

Ecosystems and Ordering: Exploring the Extent and Diversity of Ecosystem Governance

CRISTIANA MAGLIA  AND ELANA WILSON ROWE 

Norwegian Institute of International Affairs (NUPI), Oslo, Norway

This article argues that, to grasp how global ordering will be impacted by planetary-level changes, we need to systematically attend to the question of the extent to which and how ecosystems are being governed. Our inquiry builds upon—but extends beyond—the environmental governance measures that have garnered the most scholarly attention so far. The dataset departs from the current literature on regional environmental governance by taking ecosystems themselves as the unit of analysis and then exploring whether and how they are governed, rather than taking a starting point in environmental institutions and treaties. The ecosystems researched—large-scale marine, freshwater, and terrestrial ecosystems—have been previously identified by a globe-spanning, natural science inquiry. Our findings highlight the uneven extent of ecosystem governance—both the general geographic extent and certain “types” of ecosystems seemingly lending themselves more easily to ecosystem-based cooperation. Furthermore, our data highlight that there is a wider range of governance practices anchored in ecosystems than the typical focus on environmental institutions reveals. Of particular significance is the tendency by political actors to establish multi-issue governance anchored in the ecosystems themselves and covering several different policy fields. We argue that, in light of scholarship on ecosystem-anchored cooperation and given the substantive set of cases of such cooperation identified in the dataset, these forms of ecosystem-anchored cooperation may have particularly significant ordering effects. They merit attention in the international relations scholarship that seeks to account for the diversity of global ordering practices.

D’après cet article, pour comprendre les conséquences des changements à l’échelle planétaire sur l’ordre mondial, nous devons systématiquement nous intéresser à la mesure dans laquelle les écosystèmes sont gouvernés, et de quelle façon. Notre enquête se fonde sur les mesures de gouvernance environnementale qui ont le plus concentré l’attention des chercheurs jusqu’ici, tout en les dépassant. L’ensemble de données s’écarte de la littérature actuelle sur la gouvernance environnementale régionale en considérant les écosystèmes eux-mêmes comme des unités d’analyse, puis en examinant s’ils sont gouvernés, et comment, plutôt qu’en prenant les institutions et traités environnementaux comme points de départ. Les écosystèmes étudiés—marins, d’eau douce et terrestres de grande échelle—ont déjà été identifiés par une enquête de sciences naturelles mondiale. Nos résultats soulignent l’inégalité de la portée de la gouvernance d’écosystèmes, tant la mesure géographique générale que certains « types » d’écosystèmes se prêtant apparemment plus facilement à une coopération fondée sur l’écosystème. En outre, nos données mettent en évidence que l’éventail de pratiques de gouvernance ancrées dans les écosystèmes est bien plus large qu’on ne pourrait l’imaginer en se focalisant sur les institutions environnementales, comme souvent. Phénomène révélateur, les acteurs politiques ont tendance à établir une gouvernance pour de multiples problématiques, ancrée dans les écosystèmes eux-mêmes et recouvrant des domaines politiques différents. À la lumière de la recherche sur la coopération ancrée dans les écosystèmes et du grand nombre de cas d’une telle coopération identifiés dans l’ensemble de données, nous affirmons que ces formes de coopération ancrée dans les écosystèmes peuvent s’accompagner d’effets particulièrement importants sur l’ordre. Elles sont tout particulièrement intéressantes pour les chercheurs en relations internationales qui souhaitent expliquer la diversité des pratiques au sein de l’ordre mondial.

Este artículo argumenta que, para comprender cómo afectarán al orden global los cambios que están teniendo lugar a nivel planetario, debemos atender sistemáticamente la cuestión de hasta qué punto y cómo se gobiernan los ecosistemas. Nuestra investigación parte de la base (aunque va más allá de esta) de las medidas de gobernanza ambiental que han atraído una mayor atención por parte de los académicos hasta ahora. El conjunto de datos se aleja de la bibliografía existente en la actualidad sobre gobernanza ambiental regional ya que toma los ecosistemas como unidades de análisis por sí mismos y a continuación explora si estos están gobernados y cómo, en lugar de tomar las instituciones y los tratados ambientales como punto de partida. Los ecosistemas investigados (ecosistemas marinos, de agua dulce y terrestres a gran escala) han sido previamente identificados por una investigación en el campo de las ciencias naturales que abarca todo el mundo. Nuestras conclusiones resaltan el alcance desigual de la gobernanza de los ecosistemas: tanto la extensión geográfica general como ciertos «tipos» de ecosistemas se inclinan, en apariencia, más fácilmente hacia la cooperación basada en los ecosistemas. Además, nuestros datos destacan que existe una gama más amplia de prácticas de gobernanza que radican en los ecosistemas de lo que revela el enfoque habitual sobre las instituciones ambientales. Resulta de particular importancia la tendencia por parte de los agentes políticos a establecer una gobernanza multitemática radicada en los propios ecosistemas y que abarca varios campos políticos diferentes. Argumentamos que, a la luz de la bibliografía académica sobre la cooperación radicada en los ecosistemas y dado el conjunto sustantivo de casos de dicha cooperación identificados en el conjunto de datos, estas formas de cooperación radicadas en los ecosistemas pueden tener efectos de ordenación particularmente significativos. Estas merecen atención dentro

Cristiana Maglia is a senior research fellow at the Norwegian Institute of International Affairs (NUPI). She holds a PhD in Political Science (2020) from the Federal University of Rio Grande do Sul (UFRGS), Brazil. Her areas of expertise include comparative politics, global governance and international organizations.

Elana Wilson Rowe is a research professor at the Norwegian Institute of International Affairs (Oslo) and associate professor at the Norwegian University of the Life Sciences (NMBU). She has her PhD in Geography from the University of Cambridge (2006). Her books include *Arctic Governance: Power in Cross-Border Cooperation* (Manchester University Press, 2018) and *Russian Climate Politics: When Science Meets Policy* (Palgrave, 2013). She was a member of Norway’s national committee establishing research priorities for the UN Ocean Decade and is principal investigator/project leader of a five-year research project funded by the European Research Council comparing the politics of the Arctic, Amazon Basin and the Caspian Sea (‘The Lorax Project: Understanding Ecosystemic Politics’, #loraxprojectERC).

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del sector académico de las Relaciones Internacionales, que busca dar visibilidad la diversidad de prácticas de ordenación globales.

It is a fallacy to say that the Amazon is the heritage of humankind, and a misconception, scientists confirm, to say that our Amazonian forests are the lungs of the world. In resorting to those fallacies, certain countries, instead of helping, have amplified media lies, behaved disrespectfully and shown their true colonialist colours. They have even called into questioned that which we hold most dear: our sovereignty.

—Jair Bolsonaro, then President of Brazil, speech to the UN General Assembly (2019)¹

Beijing claims to be a “Near-Arctic State,” yet the shortest distance between China and the Arctic is 900 miles. There are only Arctic States and non-Arctic States. No third category exists, and claiming otherwise entitles China to exactly nothing.

—Then Secretary of State Mike Pompeo, speech at the margins of the 2019 Arctic Council Ministerial meeting (2019)²

Introduction

As the contours of planetary-level changes have become better understood, new practices of governing nature have emerged and continue to develop (Biermann and Kim 2020; Dalby 2020; Lehman 2020). The most evident practices are efforts to establish environmental governance—at all scales and from single-issue treaties to complex regimes and institutions. Many studies focusing on environmental governance explore the politics and outcomes of institutions (or processes leading to such) designed to govern environmental challenges. Although this provides important insights into how environmental governance comes about and operates, the institutional starting point and focus on environmental governance institutions leaves us with an incomplete perspective on the cross-border governance of nature. We still lack systematic insights into regional-level governance practices anchored in border-crossing natural features, but this may not be (exclusively) focused on environmental issues. We also lack an appreciation of the extent to which cross-border nature remains ungoverned, here comprising a universe of cases necessarily overlooked by any study that has institutions as the unit of analysis.

In this article, we seek to systematically explore how different ecosystems are governed beyond national borders at the intersection of multiple states at the subglobal level.³ To do this, we have developed a dataset in which the selection of ecosystem cases unfolded from a natural science-based list of global *meta-ecosystems* employing a shared methodology

(terrestrial ecosystems, Olson et al. 2001; freshwater ecosystems, Abell et al. 2008; and marine ecosystems, Spalding et al. 2007). These meta-ecosystems (hereafter referred to as “ecosystems”) are interlinked natural communities and species large enough to span multiple state borders but smaller than entire biomes (Olson et al. 2001). Assembling our dataset with this starting point of ecosystems, we have sought to correct the intrinsic biases in the literature toward successful cases of cooperation and ecosystems as an object of environmental politics alone. To do this, we capture a wider range of ecosystem-relevant governance initiatives, including a particular subset of cases in which governance covers a wide range of issues and is anchored in the ecosystems themselves. We argue that this set of cases merit particular enhanced attention in international relations’ (IR) effort to account for diversity in global ordering practices (Chowdhury 2018; Huysmans and Pontes Nogueira 2016; Jeffrey, McConnell, and Wilson 2015; Phillips and Sharman 2015; Reus-Smit 2017). We also highlight the extent of hitherto largely overlooked instances of noncooperation, pointing to further research avenues using these data.

As the quotes from Jair Bolsonaro and Mike Pompeo at the beginning of this paper suggest, highlighting adjacency to particular “natural” geographic spaces is relevant when claiming a privileged position in governance and issue framing. For this reason and for developments in both scholarship and policy, mapping the diversity of the current governance of cross-border ecosystems is a pressing task. Governing from ecosystems (for environmental ends or not) is set to become an important strategy, both for novel approaches to governing the Anthropocene and for states seeking to adapt to new or maintaining existing forms of political order in the face of planetary changes (Young 2017; Dalby 2020; Lehman 2020; Lövbrand, Möbjörk, and Söder 2020; Wilson Rowe 2021). An emerging strand of scholarship is exploring how quickly “naturalized” governance efforts anchored in what states identify as border-crossing ecosystems are efficient in reorganizing regional–global power relations (Wilson Rowe 2021; (Beaumont and Wilson Rowe 2022; Paes 2022; Yao 2022). Furthermore, normative arguments are being advanced, with ecosystems and the natural world as significant elements. These arguments suggest shifting the focus of governance from state security to ecosystem security (McDonald 2018, 2021), moving beyond the nature–culture governance binary in IR (Fagan 2017; Simangan 2020), and taking seriously the materiality of the planet in our scholarship on and practices of governance (Peters, Steinberg, and Stratford 2018). The regional level is frequently seen by political actors as a way of both addressing regional environmental challenges and achieving progress on planetary issues (for a thorough discussion, see Balsiger and Prys 2016).

The argument proceeds as follows: we present a justification from the literature on the analytical merits of systematically mapping the diversity of how ecosystems are governed at the subglobal/regional level. We then present the original dataset, which provides the empirical basis of the current article, along with our procedures for gathering and coding information on how ecosystems are governed. Next, we discuss two core findings. First, we illustrate that there is a wider range of governance practices anchored in ecosystems than the typical focus on formal environmental

¹ See <https://www.gov.br/mre/en/content-centers/speeches-articles-and-interviews/president-of-the-federative-republic-of-brazil/speeches/speech-by-brazil-s-president-jair-bolsonaro-at-the-opening-of-the-74th-United-Nations-General-Assembly-New-York-September-24-2019-photo-alan-santos-pr>, accessed November 19, 2021.

² See <https://2017-2021.state.gov/looking-north-sharpening-americas-arctic-focus/index.html>, accessed November 19, 2021.

³ The transnational governance is highlighted by much research in environmental politics. However, usually, the transnational aspect of it is more connected to climate change. Examples of datasets on the matter are the Climate Cooperative Initiatives Database (C-CID), the Global Climate Action database (<https://climateaction.unfccc.int>), and the Sustainable Development Knowledge Platform (<https://sustainabledevelopment.un.org/partnerships.html>).

institutions and treaties reveals. In particular, we highlight multi-issue cooperation anchored in border-crossing ecosystems as potentially particularly effectful repertoires of establishing (ecosystemic) regional orders. Our focus on political initiatives, in addition to formal institutions, and on measures not (or not solely) focused on environmental politics expands the set of cases that have hitherto been considered in the scholarship on ecoregions. Second, we argue that the puzzle of noncooperation and varied extent of cooperation is just as relevant as exploring how cooperation comes about and how well it works. With its starting point in the ecosystems themselves, our dataset provides some context for the ungoverned ecosystems as well, which an institutionalist-driven inquiry would overlook. Our dataset illustrates that the majority of ecosystems are indeed governed in some form or another, or at least covered by a relevant multilateral setting in which ecosystem-adjacent states meet. However, we can identify several pockets of noncooperation. Among noncooperating ecosystems, some are in regions where political history suggests challenges for international cooperation more generally, such as the Aegean Sea or South China Sea, but also many other cases that defy any easy explanations. Paving the way for investigating the causes of cooperation and noncooperation and of variation across space and material environments is a key affordance of this dataset, and potential further applications are explored in the conclusion.

Mapping Ecosystemic Politics beyond Environmental Institutions

Scholars are starting to come to grips with the impact of climate change and an “Anthropocene” era in global politics. However, the response to this call for increased conversation between politics and the rapidly changing natural world has come at a slower and more modest rate in the IR field than in other social science disciplines (Green and Hale 2017; Simangan 2020 on IR as a discipline; see Peters, Steinberg, and Stratford [2018] for how materiality is approached in political geography). As researchers have sought to integrate the reality of human-induced global change into the IR discipline, we can see a progressive shift in focus toward having the nonhuman world as the starting point of analysis, from including nonhumans in our planetary politics (Fagan 2017; Dalby 2020) to envisioning a new form of governance thinking and reflexivity (Pickering 2018) and refocusing the object of security to ecological security, specifically in securing ecosystem resilience (Fagan 2017; McDonald 2018, 2021; see also Lövbrand, Mobjörk, and Söder 2020 for a recent overview).

These are important research agendas for thinking anew about governance in ways that supersede the nature–culture binary, bringing in new dimensions for the scope and speed of planetary change. In this article, we take a starting point in the literature by taking ecosystems as the unit of analysis and exploring if and how they are governed. This approach opens up a set of questions that are set to be increasingly important in global politics and build on several strands of established and emerging scholarship. There is a strong baseline of scholarship on regional/transnational environmental governance that provides an excellent source of input for this inquiry, both empirically and conceptually. However, this stream of the literature takes its starting point in a focus on specifically environmental institutions and treaties at the regional level or in ecoregions often assessing them for their structure and effectiveness in addressing environ-

mental governance challenges and emphasizing their environmental problem-solving capacity (Balsiger 2011; Balsiger and VanDeveer 2012; Balsiger and Prys 2016; Willi, Pütz, and Müller 2018; Church 2020). Looking beyond formal institutions and capturing issue interplay and political inputs beyond the environmental field is a core challenge identified in this strand of scholarship but is not yet fully realized in new research agendas (Biermann and Kim 2020; Young 2020).

In our dataset, we seek to pick up the challenges identified by scholars of environmental politics and regional environmental governance by capturing a more complex organizational ecology as it is manifested in cooperation around ecosystems. We include projects and strategies rather than only formal institutions and cooperative efforts that may not be (exclusively or at all) focused on addressing environmental challenges. Our intention was to include the wider range of efforts that characterize global governance, such as (formal) international governmental organizations, informal international organizations (Vabulas and Snidal 2021), and transnational public–private governance initiatives (Westerwinter 2021), as well as initiatives—such as projects and strategies—within organizations. Additionally, as the quotations opening the article illustrate, “speaking for” ecosystems in global settings can (also) be an important practice of enacting sovereignty and preferred relations of power around ecosystems of global significance (Wilson Rowe 2021). Therefore, our understanding of how global relations are ordered benefits from casting a wider net beyond formal institutions. States may opt to shape the global order by filling a governance vacuum around a particularly valuable area or resource but perhaps in ways that are less comprehensive or demanding than a treaty or fully fledged organizational body (Dittmer 2017; Burke 2019; Dimitrov 2020; Jones 2020). For example, the Arctic Council is a significant forum that orders relations relating to high latitude ecosystem(s), yet it is not a formal treaty-based institution.

The importance of capturing this broader suite of initiatives anchored in ecosystems, including but beyond the environmental field, is supported by an emerging strand of scholarship that highlights how cooperation anchored in meta-ecosystems can have significant consequences for power relations more generally. This kind of “ecosystemic politics” (see Wilson Rowe [2021] for a discussion and an Arctic/Arctic Council case) may start with or take inspiration from the now widespread norm of environmental stewardship (Falkner and Buzan 2019). However, empirical studies of the Amazon, Arctic, and Caspian Sea highlight how even informal forms of cooperation anchored in what states choose to acknowledge as a border-crossing ecosystem facilitate political power practices that impact the ordered relations between regional and global actors and might have little to do with improving environmental governance of the ecosystem itself see Paes (2022) and De Oliveira Paes (2023) on the Amazon/Amazon Cooperation Treaty Organization, (Beaumont and Wilson Rowe [2022] on the Caspian, Lehman [2020] on planetary politics, and Wilson Rowe [2021] on the Arctic; see also Gruby [2017] on Micronesia).

Contrary to this, having ecosystems as the starting point themselves also allows for considering the puzzle of noncooperation. In IR, the tension between cooperation and noncooperation between states is still a topic of discussion. Whereas the realist tradition emphasizes that cooperation is possible when it aligns with strategic interests, the scholarship of global governance expects that institutions would emerge under a wider range of conditions. Therefore, this

article can pinpoint which transboundary ecosystems remain ungoverned, thereby laying the groundwork for renewed inquiry relating to this puzzle of noncooperation (Dimitrov et al. 2007).

So, how does the literature highlighted here inform the choices made in the database we turn to next? In generating the novel database for this article, our coding scheme was designed to take into account this literature, focusing on accounting for variations in the extent and type of cooperation. To capture cases of noncooperation, our search took ecosystems as the starting point rather than institutions. When our search protocol did not result in the identification of any initiative for an ecosystem, the ecosystem was coded as a “zero case.” On the other hand, when we found initiatives, our coding typology specifically classified cooperation initiatives as geographically anchored in the ecosystem itself or in broader multilateralism and then whether cooperative efforts were focused on specific functional policy fields or on a wider suite of governance challenges. In contrast to existing databases of environmental governance, our search protocol was not limited to environmental governance alone when we sought to explore how these cross-border ecosystems are governed. Instead, we have taken an analytical starting point in the ecosystem to see how it is governed in any kind of functional policy field (including political efforts to address cross-border health, security, social issues, and so on).

Ecosystems as Units of Analysis? Introducing the Dataset and Methods

In compiling political international efforts and cooperation around ecosystems, we initially cast a wide net looking for a global catalog of large-scale ecosystems.⁴ Many overviews of ecosystems focus on the specific traits relating to politics more generally—for example, those threatened ecosystems or “special ecosystems.” Ecosystems can be found on multiple scales, from large “biome-level” systems (i.e., tundra, tropical forests) to small ponds (see, for a recent consideration of ecosystems in policy development, Keith et al. 2020). Using natural science definitions, some catalogs conceptualize ecosystems on such a small scale that numerous entries within the boundaries of single states become the result. For example, the Ecological Land Units (ELU) map uses satellite data and other landscape data to identify 3,923 terrestrial ecological land units.⁵

Research funded in the 2000s by the World Wide Fund for Nature (WWF) provides a catalog of ecosystems at a “meta-scale” that lent itself to consideration of interstate/supranational cooperation around ecosystems. They cataloged what they call ecoregions in terrestrial (terrestrial ecoregions of the world [TEOWs]), marine (marine ecoregions of the world [MEOWs] and marine provinces), and freshwater (freshwater ecoregions of the world [FEOWs]) areas. These have been defined with similar natural science-based criteria (Olson et al. 2001; Spalding et al. 2007;

⁴It is important to note that these delimitations are snapshots of the boundaries in a specific moment in time. They depend on ecological relationships that are also subject to change. This means that we can expect climate change to potentially change ecosystems’ boundaries. This threat not only alters the way to delimit ecosystems, but also impacts on global cooperation. For instance, the processes of Atlantification of the Barents Sea and the Arctic have resulted in changes to the extent and features of the ecosystem (Barton et al. 2018; Ingvaldsen et al. 2021).

⁵The ELU map is a cooperation between the American Association of Geographers, the ARCGIS, and the US Geological Survey’s Climate and Land Use Change Program. For more information on this overview, see <https://www.arcgis.com/home/item.html?id=77bbcb86d5eb48a8adb084d499c117ef>.

Abell et al. 2008), resulting in a manageable number of entries for our dataset. According to their definition, ecoregions are comparatively large units of land or water that share common species, dynamics, and environmental conditions that we considered a valid way to operationalize ecosystems in this article. These ecoregions provide our universe of cross-border ecosystems and are referred to as ecosystems throughout the article.

We have used the entries identified by this team of scientists (867 terrestrial ecosystems, 232 marine ecosystems, 426 freshwater ecosystems, and 62 larger marine provinces) to select the sample of cases that we included in the dataset. To each ecosystem, we mapped the number of bordering countries along. Because we were particularly interested in the complex cooperation around these ecosystems and to make the hand coding protocol more feasible, we limited the population of ecosystems to researching only those that had four or more bordering countries.⁶ This produced a list of 221 ecosystems.⁷

We then further researched and categorized the cooperative cross-border governance initiatives anchored in each ecosystem before coding each of these based on the level and type of cooperation. In these cases, we designed and implemented a protocol to identify and classify cooperation initiatives relevant to these ecosystems. To ensure that we captured a comprehensive range of cooperative efforts and a diversity of potentially significant governance practices, we used the term *initiative* as a broad umbrella category and used a relatedly broad search protocol. The term initiatives encompasses various kinds of cooperation efforts, such as intergovernmental organizations, integration processes, cooperation treaties (even those that did not get institutionalized), formal environmental institutions, strategies, and projects within international organizations, informal international organizations, and transnational networks in which states are members. To identify those initiatives relevant to each ecosystem, we collected keywords for each ecosystem and searched for the ecosystem being mentioned in the relevant databases: the International Environmental Agreements Database (IEADB) (Mitchell et al. 2020),⁸ Correlates of War Codebook of International Organizations, the Yearbook of International Organizations, and the UN Treaty Collection.⁹ We also conducted internet-based searches to capture regional cooperation processes that some of the countries in the ecosystem were part of and that could harbor

⁶It is worth noting that the dataset focuses on ecosystems with four or more adjacent states, allowing us to capture complex cases of border-crossing efforts around ecosystems, hence resulting in a geography specific to our inquiry. The global geographical distribution of terrestrial ecosystems is uneven, with particularly high levels of potential governance complexity (if the key indicator is number of adjacent states) in Europe and Africa. Freshwater ecosystems show a similar pattern, with most cases in Europe and Africa, but they are also present in Central Asia and South America. In turn, marine ecosystems with more adjacent countries are more prominent in the Caribbean, Europe, and Middle East/North Africa. Marine provinces, aggregations of marine ecosystems, and larger areas often have more adjacent states, allowing for the inclusion of regions that are not included on the list of marine ecosystems. For example, this is the case for the Arctic, which is not included as a marine ecosystem because it was subdivided into nineteen ecosystems (of which only the *North and East Barents Sea* ecosystem was included because of its six adjacent countries).

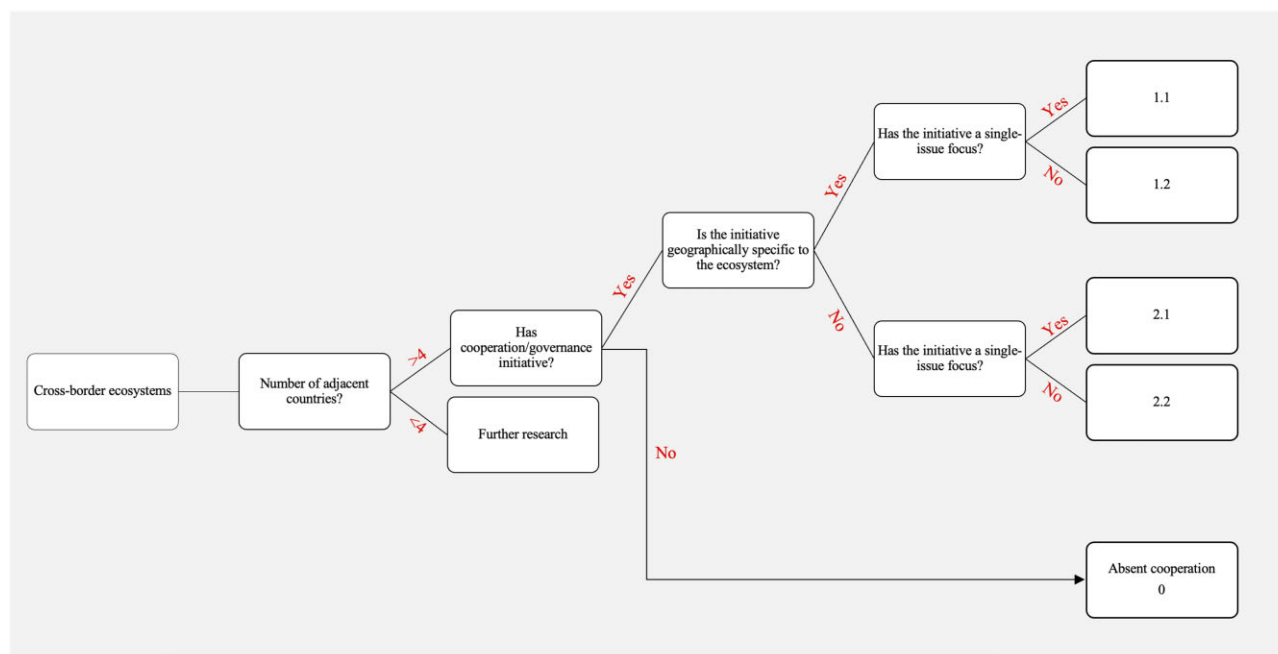
⁷The list of the 105 terrestrial ecosystems, 27 marine ecosystems, 62 freshwater ecosystems, and 27 marine provinces with four or more adjacent countries is available in the supplementary appendix.

⁸The IEADB project currently lists over 3,600 multilateral and bilateral environmental agreements, serving as one of the sources of the dataset introduced here. However, as one example of institution-centered research, this comprehensive dataset does not link agreements to specific ecosystems.

⁹More information on data collection is in the supplementary appendix. In the case of marine ecosystems and provinces, the keyword search also comprised the Large Marine Ecosystems (LME) datasets (Large Marine Ecosystems Hub website, GEF International Waters project portfolio website, Transboundary Waters

Table 1. Coding scheme for cooperation initiative classification around ecosystems and examples of political bodies falling into each category¹⁰

		<i>Geographical scope</i>	
		<i>Specific to ecosystem</i>	<i>Broader than an ecosystem</i>
Focus	Issue/resource specific	Type 1.1 (Central Africa Forests Commission—COMIFAC)	Type 2.1 (European and Mediterranean Plant Protection Organization—EPPO)
	Multifunctional	Type 1.2 (Mekong River Commission—MRC, Arctic Council, Amazon Treaty Cooperation Organization—ACTO)	Type 2.2 (Caribbean Community—CARICOM)

**Figure 1.** Coding scheme.

cooperation among states. For each cooperation initiative, we collected information on member countries, the year of establishment, where it is based, and a general description collected on their websites. We collected data for up to five initiatives per ecosystem.

We also classified and differentiated initiatives along two dimensions: *cooperation geographical scope* and *cooperation focus*, as presented in table 1. The first dimension allowed for distinguishing cooperation initiatives that were distinctively tied to an ecosystem from broader multilateral efforts whose mandate includes the ecosystem. The second dimension differentiated those initiatives focusing on a broader array of topics and themes from those that only included specific issues (i.e., environment). This was a crucial step in going beyond existing databases, which took environmental focus as a starting point, allowing for future research to investigate the potential causes of different focuses, issue linkages, and focus expansion. Table 1 shows these four types of cooperation initiatives while giving some illustrative examples of the kinds of political efforts that fall under each type. As argued conceptually and explored empirically below, the distinction between geographically specific and broad initiatives is of particular focus because it illustrates whether ecosystems are generative of (or subject to) particular forms of cooperation.

This typology classifies the cooperation initiatives within ecosystems, but its expansive nature also opens the space to identify ecosystems where cooperation is absent. When we could not find any cooperation initiatives around the ecosystem, we coded the ecosystem as a case of noncooperation. The coding for the types of ecosystem cooperation was a product of the cooperation initiatives relevant to the ecosystems (see figure 1). Because of this coding strategy, our dataset allows ecosystems to have multiple initiatives anchored on each of them and for the same initiatives to be anchored in multiple ecosystems. Yet, our unit of analysis is the unique relationship between an ecosystem and a cooperation initiative. For instance, one initiative, which is coded as type 1.1 in a given ecosystem, can be coded as type 2.1 in another.¹¹

Assessment Programme [TWAP] website, and Marine Regions website) and the Regional Fishery Bodies (RFB) of the FAO Fisheries Division database.

¹⁰The typology and table 1 were based on Wilson Rowe (2021).

¹¹One of the examples is the Community of Sahel-Saharan States (CEN-SAD), which is coded as geographically specific for three ecosystems (*Sahelian Acacia savanna*, *South Saharan steppe and woodlands*, and *East Saharan desert*) but as geographically broader for the other four ecosystems. Figure A1 in the supplementary appendix shows the frequency of the coding for all the initiatives.

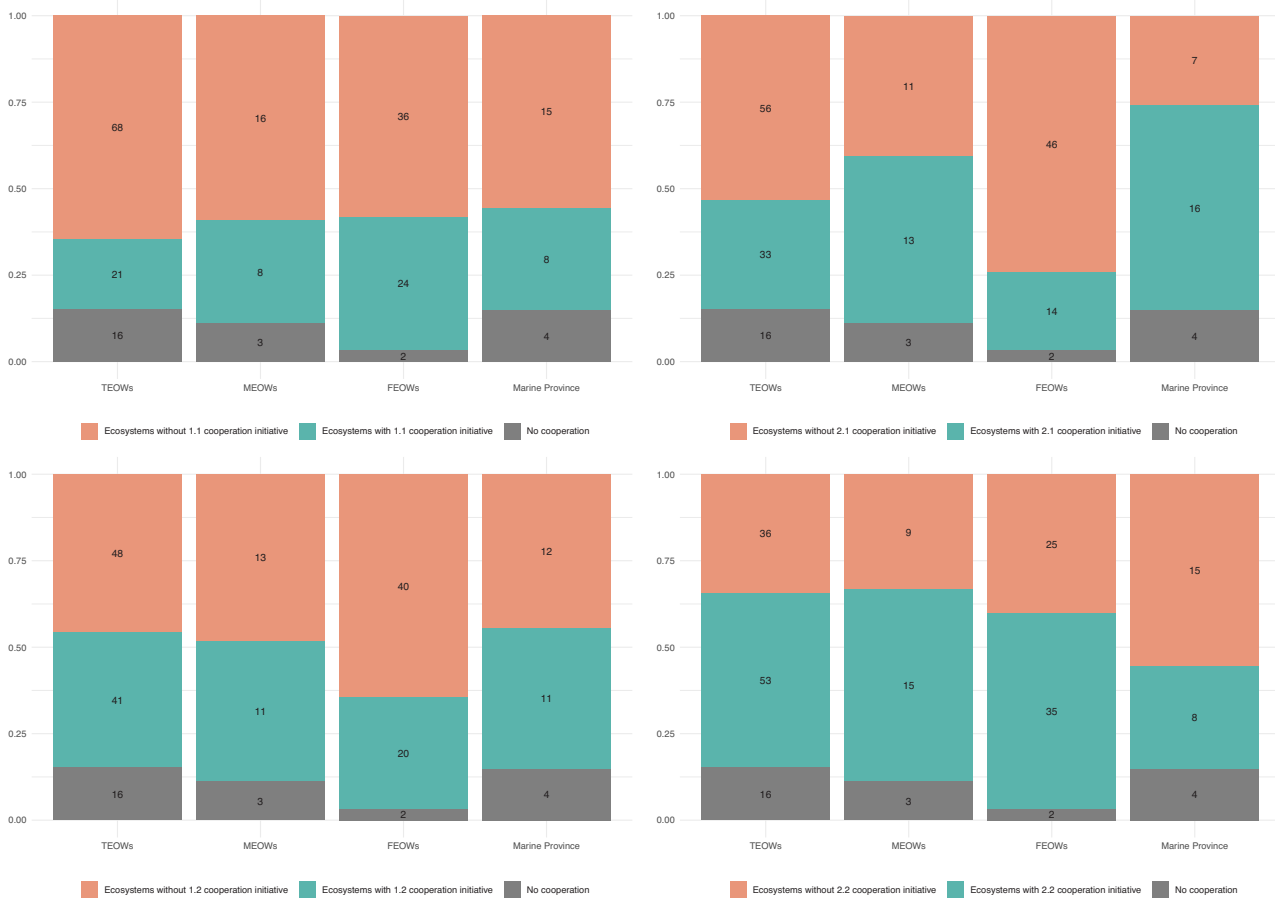


Figure 2. Variation in the types of cooperation in terrestrial, marine, and freshwater ecosystems and marine provinces.

Results and Interpretation

In this section, we discuss two key areas of the findings (and avenues for further research) that place ecosystems as the starting point of a governance analysis. First, we present the contours of how these ecosystems are governed. The most salient finding is that the majority of ecosystems have geographically specific cooperation. We also find a tendency for multi-issue area cooperation to prevail, particularly among cooperation initiatives geographically specific to ecosystems. Furthermore, we have found variations in how “different kinds” of ecosystems are governed, with marine environments being a group more frequently governed compared with terrestrial ecosystems. Second, we discuss the puzzle of no cooperation around ecosystems and how this paves the way for further investigation of the variation in the extent of cooperation.

A Populated Landscape of Governance Practices: Variation in Type of Cooperation around Cross-Border Ecosystems

When it comes to governance efforts anchored in the ecosystems themselves (types 1.1 and 1.2; see figure 1), our data show a distinct tendency for establishing multi-issue forms of cooperation. This tendency is illustrated in figure 2, which shows the frequency with which each type of cooperation initiative is present across ecosystems, here disaggregated by TEOWs (terrestrial), MEOWs (marine), FEOWs (freshwater), and marine provinces (which are even more ex-

pansive marine ecosystems). In the bottom left corner of figure 2, we can see the proportion of terrestrial, marine (and provinces), and freshwater ecosystems that have *at least one* cooperation initiative geographically specific and focused on multiple issues (type 1.2). We can see that around 40 percent of terrestrial and marine environments (on both scales, MEOWs, and marine provinces) have forms of cooperation anchored in the ecosystem itself and covering a broader range of issues, including but beyond environmental cooperation.

In contrast, as shown in the top left graph of figure 2, the proportion of ecosystems that have a geographically specific ecosystem but focus on a single issue (type 1.1) is under 30 percent for marine ecosystems and below 20 percent for terrestrial ecosystems. Hence, with the exception of river ecosystems (FEOWs), where this inverts, a greater proportion of ecosystems are found to have geographically specific cooperation with a multi-issue focus rather than a single-issue focus. The fact that river ecosystems, which have garnered more attention recently for their broader political roles and effects on governance (Coates 2013; especially Yao 2022, 2019), are somewhat exceptional in being highly governed suggests that there is value in taking a more universal view of all ecosystems and directing further attention to the political effects of other kinds of border-crossing ecosystems.

We see a similar trend regarding broader multilateral initiatives that are relevant to—but not geographically anchored in—the ecosystems (types 2.1 and 2.2; see table 1 and right-hand side of figure 2). It is important to note

that the cooperation initiatives in the broader geographical scope category (types 2.1 and 2.2) are qualitatively different from others because they are only in the dataset because these initiatives include environmental cooperation in their scope and have over 85 percent of adjacent states as members (more on the thresholds in the supplementary appendix). This includes regional integration processes being extended to govern ecosystems because of functional linkages to other issues in its mandate or just because of the political interests of the states involved therein (i.e., pooled sovereignty and heightened regional or global visibility, and so on). This general regional cooperation is assumed to provide a site for cooperation, which warrants a distinction between these ecosystems and those that have no type of cooperation at all. On the whole, those ecosystems containing only geographically broader cooperation initiatives (especially type 2.2) should be considered partially governed, in that the multilateral governance location represents a *potential* venue to discuss shared issues. This suggests that we need further research on general regional cooperation as a platform for collaboration, with the dataset as a starting point to grasp whether this broader multilateral level may result in an uptick in entirely ungoverned ecosystems—a topic that we analyze next.

To understand the extent to which ecosystems overall are governed by geographically specific initiatives or only partially governed through broader multilateral initiatives, we can look at how many ecosystems have at least one type 1.1 or type 1.2 cooperation initiative. Organizing the data in this way, our dataset shows that as many as fifty-two terrestrial ecosystems have geographically specific cooperative initiatives. Among freshwater ecosystems, thirty-nine ecosystems have this kind of geographically specific cooperation initiatives. In the case of the maritime level of analysis, seventeen ecosystems and sixteen marine provinces have specific cooperation initiatives. This means that more than half of the ecosystems with four or more adjacent countries have at least one cooperation initiative that is geographically specific and anchored on it. This suggests that anchoring cooperation initiatives specifically on an ecosystem, even if not universal, is a widespread form of governance. The relevance of this finding is undergirded by the research cited above, which has highlighted how multi-issue governance anchored in what states acknowledge to be border-crossing ecosystems can facilitate significant power political effects, particularly in structuring the norms and hierarchies of governance participation (Dodds and Nuttall 2016; Depledge 2018; Wilson Rowe 2021; Paes 2022; Yao 2022).

A second key finding relates to variations across the categories of ecosystems (terrestrial, freshwater, and marine) in terms of the extent and kind of governance. Compared with terrestrial ecosystems, fewer marine and freshwater ecosystems lack some form of cooperation. In fact, there are a greater number of ecosystem-specific cooperation initiatives around marine environments than terrestrial environments. This may be because of some of the material features of terrestrial environments, making both governance and our coding scheme more challenging to implement. One of the challenges in coding was that the terrestrial ecosystem divisions differed slightly in geographical scope from what would otherwise have seemed to be highly relevant ecosystem-anchored initiatives. In several instances, the match was so close that, after closer inspection, we opted to code the ecosystem as being governed under the relevant initiative (see the supplementary appendix for a discussion of coding challenges and solutions selected). It may be that adjacent states' political understanding of the scope and ge-

ography of terrestrial ecosystems is not as isomorphic as the natural science definitions used in our dataset when compared with oceanic ecosystems. For instance, the Amazon Cooperation Treaty Organization (ACTO) is connected to nine naturally defined different ecosystems in our sample (five terrestrial and four freshwater ecosystems in the Amazon), but they are all treated as one integrated object of governance: the Amazon rainforest (Garcia 2011). It may also be that permanently populated territorial environments—and the historical centrality of territorial control for state sovereignty—hinder or render less palatable cross-border cooperation around terrestrial ecosystems.

The higher isomorphism and absence of this coding problem in marine environments indicate that political understandings may be better with scientific definitions of marine ecosystems than with terrestrial environments. When we compare the case of freshwater ecosystems, this tendency is also evident. More than 60 percent of freshwater ecosystems have a specific initiative around the ecosystem, of which thirty-nine ecosystems have at least one cooperation initiative geographically anchored in the ecosystem area. These high levels of specificity for initiatives anchored in both marine and freshwater ecosystems reflect that the physical boundaries of maritime and riparian areas are experienced by the involved actors as salient to political processes. This echoes the work of Church (2020), which identifies and maps ninety-two institutions focused on governing ecosystems, with most of these being riparian and maritime.

In addition to the data on ecosystem-adjacent countries, our dataset also provides information on the membership of all cooperative initiatives, along with other organizational aspects, such as secretariat and year of establishment. This allows for investigating the different patterns of actor engagement in ecosystem-anchored cooperation and the politics of their establishment and membership composition. Our data show, for instance, that some states (such as Japan, the United States, and the Republic of Korea) feature significantly as actors in marine cooperation in ecosystems to which they are not adjacent. Hence, although not explored in this article, the dataset also allows for an exploration of what drives patterns of membership in ecosystemic cooperation (both in general and in specific types of initiatives) and how such adjacency dynamics manifest in the building of different initiatives.

In sum, the most salient pattern that emerges regarding forms of governance around ecosystems is that most ecosystems have at least one cooperation initiative geographically specific to them. Among these, more comprehensive, multifunctional initiatives seem to outweigh single-issue initiatives. The reasons for this deserve attention, particularly those for the expressive frequency of multifunctional initiatives anchored geographically specific in the ecosystem (type 1.2). Most often, these multifunctional initiatives combine an environmental policy strand with issues such as health, community development, or other aspects of cross-border governance. Some examples are the Arctic Council and ACTO, which are set up as more general ecosystem-based cooperation efforts. We also see that certain types of ecosystems—freshwater and marine ecosystems—seem to lend themselves to cross-border cooperation of all kinds, while terrestrial ecosystems remain less densely governed. A key takeaway is that a significant number of states and adjacent actors are opting for comprehensive, multi-issue cooperation specifically anchored in adjacent border-crossing ecosystems. In this way, as we discuss in the conclusion, ecosystems are already seen as relevant building blocks of

Table 2. Zero cases and densely governed ecosystems

<i>Zero cases</i>			
<i>Terrestrial ecosystems</i>	<i>Marine ecosystems</i>	<i>Freshwater ecosystems</i>	<i>Marine provinces</i>
Africa: East Sudanian savanna Mediterranean dry woodlands and steppe Americas: Leeward Islands xeric scrub Leeward Islands moist forests Windward Islands xeric scrub Windward Islands moist forests Windward Islands dry forests Greater Antilles mangroves Lesser Antilles mangroves Antarctic: Scotia Sea Islands tundra Asia/Middle East: Mesopotamian shrub desert Badghyz and Karabil semidesert Eastern Anatolian montane steppe South China–Vietnam subtropical evergreen forests Europe: Eastern Mediterranean conifer-sclerophyllous-broadleaf forests Italian sclerophyllous and semideciduous forests	Asia: East China Sea South China Sea Oceanic Islands Sea of Japan Europe: Aegean Sea	Europe: Gulf of Venice Drainages	Africa: Somali/Arabian Americas: Magellanic Asia: South China Sea Europe: Lusitanian
<i>Densely governed ecosystems¹²</i>			
<i>Terrestrial ecosystems</i>	<i>Marine ecosystems</i>	<i>Freshwater ecosystems</i>	<i>Marine provinces</i>
Europe: Western European broadleaf forests (4) Alps conifer and mixed forests (5) Baltic mixed forests (5) Rodope montane mixed forests (4) Carpathian montane conifer forests (4) Asia/Middle East: Arabian–Persian Gulf desert and semidesert (4) Himalayan subtropical pine forests (4) Peninsular Malaysian rainforests (4) Central Indochina dry forests (4) Southeastern Indochina dry evergreen forests (4) Western Himalayan subalpine conifer forests (4) Americas: Central American montane forests (4)	Africa/Europe: West Mediterranean (4) Americas: Southwestern Caribbean (4) Western Caribbean (4) Europe: North Sea (4) Baltic Sea (4)	Africa: Sahara (4) Senegal—Gambia (4) Asia: Lower Lan Cang (Mekong) (4) Kura—South Caspian Drainages (4)	Africa/Europe: Mediterranean Sea (4) Americas: Tropical Northwestern Atlantic (4)

governance—within and substantially beyond the environmental policy field.

The Puzzle of No Cooperation: Variation in the Extent of Cooperation around Cross-Border Ecosystems

The second contribution of this paper is its ability to map the extent of noncooperation around ecosystems. As previously mentioned, it allows for the identification of “negative cases,” where states do not construct any international arrangement to govern their shared ecosystems. This is similar to what Dimitrov et al. (2007) have called nonregimes,

in which some areas of global politics remain stubbornly un-governed at the international institutional level. With ecosystems as the entries in our dataset, we can supplement the focus on institutions of cooperation to also consider the extent of cooperation (or lack thereof). Considering the 105 terrestrial ecosystems, 27 marine ecosystems, 62 freshwater ecosystems, and 27 marine provinces researched and described in the dataset, on average, 11 percent do not have any cooperation initiative anchored on/around them. The twenty-five cases of noncooperation appear in table 2. Being more numerous, terrestrial ecosystems have more

¹² In parentheses, the number of governance initiatives.

cases of noncooperation (sixteen) than freshwater ecosystems, maritime ecosystems, and provinces. In both absolute and relative terms, freshwater (often river ecosystems in our dataset) have the lowest number of cases of no cooperation (two).

Table 2 presents these zero cases compared with cases of densely governed ecosystems. This visualization makes broader regional patterns more visible. For example, in Europe, there are only two ecosystems without a cooperation initiative and five ecosystems with four or more initiatives anchored in them. This reflects the comprehensive integration process developed around the European Union. Initiatives such as the Convention on the European Forest Institute (EFI), the Convention on the Conservation of European Wildlife and Natural Habitats, and the European and Mediterranean Plant Protection Organization (EPPO) are examples of broad initiatives that aggregate dozens of countries and are anchored in multiple ecosystems.

The African continent also has several integration processes with the provisions for environmental governance. This is reflected in the low number of ecosystems lacking cooperation initiatives in Africa. In contrast, terrestrial ecosystems without cooperation seem to be concentrated in Asia, the Middle East, and the Americas. In the latter, these tend to be in the Caribbean, a region formed by islands and seas, where little attention has been paid to cooperation anchored in terrestrial ecosystems. Conversely, cooperation around maritime ecosystems and provinces is prominent in the Caribbean. In Asia and the Middle East, the absence of cooperation in ecosystems defies easy answers and points to the need for greater investigation. Although continent-wide initiatives—such as the Asian Forest Cooperation Organization (AfoCo) and the Asia Cooperation Dialogue (ACD)—span across ecosystems and countries, the four ecosystems do not have any cooperation around them. This is the case in the *South China Sea* marine province, along with the *East China Sea* and the *South China Sea Oceanic Islands* marine ecosystems.

The different cases bring about a discussion on the causes of cooperation that are anchored in ecosystems. In the case of the China Sea and Aegean Sea, contending territorial claims and a history of political animosity have resulted in the regions being areas of potential conflict rather than cooperation. Some ecosystems can have more prosaic causes for noncooperation. For instance, there are those mostly within the same country, such as the *Gulf of Venice Drainages* and the *Italian sclerophyllous and semideciduous forests*, which are mostly in Italy, so they may end up being governed as domestic issues. These examples show that we can think of a variety of determinants for ecosystemic cooperation, both in terms of domestic aspects of the adjacent countries and also of the relationships among them.

Having this spectrum of variation in the extent of cooperation all the way to noncooperation opens up further possibilities in addressing the causes and consequences of cooperation through different analytical tools. First, the comprehensiveness of our universe of cases gives a baseline for multivariate analysis at the ecosystem and country levels to examine the reasons behind the variations in forms of cooperation and absence of them. In the first, connected to the ecosystems themselves, one could integrate additional information about other ecosystem attributes, such as the economic potential of its natural resources or its levels of preservation, which are associated with the extent and types of cooperation identified in our database. As a second level, one could include additional characteristics or linked databases to examine if causality when it comes to

the levels of cooperation may stem from country attributes of ecosystem-adjacent states (e.g., income, regime type, and capability), as well as from the relations among these neighbors (e.g., alliances, conflicts, and comembership in organizations). For instance, drawing on the literature on international cooperation, one could expect that similarity in regime type could facilitate the establishment of cooperation initiatives (Bueno de Mesquita et al. 1999; von Stein 2022) or that a history of rivalry or military conflict makes cooperation more unlikely (Powell 1991). Taken together, the dataset represents a substantial contribution to further research on patterns of cooperation and noncooperation around ecosystems.

Conclusion and Ways Forward

This article has presented a research agenda and preliminary findings on the extent and diversity of governance of ecosystems, including but going beyond formal environmental governance treaties and institutions. Our analysis of the dataset has revealed a tendency by political actors to approach the governance of ecosystems from a multi-issue perspective. This makes the long-standing puzzle of interplay with nonenvironmental regimes a core—rather than additional—challenge for understanding how environmental cooperation works (or fails to) and how environmental institutional design can be optimized (Biermann and Kim 2020; Young 2020). Our mapping of the extent and diversity of governance in ecosystems allows for empirically assessing the ways in which ecosystem-level cooperation links to the formation of different environmental and nonenvironmental regimes, both regionally and globally.

Having taken a cue from the growing literature underlining the importance of accounting for the agency of the natural world, the database presented here starts with a catalog of global meta-ecosystems before turning to the question of how they are governed. This approach draws upon and builds beyond the typical scholarly focus on the institutions of environmental or natural governance and the effects of such environmental cooperation. By using ecosystems as our main unit of analysis, our dataset addresses key questions of variation in the modes of governance across ecosystems. It also makes it possible to capture ecosystems that have not yet been subject to cooperation. This lays the groundwork for considering the causal factors leading to cooperation and noncooperation while illustrating the uneven extent of the phenomenon of cooperation around cross-border ecosystems. Importantly, our approach maps cooperation anchored on ecosystems but not around explicit environmental issues. This is particularly important to come to grips with as growing awareness of planetary change may usher in heightened attention to the political significance of cross-border ecosystems. This approach also includes cases in which ecosystems do not generate formal institutions but are managed cooperatively in other ways, thereby providing a more complete view of efforts anchored in ecosystems that may operate below the level of treaties or treaty-based institutions that are the focus of other databases.

Our findings illustrate that anchoring a cooperation initiative in the ecosystem itself and across multiple issue areas is a relatively widespread practice of governance and that certain natural kinds of ecosystems are more densely governed than others. Our study has highlighted the uneven governance practices when comparing aquatic (marine and freshwater) and terrestrial environments, noting how marine environments are more densely governed, with greater isomorphism between governance initiatives and

actual ecosystem boundaries, as identified with a natural science approach. Furthermore, we have identified a significant set of cases of multi-issue cooperation initiatives anchored in the ecosystems themselves. In the broader context of the dataset, it becomes readily apparent that this is a choice: there is significant variation in governance modes, and ecosystem-specific governance is a substantial—but by no means universal—approach. This significant set of cases of multi-issue cooperation anchored in ecosystems raises the question of why states or other adjacent actors opt for this approach and what the specific resulting political effects may be. These cases may merit particular attention as a form of ordering in global relations because the qualitative cases of similar ecosystems reviewed above have shown such cooperations to be particularly effective in rapidly “naturalizing” those relations privileging actors adjacent to the ecosystem, despite the global or broader significance of the ecosystem at hand.

The inclusion of cases of noncooperation also highlights that there is no automatic drive toward cooperation around ecosystems and that there remain a significant number of terrestrial and smaller number of marine and freshwater environments with four or more adjacent states that are not yet governed in any substantive manner. In this way, the findings serve as a reminder of the importance of accounting for the diversity of ordering forms in the international system, including variations across different materials and natural spaces. A better understanding of how ecosystems are (and can be) governed becomes only more relevant as the policy world turns increasingly toward ecosystems as a resource in managing the challenges of the Anthropocene and toward the regional level as a way forward through seemingly intractable global problems.

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Supplementary Information

Supplementary information is available at the *Global Studies Quarterly* data archive.

Funder Information

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