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Assessing the Theoretical Scope of Environmental Justice in Contemporary Literature and Developing a Pragmatic Monitoring Framework

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Abstract: The environmental justice (EJ) movement has evolved over five decades, encapsulating diverse theories, principles, frameworks, and practices. Despite considerable advancements in this field, the nuances of EJ in the Anthropocene era, along with its monitoring and evaluation, remain ambiguous. This paper endeavors to bridge this gap by amalgamating more than 200 review and empirical articles and theoretical literature to delve into a comprehensive exploration of the EJ discourse to date, utilizing the Planetary Justice Research Framework (PJRF). First, we build on the existing knowledge by using three dimensions of EJ from the PJRF, acknowledging historical legacies, and explaining them with practical examples. Second, we create a comprehensive framework to evaluate (in)justice in real-world applications, highlighting the contextual relationships (intra-, inter-, and transdisciplinary) and the role of spatial, temporal, and contextual factors. Finally, we explore the complex connections between living beings and non-living components, showing how (un)just actions impact the balance within and between planetary systems. Consequently, the newly devised monitoring framework highlights potential instances where questions of (in)justice may arise in practical settings, thereby guiding the formulation of measuring indicators and procedural methodologies.

Keywords: ecosystem and species; planetary justice; human–nature relationship; smart framework; social equity

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1. Introduction

Injustice occurs when imbalances or inequalities contradict existing legal frameworks, international protocols, and established moral values and norms [1–3]. This inequity is evaluated across various scales to assess the impact of interventions on subjects, entities, or systems, thereby determining the status of (in)justice [4,5]. Environmental justice (EJ) originated with the unequal compensation and unjust working conditions experienced by black garbage workers in the late 1960s concerning the implementation of environmental policies [6]. This was followed by analogous mistreatment in sanitary management during the 1970s, which highlighted the disparities in the environmental risks faced by specific communities in contrast to others [7,8]. In 1982, Benjamin Chavis, then executive director of the United Church of Christ's Commission for Racial Justice, defined environmental racism as racial discrimination in environmental policy-making, law enforcement, and the targeting of communities of color for toxic waste facilities while excluding them from ecological leadership [9,10]. Over time, it has evolved into a well-established theory of justice on a

global scale [6,7,11]. However, throughout history, EJ has led to the emergence of various thoughts, theories, principles, practices, perspectives, arguments, debates, narratives, and understandings, expanding its scope and relevance from its early conception to the modern era [1,3,6,12–16]. There are noteworthy contributions from numerous philosophers towards broadening the sphere of EJ beyond the human sphere too [3,13,17].

Such a theoretical background catalyzes the advancement of new ideas and knowledge, providing EJ with the flexibility to broaden its scope [6]. Reviewing the theoretical framework of environmental justice (EJ) is essential to better understand its dimensions within the existing body of knowledge and to expand its horizons [18]. This aligns with the global commitment to the principle of justice for all [19] and supports the aim of achieving sustainability for the 3Ps (People, Places, Planet) in Earth system governance [20], as well as the broader goals of the 5Ps (People, Planet, Prosperity, Peace, and Partnership) in global agendas [21] through just actions.

Further, the monitoring and/or evaluation of the status of justice is a cornerstone for understanding the status of (in)justice, thereby maintaining social well-being, ecological integrity, and environmental security. To achieve this, various practices are being proposed and used on the ground. For example, Tschakert et al. (2021) explored how humans interact with society, non-human beings, and the climate to illustrate justice in relation to the environment [22]. A study suggests that justice involves comparing initiatives within, between, and beyond communities using energy distribution [23]. Another framework for planetary justice has been proposed for research; however, this is solely focused on social science research and is theoretically founded [19,24]. Further, few studies are concerned with the inter-generational relationship in terms of sustainability [25,26] or unfair treatment of one community compared to others [6,8], or with the social–ecological relationship [27]. However, it is unclear how to analyze the status of (in)justice in practice. Furthermore, some studies have reported on questions of social justice in spatial planning [28,29], global justice [26], inter-generational justice [30–32], climate justice [6,33,34], and planetary justice [19,24,35,36]. However, the status of the horizontal and vertical theoretical scope of environmental justice (EJ) in the 21st century remains unclear. This suggests that the contemporary understanding of the implications of environmental policies, laws, programs, and practices has inadequately captured both their broad applications and their depth of influence in addressing the modern environmental challenges affecting human and non-human lives [2,4,18]. Further questions remain unanswered, including the following: What is the theoretical and practical EJ discourse in the contemporary literature? What is the synthesis of the EJ sphere in a single piece of literature? What is the understanding of the EJ sphere in practice? What is a simple and sufficient monitoring framework to realize and measure the status of EJ in praxis? Realizing these facts and these gaps in the understanding and monitoring of EJ in the 21st century, this study decouples the silence on strategies for examining the status of (in)justice, the scales of measurement [37,38], and the baseline for evaluating the status of artifacts under EJ spheres [18,39,40].

For this, we endeavor to comprehend the response to this existing yet unanswered research question: What is the contemporary understanding of the theoretical sphere of environmental justice as it has emerged and been discoursed, debated, and advanced over the years in the literature? And what is a comprehensive monitoring framework for EJ in practice to realize and measure its status on the ground and thus propose a better monitoring model? The paper tries to answer these questions by consolidating the existing body of theoretical knowledge on the EJ sphere and proposing a SMART framework for monitoring and/or evaluating EJ in practice, which is yet to be done. Specifically, this study aims to (1) comprehend the existing body of knowledge in the environmental justice sphere to provide a comprehensive understanding of it in the contemporary world; and (2) develop a methodological framework for monitoring and/or evaluating the status of (in)justice for easing empirical research on the discipline. In addition to these aims, the study demonstrates a mutually interconnected relationship of planetary systems and the consequences of (un)just actions on the mutual benefits of every element of these systems

that is poorly covered under the EJ domain [20,41]: for example, displacing people from their residencies for the conservation of wildlife [42]. So, established relationships among and between humans, non-human lives, and ecosystems (the environment) respect the moral of life on the Earth and, thereby, seek to foster planetary sustainability in the 21st century. For the consistency and simplicity of the subject, in this paper we consider the basic understanding of EJ as the "justice, fairness, and equity" treatment applied to the subject in relative and relationship situations while executing environmental policies, procedures, practices, and plans, as explained by Biermann et al., (2009) [20]. In other words, equity has to do with fairness, impartiality, and possibly even efficiency, uniformity in treatment, and impartial justice, especially the status of enjoying equal rights while executing the environmental policies and procedures concerning this study (EJ) [43]. Fairness in EJ is the impartial treatment of environmental policies, practices, and systems that prioritize equity, accountability, and the elimination of systemic disparities [44,45].

2. Materials and Methods

We conducted a global synthesis of both the systematic and the subject-specific literature reviews on the topic of EJ, focusing on the existing theories, principles, frameworks, and matrices from the contemporary discourse of knowledge following the standard procedure [46]. For the systematic literature search, specific search strings were formulated. Such systematic literature search strings were "Environment* Equi*" OR "Environment* Just*") AND "Theor*" OR "Framework" OR "Principle" OR "Concept" OR "Matri*" OR "Lens", in consultation with three experts and a review of numerous theoretical and empirical studies considering sensitivity and specificity. These search strings were used to explore the existing peer-reviewed articles primarily from three prominent science databases—namely, Web of Science, Scopus, and Science Direct—at the topic level, including titles, abstracts, and keywords, to ensure comprehensive coverage of the high-quality literature on the subject (Figure 1). Articles of all ages written in English and listed in the targeted databases were included for screening and skimming. However, books, book chapters, non-English articles, reports, case studies, unpublished literature, and gray literature beyond these databases were excluded from the scope of this review.

Additionally, recognizing the broad scope of EJ in contemporary scholarship, a subject-specific literature search was conducted to access crucial documents such as reports, policies, programs, and thematic and/or discussion papers that may not be accessible through the pathways of systematic searching in science databases. Moreover, the search strategies were further extended through index, citation, and reference searching to capture the current scientific discourse on EJ beyond the sphere of peer-reviewed journal articles and gray literature. The accessed literature underwent three levels of screening, viz., title, abstract, and full text. In addition, a dozen theoretical books and thematic webpages related to the topic were also scanned and skimmed but not systematically reviewed, e.g., [1,3,12,14,47].

The selected review articles were then subjected to comprehensive data extraction, enabling the identification of the scope and breadth of the theoretical literature on environmental justice, fairness, and equity (see the detailed list of literature: Supplementary File S1). The collected information was used to frame the scope and extent of the EJ lens from the existing body of knowledge. Subsequently, a synthesized and comprehensive diagram was developed to facilitate a simplified understanding and to demonstrate the EJ sphere in the context of the Anthropocene era in the 21st century. In doing so, we adopted and customized the Planetary Justice Research Framework (PJRF) developed by Biermann and Kalfagianni (2020) in key three categories, viz., subjects/aspects of justice, metrics and principles of justice (contexts/sectors), and mechanisms or basis of justice concerned with persuasion [41]. Then, acknowledging past efforts on EJ, we developed a novel and smart framework for monitoring and/or evaluating the status of (in)justice for practical examination with potential examples.

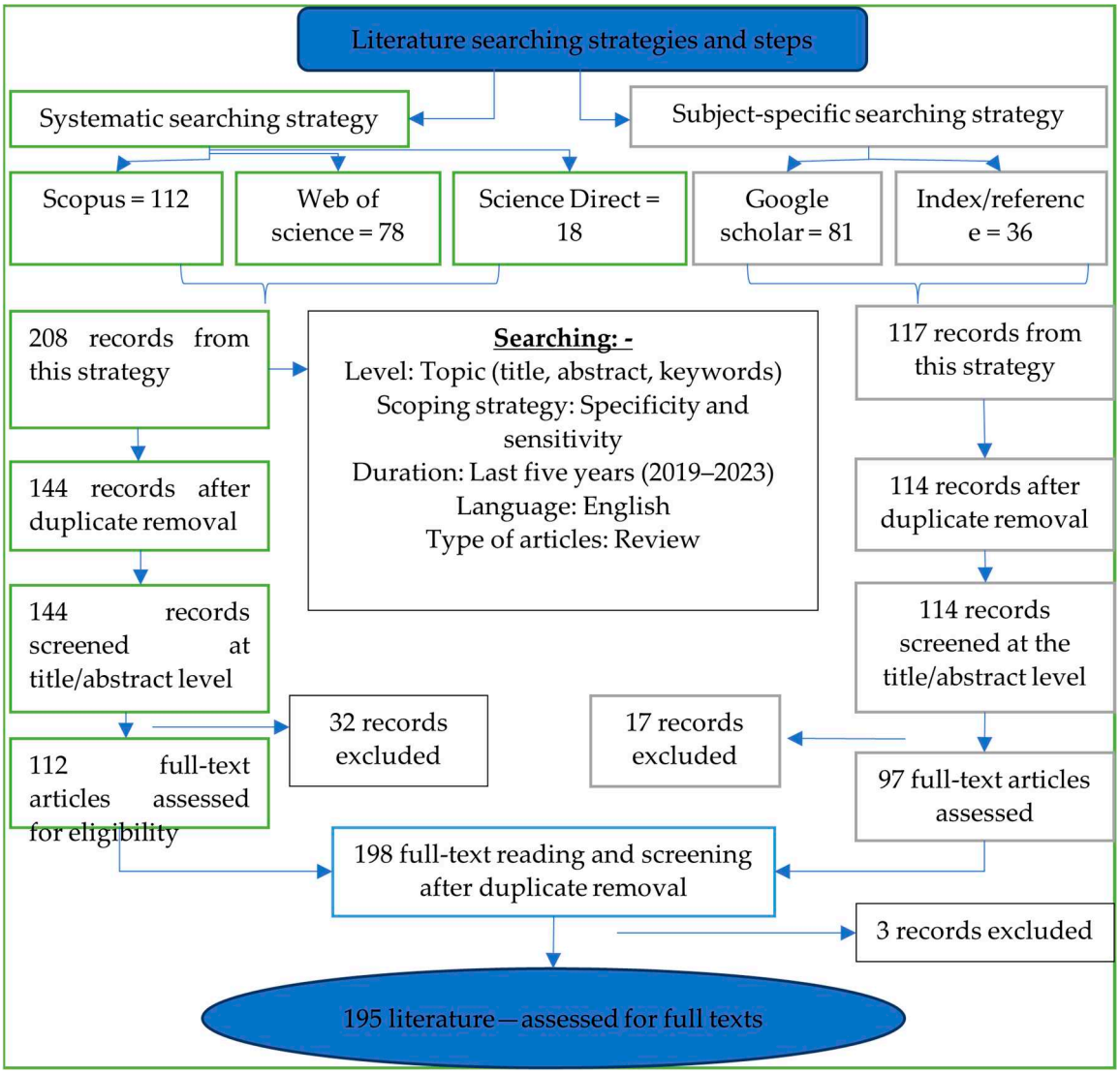

Figure 1. The literature search and screening outputs for the study's strategies and the quantitative yield of literature referred to the study.

3. Results

3.1. Scoping of Environmental Justice in the Contemporary Literature

To date, knowledge about justice has permeated various spatial and temporal scales across the globe and encompasses a wide range of subjects, themes, sectors, and (in)justice concerns (Figure 2). Initially, EJ focused on social movements related to unequal payment, waste disposal, and the risks faced by black racial communities [1,7] given the unfair burden of deleterious environmental effects. In line with this initial thought, the initial understanding of EJ was related to the fair treatment and meaningful involvement of all people, regardless of their diverse backgrounds, concerning environmental-related policy formulation and implementation [48]. This understanding of Environmental Justice (EJ) persisted until the Earth Summit in 1992, focusing on fairness, participation in decision-making, and the distribution of environmental burdens among different racial communities, particularly in relation to environmental protection mechanisms [1], under the broad concept of the social justice sphere—a subset of EJ. Because of the consensus of the global community committed to the conservation of biological diversity, combating desertification, and climate change actions, beyond the Earth Summit, the scope of EJ also broadened its reach from the racial background of human communities to concerns about non-human lives, climate actions, and ecosystems [3,20,43].

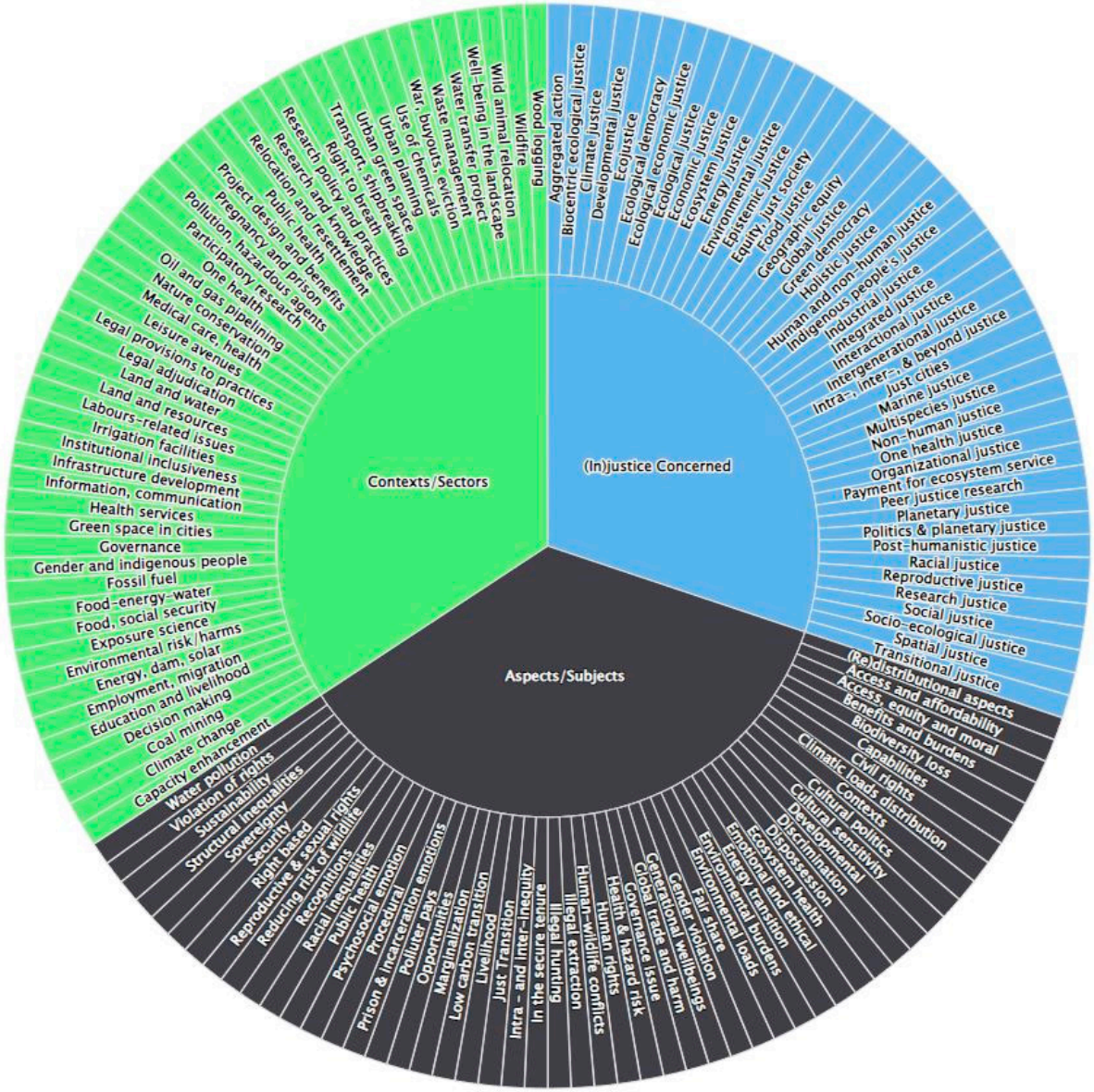

Figure 2. A summary of the current status of knowledge under the environmental justice framework. This EJ sphere is adopted from the reviews of the current body of knowledge on the topic. The relationship between the sphere's components or subcomponents is not in the corresponding order of the subject specified in each section, but could have any kind of combination. The potential sphere of EJ in the modern era could be the aggregation of all of the possible combinations of these subjects, contexts, or aspects in practical terms. This framework was adopted by Biermann and Kalfagianni (2020) [19] and is customized.

Various topics and issues have been explored and debated, including justice in warfare, livelihood, food justice, water justice, development justice, energy justice, climate justice, gentrification justice, urban justice, good governance and justice, health and justice, education and justice, inter-generational justice, and epistemic justice, among others (Figure 2). In these thematic studies, a range of global scholars have contributed to the social justice sphere to broaden the EJ discourse [14,32,49–51]. This discourse reveals that there are no human spheres that remain left behind or untouched under the domain of the social justice sphere and, broadly, the EJ sphere across the world. This means the existing literature has expanded its horizon vertically and horizontally in every dimension of human activity, beyond the traditional confinement across the distribution, recognition,

participation, and capabilities of justice [52,53]. This advancement in EJ encompasses a wide range of debates, discussions, and debates using various philosophical frameworks such as ethics and politics, egalitarianism, cosmopolitanism, capabilities, libertarianism, and critical approaches [19,24,35].

Apart from these philosophies on the social (human) spheres, EJ later expanded to encompass the unfair treatment of non-human lives. This expansion marked the introduction of ecological justice [3,11,54]. This philosophy covers the sphere beyond the social sphere of conscious and nonconscious living beings—the sphere of all non-human living beings [3,13,55]. Within this sphere, various philosophical ideas have emerged, such as the ecologically unequal exchange theory [56,57], species justice, wildlife justice, and animal justice [3,13,17,22]. These perspectives transcend the human-centered lens of justice and acknowledge the importance of addressing inequalities in the treatment of non-human entities (Figure 2). Furthermore, advancements in EJ thought have led to the concepts of socio-ecological justice [27], developmental justice [6,58], justice for rivers [59,60], planetary justice [35,52], climate justice [33,34], ocean justice, and wetland justice [61–63], to name a few. These ideas further expand the justice lens beyond the realms of living beings (both human and non-human), urging us to consider non-human justice.

Spatially, the concept of EJ has transcended its origins in the United States and expanded to encompass the continents worldwide, including marine and even extra-terrestrial realms, in a transdisciplinary or holistic philosophy. Although the existing body of knowledge is not comprehensive beyond non-living things in practice, it provides a solid background to expand the EJ framework beyond living things up to whole ecosystems (or the environment) [3,13,17,41]. Against this background, acknowledging the existing body of literature (Figure 2), this study proposes a discourse beyond human lives and affirms the inclusion of non-human lives, as well as the structure and functionality within and between living and non-living things (i.e., the ecosystem or environment), under the EJ sphere.

The rationale for encompassing social justice, economic justice, animal rights justice, ecological justice, and other dimensions of justice under the umbrella of EJ is that these areas are differentially impacted during the execution and implementation of environmental policies, procedures, practices, and plans aimed at maintaining equity and fairness within systems [5,64–66]. For example, implementing tiger conservation policies, particularly in a national park categorized as IUCN Category II, may result in human displacement or restricted access [42]. Traditional hunting rights might be curtailed, economic growth could be affected, infrastructure development might be restricted, and conservation priorities for rhinos or other species could face unequal treatment. Additionally, forest clearing to create grasslands for tiger prey bases may conflict with climate goals [67,68]. These instances illustrate how EJ intersects with and impacts various aspects of human and non-human life and entire ecosystems. In this sense, EJ extends beyond other justice concerns that fall outside the scope of environmental policy. To enhance clarity for readers, we have explicitly differentiated the concept of EJ from other justice concerns in the text.

Overall, we have categorized the current knowledge into three primary sections using the PJRF framework. These categories are not isolated; they are interconnected, indicating their interdependence rather than their exclusivity. They exist in a relational status within and beyond each category to elucidate the status of justice. Firstly, the initial section provides an overview of the contexts, sectors, actors, themes, and subjects where unfairness—questioned as (in)justice—arises due to anthropogenic interventions or actions impacting these subjects. The second section delves into the specific justice issues emerging within these contexts, comparing interventions that propagate unfairness. Similarly, the third section highlights the potential framework of Environmental Justice (EJ) under which the subjects or issues of (in)justice are categorized. In essence, the existing literature on EJ addresses every sector, actor, theme, paradigm, and organization concerning issues of distribution, procedures, capabilities, recognition, governance, (under)development, socio-economic welfare (human justice), ecological integrity (non-human justice), and

environmental security (ecosystem or environmental justice), and their interrelationships (Figure 2).

3.2. Monitoring the Framework of EJ Under Relativeness and Relational Scales with Potential Examples

Injustice occurs when there is an imbalance or inequality that contradicts the existing legal frameworks, international protocols, established moral values, and norms. This inequity is assessed across different scales to gauge interventions' impact on subjects, entities, or systems, determining the status of (in)justice. Such instances of (in)justice are specific to particular cases, contexts, sites, or situations. The presence of injustice relies on how fairness or unfairness is relative to similar themes or comparable conditions within specific contexts or subjects, considering spatial, temporal, or both scales. These situations require monitoring and assessment to identify (un)just, (un)fair, or (in)equitable circumstances when implementing policies, plans, programs, projects, and activities. To consolidate the various monitoring approaches in Environmental Justice (EJ), a comprehensive framework has been developed. This framework encompasses intra-, inter-, and broader relationships alongside temporal and spatial aspects. It serves as an advanced method for monitoring and evaluating (in)justice in practice, providing examples across various levels or categories of (in)justice that would help to develop the monitoring criteria to examine the fairness and equity situation when implementing environmental policies and procedures (Table 1).

We illustrate how various subjects within the justice spheres are interconnected, spanning the intra-, inter-, and transdisciplinary dimensions across different contexts, while considering the spatial and temporal factors. Environmental justice (EJ) lies within the framework of environmental policies, laws, programs, practices, and activities, assessing whether these policy instruments promote fairness and equity or act against them. As the above synthesis suggests, the scope of EJ in the contemporary world extends beyond humans, encompassing fairness and equity across multiple dimensions through multidisciplinary approaches. For example, in Table 1, displacing human settlements to create wildlife sanctuaries—or vice versa—can be unjust. The indicators of fairness and equity for the human side might include whether the displaced individuals receive distributive justice in compensation, whether their culture and traditional practices are preserved, whether their voices are recognized, whether their basic needs are met, and whether comparable facilities and opportunities are provided at the new resettlement sites.

On the ecological side, the indicators might include whether the displacement of the human settlements effectively supports wildlife recovery, the environmental impact on the newly resettled areas, and whether critical habitats have been restored or destroyed elsewhere. These local, context-specific factors could serve as the indicators for monitoring and evaluating (un)just actions on the ground. This framework provides insights into the relative nature of justice within and across different contexts, emphasizing the importance of investigating interconnections in the relational and relative dimensions. It also examines the process of transitioning from injustice to justice across the spatial and temporal scales (last column of Table 1). Building upon previous studies, we argue that this comprehensive framework offers a holistic view of justice in intra-, inter-, and transdisciplinary relationships, with considerations of temporal and spatial scales. These scales, along with real-world examples, can serve as tools for monitoring and evaluating EJ in practical applications. By customizing the examples and the corresponding indicators to suit specific research interests and requirements, this framework supports the convergence of ideas, policies, and practices for sustainability [2,4].

Table 1. The relational (intra-, inter-, and beyond) and relativeness (temporal and spatial) scales of a possible status of (in)justice and the potential situational examples that provide insights to develop the indicators for the monitoring and evaluation of the status of EJ at the ground level. Based on these scales, scholars can assess the grounded status of (in)justice at any place or time and upon the listed themes or subjects using customized indicators and methodologies as per the objectives.

Relatedness						**Relationships**
Justice Within—Intra	**Possible Examples**	**Justice in Between**	**Possible Examples**	**Transdisciplinary Justice**	**Possible Examples**	**Temporal and Spatial Scales**
Social domain (human EJ sphere)						
People or generation	Unfair to the same generation	Between people or generations	Access to natural resources given to some and restricted to others	People and non-human	Displacing people from their residencies in place of tiger conservation. On the other hand, allowing people to hunt wildlife sacrifices the life of the wildlife without any conservation contribution by people.	Comparison of the fairness on people before and after, here and there of the effect of environmental policy
Household	Unfair treatment between person and person considering their background (age, gender, physical conditions)	Fairness between households	Displacing some households while replacing others from declared national parks	People's family to non-humans' family	Demolish the house of a family to create a water pond for wildlife. Or the other way round, constructing and blacktopping a motorable road in a wildlife corridor without considering the crossing difficulties of certain wildlife.	Comparison of the equity of ecological resettlements, before and after, here and there
Community	Differential treatment for socio-economic status, ethnic groups, religious belief, developmental benefits	Between communities	Unequal distribution of compensation and health facilities among conservation-led displaced communities	People's community to non-people communities	Revoking the right of wildlife hunting and fishing. Creating a deer wilderness near a farm without erecting barriers to entering the farm and without devising reasonable compensation.	Fairness between communities before and after, here and there after ecological displacements
Society or geographic or administrative domain	Involving richer people and excluding poorer people in an executive committee of a society	Unfair treatment between societies or boundaries	Involving one class of members (or geography) while excluding others (or other geographies) in decision-making in park revenue distribution meeting	Unfair treatment beyond the boundaries of society	Resettlement plan in a critical wildlife habitat and vice versa	Unfair distribution of landfill site budget among societies or geographical areas having similar backgrounds

Table 1. *Cont.*

Relatedness						Relationships
Justice Within—Intra	**Possible Examples**	**Justice in Between**	**Possible Examples**	**Transdisciplinary Justice**	**Possible Examples**	**Temporal and Spatial Scales**
Countries or continents	Higher investment in some villages over others in similar sorts of climate vulnerability	Between countries or continents	Unequal financial support in executing environmental standards from UN between two countries having a similar background	Beyond the country's boundary or continent to landscape, seascape, atmosphere, water bodies, and space	Constructing barriers in rivers flowing across countries or continents without taking precautions	Unfair distribution of climate action assistance among developing countries or across continents impacted with a similar severity and having similar resilience capacities
Ecological domain (non-human beings EJ sphere)						
Species (including species community)	Grassland burning in favor of deer, ignoring rodents and birds	Within the same species groups	Creating grasslands by felling old trees for mammals without considering the habitat of vultures	Living beings to non-living beings in the wild	Construction of a wetland for aquatic lives against the groundwater recharge and flood reduction ecological function of that area	Differential impact on various wildlife before and after, here and there after devising the new environment laws
Ecosystem domain (EJ sphere including non-living beings (whole ecosystems or environmental system)						
Ecosystems	Restoration of one wetland compared to another having similar importance	Unfair treatment between ecosystems	Promoting the agriculture ecosystem by encroaching on and destroying the forest ecosystem	Ecosystem to air and space	Ozone layer depletion and negative impact on the ecosystems	Comparison of fair treatment among the ecosystems before and after, here and there after implementing environmental policies
Landscape or seascape	Differential treatment within a landscape	Differential treatments between landscapes	Unfair treatment or interventions between seascapes or landscapes of particular importance	Landscape to seascape, airspace, hydrospace	Construction of large-scale river dams and water channelization in a cross-landscape (or cross-countries) river system without leaving enough discharge, fish ladders, and ramps	Fairness of the policy interventions before and after, here and there in the landscape or seascapes
Global/planetary	One healthy, living planet	Between spheres (hydro-, bio-, cryo-, litho-, atmo-, anthropo-sphere) of the living planet	Environmental load displacement from one sphere to another: for instance, fossil fuel extraction and combustion and its impact on climate change	Beyond Earth's system	Space stations, astronomical activities, ozone layer depletion, and negative impact on the living planet	Fairness of the environmental policies' implication before and after, one planet to others, or space stations in one place to others.

3.3. Two Ways to Balance the Relationship of EJ Monitoring Scales (Relativeness and Relational)

We assert that the breadth and depth of Environmental Justice (EJ) issues are contingent upon the relatedness (even if the subjects have no relation but comparing the fairness among them) and the relational (if the subjects have interconnectedness and relationships) scales. The scope and scale determine the magnitude of the (in)justice sphere—micro, meso, and macro levels—of relationships (intra-, inter-, and transdisciplinary) and relativity (spatial—proximity or distance; temporal—present or past/future) among comparable subjects or interventions. For instance, if injustices occur between individuals, the EJ implication would be more confined, whereas injustices spanning countries or continents would expand the sphere. Similarly, issues entwined across social, ecological, and environmental aspects—like climate and planetary justice—contribute to a broader EJ scope compared to injustices at local or regional levels. Figure 3 illustrates the two-way equilibrium of monitoring the scales determining the scope and extent of the EJ status.

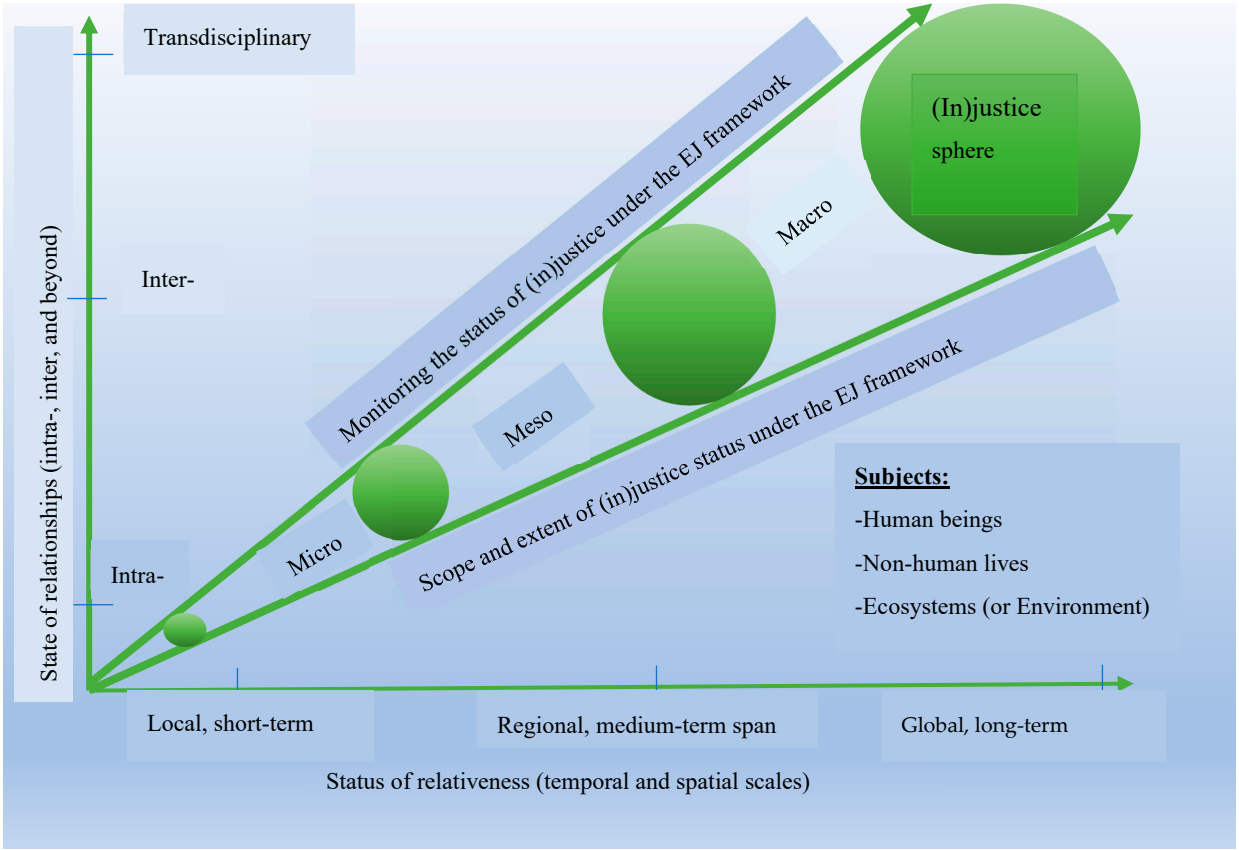

Figure 3. The balance between the status of relativeness and the status of relationships determines the status of the (in)justice sphere. This illustration provides a complete pathway for the monitoring/evaluation of the status of justice in practical terms.

The three dimensions of the sphere of (in)justice (relationship, temporal, and spatial) provide the complete set of scales that are essential for monitoring and evaluating the status of EJ in each context (Figure 3). The size and scope of this sphere of EJ depend on the various factors under consideration, including the relationships involved (within the discipline, between disciplines, and across disciplines), the duration of the existence of the situation (short-term, medium-term, and long-term), and the area coverage or influence (small space, medium space, and larger space). Because of the complete understanding of the relatedness, relationships, and relativeness between and among the subjects, this novel framework provides a complete pathway for the monitoring/evaluation of the status of justice in practical terms. Moreover, this framework also stimulates a balance between

the subsystems of the planet for their sustainability, because they are intertwined and interdependent with each other (Figure 4).

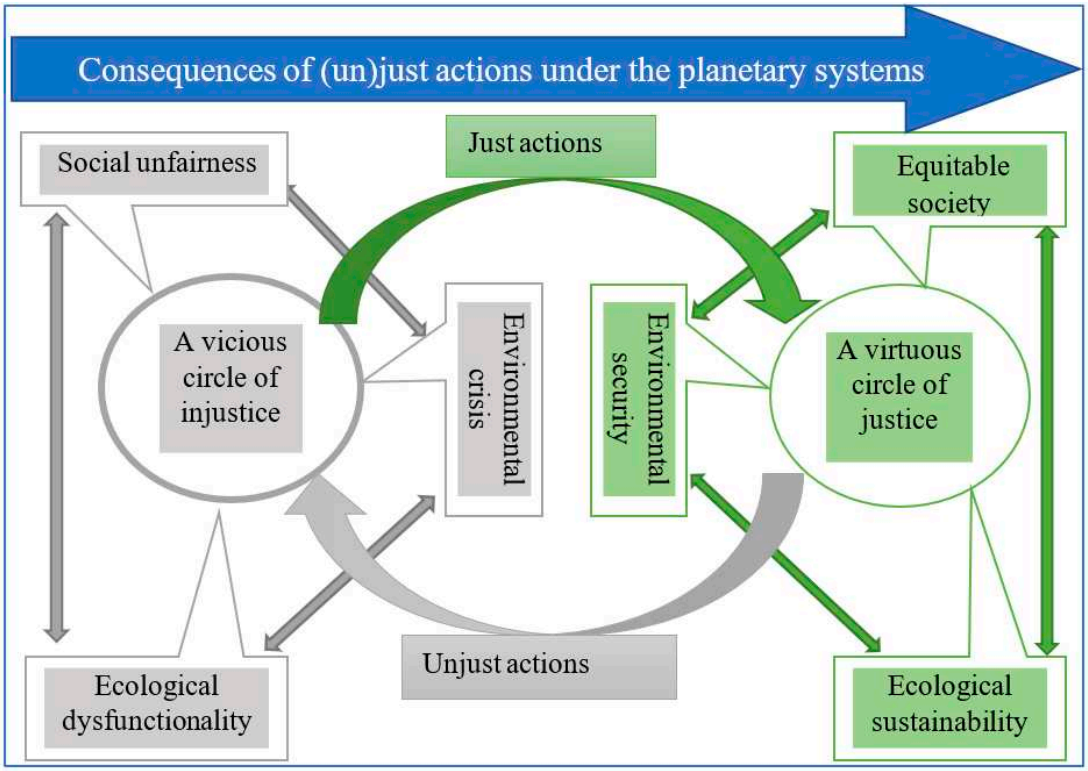

Figure 4. Intertwined relationships between just and unjust actions in the planetary systems under the EJ framework [two-way arrows indicate the relational status, the color codes (gray and green) indicate the relative status of the justice sphere, and the circle indicates the Earth systems].

We posit that the status of planetary systems hinges on the causal links and impacts resulting from the just and unjust actions within and among distinct systems—namely, social systems (comprising human beings, including cultural, economic, institutional, and other socially constructed elements), ecological systems (encompassing non-human living beings like plants, organisms, and their functions), and environmental systems (encompassing non-living entities, global non-human systems, and their interconnectedness with living beings, including humans). The double-headed arrows depicted in our illustration signify the interconnections among these sectors, highlighting their reciprocal influence and interactions. Conversely, the single-headed arrows denote the cyclical transformations occurring within the entire system, transitioning between the statuses of virtue and vice, both within the system and between its subsystems (Figure 4). The status of the planetary system is inherently influenced by the nature of the actions exerted upon its subsystems or the actions these subsystems undergo. For example, if deforestation occurs in a tiger's core habitat, the tiger population may decline. Consequently, the prey base could proliferate and invade nearby farmlands, affecting the residents. If wildlife destroys agricultural production, the government would need to compensate the farmers, resulting in a significant expenditure of taxpayer money that could have been allocated to other critical needs. This situation may lead to challenges in farm-based employment and food security, increased hunger, reliance on wild-based food, wildlife hunting, conflicts between people and the state, reduced community investments, and a continuing vicious cycle—all stemming from unjust actions. We contend that the nature of these (in)actions significantly determines the eventual consequences for the planetary systems, steering them toward a cycle of either virtue or vice. Our stance advocates for

nurturing a virtuous cycle within the planetary systems, advocating for just actions or interventions across all components of the Earth's subsystems.

3.4. Significance of the Monitoring Framework and Limitation

This study contributes significantly to three aspects, expanding the comprehension of the Environmental Justice (EJ) sphere within global knowledge discussions and practical applications. Firstly, it synthesizes key theoretical debates and presents them in an accessible and simplified manner, enhancing our understanding of EJ for the current era. Secondly, it confirms the recognition of ecosystem (or environmental) justice as a distinct yet integral component of EJ, in both theoretical progressions and practical implementation. Lastly, it introduces a comprehensive and sophisticated monitoring and evaluation framework for assessing the status of EJ in real-world contexts. By doing so, we illustrate unique potential examples for each sphere of EJ, which will provide a further space for discussion and discourse in the vertical and horizontal directions that expand topical space, as believed by scholars [6,20,41]. Further, we demonstrated the relational and relative scales of assessing (in)justice with illustrations that understand a complete set of measures. So, developing and proposing a monitoring framework for the status of EJ will provide a complete picture of interlinked relationships and the relative status of (in)justice in practice. Such a novel monitoring framework illustrates the importance of the just against unjust actions that play a pivotal role in maintaining planetary justice.

Specifically, our proposed EJ monitoring and/or evaluation framework offers insights into a complete set of scales. This includes both relativeness (spatial and temporal) and relational (intra-, inter-, and transdisciplinary) scales for monitoring and evaluating the status of (in)justice. This will aid in the pursuit of just actions for a virtuous cycle encompassing social equity, ecological sustainability, and environmental security, which are intertwined and interlinked systems of the living planet (Figure 4). Previous studies have also emphasized just actions for planetary justice [20,35,41]. Further, we simply provided possible examples of each tier of subjects that can offer a vivid pathway to assess the EJ sphere at any time, in any space, and with any people if the issue of fairness or equity arises. This will support a better understanding and inform the on-the-ground reality of the status of EJ and, in turn, informed and rational decision-making [19] for the sustainability of the living planet [20] through just governance in a differential way but for common goals [21]. The utilization of this proposed novel monitoring framework provides a foundation to decouple the ground-rooted (in)justice spheres in the modern era for the advancement of knowledge via facilitates to promote a sustainable planet through informed planning and just governance.

Better understanding and monitoring of EJ is key for the sustainability needed to evaluate the environmental performance indices, maintain ecological integrity [25,69], ensure social sustainability [14,24,70], and attain local to global goals such as combating the climatic crisis, biodiversity conservation targets, alleviating poverty [71–73], and so forth. Our synthesis of the EJ sphere of the existing body of knowledge in these areas will support the attainment of such goals. This is crucial because EJ theories and practices support the robustness of sustainable spatial planning [28,74–76], provide insights for generating (in)justice screening tools and indices [77], and think beyond the human sphere to consider the welfare of non-human beings through the moral lens [3,20,78].

Our study addresses the gap in comprehending Environmental Justice (EJ) at a level accessible to the general populace, emphasizing clarity and the synthesis of theories [47,79] by consolidating the existing sphere of EJ under the PJRF (Figure 2) and providing practical examples of measuring the status of justice in the real world (Table 1). However, this study is based largely on the limited literature and theoretical framework; we duly acknowledge and appreciate the feedback on these shortcomings, and future research could further expand the understanding through synthesizing extensive discourse on the topic. In addition, we have not focused on each theory and its lacunas in the contemporary discourse of the EJ sphere to interpret the findings. Instead, this study mapped the extent and scope of EJ in

the contemporary discourse so that readers can cautiously utilize this synthesis, bearing in mind that this is not a criticism of the existing body of knowledge in this field but a comprehensive summary of the discipline and the construction of a monitoring framework based on this synthesis and customization. Nevertheless, our study expands and affirms the theoretical understanding of EJ through its simplification and comprehension of the existing body of knowledge utilizing the Planetary Justice Research Framework [19] and broadens the debates under the planetary system [41]. This new framework would provide insights for monitoring and/or evaluating the status of (in)justice sphere in the praxis for just actions and a just planet.

4. Conclusions

The study presents an outlook on the Environmental Justice (EJ) discourse and proposes a simple but smart monitoring framework for examining the status of EJ on the ground. Through an extensive review of over 200 contemporary theoretical works on EJ, we distilled complex information into an accessible format, ensuring a comprehensive understanding for readers from diverse backgrounds. Our endeavor aimed to underline the fundamental integration of non-human lives and the entire ecosystem into the larger framework of the planetary system, transcending solely human-centered notions of justice. This was achieved by illustrating concrete scenarios for each constituent part (social, non-human lives, and ecosystem) of our planet. Moreover, we introduced an innovative methodological framework that recognizes the complex and relative nature of justice in this context. This framework provides a comprehensive set of measures to assess (in)justice in practical applications. It incorporates relational aspects (intra-, inter-, and transdisciplinary) and relative dimensions (spatial and temporal) within social constructs. The scenarios and examples presented in the tabular framework, based on real-life situations that may arise during the implementation of environmental policies, programs, plans, and practices, can guide scholars in developing indicators and criteria to monitor and evaluate (in)justice in various contexts effectively. We intend to furnish robust examples and guidance for effectively monitoring and evaluating the status of (in)justice within social, ecological, and environmental systems in real-world settings. Understanding the status of (in)justice holds paramount importance in guiding actions that impact the subsystems of our planet, ultimately shaping the balance or imbalance within the Earth's systems and leading toward either vicious or virtuous cycles. In essence, this study facilitates informed decision-making within Earth system governance, seeking to advance the cause of planetary justice in the current 21st century and beyond.

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