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Dataset development in earth system governance: Learnings, stakes, and pathways for impact

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A B S T R A C T

The construction and use of datasets have become an important practice in Earth system governance research. By systematically cataloguing various outcomes, policy issues, actors, sites, and processes, datasets enhance the reliability, transparency, and replicability of research. Yet, despite growing interest, efforts to share data, integrate datasets, and develop common standards remain fragmented. This *Perspective* surveys various scholarly efforts to create datasets and provides a classification of the emerging dataset landscape in the field of Earth system governance. Drawing on examples from our own research and group discussions, we identify current best practices and lessons learned regarding data collection, management, and integration, as well as data usability and sharing. We argue that the design of datasets is not a neutral technical exercise, but has implications for how global environmental governance is theorized and studied. We also highlight how greater attention to data infrastructures can strengthen the relevance of research for policy practitioners and other stakeholders beyond academia.

1. Introduction

Datasets play a crucial role in knowledge generation. They reveal patterns, trends, correlations, and generalizable insights. Datasets also invite reviewers and readers to ask difficult questions about data reliability and validity, helping to expose weaknesses and blind spots in empirical research. This encourages researchers to collect data in a reflexive, systematic, and rigorous manner (Fairfield and Charman, 2019) and contributes to making scientific inquiry more transparent, cumulative, and robust. Reflecting on data practices, documenting collection and curation processes, and sharing datasets for scholarly reuse collectively foster a more integrated and impactful Earth system governance

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research community, which is essential for upping the methodological and ethical stakes of global environmental change and agreement-making (Hughes et al., 2021).

Earth system governance researchers have developed an impressive number and diversity of datasets. They provide insights into a wide range of individuals, organizations, rules, ideas, documents, resources, events, activities, policies, discourses, and practices. They support diverse epistemological, theoretical, and empirical approaches. Existing datasets rely on varied data generation techniques, including content analysis, ethnography, archival research, field experiments, surveys, systematic reviews, and structured interviews. They can be analyzed with methods such as econometrics, network analysis, topic modelling, and qualitative comparative analysis, to name a few. Large datasets are valuable even for single case studies, either to identify, select, and situate a case within a broader universe (Glaesser and Cooper, 2011) or to combine multiple observations related to that case.

However, the Earth system governance community rarely reflects on how individual datasets are generated, communicated, and maintained. More self-conscious attention is also needed for the integration, coordination, and synthesis across multiple datasets. How can we minimize unnecessary duplication while maximizing synergies among researchers? What systematic biases exist in our datasets, and how can we mitigate them? How can we critically assess the quality of datasets and improve them over time? How can datasets become more interoperable and better integrated to facilitate projects that combine multiple sources? How can datasets be safely shared and stored, while protecting confidential information and ensuring fairness? How can we maintain and update existing datasets once their original creators have completed their initial projects? Where and how should they be communicated to reach a wider range of users beyond academia?

Such questions have never been more important and timely. The practices of creating and maintaining environmental governance data are undergoing significant transformation. First, new tools for identifying patterns, analyzing data, and interpreting results are rapidly developing. Data managers are increasingly pressed to provide richer and more granular data. Second, both institutional and governmental support for the collection and storage of data, including environmental governance data, is under threat in many countries. Third, researchers and organizations are beginning to create and use datasets that have been partially or completely created computationally via machine learning or other artificial intelligence technologies. This allows larger datasets to be developed more rapidly and updated more frequently.

This *Perspective* seeks to start a conversation and encourage others to create and share datasets in a way that enhances their usefulness for research and policy. Drawing on insights emerging from workshops held in 2024-2025, we map some of the major datasets available in the field, share our experiences, reflect on our practices, and explore pathways for moving forward. By foregrounding data infrastructures, we hope to support a more integrated, ethical, and impactful research community.

2. Mapping datasets

Over the last two decades, researchers have created an increasing number and variety of datasets to answer various research questions on environmental governance. While exhaustively listing all environmental governance-related datasets is impossible, this section maps key datasets created to investigate the dynamics of environmental governance across different levels of society. By assessing their key features, including both merits and limitations as well as their relationships, we take stock of existing knowledge and identify challenges facing dataset curators.

It is reasonable to estimate that at least a few thousand datasets have been created in the field of environmental governance. For instance, over 1100 datasets on Earth and environmental sciences and social sciences have been stored on Harvard Dataverse since 2012,[1] and 6325 datasets in social sciences have been stored on Zenodo. The proliferation of these datasets is likely driven by a combination of several factors, especially the existence of new methods to collect and analyze data, efforts from environmental governance researchers to move beyond case studies and develop more quantitative research, and many journals' requirements to publish data for research transparency and replication.

Here, we present a small sample of datasets that reflect key developments in the field of environmental governance. Our focus on governance leads us to exclude datasets purely focusing on environmental and ecological indicators. We prioritize datasets developed by academics but mention examples created by non-academic institutions. Datasets on Earth system governance can be subject-driven, aiming to systematically track specific phenomena such as international agreements, transnational partnerships, and national policies, and/or question-driven, aiming to answer a specific research question, such as data reflecting synergies and trade-offs between different institutions. Below, we use three broad levels of governance (intergovernmental, transnational, and national) to map subject-driven and question-driven datasets based on the level of their primary unit of analysis (see Table 1). Basing this typology on governance scale does not easily accommodate those actors and institutions that operate across scales. However, since most datasets orient themselves to one of these levels fairly well, it is a useful way to show the emerging dataset landscape in the field of Earth system governance.

At the intergovernmental level, the most influential and arguably most widely used dataset is the International Environmental Agreements Database (IEADB), initially created by Mitchell and his team at the University of Oregon, where it was maintained for 23 years, before being transferred in 2024 to Université Laval. The IEADB provides a detailed repository of all international environmental agreements (IEAs) defined as legally binding treaties involving at least two states that consciously seek to manage human impacts on natural resources (Mitchell et al., 2020; IEADB, 2025). The current dataset covers over 3000 IEAs, of which about one-fourth are multilateral (3 parties or more) and the remainder are bilateral. Since its creation, the IEADB has been used in more than 125 peer-reviewed studies on the design, evolution, and effectiveness of IEAs.

Interest in intergovernmental arrangements is also reflected in more issue-specific datasets. A prominent example is the Transboundary

Table 1
Summary of key datasets on environmental governance.

	Intergovernmental	Transnational	National
Subject-driven	• IEADB • TFDD and IFTD • TREND • Climate Agendas Database • MARIPOLDATAbase	• Transnational climate governance dataset • Climate Cooperative Initiatives Database	• Climate Change Laws of the World database • Climate Policy Inventory Database
Question-driven	• Net Zero Tracker • Problem Shifts • YouthEarth dataset • China's Global Environmental Leadership (CGEL) Database	• ClimBio Frontiers • Transform 2030	• Environmental Performance Index • Oxford Climate Policy Monitor

[1] See the details at https://dataverse.harvard.edu/dataverse/harvard?q=&fq2=subject_ss%3A%22Earth+and+Environmental+Sciences%22&fq0=subject_ss%3A%22Social+Sciences%22&fq1=dvObjectType%3A%28datasets%29&types=datasets&sort=dateSort&order=.

Freshwater Diplomacy Database (TFDD) focusing on international river basins (Turgul et al., 2024). The TFDD contains a range of physical, socioeconomic, and political data relating to the world's international river basins, and within it, the International Freshwater Treaties Database includes more than 800 international, freshwater-related agreements from 1820. Moving beyond treaties directly focusing on environmental issues, the Trade and Environment Database (TREND) documents environmental provisions in trade agreements. The dataset, released in 2018 (Morin et al., 2018) and updated in 2022 (Brandi and Morin, 2023), identifies nearly 300 types of environmental provisions in 775 trade agreements.

Other scholars have also developed datasets that contain both IEAs and international treaties on other issue areas such as trade and health (Hollway, 2021) with the aim of assessing interrelationships among treaties across different issues. The Problem Shifts Database serves as a repository of negative spillover cases between such treaties, documenting over 117 instances where policies and decisions aimed at solving one environmental problem have created new problems that undermine the effectiveness of other treaties (Kim et al., 2022Kim et al., 2022).

Other datasets categorize the decision-making processes of relevant intergovernmental governance arrangements using different methods. Key examples include the MARIPOLDATAbase, systematically cataloging observations covering the entire Biodiversity Beyond National Jurisdiction negotiations (Vadrot et al., 2024; Langlet and Vadrot, 2023), a dataset related to the plastic treaty negotiations (Coawn 2025), the dataset of the agendas adopted in UN climate negotiations (Allan and Bhandary, 2022), and also recent efforts to track regulatory decisions made by multilateral environmental agreements (Morton, 2026). These datasets draw on methods ranging from participant observation and systematic field-note taking to text analysis and machine learning to collect both qualitative and quantitative data related to decision-making processes of intergovernmental environmental governance (Vadrot et al., 2025).

At the transnational level, a burgeoning literature examines the rise of non-state and sub-national actors in environmental governance and the governance initiatives created by these actors. Efforts to track this phenomenon date back to the mapping analysis of transnational climate governance in the early 2010s (Bulkeley et al., 2014). The past fifteen years have seen an expansion in transnational governance itself and the systematic collection of comprehensive data to examine this phenomenon. One of the largest datasets of this sort is the Climate Cooperative Initiatives Database (Chan et al., 2024), which contains more than 70 variables on over 1000 transnational climate cooperative initiatives covering characteristics such as actors, themes, geographies, functions, and outputs. That dataset's documentation of the growth of non-state climate action has allowed scholars to assess the performance and effectiveness of transnational climate governance (Chan et al., 2022).

Other datasets capture transnational governance beyond climate change. For instance, the ClimBio Frontier project is developing a dataset to systematically map transnational governance initiatives that recognize climate change and biodiversity loss as inter-linked challenges (Betsill et al., 2025). The YouthEarth dataset presents data on youth groups in environmental negotiations (Vergonjeanne and Orsini, 2026). Additionally, multi-stakeholder partnerships for sustainable development have been the subject of many studies, including early efforts to assess public-private partnerships in various sustainability areas (Andonova, 2017) and more recent datasets on multi-stakeholder partnerships connecting different Sustainable Development Goals, such as the Transform 2030 dataset (Widerberg et al., 2023). The emergence of these new datasets shows the growing attention of transnational governance initiatives to interlinkages among different sustainability issues.

At the national level, a range of datasets have been developed to comparatively assess national policies, laws, and institutions. Most of them are therefore subject-driven. Many focus on climate change. One of the largest in this regard is the Climate Change Laws of the World Database, jointly developed by the Grantham Research Institute at the London School of Economics and the Sabin Center at Columbia Law School (2023), to cover national-level climate change legislation and policies globally. The Climate Policy Inventory Database, developed by the Climate Policy Lab (2022) at the Fletcher School, tracks national climate change policies and actions in 13 major emitting countries.

Some efforts in policy tracking have moved beyond cataloguing policies and toward evaluating environmental rules. A well-known and widly used dataset is the Environmental Performance Index (EPI), developed by Yale Center for Environmental Law and Policy and Columbia University, to quantify and rank the performance of a state's environmental policies. Started in 2002, the EPI updated biennially and the latest version was released in 2024, which organizes 58 indicators into 11 issue categories and three policy objectives – climate change, environmental health, and ecosystem vitality (Block et al., 2024). More recently, the Oxford Climate Policy Monitor (climatepolicymonitor.ox.ac.uk) tracks climate rules across six policy domains and in over 35 countries, analyzing each policy against over 200 variables to evaluate the ambition, stringency, comprehensiveness, and implementation of each rule (Lecavalier et al., 2025). Other scholars have developed datasets to map and evaluate policy mixes on renewable energy (Schmidt and Sewerin, 2019), policy ambition (Ye, 2025), and policy harmonization between a country's mitigation pledge and its national policies (Baker et al., 2025). Existing national-level datasets have predominantly focused on climate change, leaving important research gaps on national policies and actions on biodiversity, water quality, air pollution, and other environmental issues.

While most datasets focus on a specific governance level, some datasets document phenomena across more than one governance level. This is the case of the Net Zero Tracker, which collects net zero pledges made by states, companies, and cities (Lang et al., 2025), and the China's Global Environmental Leadership (CGEL) dataset, gathering data on China-led environmental governance initiatives at the bilateral, multilateral, and transnational levels (Sun et al., 2026). Additionally, researchers interested in more localized actions may develop dedicated datasets on policies and governance by subnational entities (Schoch et al., 2026) or specific jurisdictions, such as protected areas.

The construction and sharing of environmental datasets, as seen in the examples above, are often driven by a desire to strengthen scientific credibility and data usability. In this regard, these efforts resonate with the FAIR (Findable, Accessible, Interoperable, Reusable) Guiding Principles for scientific data management and stewardship.[2] By encouraging improved findability, accessibility, and reuse of digital assets, dataset development and sharing also foster community building and collaboration. Reflecting the ethical stakes of our research, this transparent approach ensures that diverse datasets complement one another—minimizing redundancy while creating space for novel collaborative efforts around data and data quality.

While the data generated can advance our knowledge, there is a growing diversity across environmental governance-related datasets in terms of structure, format, and unit of analysis. Such diversity may sometimes lead to low interoperability and comparability between datasets. For instance, researchers may use different approaches to conceptualize similar variables such that the same variable may mean different things in different datasets, or the value of a dollar varies from one country to another. This may ultimately prevent data curators from building synergies among their work. In the next section, we reflect on key lessons learned and suggest possible ways to overcome relevant challenges, which may yet inspire future dataset builders in an ever evolving field.

[2] https://www.go-fair.org/fair-principles/.

3. Lessons from dataset creators

The art and science of creating, maintaining, and communicating a large dataset rely as much on crystallized intelligence, gained through experience, as fluid intelligence (Cattell, 1943). Many of us made mistakes when we created our first large dataset. We discovered too late that our file naming conventions were suboptimal, our annotation systems failed to document important methodological decisions, or our assumptions about future users were misguided (see Broman and Woo, 2018). Yet, such hard-earned lessons are rarely communicated explicitly (for an exception, see Weidmann, 2023). While technical skills, such as how to use specific software, can be acquired through formal training or written manuals, the more strategic knowledge required to anticipate pitfalls and maximize impacts is often retained tacitly, if at all, in the heads of the team that developed the data.

Why are such lessons so rarely shared? One reason is the principal-agent problem faced by researchers using data constructed by others. Unless they replicate the database creator's collection and coding, the user must trust how the data was constructed and its fidelity to the concepts raised. The data developer agent, if they wish to maximize further usage and citations to their data, has an incentive to minimize the challenges, compromises, inaccuracies, and errors likely made during data collection and coding. Such incentives decrease precisely the transparency that should increase researchers' trust in the data product.

Moreover, the trade-offs inherent in dataset creation hinder the identification of universal best practices. Constructing a dataset requires balancing competing demands related to breadth, depth, granularity, anonymity, and accessibility of data, each shaped by the expectations of diverse stakeholders, including funding agencies, research assistants, anonymous reviewers, fellow researchers, and decision makers. For example, research councils may expect datasets to be released promptly, while early career researchers typically benefit from privileged access and might prefer restricted or delayed data sharing. Some journal editors favor articles that make multiple empirical contributions, whereas dataset users often prefer a paper dedicated to describing at length a dataset's structure and features. Users increasingly value extended and up-to-date time series that allow for the analysis of temporal change, but principal investigators often lack the incentive or resources to maintain datasets beyond their funded projects. Researchers tend to seek highly granular data they can repurpose for their own analyses, while the broader public prefers simplified and aggregated outputs. These divergent interests create tensions that make it difficult to meet all expectations at once, let alone to articulate a consistent set of best practices that can be broadly adopted.

Despite these issues, some broad advice can be shared. Table 2 lists recommendations we believe can improve the quality of datasets along the lifecycle of dataset creation. They emerged from our discussions during our 2025 workshop.

Central to our recommendations is an attempt to address the tacit nature of much knowledge acquired during data collection. Such knowledge often surrounds decisions about what variables and what observations to include, and crucially, what not to include in the dataset,

Table 2
Recommendations along the lifecycle of dataset development.

1	Review similar or overlapping datasets	Examine existing datasets for what they have included or excluded. Information about the observations and variables (and variable names) they include, the standards and definitions they use, and how they manage missing data, for example, may inform how you construct your own dataset. Consider collaboration opportunities. Either adopt prior datasets' choices where possible or develop your own to foster inter-dataset compatibility.
2	Plan for purpose	Carefully identify how you and others are likely to use the data before collecting it. This can guide decisions on format, structure, and coding. Consider collecting more variables and more granular data than first needed if it may be useful further down the track, such as actual dates instead of just the year. It is easier to aggregate later than disaggregate later. Opening sources again later to add variables takes nearly as much time as coding everything from scratch.
3	Consider what is missing	Carefully define the conceptual and logistical rules for inclusion, exclusion, and exceptions. Consider carefully any systematic biases – such as sampling or survivorship biases – and design strategies to mitigate them, recording both exclusions and exceptions. Missing data points may be induced through digital, language, or geographic biases. Distinguish between missing data and null data. Maintain a list of cases that were considered, but excluded because they did not meet the inclusion criteria.
4	Pilot data collection	Conduct a pilot phase that allows mistakes to be made, identified, trouble-shot, and corrected before launching the full-scale data collection. Trial the data in your intended analytic workflow to see whether it would be fit for purpose once complete. Do the initial coding on a subset of data to identify coding problems. Once complete, re-code all observations using the "final" codebook to avoid having "early" data coded by different rules from subsequent coding.
5	Trial on multiple coders	Assign the same task to two or more people to explore alternative approaches to collecting the same data. Check intercoder reliability, but also have coders meet together to discuss the tacit knowledge each is using in their data collection and coding. This contrast can reveal measurement biases built into their worldview. Build the norm that "data collection quality must come first with data collection speed a distant second." Have coders collectively decide how to make their tacit knowledge explicit in the codebook and further training. If appropriate to the approach, establish valid values together.
6	Standardize what can be standardized	Use clear, consistent, and widely shared naming conventions for files and variables, such as country names and dates. These can serve as the basis for interoperability. Avoid long variable names; instead, put more explanatory detail into a codebook. Avoid indecipherable acronyms or abbreviations. Add more descriptive labels if possible to make the analysis easy to interpret.
7	Allow annotations	Develop a structured annotation system so that your future self and others can understand the dataset long after its creation. A catch-all "comment" column should be a last resort. Useful options include, e.g., annotating the values directly, adding a variable, or using a version control system to explicate each change.
8	Regular quality control	Apply quality control measures along the way, ideally involving someone not directly involved in data collection, to identify inconsistencies, bias, and errors before they become too costly to correct. Create a group culture where acknowledging mistakes is valued to prevent them from being hidden. Acknowledge that mistakes and errors are part of the process. Each team member should not only check and identify errors in their own work but also in others, and work together to ensure data quality. Mitigate the risks associated with groupthink by cultivating diversity and internal debates. Ultimately, limitations can provide engaging material for a codebook or data paper. Back up your data constantly.
9	Facilitate recognition	Assign a DOI to the dataset for proper citations and make access conditions clear in your documentation and in all portals to your dataset. A codebook is often a useful document for citation purposes in lieu of a data paper. Establish a versioning protocol from the outset, even if you are not immediately intending to continue updating the data.
10	Facilitate access	Enable researchers to find the data by advertising it or making it available where they are likely to use it. Consider creating a visually attractive and easily navigable website to communicate data beyond academia while also making the full dataset available for researchers, as synergies can be created between the two communities. Organize a webinar to present your dataset, its content, and its construction process and make its recording available online. Comma-separated values files are most system agnostic and avoid issues with e.g. Excel. Understand the challenges posed by treatment by different software programs of Unicode characters and date conventions. Consider whether the data (or particular variables) are available only in English or in multiple languages. Establish the terms of access and use, considering issues of consent, copyright, and confidentiality.

as well as the potential alternatives decided against in terms of coding. The same feature that makes this knowledge difficult to pinpoint and transfer also makes it precious. As any dataset rests on some form of tacit knowledge, dataset creators should be as aware as possible of both the vulnerabilities and competitive advantages that this situation creates.

In particular, dataset creators should recognize that the development of human expertise is more valuable than the accumulation of raw information. As a result, expertise should be carefully cultivated and acknowledged. In practical terms, time and money invested in training research assistants yield a high return. In contrast, losing a capable research assistant mid-project, especially one who has accumulated valuable expertise, can significantly hinder progress. They often hold tacit knowledge that is difficult to transfer to their successors. To mitigate such risks, it is advisable to offer research assistants fair compensation, intellectual engagement, public acknowledgment, and meaningful professional development opportunities. Keeping them motivated and committed is not just a matter of ethics; it is essential for ensuring the continuity and quality of a complex dataset project.

Expertise can also be cultivated by establishing an advisory committee. A dataset built by people with similar positionalities tends to encode their shared blind spots. If composed of a diverse group of data producers and users holding tacit knowledge, such a committee can play a crucial role in identifying pitfalls, biases, and opportunities throughout the project. Their input is especially valuable before data collection begins and after the pilot phase, when adjustments are still possible, but is useful too when it comes to providing an external perspective to the annotation decisions taken by the core data team. Beyond advising on methodological and strategic issues, the committee can also serve as a springboard for extending the lifespan of the dataset beyond the initial project. Ongoing maintenance raises challenging questions about funding, institutional support, and the transfer of expertise across generations of dataset curators. A permanent, well-structured, and diverse advisory committee can help navigate these challenges and ensure the dataset's long-term relevance by collectivizing tacit knowledge.

The strategic value of tacit knowledge also implies that dataset creators should not be unduly afraid of competition. They can be victims of the curse of knowledge, forgetting that other researchers will not easily navigate their datasets and understand their potential. The tacit knowledge accumulated during data collection means that third parties with access to the dataset are unlikely to get familiarized quickly and produce rival studies. In most cases, and so long as the community recognizes the contributions of data development, it is in the project's best interest to release the full dataset early, while recognizing initial limitations. Doing so generates visibility and citations, attracts opportunities for collaboration, and empowers colleagues who may pursue research avenues the original creators never considered. Also, data generally does not age well (Stigler, 2019), such that it should be expected that the dataset you are working on today will be overtaken or subsumed by more recent, relevant data.

4. Stakes and pathways for impact

The importance of enhancing the scientific rigor and utility of datasets in Earth system governance research cannot be overstated. Continuous environmental degradation, geopolitical friction, and anti-environmental sentiment are raising the ethical stakes for Earth system governance scholarship, demanding critical reflection on our research objectives, methodologies and data collection practices. Both scholars and practitioners stand to gain from improved transparency, reliability, validity, and usefulness of data. Achieving this elevated standard necessitates a concerted focus on three interconnected areas: conceptualization, policy implications, and academic practices. We examine each in turn.

First, scholars should critically investigate the reciprocal relationship between their datasets and their conceptualizations of Earth system governance. Datasets are not neutral repositories; they inherently reflect and actively shape our understanding and theoretical frameworks. They rest on and reproduce normative assumptions that are too often left implicit (e.g., that formal institutions are of more interest than activist movements). Making these assumptions explicit requires scrutinizing how data collection, aggregation, and interpretation influence the constructs we employ in research.

In particular, the ontological and epistemological implications of a dataset are influenced by the unit of analysis we adopt and the labels that we attach to variables and indicators. These choices affect how we conceptualize the actors, sites, institutions, and processes of Earth system governance. For example, studying the Global South, low-income populations, developing countries, vulnerable communities, and former colonies have different implications. By critically examining the dataset–conceptualization interplay, we can move toward a more sophisticated and nuanced understanding of Earth system governance, grounded in empirically informed and theoretically sound datasets.

Second, translating datasets into actionable governance reforms is essential for informing real-world decision-making and contributing to societal transformation. Social science and humanities data must complement natural science datasets to support the evaluation and revision of environmental policy. There are various opportunities to better incorporate governance-related data (Coglianese and Starobin, 2020; Goldberg et al., 2020). For example, Multilateral Environmental Agreements, such as the Convention on Biological Diversity (CBD) and the United Nations Framework Convention on Climate Change (UNFCCC), increasingly mandate rigorous monitoring and review mechanisms, as illustrated by the examples of the CBD Global Biodiversity Monitoring Framework (Affinito et al., 2025) and the UNFCCC's Global Stocktake (Zhu et al., 2023). In addition, authors involved in the writing of global environmental assessment reports of the Intergovernmental Panel on Climate Change (IPCC), the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), or the newly established Intergovernmental Science-Policy Panel on Chemicals, Waste, and Pollution (Allan et al., 2025) would benefit from datasets related to the societal, political, legal, or institutional aspects of transformative change. Unfortunately, these initiatives do not mobilize social science data to its full potential. This leads to a disconnect where an increasing number of datasets are available, yet the use of social science data by policymakers remains limited. Ignoring governance data can lead policymakers to overlook important contextual factors and to over- or underestimate the likely impact of a given intervention.

To facilitate evidence-based decision-making, outputs from datasets must be relevant to the immediate concerns of decision-makers, as well as being visually compelling and intuitively accessible. This necessitates attention to the development of user-friendly web platforms and publications featuring clear and concise visualizations accessible to policymakers and stakeholders (e.g., simplified graphs, infographics). Examples include www.TRENDanalytics.info, https://tfddmgmt.github.io/tfdd/map.html, www.maripoldata.eu, https://climatepolicymonitor.ox.ac.uk, www.problemshifting.directory, and https://zerotracker.net. In addition, these data products need to be strategically disseminated beyond academic publications, and communication materials must be tailored for non-academic audiences. Using datasets for ranking entities or benchmarking environmental performance is one strategy that can be used to exert political influence (Arndt, 2008, though see Shi et al., 2019), although such rankings may also be politically sensitive and generate backlash.

One of the most valuable strategies to maximize the impact of datasets is to involve non-academic stakeholders in the early stages of the project, before data collection begins. Research processes benefit from being inclusive and collaborative, potentially through participatory data collection or co-production of knowledge (Bäckstrand, 2003), thereby enhancing the relevance and applicability of the findings. Engaging users early on allows tailoring the dataset to their needs and, thereby, greatly increasing the odds that potential users become actual users.

Third, datasets heavily influence our research and teaching practices. They raise new questions, reveal puzzles to be explained, and enable empirical investigation. They also structure collaboration around certain topics or methods. However, they leave other dimensions in the dark, especially elements that are difficult to observe or document, which can hinder the exploration of certain research questions.

We must create social spaces for scholarship to critically reflect on how datasets impact and transform research and teaching practices on Earth system governance. Several challenges remain to be addressed. These include exploring novel forms of collaboration between data producers and users (e.g., how can we pool resources from various projects?), rethinking how research performance is assessed to incentivize impactful dataset production and communication (e.g., should we create a prize for data generators?), teaching data management and communication to the next generation of researchers (e.g., should we create a summer school on data visualization related to Earth system governance?), and reforming the peer-review processes of research outputs involving new datasets (should reviewers have access to datasets and assess their quality?). These actions could foster a more robust and responsive scientific community.

5. Steps forward

As a group of scholars producing and using datasets related to Earth system governance, we suggest some actions our research community can undertake to address these challenges. First and foremost, we believe that opening discussions to share advice, provide feedback, and explore future directions is a healthy scientific practice. Some of us have recently organized panels, workshops, and conferences where dataset creation, maintenance, and communication were discussed, and we are committed to continuing these conversations. This *Perspective* both reflects on and contributes to these ongoing discussions.

Second, we recognize the need to create a public list of existing and planned datasets related to Earth system governance. Disciplinary and field silos remain powerful blinders, limiting our horizon. A centralized list of related datasets could help expand research opportunities across disciplines. Research on Earth system governance is inherently multidisciplinary, and datasets created by researchers in one discipline could often be useful to those in another. Moreover, signaling datasets under construction could reduce the risk of unintended duplication and create new opportunities for collaboration. Early-career researchers and academics from marginalized communities are likely to be among the main beneficiaries of such an initiative. Fostering coordination across datasets can only begin with mutual awareness of what other datasets are "out there."

With this in mind, the Earth System Governance Project started in June 2025 to develop a data directory (www.earthsystemgovernance.org/data-directory/). This data directory aims to share key information on existing and upcoming environmental governance-related datasets, including the nature of data, geographical and temporal coverage, number of observations, year of most recent update, URL, and contact information. It will be regularly updated, and any researchers are welcome to submit their dataset projects.

Third, we believe that our scientific community should create spaces for the valorization of datasets and the description of trends and patterns that can but need not be the premise for further inferential work. Unfortunately, some datasets bury fascinating descriptive findings in hard-to-access spreadsheets or in footnotes of research papers' methodological sections. Some journals in social sciences discard the scientific merit of description and offer neither opportunities nor incentives to update already published datasets. Accurate and timely description is one of the most important contributions of datasets, but such an aim is frustrated by making publication conditional on new theory, new results, or the delays and unpredictability of the publication process.

To better promote the descriptive value of datasets and reaction to our suggestions, the *Earth System Governance* journal has created a new manuscript type, called "Data Insights" (Morin, 2026). Its review process and format are specifically designed to support dataset producers and users. We believe that the descriptions of trends and patterns will serve as an excellent basis for identifying future research questions, regarding either their causes or consequences. The accessibility of "Data Insights" will also make them appealing to undergraduate and postgraduate students and policymakers, including those not well versed in methodology.

To fully realize the transformative potential of datasets in Earth system governance, we must embed data practices more deeply within the scholarly and political context that shapes global environmental action. This requires not only better tools but also a cultural shift that embraces openness, critical reflection, and co-production. By fostering a vibrant community of data producers and users, we can build a more responsive, cumulative, and impactful body of knowledge. The future of environmental governance hinges not only on better theories and institutions, but also on better datasets and better ways of working with them.

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Data availability

No data was used for the research described in the article.

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