topographical and military maps), and digital geodesy is the era of data and networks, the "cartographic metaverse" could be read as the next paradigm: the map as an immersive space, in which the distinction between representation and reality becomes blurred, in a parallel digital 'world' connected to reality (multilayer, Augmented Reality/Virtual Reality, digital twin, real-time data streams), where users/actors can inhabit, intervene, challenge and recode the territory.

The tools of this parallel world are diverse: urban digital twins, Web3/ledgers for versioning[148], AR overlays, dynamic map layers, collaborative platforms (OSM + tag/version control), integrated PGIS, machine learning for scenarios.

[147] « Nel frontespizio della prima raccolta moderna di carte geografiche, pubblicata a Roma da Antonio Lafreri tra il 1565 e il 1570, Atlante era raffigurato nell'atto di sorreggere il grande globo con un ginocchio appoggiato a terra. Probabilmente, questo frontespizio ispirò il titolo della postuma e più celebre raccolta cartografica di Mercatore, dove Atlante non compare più nell'atto di sorreggere il mondo, ma seduto, intento a misurare il globo con un compasso, poggiato sulla sua gamba.
Oggi, questa figurazione assume un significato ulteriore: la distanza lineare, sempre più imponente, diventa principio costitutivo e misura della realtà. Se si osserva il frontespizio originale, la smorfia di dolore del gigante non può più essere attribuita solo al peso materiale della sfera, ma rinvia anche a una sofferenza interiore, derivante da un'esperienza personale. Tale esperienza si può fare coincidere con quella della conoscenza: oggi, siamo preda della smaterializzazione, secondo la quale gli atlanti, pur apparentemente raffigurando oggetti, sono in realtà repertori di concetti e sillogi di modelli mentali, dai quali dipende la nostra fiducia – ormai ingenua – che la spiegazione del mondo possa derivare dalla sua semplice rappresentazione. Lo sforzo di Atlante non consiste più nel sorreggere il mondo, ma nel prevenire che esso sfugga definitivamente alle nostre capacità sensoriali, impedendogli di diventare completamente invisibile. In questo senso, lo sforzo, più o meno consapevole, che anima oggi quella che viene chiamata geografia umanistica, consiste nel tentativo di mantenere visibile e interpretabile la complessità dello spazio e delle relazioni che lo attraversano, riconoscendo la mediazione e la costruzione sociale di ogni rappresentazione. » (Farinelli, 1992).

[148] Web3 refers to the next generation of the internet, emphasizing decentralization, user ownership, and blockchain-based systems. Unlike the current Web2, where data is often controlled by central platforms, Web3 aims to give users direct control over their data, assets, and digital interactions.

This argument has theoretical implications: at the epistemological level, we move from "what the map represents" to "what the map produces". There are also political implications, given that the map becomes an arena for governance, participation and conflict, implications that can have repercussions in the field of urban/landscape planning: planning no longer uses maps as static tools, but as interactive platforms for negotiation, true "digital twins" of the territory.

In this sense, calling digital geography a 'cartographic metaverse' makes sense if you use it as a bridge concept to describe the transition from two-dimensional representations to immersive and participatory ecosystems. It does not replace Farinelli, but radicalises his reading, showing how cartography has now become an environment in which we live, not just a representation that we look at.

In the era of decentralised map production, the number of map producers (communities, NGOs, activists) is increasing, but issues of power remain (who decides what to map, how to publish, which data is "authorised").

In this context, the map becomes an arena of power and conflict, a place of reclamation, protest, and renegotiation of spatial meanings. It is here that rebellious practices such as counter-mapping, tag wars, "protest maps", and spatial counter-narratives emerge.

In reality, attributing the adjective "rebellious" to cartography, somewhat indomitable and even undisciplined, suits it well, precisely because of its ability, as we have seen, to somehow manage to provide definitions that can even be opposites, i.e. cartography as an instrument of peace and empowerment (as emerged in the participatory workshops held in Marrakesh and during the post-earthquake humanitarian mapping in 2023 described in ch.5, section 2, where collective data production generated empowerment and visibility for local women's associations) but at the same time cartography as an instrument of war .

Maps become performative acts, because they no longer merely describe; they produce social effects (legitimisation of rights, exclusion, visibility). In a cartographic metaverse, performance is immediate: adding, renaming, highlighting becomes a political act.

Marginalised communities or movements can build alternative counter-maps to claim resources, denounce environmental damage, or oppose infrastructure projects. These maps challenge official representations (e.g., maps of exploitation, maps of common goods).

As we have seen extensively in Chapter 6, there is a possibility that the political nature of maps may trigger tag wars/edit wars within collaborative platforms (e.g., OpenStreetMap), conflicts over tagging and data modification: repeated removals and reinsertions (edit wars) can become digital forms of protest or symbolic guerrilla warfare — "making visible/invisible" becomes a political technique.

As we have experienced first-hand in the case study of humanitarian mapping in Morocco (chapter 5, section 2), communities or emergency agencies can organise mapathons, crowdsourcing and mobilisation. Collective mapping events (mapathons) can become political actions: mapping invisible areas, collecting evidence, creating tools for public

pressure or emergency support. Indee, operationally, our field experience suggests combining PGIS mapathons, community training and co-validation protocols — e.g., the workshop series with Radio El Amane youth — to improve data quality and local ownership.
Crucial issues arise in the cartographic metaverse: who controls metadata, quality, the permanence of changes, validation mechanisms, privacy? Data governance is political.
That said, there are strong implications for policy, planning and governance: planners and policy-makers must recognise participatory maps/metaverses as legitimate sources of knowledge and conflict; procedures are needed to integrate, verify and negotiate them.
The political dimension of this metaverse manifests itself through various rebellious dynamics. Protest maps and counter-mapping emerge as fundamental political acts, in which marginalised communities or civic movements construct alternative spatial narratives to claim rights, denounce injustices or contest official projects. In this context, the act of adding a point or a boundary to the map becomes a claim of symbolic sovereignty. At the same time, collaborative platforms such as OpenStreetMap are the scene of "tag wars" and "edit wars", where the struggle to define a place ("public" or "private", "official" or "alternative") translates into a veritable symbolic guerrilla war. The power to "make visible or invisible" an element on the map becomes a political technique. As documented in Chapter 6, OpenStreetMap "tag wars" and carto-vandalism reveal the fragility of open datasets and the need for governance protocols to prevent manipulation and exclusion.

As highlighted extensively in Chapter 4, there is a need for regulation, i.e. rules on layer transparency, change history, publisher responsibility and sensitive data protection.
Furthermore, we should move towards professionalising the mediation process that is already in place and regulated by mapping communities (such as OSM, for example, and as highlighted in the tag wars amendments triggered by ongoing political conflicts over disputed borders such as Palestine or Crimea): dispute resolution mechanisms within mapping platforms (moderation, versioning, trusted validators).
Of course, a process of professionalisation goes hand in hand with inclusion and capacity: as reiterated by the OSM community itself, there is a need for community training in order to participate effectively (data literacy, GIS training).
However, these dynamics pose crucial data governance challenges. Who controls metadata, validation, and the permanence of changes? In this environment, control and conflict mediation are of paramount importance to prevent manipulation and ensure inclusion. The "cartographic metaverse" is not only a space of opportunity for democratic participation, but also a potential terrain for the expansion of digital inequalities and surveillance. Understanding it therefore requires an approach that integrates technical analysis with a deep reflection on its political nature, as suggested by digital ethnography practices and the assessment of its impact on policy decisions.

In short, greater regulation would help prevent the tangible risks of collaborative mapping platforms: surveillance, manipulation, digital divide, appropriation of representations by powerful actors.

As a recommendation grounded in the Moroccan case studies (ch.5) where PGIS directly identified critical needs and resources, we can draw some suggestions on how to operationalise the methodology for research or a practical project: it is essential to use mixed mapping: integrating PGIS (interviews, focus groups, mapathons) with data derived from bottom-up participatory processes.
Protocols must be flexible by necessity: nothing can be planned with precision. The unexpected is part of the process, and the creative freedom of communities must be considered inviolable. A surprising aspect that emerged from these field activities during my research was the informative value of maps: for example, projects that were previously unknown came to light, such as experimental vegetable gardens and the introduction of new crops (e.g. informal groups of women who want to form a cooperative for the cultivation and production of almonds in the humanitarian mapping phase in the areas affected by the earthquake in Morocco).
Participatory cartography thus proved to be not only a tool for representation, but also a powerful means of knowledge production. In particular, when communities were asked to represent key elements such as houses or water, unexpected amounts of information emerged that astonished even economists and sustainability experts.The work revealed important chains of vulnerability linked to essential resources such as water, energy and the economy.
Mapping is an act of power and affirmation: when the community does it, the territory drawn is the one they live in, the real, shared one.

JOSE' ARCADIO BUENDIA E LE MAPPE

“Alla fine, stanco di aspettare, si lamentò con Melquìades del fallimento della sua iniziativa, e lo zingaro diede allora una prova convincente di onestà: gli restituì i dobloni in cambio della lente, e gli lasciò inoltre delle mappe portoghesi e diversi strumenti di navigazione. Scrisse di suo pugno una succinta sintesi degli studi del monaco Hermann, che lasciò a sua disposizione perché potesse servirsi dell'astrolabio, della bussola e del sestante. José Arcadio Buendìa trascorse i lunghi mesi di pioggia chiuso in uno stanzino che aveva costruito in fondo alla casa perché nessuno turbasse i suoi esperimenti. Tralasciò completamente i propri doveri domestici, rimase nel patio per notti intere a sorvegliare il corso degli astri, e fu sul punto di contrarre un'insolazione mentre cercava di stabilire un metodo esatto per trovare il mezzogiorno. Quando fu esperto nell'uso e nel maneggio dei suoi strumenti, ebbe una nozione dello spazio che gli permise di navigare per mari incogniti, di visitare territori disabitati e di allacciare rapporti con esseri splendidi, senza bisogno di lasciare il suo laboratorio".

Da "Cent'anni di solitudine". G. Gabo Marquez, Feltrinelli, 1968.

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List of acronymes

ABHDON – Agence du Bassin des Fleuves Drâa et Oued Noun (Agency for the Management of the Drâa and Oued Noun River Basins, Morocco)
CA – Capability Approach (theory by Amartya Sen and Martha Nussbaum)
CLMS – Copernicus Land Monitoring Service (European Union Land Monitoring Service)
COPE – Cooperazione Paesi Emergenti (Italian NGO for Emerging Countries Cooperation)
DISFOR – Dipartimento di Scienze della Formazione, Università di Catania (Department of Education Sciences, University of Catania)
DWG – Data Working Group (OpenStreetMap working group managing disputes, vandalism, and data consistency issues)
EBF – Emerging Business Factory (entrepreneurial, creative, and digital hub of Marrakech-Safi)
EU WFD – European Union Water Framework Directive (2000/60/EC)
FAO – Food and Agriculture Organization of the United Nations
FOSS – Free and Open Source Software
FGM – Female Genital Mutilation
FGM/C – Female Genital Mutilation/Cutting
GED – Gender, Environment, and Development
GENANET – Gender and Natural Resource Management Network
GenderCC – Women for Climate Justice
GGCA – Global Gender and Climate Alliance
GDF – Global Diversity Foundation
GDP – Gross Domestic Product
GIS – Geographic Information System
GIS – Geographic Information Systems
GPS – Global Positioning System
HDI – Human Development Index
HCP – Haut-Commissariat au Plan (High Commission for Planning, Morocco)
HOT – Humanitarian OpenStreetMap Team
HOTOSM – Humanitarian OpenStreetMap Team
IMF – International Monetary Fund
IPCC – Intergovernmental Panel on Climate Change
LERMA – Laboratoire des Études sur les Ressources, Mobilité et Attractivité (Université Cadi Ayyad, Marrakech)
NGO – Non-Governmental Organization
OSM – OpenStreetMap
OSM – OpenStreetMap (collaborative mapping platform)
OSMAnd – OpenStreetMap Automated Navigation Directions (Android offline maps app based on OSM)

OSMPatrol – Algorithmic tool for automatic monitoring and vandalism detection on OpenStreetMap
PGIS – Participatory Geographic Information System
PPGIS – Public Participation Geographic Information Systems
PNE – Plan National de l'Eau (National Water Plan, Morocco)
PMV – Plan Maroc Vert (Green Morocco Plan, agricultural development program)
PLA – Participatory Learning and Action
PRA – Participatory Rural Appraisal
RRA – Rapid Rural Appraisal
SDG – Sustainable Development Goals
SDI – Slum/Shack Dwellers International
SERVIR-Mekong – Enhancing climate change adaptation & landscape management in Lower Mekong
SADR – Sahrawi Arab Democratic Republic
SYBA – Sidi Youssef Ben Ali (peripheral neighborhood of Marrakech)
UN – United Nations
UNCCD – United Nations Convention to Combat Desertification
UNDP – United Nations Development Programme
UN-Habitat – United Nations Human Settlements Programme
UNESCO – United Nations Educational, Scientific and Cultural Organization
UNIFEM – United Nations Development Fund for Women
UGC – User Generated Content
VGI – Volunteered Geographic Information
WEF – Water-Energy-Food Nexus
WEF – Water-Energy-Food Nexus (interconnection of water, energy, and food for global resource security)
WEDO – Women's Environment and Development Organization
WECAN – Women's Earth and Climate Action Network

Hashtags in Feminist Activism

#MeToo – Movimento internazionale contro molestie sessuali
#Niunamenos – Movimento contro femminicidio e violenza sulle donne
#YesAllWomen – Movimento social su violenza e discriminazione

Bibliography

1. Alston, M. (2014). Gender mainstreaming and climate change. *Women's Studies International Forum*, 47 (Part B), 287–294. https://doi.org/10.1016/j.wsif.2013.01.016
2. Alston, M. (2017). Women and climate change in Bangladesh. Routledge. https://doi.org/10.4324/9781315139306
3. Anderson, C. (2006). The long tail: Why the future of business is selling less of more. *Hyperion*.
4. Anderson, C. (2009). *Free: The future of a radical price*. Hyperion.
5. Arora-Jonsson, S. (2011). Virtue and vulnerability: Discourses on women, gender and climate change. *Global Environmental Change*, 21(2), 744–751.
6. Azong Cho M., Mutanga O. (2021). Understanding participatory GIS application in rangeland use planning: a review of PGIS practice in Africa, *Journal of Land Use Science*, 16(2), 174-187.
7. Ballatore, A. (2014). Defacing the map: Cartographic vandalism in the digital commons. *The Cartographic Journal*, 51(1), 1–25. https://doi.org/10.1179/1743277414Y.0000000085
8. Bassett, T. J. (1998). Indigenous mapmaking in intertropical Africa. In D. Woodward & G. M. Lewis (Eds.), *The History of Cartography* (Vol. 2, Book 3, pp. 24–48). Chicago: University of Chicago Press.
9. Bianchi, B. (2020). Genere, generazioni e cambiamento climatico. Temi e questioni per una rubrica. *DEP. Deportate, esuli, profughe*, 41-42, 243-253.
10. Birdsall, W. F. (2011). Human capabilities and information and communication technology: The communicative connection. *Ethics and Information Technology*, 13(2), 93–106. https://doi.org/10.1007/s10676-010-9253-8
11. Bluecher, S., & Hansons, A. M. (2017). *A political ecology of women, water and global environmental change.* Routledge.
12. Bouchouba, J. (2014). The Moudawana Syndrome: Gender Trouble in Contemporary Morocco. *Research in African Literatures*, 45(1), 24–38.
13. Bordogna, G., Carrara, P., Criscuolo, L., Pepe, M., & Rampini, A. (2016). On predicting and improving the quality of Volunteer Geographic Information projects. *International Journal of Digital Earth*, 9(2), 134–155. https://doi.org/10.1080/17538947.2014.976774
14. Bryce, E. (2016, November 7). A drive to save Saharan oases as climate change takes a toll: COP22. Yale e360. Retrieved from https://e360.yale.edu/features/adrivetosavesaharanoasesasclimatechangetakesatollcop22br
15. Buechler, S. (2009). Gender, water, and climate change in Sonora, Mexico: Implications for policies and programmes on agricultural income generation. *Gender and Development,* 17(1), 15-29. https://doi.org/10.1080/13552070802696912
16. Burns, R. Rethinking big data in digital humanitarianism: practices, epistemologies, and social relations. *GeoJournal* 80, 477–490 (2015). https://doi.org/10.1007/s10708-014-9599-x
17. Burini, F. (2006). La cartografia partecipativa e la cooperazione ambientale in Africa. Il caso del villaggio di Bossia (Niger). *Bollettino della Società Geografica Italiana*, 11, 961–980.
18. Burini, F. (2010). Per una cartografia partecipativa nel dialogo interculturale. In E. Casti & J. Lévy (a cura di), *Le sfide cartografiche. Movimento, partecipazione, rischio* (pp. 186–198). Il Lavoro Editoriale/Università.
19. Burini, F. (2016). *Cartografia partecipativa. Mapping per la governance ambientale e urbana. Milano*: FrancoAngeli. ISBN 9788891740878.
20. Cardullo, P. (2018, October 29). New paper published "Smart urbanism and smart citizenship" - *The Programmable City*. https://progcity.maynoothuniversity.ie/author/pcardullo/
21. Cariani, D. et all (2022), *Rapporto Labsus 2021 sull'aministrazione condivisa dei beni comuni*, Fondazione Compagnia San Paolo, in labsus.org.

22. Carvalho, I. C. (2021). Critical Spatial Thinking in Women's Resilience for An Inclusive City. *Journal of Advanced Research in Social Sciences*, 4(1), 32-40. https://doi.org/10.33422/jarss.v4i1.688
23. Carta, M. (2003). T*eorie della pianificazione: Questioni, paradigmi e progetto*. Palermo: Palumbo.
24. Carta, M. (2009). *Governare l'evoluzione: Principi, metodi e progetti per una urbanistica in azione*. Milano: Franco Angeli.
25. Carta, M. (2003), *Teorie della pianificazione: questioni, paradigmi e progetto*, Palermo, Palumbo Editore. ISBN 88-8020-519-6.
26. Carta, M., & Ronsivalle, D. (2016). *The fluid city paradigm: Waterfront regeneration as an urban renewal strategy.* Palermo: Springer.
27. Cassese, S. (1975). I beni culturali da Bottai a Spadolini. *Rassegna degli Archivi di Stato*, 1-3, 116–142.
28. Casti, E. (2006). Geografia e partecipazione: la strategia SIGAP nella riserva della biosfera transfrontaliera "W" (Africa Occidentale). *Bollettino della Società Geografica Italiana,* 12(11), 949–975.
29. Casti, E. (2013). *Cartografia critica: Dal topos alla chora*. Guerini Scientifica. (v. capitolo 7, p. 141–142).
30. Casti, E. (2015). *Reflexive Cartography. A Modern Perspective in Mapping*. Amsterdam, Oxford, Waltham: Elsevier.
31. Chapin, M., & Threlkeld, B. (2001). I*ndigenous Landscapes: A Study in Ethnocartography*. Center for the Support of Native Lands. ISBN: 978-0840023285.
32. Chapin, M., Lamb, Z., & Threlkeld, B. (2005). Mapping Indigenous lands. *Annual Review of Anthropology*, 34, 619–638. https://doi.org/10.1146/annurev.anthro.34.081804.120429
33. Chierichetti, Nicolò & Gardino, Maria & Mercatili, Greta. (2020). *URBAN FRINGES AS URBAN LABORATORIES - The inefficiency of Villes Sans Bidonvilles Program and the new vision of the Douars, in Marrakech*. 10.13140/RG.2.2.27581.49127.
34. Choplin, A., & Lozivit, M. (2019). Mapping a slum: Learning from participatory mapping and digital innovation in Cotonou (Benin). *Cybergeo: European Journal of Geography*, (894).
35. Cope, M., & Elwood, S. (Eds.). (2009). *Qualitative GIS: A mixed methods approach*. London, UK: SAGE Publications.
36. Crawford, K., Finn, M. The limits of crisis data: analytical and ethical challenges of using social and mobile data to understand disasters. *GeoJournal* 80, 491–502 (2015). https://doi.org/10.1007/s10708-014-9597-z
37. Cutter, S. L. (1995). The forgotten casualties: Women, children, and environmental change. *Global Environmental Change*, 5(3), 181-194. https://doi.org/10.1016/0959-3780(95)00046-Q
38. Dankelman, I. (Ed.). (2010). *Gender and Climate Change: An Introduction* (1st ed.). Routledge. https://doi.org/10.4324/9781849775274
39. De Spuches, G. (2021). Per una didattica della geografia sociale: sopralluoghi ed esplorazioni urbane. *Geography Notebooks*, 4(2), 55-64. doi:https://doi.org/10.7358/gn-2021-002-spu1
40. De Vet, A. (2023). *The problem of cartography: From singular to plural mapping*. TYPP, Sint Lucas School of Arts.
41. *Decreto Legislativo n. 235 del 30 dicembre 2010*, https://www.normattiva.it/
42. Eckstein, D., Künzel, V., & Schäfer, L. (2021). Global Climate Risk Index 2021: Who suffers most from extreme weather events? Weather-related loss events in 2019 and 2000–2019. https://www.germanwatch.org/en/19777
43. Echavarren, J. (2023). The gender gap in environmental concern: Support for an ecofeminist perspective and the role of gender egalitarian attitudes. Sex Roles, 89(1), 1-14. https://doi.org/10.1007/s11199-023-01397-3
44. Elkhalifi, A., Aït Moussa, A., & Bouaouinate, A. (2022). Tourisme et pauvreté au Drâa moyen. Cas de la palmeraie de M'hamid El Ghizlane (Province de Zagora, Maroc). *Revue d'Innovation et Dynamiques Territoriales*, 1.

45. El Kahlaoui, S. (2015). Revendiquer un droit en situation d'illégalité. In B. Dupret, Z. Rhani, A. Boutaleb, & J. Ferrié (Eds.), *Le Maroc au présent.* Casablanca: Centre Jacques-Berque.
46. Elwood S. (2008). "Volunteered geographic information: Future research directions motivated by critical, participatory, and feminist GIS", *GeoJournal,* 72(3–4), 173–183.
47. Elwood, S., Goodchild, M. F., & Sui, D. (2013). Prospects for VGI research and the emerging fourth paradigm. In D. Sui, S. Elwood, & M. F. Goodchild (Eds.), *Crowdsourcing geographic knowledge: Volunteered geographic information (VGI) in theory and practice* (pp. 361–375). New York: Springer. doi: https://link.springer.com/chapter/10.1007/978-94-007-4587-2_20
48. Farinelli, F. (1992). *I segni del mondo. Immagine cartografica e discorso geografico in età moderna*. Firenze: La Nuova Italia.
49. FAO. (2015, May). The impact of natural hazards and disasters on agriculture and food security and nutrition. Food and Agriculture Organization of the United Nations. https://openknowledge.fao.org/server/api/core/bitstreams/a9b93dc0-9b13-4644-96d0-fd8879e66007/content
50. Fernández, M. E. (2014). A map is not a place. In Memories of Underdevelopment: Art and the Decolonial Turn in Latin America, 1960–1985 (exhibition catalog, pp. 38–41). Austin: University of Texas Press.
51. Gardner, Z., & Mooney, P. (2018). Investigating gender differences in OpenStreetMap activities in Malawi: A small case-study. *AGILE 2018 - Lund*, June 12-15, 2018.
52. Giacomini, T. (2016–2017). Ecofeminism and System Change. Women on the Frontlines of the Struggles against Fossil Capitalism and for Solar Commons. *Canadian Woman Studies/Les cahiers de la femme*, 31(1-2), 95-100.
53. Giacomini, T., Turner, T. T., Isla, A., & Brownhill, L. (2018). Ecofeminism against Capitalism and for the Commons. *Capitalism, Nature, Socialism,* 29(1), 1-6.
54. Giampaolo, M., & Ianni, A. (2021). La migrazione rurale-urbana in Africa. *Quaderni FOCSIV, I volti delle migrazioni* (n. 10).
55. Giannola E. (2013). "Processi innovativi di costruzione dell'immagine territoriale: ruolo culturale e contributo alla pianificazione". IN FOLIO, 30(30), 27-30.
56. Giorgi, F., & Lionello, P. (2008). Climate change projections for the Mediterranean region. *Global and Planetary Change*, 63(2–3), 90–104. https://doi.org/10.1016/j.gloplacha.2007.09.005
57. Goodchild, Michael & Fu, Pinde & Rich, Paul. (2007). Sharing Geographic Information: An Assessment of the Geospatial One-Stop. *Annals of the Association of American Geographers*. 97. 250 - 266. 10.1111/j.1467-8306.2007.00534.x.
58. Goodchild M.F. (2007). Citizens as sensors: the world of volunteered geography. *GeoJournal* 69, 211–221. https://doi.org/10.1007/s10708-007-9111-y
59. Goodchild, M. F., & Glennon, J. A. (2010). Crowdsourcing geographic information for disaster response: A research frontier. International Journal of Digital Earth, 3(3), 231–241. https://doi.org/10.1080/17538941003759255
60. Goodchild, M. F., & Li, L. (2012). Assuring the quality of volunteered geographic information. Spatial Statistics, 1, 110–120. https://doi.org/10.1016/j.spasta.2012.03.002
61. Görg, C. (2007). Landscape governance: The "politics of scale" and the "natural" conditions of places. *Geoforum*, 38(5), 954-966.
62. Guarrasi V. (2006), L'indagine sul terreno e l'arte del sopralluogo, in Marengo M., a cura di, *La dimensione locale. Esperienze (multidisciplinari) di ricerca e questioni metodologiche*, Aracne, Roma.
63. Granata, E. (2023). *Il senso delle donne per la città: Curiosità, ingegno, apertura.* Passaggi Einaudi.
64. Gullo, N. (2022). Il recupero dei beni confiscati tra restyling normativo e opportunità delle politiche di coesione e di attuazione del PNRR. Istituzioni del federalismo: *Rivista di studi giuridici e politici*, XLIII(1), 71–97. Soveria Mannelli: Rubbettino. http://digital.casalini.it/10.1400/290132

65. Gutiérrez, M. (2018). Crowdsourcing and Mapping Data for Humanitarianism. In: Data Activism and Social Change. *Palgrave Studies in Communication for Social Change*. Palgrave Pivot, Cham. https://doi.org/10.1007/978-3-319-78319-2_4
66. Haklay, M. (2010). How good is volunteered geographical information? A comparative study of OpenStreetMap and Ordnance Survey datasets. *Environment and planning B: Planning and design,* 37, 682--703.
67. Haklay, M. (2013). Citizen science and volunteered geographic information: Overview and typology of participation. In D. Sui, S. Elwood, & M. Goodchild (Eds.), *Crowdsourcing Geographic Knowledge: Volunteered Geographic Information (VGI)* in Theory and Practice (pp. 105–122). Dordrecht: Springer. https://doi.org/10.1007/978-94-007-4587-2_
68. Hanafi, L. (2012). Moudawana And Women's Rights In Morocco: Balancing National And International Law. *ILSA Journal of International & Comparative Law*, 18(2), Article 10.
69. Hanson, A.-M., & Alston, M. (2018). Gender and climate change: Expanding feminist engagements with ICT for adaptation and innovation. *Journal of Feminist Geography*, 25(3), 123-138.
70. Harley, J. B. (1989). *Deconstructing the map*. Ann Arbor, MI: MPublishing, University of Michigan Library. http://hdl.handle.net/2027/spo.4761530.0003.008
71. Harley, J. B., & Woodward, D. (Eds.). (1987). *The History of Cartography, Volume 1: Cartography in Prehistoric, Ancient, and Medieval Europe and the Mediterranean*. Chicago: University of Chicago Press. ISBN: 0-226-31633-5.
72. Harris, T. M., Weiner, D., Warner, T. A., & Levin, R. (1995). Pursuing social goals through participatory geographic information systems. In J. Pickles (Ed.), *Ground Truth: The Social Implications of Geographic Information Systems* (pp. 196–222). New York: The Guilford Press.
73. Harris, T., & Weiner, D. (1998). Empowerment, Marginalization, and "Community-integrated" GIS. Cartography and Geographic Information Systems, 25(2), 67–76. https://doi.org/10.1559/152304098782594580
74. Harvey, David (2008). *The Right to the City*. New Left Review.
75. Herfort, B., Lautenbach, S., Porto de Albuquerque, J., et al. (2023). A spatio-temporal analysis investigating completeness and inequalities of global urban building data in OpenStreetMap. *Nature Communications*, 14, 3985. https://doi.org/10.1038/s41467-023-39698-6
76. Howe, J. 2008. Crowdsourcing: Why the Power of the Crowd Is Driving the Future of Business. *New York: McGraw-Hill*, pp. 401–408.
77. Ilse Oosterlaken, & van den Hoven, J. (2011). ICT and the capability approach. *Ethics and Information Technology*, 13, 65–67.
78. Ishigami, A., Hajat, S., Kovats, R.S. et al. An ecological time-series study of heat-related mortality in three European cities. *Environmental Health* 7,5 (2008). https://doi.org/10.1186/1476-069X-7-5
79. Iturralde-Vinent, M. (2009). *GeoCuba para todos: una cartografía partecipativa para la gestión del territorio*. La Habana: Editorial Academia.
80. Jankowski, P. (2011). Designing public participation geographic information systems. In T. Nyerges, H. Couclelis, & R. McMaster (Eds.), *The SAGE Handbook of GIS and Society* (pp. 347–360). London: SAGE. https://doi.org/10.4135/9781446201046.n18
81. Jeleński, T. (2018). Review practices of built heritage post-disaster reconstruction for resilient cities. Buildings, 8(4), 53. https://doi.org/10.3390/buildings8040053
82. Jha, A. (2020). ICT with open and distance learning for capability enhancement: Practices of higher education institutions of Nepal. *Journal of Training and Development,* 5, 60-70. https://doi.org/10.3126/jtd.v5i0.33895
83. Kienberger S. (2014) "Participatory mapping of flood hazard risk in Munamicua, District of Búzi, Mozambique", *Journal of Maps*, 10(2).
84. Kent, A. (2017). Trust me, I'm a cartographer: Post-truth and the problem of acritical cartography. *The Cartographic Journal*, 47(2), 77–79. https://doi.org/10.3138/carto.47.2.77
85. Kern. L. *La città femminista. La lotta per lo spazio in un mondo disegnato da uomini.* Roma: Treccani Libri, 2021

86. Kitchin, R. (2014). *Big data. In The data revolution: Big data, open data, data infrastructures & their consequences* (pp. 67–79). SAGE Publications Ltd. https://doi.org/10.4135/9781473909472
87. Krupar, S. (2015). Map power and map methodologies for social justice. *Georgetown Journal of International Affairs*, 16(2), 91–101.
88. Kwan, M.-P. (2002). Feminist Visualization: Re-envisioning GIS as a Method in Feminist Geographic Research. *Annals of the American Association of Geographers*, 92(4), 645–661. https://doi.org/10.1111/1467-8306.00309
89. Karmaoui, A., Ifaadassan, I., Babqiqi, A., Messouli, M., & Khebiza, M. Y. (2016). Analysis of the Water Supply-demand Relationship in the Middle Draa Valley, Morocco. *Journal of Scientific Research and Reports,* 9, 1–10. https://doi.org/10.9734/JSRR/2016/21536
90. Elkhalifi, A., Aït Moussa, A., Bouaouinate, A. (2012). Tourisme et pauvreté au Drâa Moyen. *Revue d'Innovation et Dynamiques Territoriales*, No. 1 (2022): Tourisme rural et réduction de la pauvreté.
91. Kern. L. *La città femminista. La lotta per lo spazio in un mondo disegnato da uomini.* Roma: Treccani Libri, 2021
92. Kent, A. (2017). Trust me, I'm a cartographer: Post-truth and the problem of acritical cartography. *The Cartographic Journal*, 47(2), 77–79. https://doi.org/10.3138/carto.47.2.77
93. Kienberger S. (2014) "Participatory mapping of flood hazard risk in Munamicua, District of Búzi, Mozambique", *Journal of Maps*, 10(2).
94. Kitchin, R. (2014). Big data. In The data revolution: Big data, open data, data infrastructures & their consequences (pp. 67–79). SAGE Publications Ltd. https://doi.org/10.4135/9781473909472
95. Kostanian, Gevorg. Conflict in OSINT: OSM Data Abuse, Vandalism and Corruption in Conflicted Regions. *LinkedIn Pulse,* October 29, 2023. https://www.linkedin.com/pulse/conflict-osint-osm-data-abuse-vandalism-corruption-gevorg-kostanian-irpdf/.
96. Krupar, S. (2015). Map power and map methodologies for social justice. *Georgetown Journal of International Affairs*, 16(2), 91–101.
97. Kwan, M.-P. (2002). Feminist Visualization: Re-envisioning GIS as a Method in Feminist Geographic Research. *Annals of the American Association of Geographers*, 92(4), 645–661. https://doi.org/10.1111/1467-8306.00309
98. Lambrou, Y., & Piana, G. (2006). *Gender: The Missing Component of the Response to Climate Change.* Rome: FAO, Gender and Population Division, Sustainable Development Department.
99. Lefebvre, H. (1968). Le droit à la ville. Paris: Éditions Anthropos.
100. Leszczynski, A. (2011). Situating the geoweb in political economy. *Progress in Human Geography,* 36(1), 72-89. https://doi.org/10.1177/0309132511411231
101. Lévy, P. (1996). *L'intelligenza collettiva: Per un'antropologia del cyberspazio* (1ª ed. italiana, trad. dall'originale del 1994). Milano: Feltrinelli.
102. Lévy, J., & Lussault, J. (Eds.). (2000). *Logiques de l'espace, esprit des lieux. Géographies à Cerisy*. Paris: Belin.
103. Lewis, G. M. (Ed.). (1998). *Cartographic Encounters: Perspectives on Native American Mapmaking and Map Use.* Chicago: University of Chicago Press.
104. Linstädter, A., Baumann, G., Diekkrüger, B., & Fritzsche, P. (2010). Land use and land cover in Southern Morocco: Managing unpredictable resources and extreme events. In *Climate and Environmental Change in the Mediterranean Basin.* Springer.
105. Listerborn, C. (2023). Who is telling the smart city story? Feminist diffractions of smart cities. In *Digital (in)justice in the smart city* (pp. 39–52).
106. Louis, R. P., Johnson, J. T., & Pramono, A. H. (2012). Introduction: Indigenous cartographies and counter-mapping. *Cartographica: The International Journal for Geographic Information and Geovisualization*, 47(2), 77–81. https://doi.org/10.3138/carto.47.2.77
107. Lussault, M. (2007). *L'homme spatial: la construction sociale de l'espace humain*. Paris: Éditions du Seuil.
108. Lynch, K. (1960). *The Image of the City*. Cambridge, MA: MIT Press.

109. Lynch, K. (1980). *Good City Form.* Cambridge, MA: MIT Press.
110. MacKinnon, D., Burns, R., & Fast, V. (2023). *Digital (in)justice in the smart city.* Toronto: University of Toronto Press.
111. Markham, B. (1987). *West with the night*. North Point Press.
112. McCall, M. K. (2003). Seeking good governance in participatory-GIS: A review of processes and governance dimensions in applying GIS to participatory spatial planning. *Habitat International*, 27(4), 549–573. https://doi.org/10.1016/S0197-3975(03)00005-5
113. Merchant, C. (1980). *The death of nature: Women, ecology, and the scientific revolution.* Harper & Row.
114. Mhamka, B., & Masto, R. (2008). *La scelta di Said. Storia di un kamikaze.* Sperling & Kupfer.
115. Mies, M., & Shiva, V. (1993). *Ecofeminism.* Zed Books.
116. Minghini, M., & Grinberger, Y. (2024). What happens when VGI is threatened? A systems perspective analysis of the events behind the introduction of rate limiting in OpenStreetMap. *Talk presented at State of the Map 2024,* OpenStreetMap Foundation. https://2024.stateofthemap.org/sessions/FSYR9S/
117. Minor, H. H. (1999). Mapping Mussolini: Ritual and cartography in public art during the Second Roman Empire. *Imago Mundi,* 51(1), 147–162.
118. Mills-Novoa, M., Boelens, R., & Hoogesteger, J. (2022). Climate change and water justice. In *Encyclopedia of Water: Science, Technology, and Society*. Elsevier. https://doi.org/10.1016/B978-0-323-99875-8.00014-8
119. Mouton, M., & Burns, R. (2021). (Digital) neo-colonialism in the smart city. *Regional Studies,* 55(12), 1890–1901. https://doi.org/10.1080/00343404.2021.1915974
120. Nagel, J. (2016). *Gender and climate change: Impacts, science, policy.* Routledge.
121. Noss, R. F. (1983). A regional landscape approach to maintain diversity. *BioScience,* 33(11), 700–706. https://doi.org/10.2307/1309350
122. Nossov, K. (2013). Protecting travel and trade: Seljuq fortified caravanserais in Anatolia. *Medieval Warfare,* 3(3), 22–27. https://www.jstor.org/stable/48578236
123. Nussbaum, M. (2000). *Diventare persone: Women and human development. The capability approach.* Il Mulino.
124. Nussbaum, M. (2000). *Giustizia sociale e dignità umana*. Il Mulino.
125. Nussbaum, M. (2000). Women's Capabilities and Social Justice. *Journal of Human Development*, 1(2), 219–247. https://doi.org/10.1080/713678045
126. Nussbaum, M. (2022). *Justice for Animals: Our Collective Responsibility*. Simon & Schuster.
127. Nussbaum, M. C. (2000). *Women and human development: The capabilities approach*. Cambridge University Press.
128. Nussbaum, M. C. (2000). *Diventare persone.* Il Mulino.
129. Nussbaum, M. C. (2006). *Frontiers of justice: Disability, nationality, species membership.* Harvard University Press.
130. OECD (2002) Organizzazione per la cooperazione e lo sviluppo economico (OECD). (2002). *Measuring the non-observed economy: A handbook.* OECD Publishing. https://doi.org/10.1787/9789264175358-en
131. Oosterlaken, I., & van den Hoven, J. (2011). ICT and the capability approach. *Ethics and Information Technology*, 13(1), 65–67.
132. Ouassou, A., Amziane, T. H., & Lajouad, L. (n.d.). State of natural resources degradation in Morocco. In *Desertification in the Mediterranean region: A security issue* (pp. 251–268).
133. Oxfam. (2002). Gender and development: Special issue on climate change. *Gender and Development,* 10(2).
134. Peluso, N. L. (1995). Whose woods are these? Counter-mapping forest territories in Kalimantan, Indonesia. Antipode, 27(4), 383–406. https://doi.org/10.1111/j.1467-8330.1995.tb00286.x
135. Picone, M. (2012). Scienze sociali e progetto di territorio. In F. Schilleci (a cura di), *Ambiente ed ecologia. Per una nuova visone del progetto territoriale* (pp. 119-135). Milano : FrancoAngeli.

136. Picone, M., & Piccolo, F. (2014). Ethical e-participation: Reasons for introducing a "qualitative turn" for PPGIS. *International Journal of E-Planning Research,* 3, 57–78. https://doi.org/10.4018/ijepr.2014100104
137. Picone M., Piccolo F. (2014). "Ethical E-Participation: Reasons for Introducing a 'Qualitative Turn' for PPGIS", *International Journal of E-Planning Research*, 3, 57–78. https://doi.org/10.4018/ijepr.2014100104
138. Pirani, N., Ricker, B., & Kraak, M.-J. (2019). Feminist cartography and gender equality. *The Canadian Geographer*, 64. https://doi.org/10.1111/cag.12575
139. Pirani, N., Ricker, B., & Kraak, M.-J. (2019). Feminist cartography and the United Nations Sustainable Development Goal on gender equality: Emotional responses to three thematic maps. *The Canadian Geographer / Le Géographe canadien*, 64(4), 460-471.
140. Plumwood, V. (1993). *Feminism and the mastery of nature*. Routledge.
141. Radcliffe, S. A. (2017). Decolonising geographical knowledges. Transactions of the *Institute of British Geographer*s, 42(3), 329–333. https://doi.org/10.1111/tran.12195
142. Rambaldi, G., Chambers, R., McCall, M., & Fox, J. (2006). Mapping for change: The emergence of a new practice. *Participatory Learning and Action*, 54(1), 13–19.
143. Rambaldi, G., Corbett, J., Olson, R., Muchemi, J., Kyem, P., Weiner, D., & Chambers, R. (Eds.). (2006). *PLA 54: Mapping for change: Practice, technologies and communication*. IIED. https://www.iied.org/14507iied
144. Ratti, C., & Claudel, M. (2017). *La città di domani: Sempre più smart, trasformata dai progressi della tecnologia e dalla diffusione delle reti.* Torino: Einaudi.
145. Reed, J., Ickowitz, A., Chervier, C., Djoudi, H., Moombe, K., Ros-Tonen, M., Yanou, M., Yuliani, L., & Sunderland, T. (2020). Integrated landscape approaches in the tropics: A brief stock-take. *Land Use Policy*, 99, 104822. https://doi.org/10.1016/j.landusepol.2020.104822
146. Robinson, S. (2014). *Nesting: Body, habitation, mind* (p. 21). Pordenone: Safarà Editore.
147. Roche, S. (2010). Leggere e scrivere la carta sull'onda del Geoweb. In S. Roche & G. Zamboni (Eds.), *Sfide cartografiche. Movimento, partecipazione, rischio.* Il lavoro editoirale/Università, Ancona (pp. 47–61).
148. Ross, E. (a cura di, 2022). *Sufi City: Urban Design and Archetypes in Touba* (Vol. 24). Rochester Studies in African History and the Diaspora. https://doi.org/10.1515/9781580466615
149. Rossi, V. (2024), Ruins of redemption: The role of crowd-mapping within humanitarian rescue operations, Folio, 43 (June 2024), 137–145.
150. Rössler, M., Kirscht, H., Rademacher-Schulz, C., Platt, S., Kemmerling, B., & Linstädter, A. (2010). Migration and resource management in the Drâa Valley, Southern Morocco, in P. Speth, M. Christoph, & B. Diekkrüger (Eds.), *Impacts of global change on the hydrological cycle in West and Northwest Africa* (pp. 584–597). Springer, 2011. ISBN: 978-3-642-12956-8.
151. Rosol, M., & Blue, G. (2022). From the smart city to urban justice in a digital age. *City*, 26(4), 684–705. https://doi.org/10.1080/13604813.2022.2079881
152. Sanna Venere, V. S., Capineri, C., Salerno, G. M., & Teobaldi, M. (2025). *Citizen science, territorio e comunità: Prospettive geografiche per la ricerca e azione.* Firenze University Press. https://doi.org/10.36253/979-12-215-0698-3
153. Schlosberg, D., & Collins, L. B. (2014). From environmental to climate justice: Climate change and the discourse of environmental justice. *WIREs Climate Change*, 5(3), 359–374. https://doi.org/10.1002/wcc.275
154. Sen, A. (1999). *Development as freedom*. Oxford University Press.
155. Sen, A. (2009). *The idea of justice.* Cambridge, MA: The Belknap Press of Harvard University Press
156. SERVIR-Mekong. (2015). *Gender and GIS: Guidance Notes*. Asian Disaster Preparedness Center.
157. Shiva, V. (1988). *Staying alive: Women, ecology, and development.* Zed Books.
158. Smith, Linda Tuhiwai. *Decolonizing Methodologies: Research and Indigenous Peoples*. London & New York: Zed Books, 1999.

159. Stock, P. (2016). America and the American Revolution in British geographical thought, c.1760–1830. *The English Historical Review*, 131(553), 1–31. https://doi.org/10.1093/ehr/cew278
160. Strengers, Y., & Nicholls, L. (2017). Aesthetic pleasures and gendered tech-work in the 21st-century smart home. *Media International Australia*, 166(1), 70–80. https://doi.org/10.1177/1329878X17737661
161. Strohmaier, A., & Krewani, A. (2021). *Media and mapping practices in the Middle East and North Africa: Producing space.* Amsterdam University Press. https://doi.org/10.2307/j.ctv1hw3z0w
162. Sui, D., Goodchild, M., & Elwood, S. (2013). Volunteered geographic information, the exaflood, and the growing digital divide. In D. Sui, S. Elwood, & M. Goodchild (Eds.), *Crowdsourcing Geographic Knowledge* (pp. 1–14). Dordrecht: Springer. https://doi.org/10.1007/978-94-007-4587-2_1
163. Sultana, F. (2014). Gendering climate change: Geographical insights. *The Professional Geographer*, 66(3), 372–381.
164. Talen, E. (2000). Bottom-Up GIS: A New Tool for Individual and Group Expression in Participatory Planning. *Journal of the American Planning Association*, 66(3), 279–294. https://doi.org/10.1080/01944360008976107
165. Truong, Q.-T., Touya, G., & De Runz, C. (2018). Towards vandalism detection in OpenStreetMap through a data-driven approach. In *LIPIcs – GIScience 2018* (No. 61). https://doi.org/10.4230/LIPIcs.GISCIENCE.2018.61
166. Turchi, P. (2004). *Maps of the Imagination: The Writer as Cartographer.* Trinity University Press
167. Turco, A. (1986). *Geografie della complessità in Africa: interpretando il Senegal.* Milano: Unicopli. ISBN 88-400-0041-0.
168. Turner, A. (2006). *Introduction to Neogeography.* O'Reilly.
169. UNESCO. (2003). *Convention for the safeguarding of the intangible cultural heritage.* https://ich.unesco.org/en/convention
170. UN-Habitat. (2003). *The Challenge of Slums: Global Report on Human Settlements 2003*. London: Earthscan.
171. United Nations, Department of Economic and Social Affairs, Population Division. (2024). *World Population Prospects 2024*. UN DESA/POP/2024/DC/NO. 10.
172. Vaughan, D. (2011). The importance of capabilities in the sustainability of information and communications technology programs: The case of remote Indigenous Australian communities. *Ethics and Information Technology,* 13(2), 131–150. https://doi.org/10.1007/s10676-011-9269-3
173. Viitanen, J., & Kingston, R. (2014). Smart cities and green growth: Outsourcing democratic and environmental resilience to the global technology sector. *Environment and Planning A: Economy and Space*, 46(4), 803–819. https://doi.org/10.1068/a46242
174. Virgilio, F., & Carbonari, M. (2022, June 23-24). *Il Data Activism contro la violenza di genere. Uno studio esplorativo su pratiche partecipative, saperi ed iniziative "dal basso"*. IV Convegno Società Scientifica Italiana di Sociologia, Cultura, Comunicazione, Università Federico II, Napoli. Intervento a convegno non pubblicato.
175. Walton, J., Shefner, J., & Seddon, D. (2008). *Free markets & food riots: The politics of global adjustment.* https://doi.org/10.1002/9780470712962.ch4
176. Winner, L. (1986). T*he whale and the reactor: A search for limits in an age of high technology*. University of Chicago Press.
177. Wolf, Eric R. (1982). *Europe and the People Without History.* Berkeley: University of California Press.
178. Wood, D. (1992). *The power of maps.* New York: Guilford Press.
179. Woodward, D., & Lewis, G. M. (Eds.). (1998). *Cartography in the Traditional African, American, Arctic, Australian, and Pacific Societies* (Vol. 2, Book 3). Chicago: University of Chicago Press. ISBN 978-0226907284.

WEB REFERENCES

Australian Urban Research Infrastructure Network (AURIN). (n.d.). *Tools and documentation for public participation with GIS*. Retrieved from https://aurin.org.au

Decreto Legislativo n. 235 del 30 dicembre 2010. (2010). Retrieved from https://www.normattiva.it/

Food and Agriculture Organization of the United Nations (FAO). (2015, May). *The impact of natural hazards and disasters on agriculture and food security and nutrition.* Retrieved from https://openknowledge.fao.org/server/api/core/bitstreams/a9b93dc0-9b13-4644-96d0-fd8879e66007/content

Germanwatch. (2021). Retrieved from https://www.germanwatch.org/en/19777
Geoportal Humanitarian Mapping Project by Caritas (section 5.2.2)
https://www.arcgis.com/apps/instant/portfolio/index.html?appid=ddf0601c4eb84adba9dde6a78ac6d6fc

Kebir, O. (2023, October 22). *Anti-Israel activists attempt to 'wipe Tel Aviv off the map*.' Calcalistech. Retrieved from https://www.calcalistech.com/ctechnews/article/r1hyeammt

Kostanian, G. (2023, October 29). *Conflict in OSINT: OSM data abuse, vandalism and corruption in conflicted regions.* LinkedIn Pulse. Retrieved from https://www.linkedin.com/pulse/conflict-osint-osm-data-abuse-vandalism-corruption-gevorg-kostanian-irpdf/

Mason, B. (2018, November 16). *Why your mental map of the world is (probably) wrong*. National Geographic Education. Retrieved from https://education.nationalgeographic.org/resource/why-your-mental-map-world-probably-wrong/

O'Sullivan, D., & Kourdi, E. (2023, October 29). *Fake placenames with anti-Israel messages flood Google Maps' depiction of the Rafah border crossing between Gaza and Egypt.* CNN. Retrieved from https://edition.cnn.com/2023/10/24/tech/anti-israel-messages-google-maps-rafah-border-crossing/index.html

Portland Maps. (n.d.). *Interactive GIS platform for community participation*. Retrieved from https://www.portland.gov/bts/cgis/portlandmaps

Public Participation GIS (PPGIS). (n.d.). *Principles and practices*. Retrieved from https://ppgis.net

Radio El Amane. (n.d.). Retrieved from https://radiopublic.com/radio-el-amane-GKRz9Q

Recensement Général de la Population et de l'Habitat 2024. (2025). Haut Commissariat au Plan. Retrieved March 2025, from https://www.hcp.ma/

Shandra, A. (2018, November 23). *Open Street Map decides to mark Crimea as Russian territory*. Euromaidan Press. Retrieved from https://euromaidanpress.com/2018/11/23/open-street-map-decides-to-mark-crimea-as-russian-territory/

Slum Dwellers International. (n.d.). Retrieved from https://sdinet.org/

United Nations Human Rights Council. (2008). *Human rights and climate change (Resolution 7/23)*. United Nations. Retrieved from https://www.right-docs.org/doc/a-hrc-res-7-23

UNICEF. (2022, June 28). *Child marriage on the rise in Horn of Africa as drought crisis intensifies*. Retrieved from https://www.unicef.org/press-releases/child-marriage-rise-horn-africa-drought-crisis-intensifies

WECAN: Women's Earth and Climate Action Network. (n.d.). Retrieved October 19, 2024, from https://www.wecaninternational.org

World Bank. (2025). Population living in slums (% of urban population). Retrieved March 2025, from https://data.worldbank.org

World Economic Forum. (2023, January). *The climate crisis disproportionately hits the poor. How can we protect them?* Retrieved from https://www.weforum.org/stories/2023/01/climate-crisis-poor-davos2023

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- POSTER : Colloque International Hybride Phc Toubkal Des Jeunes Chercheurs En Geographie 21-22 avril 2025 Università di Marrakech / LERMA