Europe’s nature governance revolution: harnessing the shadow of heterarchy

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Abstract
In the battle to address Europe’s biodiversity crisis, fixing its implementation gap—the gap between EU nature law on the books, and on the ground—is vital. Europe’s private nature governance revolution, underpinned by the UNECE Aarhus Convention, is a core part of its response. This article breaks new empirical ground in understanding how those mechanisms have been working in practice, and their knock-on effects for traditional enforcement by the State. We develop an innovative methodological tool, the Nature Governance Effectiveness Indicators (“NGEI”), enabling the first quantitative measurement of the effectiveness of public and private nature governance in practice. In collecting data on these indicators, we create a novel dataset spanning three jurisdictions and 23 years, giving a unique insight into Europe’s “environmental democracy in action”. We regress the NGEIs against the Nature Governance Index, an original longitudinal index measuring the evolution in nature governance laws over this period. Our results provide the first systematic empirical evidence that, despite the widespread embrace of private nature governance laws on the books across our studied jurisdictions from 1992 to 2015, the enhanced citizens’ rights conferred by these laws are not being consistently used in practice. They also reveal that, despite these inconsistencies in usage of the Aarhus mechanisms in practice, passing private governance laws can in fact improve levels of State enforcement of EU nature law in practice. For policymakers seeking to increase enforcement of EU nature law on the ground, harnessing what we term the shadow of heterarchy, by strengthening private governance rights, may therefore be a more effective means of doing so than simply ratcheting up existing traditional governance mechanisms such as levels of maximum criminal penalties or civil fines.

Keywords EU law · Private governance · Aarhus convention · Quantitative research methods · Panel data analysis · Effectiveness of law · Shadow of heterarchy

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1 Introduction

Over the past generation, Europe has embraced private environmental enforcement. As a result of implementation of the UNECE Aarhus Convention (UNECE, 1998), EU law now grants legal rights to members of the public and environmental non-governmental organisations (“ENGOs”) to access environmental information, participate in environmental decision-making and access environmental justice. These principles of “environmental democracy” contrast with the EU’s traditional enforcement model reliant upon national public enforcement authorities, supplemented by the European Commission. Under this new model of governance, citizens are themselves harnessed as environmental enforcers, to act as “watchdogs” policing compliance with European environmental law (European Commission, 2020a, p. 16). This democratisation of environmental governance forms an important pillar of Europe’s response to the biodiversity crisis. While Europe has impressive nature laws on its books, its core problem is under-implementation (European Commission, 2020a, p. 15). The EU Biodiversity Strategy for 2030, part of the European Green Deal, identifies civil society enforcement as vital in plugging that implementation gap (European Commission, 2020a, p. 15).

Although an extensive body of legal and governance scholarship has emerged analysing this European private governance revolution (see, for example, Eliantonio, 2018; Kingston & Alblas, 2020), surprisingly little quantitative research has been done in the field and there is little systematic research on how these innovative legal rights have been working in practice.

This article is, to our knowledge, the first attempt to measure the impact of these private nature governance laws in Europe. We build upon the Nature Governance Index (“NGI”) which provides the first dataset showing this transformation of European nature governance regimes over time. As presented in a partner article (Kingston et al., 2022), the NGI codes over 6,000 environmental governance laws from three levels of legal sources (international, EU and national), focusing on three Member States (France, Ireland and the Netherlands). As we explain further below, our chosen EU Member States have been selected to give a variety of geographic size of Member State, record of compliance with EU environmental law, legal “family” to which the legal system belongs (common law, civil law), and length of time taken to ratify Europe’s groundbreaking international environmental governance treaty, the 1998 UNECE Aarhus Convention (UNECE, 1998): (Kingston et al., 2022).

By governance rules, we mean the legal tools or “architectures” used to promote compliance with nature conservation rules (Heyvaert, 2018, p. 31). We include all forms of law within this definition, including legislation and case-law, but also soft law, i.e. law that has a persuasive but not binding legal character within the legal system at issue. This is important in the field of European environmental governance where, for instance, the European Commission has frequently issued guidance in the form of Communications and/or Notices, which are not formally binding as a matter of law but are often referenced in case-law (Kingston et al., 2017). Our definition of EU nature governance rules therefore encompasses traditional public nature governance rules, such as criminal penalties and civil fines, as well as rules promoting private governance such as rules on legal standing, and rules on legal costs. It also captures the multilevel nature of nature governance within Europe (international, EU, and national) (Kingston et al., 2022).

We develop the Nature Governance Effectiveness Indicators (“NGEIs”), creating a novel method of measuring the impact of these new governance rights in practice since the creation of the EU’s flagship nature conservation law, the 1992 Habitats Directive.
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By collecting the NGEIs over a 23-year period, we create a unique dataset showing how European—public and private—nature governance rules have been used in practice. By regressing the NGEIs against the NGI, we provide a first quantitative insight into whether these major shifts in nature governance laws have actually made a difference in practice, their impacts on levels of traditional State enforcement, and the extent to which Europe’s aims of environmental democratisation through law have in fact been realised.

2 Measuring the effectiveness of private nature governance laws: theoretical background

A substantial literature has developed examining the potential of non-State actors (citizens and ENGOs) to play a role in enforcing environmental law, complementing the activities of public enforcers (Kingston & Alblas, 2020). Within Europe, much of this literature has focused upon the 1998 UNECE Aarhus Convention, hailed by then UN Secretary-General Kofi Annan as “a giant step forward in the development of international law” (UNECE, 2000: v) (see, for example, Mason, 2010; Eliantonio, 2018). The aim of the Aarhus Convention is to increase citizens’ involvement in environmental matters, by creating the three so-called pillars of environmental governance rights: access to information, public participation and access to justice. In the case of access to information, these rights are to be granted to the public in general; in the case of public participation and access to justice, they are to be granted to the public “concerned” by the matter at issue (UNECE, 1998: Articles 6(2) and 9(2)). Qualifying ENGOs are granted privileged status to enforce environmental law, being afforded legal standing to bring legal proceedings as of right (UNECE, 1998: Article 9(2). The State Parties are also obliged to ensure that legal proceedings falling within the scope of the Convention are not “prohibitively expensive” (UNECE, 1998, Article 9(4)).

The EU has embraced the private enforcement rights provided by the Aarhus Convention mechanisms as a means of combatting the serious problem of under-implementation of environmental law within Europe, including its nature laws. These laws, notably the Habitats Directive (92/43/EC) and Birds Directive (2009/147/EC), provide for extensive protections including, in the Natura 2000 network, the largest coordinated network of protected sites in the world, covering over 18% of the EU’s terrestrial area and more than 8% of its sea area (European Commission, 2020a). Buttressed by robust judgments from the Court of Justice of the EU (“CJEU”) interpreting the requirements of the Habitats and Birds Directives strictly, in the light of the precautionary principle, protected habitats and species are subject to an impressively stringent legal regime in theory (Kingston et al, 2017: ch. 12). The practice, however, is often very different. In 2019, only 16% of protected habitats and 23% of protected species were in favourable conservation status (European Environment Agency, 2019).

To date, the EU has applied all three pillars of the Aarhus Convention to its own institutions via the so-called Aarhus Regulation (Regulation 1367/2006), but has only partially incorporated the Aarhus Convention into laws binding its Member States (Kingston, 2017: ch. 7). Aarhus’ first pillar (the right of access to environmental information) applies across the board (Directive 2003/4/EC). However, Aarhus’ second and third pillars (the rights of public participation and access to justice) have been incorporated only in certain fields (Directive 2003/35/EC), and have not been expressly incorporated into the Habitats or
Birds Directives. Nevertheless, the CJEU has interpreted these Directives in the light of the Aarhus Convention, emphasising the link between access to justice in environmental matters and “the desire of the European Union legislature to preserve, protect and improve the quality of the environment and to ensure that, to that end, the public plays an active role” (CJEU, 2013: Edwards). As a result, when applying the Habitats Directive, national courts must interpret their national procedural rules “in a way which, to the fullest extent possible, is consistent with the objectives laid down” in the Aarhus Convention (CJEU, 2011: Slovak Brown Bear). The European Commission has proposed legislation harmonising environmental access to justice within Member States, thus far to no avail (Kingston, 2017: ch. 7). The failure of the proposal to pass through the Council reflects the sensitivity of the area and the continued significant divergences between certain Member States’ national procedural rules, including rules on access to justice (Kingston, 2017: ch. 7). These divergences are confirmed by the results of our empirical research, below.

Strengthening the Aarhus mechanisms forms an important aspect of the governance reforms proposed by the European Green Deal, as highlighted by the recent strengthening of the Aarhus Regulation, and the issuing of a (non-binding) 2020 communication on improving access to justice within Member States (European Commission, 2019, 2020b and 2020c). The European Parliament and European Court of Auditors have identified addressing the implementation gap in EU nature law as an urgent priority in tackling the European biodiversity crisis (European Court of Auditors, 2017; Parliament, 2021). The EU’s current Biodiversity Strategy acknowledges that improving the implementation of EU environmental law is at the strategy’s “heart” (European Commission, 2020a). To this end, the engagement of the public with the Aarhus mechanisms is stated to be vital, to “strengthen the role which civil society can play as watchdog in the democratic space” (European Commission, 2020b). The Aarhus Convention is not only being embraced in Europe, but also in other continents: the 2018 Escazú Agreement in Latin America and the Caribbean, for instance, adopts the Aarhus model.

Within the legal and governance literature, doctrinal scholarship has considered the role of the CJEU in fortifying the legal protections of the Aarhus mechanisms, the role of the Aarhus Convention’s Compliance Committee, and the nature of the Aarhus Convention’s protections compared to those offered by other sources, such as the European Convention on Human Rights (Peters, 2018; Pirker, 2016; Samvel, 2020; Weaver, 2018). Surveying EU Member States’ legal implementation of the access to justice pillar of the Aarhus Convention, Darpö (2013, p. 3) concludes that there are “great disparities” in the manner of its implementation between legal orders, on issues such as ENGOs’ standing to bring legal proceedings, intensity of judicial review, and legal costs.

By way of illustration, within France, certain ENGOs may benefit from a special legal status by applying for an agrément (governmental approval) if they meet certain conditions, including that they have the principal object of environmental protection, have existed for at least 3 years, have a sufficient number of members, and a non-profit aim (Code de l’environnement, Article 141–2). If approved, ENGOs benefit from a variety of rights, including the right to participate in national or regional environmental consultative bodies, and a presumption of legal interest when bringing legal proceedings (Kingston et al., 2021b). Conversely, in the Netherlands, in order to have standing to bring legal proceedings, ENGOs need only show that the interests they seek to defend are reflected in their statutory aims and actual activities undertaken (Kingston et al, 2021b). In Ireland, ENGOs have standing as of right, and do not need to show a sufficient interest (Planning and Development Act, s. 50A(3)). As to legal costs, while the “loser pays” principle applies in France and the Netherlands, legal costs are typically far
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less than in common law systems such as Ireland, and means-tested legal aid is available for private citizens and ENGOs (Kingston et al., 2021b). Conversely, in order to implement EU law within the fields covered by the Aarhus Convention, Ireland has created a special environmental costs regime applicable to a number of areas within the scope of EU law, including Environmental Impact Assessment as well as the Habitats and Birds Directives, whereby each party pays their own costs (Planning and Development Act, s. 50B; Environment (Miscellaneous Provisions) Act 2011, s. 3), thus significantly reducing the risk that an environmentally motivated application might have to pay a large costs award if he/she loses the case.

Further work has focussed on limitations in the enforcement strategies of the European Commission as public enforcer. Eliantonio (2018, p. 762) has criticised “contradictory messages from the Commission” regarding ENGOs’ role in implementing EU environmental law, as they are excluded from the legal procedure where the European Commission decides to take infringement action against a Member State. Pointing to statistics showing that the number of environmental infringement actions brought by the European Commission has decreased significantly since 2008, Hofmann (2019, p. 358) has argued that the new private enforcement mechanisms available appear “to give the Commission an excuse to do less” in terms of public enforcement.

To date, however, remarkably little systematic data exists on how Europe’s private environmental governance laws have been working in practice, and the extent to which these laws have in fact been effective in achieving Aarhus’ environmental democratisation aims. While certain information can be found in the Aarhus State Parties’ periodical reports to the Aarhus Convention Secretariat, this information is patchy and is largely confined to reports of legal implementation (law “on the books”). Similarly, the European Commission’s biennial Environmental Implementation Review country reports largely reflect legal implementation and do not provide systematic data on use of the Aarhus mechanisms in practice. As Peters et al. conclude in a 2014 report surveying the information made available by EU Member States concerning the Habitats and Birds Directives “[a] major concern is that legal information on strict protection, court rulings and derogations, as well as information on impact assessments were rarely found within the different Member States” (Peters et al., 2014, p. 14). This is surprising, given the centrality of private environmental governance to the European Green Deal and the EU’s strategy to tackle the biodiversity crisis, and the fundamental transparency objective underpinning the Aarhus Convention.

Against this background, we break new ground in three principal ways.

First, we develop the Nature Governance Effectiveness Indicators (“NGEIs”), enabling quantitative measurement of the practical impact of Europe’s private nature governance laws, as compared to traditional public enforcement by the European Commission and by Member States’ enforcement bodies at national level. By governance rules, we mean, as mentioned above, the legal tools or “architectures” used to promote compliance with nature conservation rules (Heyvaert, 2018, p. 31).

Existing literature on compliance with EU environmental law has typically focused upon the compliance of Member States with EU law (see, for example, Börzel and Buzogány, 2019) and, at the national level, the compliance of regulated parties (such as industry and farmers) with environmental law (see, for example, Gunningham, 2010). We prefer the broader term effectiveness to the term compliance, in order better to reflect the focus of our study, namely the extent to which private nature governance laws have meant greater private enforcement in practice. The NGEIs represent, to our knowledge, the first indicators developed enabling such measurement of nature governance levels, drawing upon prior quantitative work in fields such as international human rights law (Cope et al., 2019).
By “effectiveness” of law, we mean the extent to which it has resulted in the desired changes in behaviour (Wanner, 2021; Young, 2011). In this, we acknowledge the “plethora of definitions and operationalisations of effectiveness” (Wanner, 2021, p. 116). In common with other environmental governance scholars (e.g., Dimitrov et al, 2019; Groen, 2019; Wanner, 2021; Young, 2011), we have deliberately excluded biogeophysical ecological quality measurements (such as the population levels of protected species over time) from the NGEIs, given the many confounding factors influencing such measurements aside from the governance regime. Our focus is therefore squarely on measuring the effectiveness of private governance laws in achieving their stated aim, not on the effectiveness of the Habitats and Birds Directives as such in improving on-the-ground nature quality.

Second, drawing upon data derived from publicly available information as well as over 300 formal and informal requests for access to environmental information made to the European Commission, and to national and sub-national bodies within Ireland, France and the Netherlands, we create a unique NGEI dataset, spanning 23 years from the birth of the Habitats Directive, showing the extent to which State and non-State enforcement mechanisms have been used in each jurisdiction. We respond to the repeated emphasis in the private governance literature for empirical research to evaluate the effectiveness of new governance approaches and to understand how the Aarhus Convention rights are working in practice (e.g., Verbruggen, 2013; Whittaker et al., 2019). In adopting a quantitative approach through the creation of the NGEI database, we complement existing qualitative research seeking to evaluate the effectiveness of private governance schemes under the Habitats Directive (e.g., Kingston et al., 2021b; Morris et al., 2014). We also complement existing quantitative research focusing on the impacts of public enforcement actions on levels of environmental compliance by regulated industry (Gray & Shimshack, 2011). In collecting data on the NGEIs, our core aim is to go beyond traditional analysis of law “on the books” to gain detailed insights into how these laws have been working on the ground.

Third, we measure the relationships between the changes in the nature governance laws over these 23 years and their effectiveness in practice over this time. We do so by regressing the NGEIs against the Comparative Nature Governance Index (“NGI”), an original index measuring the evolution of environmental governance laws in the EU. The NGI constitutes, to our knowledge, the first attempt to quantify the strength of nature governance rules. As set out in further detail in (Kingston et al., 2022), the NGI was constructed by coding over 6,000 nature governance laws from three levels of legal sources (international, EU and national), to provide the first systematic data showing the transformation of European nature governance regimes over a 23-year period, 1992–2015.

We employ panel data analysis to reveal the extent to which stronger private nature governance laws have, in reality, resulted in more private nature governance in practice over time. This statistical technique enables us to take into account the dynamic interactions between changes in the law and their effectiveness over time, going beyond cross-sectional approaches and providing a more robust test of these relationships. It also enables us empirically to test the relationships between stronger private nature governance laws and levels of public enforcement over time, and whether it is in fact accurate to say that more private enforcement has meant less public enforcement.

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1 Dimitrov et al (2019) helpfully distinguish between institutional and environmental effectiveness of environmental governance regimes to convey this difference.
3 Measuring the effectiveness of private nature governance laws: research design and method

3.1 Overview and country selection

We constructed the NGI (as independent variable) and NGEI (as dependent variable) datasets over a five-year period (2015–2020), with the assistance of a team of over 50 law students and graduates, selected from Irish, French and Dutch universities. As Table 1 illustrates, the States were selected to present a variety of geographic size of Member State, environmental conditions and record of compliance with EU environmental law, legal “family” of the State at issue (common law or civil law), and length of time taken to ratify the Aarhus Convention: see further, (Kingston et al., 2022).

3.2 Dependent variables: the nature governance effectiveness indicators

The NGEIs, as dependent variables, seek to show the manner in which nature governance laws have been employed in practice per year within our three selected jurisdictions, Ireland, France and the Netherlands, over the 23-year period 1992–2015. In constructing the NGEIs, we follow prior scholarship (Davis, 2014; OECD, 2005) on best practice in developing a composite set of legal indicators enabling quantitative measurement of the performance of law (in our case, nature governance rules) in practice. In line with this, the NGEIs were selected with the triple aims of being:

(1) As objective, and objectively measurable, as possible. To this end, the NGEIs measure behaviour, based upon data on actual use of traditional and Aarhus governance laws, rather than subjective opinions or beliefs (Davis, 2014, p. 43);

(2) Enabling the collection of data in as uniform a manner as possible across jurisdictions, allowing comparison between Member States, and avoiding measures that are not readily comparable or for which no complete data is available for certain Member States (OECD, 2005); and

(3) As detailed as possible, enabling a richness of analysis and avoiding undue oversimplification while maintaining objectivity and comparability (Davis: 44–45).

In this way, we have sought to avoid undue subjectivity and to construct the NGEIs in a manner that is as robust as possible (OECD, 2005; Voigt, 2013, pp. 18, 22). Specifically, in line with our theoretical focus set out above, the NGEIs distinguish between (a) public enforcement led by the State at national level, in Ireland, France and the Netherlands; (b) public enforcement led by the EU at EU level; and (c) enforcement by non-State actors, using the Aarhus mechanisms. The data collected were derived from a combination of publicly available information and over 300 formal and informal requests for access to environmental information made to the European Commission and to national and sub-national bodies within Ireland, France and the Netherlands. Where data was collected from searches of publicly available legal databases (such as www.eur-lex.europa.eu, and national legal databases), care was taken to employ the same search terms per indicator in each database, translated into the relevant language.

In line with our theoretical framework including the above definition of nature governance laws, which includes financial nature governance mechanisms, the NGEIs also
capture levels of funding relating to Natura 2000 sites, as foreseen by the Habitats Directive and the EU’s LIFE Regulation (in its current form, Regulation (EU) 2021/783). We also include figures on the levels of impact assessments carried out by State bodies under the core legal obligation imposed by Article 6(3) of the Habitats Directive, which is the obligation to carry out an “appropriate assessment” (AA) of any project that is likely to have a significant effect on a Natura 2000 site, and is not directly connected with or necessary to the management of that site, as well as levels of screening for AA (i.e. verification of whether an AA is required). Finally, again to capture the different means of operationalising nature governance rules, we include figures on enforcement not only before formal courts (such as national courts, and the CJEU), but also administrative bodies (such as the administrative planning appeals body in Ireland, An Bord Pleanála) and quasi-judicial bodies (such as the Aarhus Convention Compliance Committee). Figure 1 depicts the NGEIs as included in our model. A fuller explanation of the parameters of each NGEI, and the methods used to collect these data, can be found in Table 4 of the Appendix.

The NGEIs therefore measure core aspects of the ways in which the EU nature governance rules have worked in practice since the adoption of the Habitats Directive up to and including 2015. We do not, however, claim that the NGEIs capture all of the possible ways of measuring the practical impacts of these nature governance rules. In line with the literature on indicators (OECD, 2005), in constructing the NGEIs we sought to balance the aim of achieving sufficient breadth of indicators with the need to ensure robust data based on the information actually available, and which is comparable between jurisdictions. In our case, for instance, we had originally sought to include additional ways in which the Aarhus mechanisms are used by private parties, such as levels of third-party submissions made to administrative decision-makers in taking decisions to authorise individual projects. While this information is not publicly available, we sought to obtain it by means of informal contacts and formal requests for access to environmental information, made to relevant public bodies within each Member State, over a period of three years. Ultimately, however, we found that such data were not consistently recorded by the relevant public bodies, and the consistency, comparability and robustness of the data we obtained for these potential indicators was not of sufficient quality for inclusion within the

Table 1 Comparative data for jurisdiction selection. Sources: European Commission; European Environment Agency; Zweigert and Kötz (1998); UNECE

|                      | Ireland | France     | The Netherlands |
|----------------------|---------|------------|-----------------|
| Area (km²) (excluding overseas territories) | 70,273  | 551,695    | 41,198          |
| Area (km²) of Natura 2000 protected sites (incl. marine areas) | 19,481  | 203,564    | 20,605          |
| Open environmental infringement actions (Article 258 TFEU) in 2015 | 13      | 18         | 1               |
| Legal “family”        | Common law | Civil Law (Romanistic) | Civil Law (Germanic) |
| Length of time taken to ratify the Aarhus Convention (from 1998) | 14 years | 4 years    | 6 years         |

2 Further detail on the laws included as nature governance rules is provided below, in our discussion of the independent variable, and in (Kingston et al., 2022).
3.3 Independent variable: the comparative nature governance index

The NGI, representing our independent variable, comprises four continuous sub-indices aimed at measuring different aspects of what we term the strength of nature governance rules meaning, as discussed above, the legal tools or “architectures” used to promote compliance with nature conservation rules (Heyvaert, 2018, p. 31). In constructing the NGI, we build upon prior work (Kingston & Alblas, 2020; Kingston et al., 2017) to distinguish between laws imposing a criminal penalty for breach of a substantive rule; laws imposing a fine for breach of a substantive rule; laws or other rules creating economic incentives to engage in compliance (such as payments and subsidies granted to farmers and landowners for the provision of eco-system services); and laws promoting the principles of transparency, participation and/or access to justice in environmental matters. The last category encompasses the private environmental governance principles set out in the Aarhus Convention, which we term collectively the “Aarhus mechanisms”.

As further discussed in the partner article, we deliberately prefer the term nature governance rules to enforcement rules, as the former term encompasses a broader variety of rules aimed at promoting non-State actor compliance, including rules creating economic incentives to comply, or promoting private environmental governance and the Aarhus mechanisms. In this way, we look beyond traditional enforcement by State bodies or public agencies, recognising that effectiveness of different nature governance rules in achieving compliance increasingly depends on the broader environmental regulatory toolkit available, to harness the regulatory potential of non-State actors such as regulatees but also ENGOs and private citizens (European Commission, 2020a; Kingston et al., 2017). We also include governance rules that may apply to all types of environmental governance, as long as they apply to nature governance.

Applying this analysis in constructing the NGI, we develop what we term the “Traditional Governance” sub-index, comprising laws providing for criminal penalties (with or without a potential term of imprisonment and/or fine); civil and administrative fines; and financial incentives to comply (including payments and subsidies). The second, third and fourth sub-indices comprise laws providing for private governance in the form of the private environmental governance principles set out in the Aarhus Convention, which we term collectively the “Aarhus mechanisms”: access to information (“ATI”), public participation (“PP”) and access to justice (“ATJ”).

We divide these mechanisms into separate sub-indices in order more accurately to chart the strength of the private governance / Aarhus mechanisms over time. Within each sub-index, we identify 6 to 15 variables, each representing key aspects of that sub-index. In selecting these variables, we had regard to the state-of-the-art in scholarship on typologies of regulatory tools employed in environmental compliance and enforcement, official guidance of relevance to European nature governance and, in the case of the Aarhus mechanisms, the provisions of that Convention. Figure 2 shows the principal components of the

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3 For instance, there were no consistent overall data available on the number of projects subject to appropriate assessment during the studied time period; however, these data were available for a sub-group of projects (major infrastructure projects) in each State.
Fig. 1 Construction of the nature governance effectiveness indicators
NGI and a description of the coding protocol can be found in Table 5 of the Appendix. Further detail on the construction of the NGI is to be found in (Kingston et al., 2022).

We coded nature governance laws from 1992 (the date of adoption of the Habitats Directive) to 2015 inclusive, from five sources: international law, EU law, Irish domestic law, French domestic law and Dutch domestic law. In our final database, we coded a total of 6,145 laws, of which 403 comprise international laws, 470 EU laws, 1,161 Irish laws, 2,307 French laws and 1,804 Dutch laws. The database of laws to be coded was compiled by, first, performing a methodical search for the nature governance laws in force within the jurisdiction identified during this 23-year period, including constitutional law, legislation, case-law, and soft law. Second, in order to ensure that no important nature governance laws had been missed, a cross-check was performed against leading practitioner and academic textbooks and articles in the field. Third, a quality check was performed across all five sources to ensure that a consistent approach had been adopted to inclusion in the database (see further, Kingston et al., 2022).

Coding was based upon a questionnaire of 40 questions on the NGI variables, summarised in the Appendix, which was completed by the coders on Qualtrics.com for each of the laws in our nature governance database. In essence, in the case of the traditional governance sub-index, a higher score was assigned where stricter penalties and/or higher payments/subsidies were provided for in law. In the case of the Aarhus private governance sub-indices, a higher score was assigned to laws more fully enabling access to information, public participation and/or access to justice in environmental matters. Further detail on the NGI coding process can be found in (Kingston et al., 2022).

We then aggregated the variables in their numeric form within each sub-index per year and per legal source, to construct 20 continuous variables representing the strength of traditional and private/Aarhus nature governance rules, taking into account only those laws in force in the particular year in question.

To enhance comparability of indices between jurisdictions, we employed a novel technique removing the bias resulting from different absolute numbers of governance laws, which we term “inter-jurisdictional normalisation” (Kingston et al., 2022). This technique seeks to address the difficulty we had observed in the comparative leximetrics literature in making a proper comparison between the measurement of laws in one State and another. This may arise, for instance, because of the necessarily different structure in the legal systems of each State, meaning that, for instance, there may be numerically a greater number of French laws implementing the Habitats Directive than Irish laws implementing that Directive. To address this difficulty, we avoided a pure aggregation approach as used in prior literature, where ranking is based on the absolute values of the indices. Instead, employing an inter-jurisdictional normalisation approach, we first aggregated all variables within each index per jurisdiction by year. Using the minimum number of laws in one as the base, we then multiplied the values of index for each jurisdiction by this number and divided it by the number of laws for that jurisdiction. This approach enabled a more refined comparison between changes in the strength of nature governance rules between jurisdictions (see further, Kingston et al., 2022).

3.4 Control variables

To counter omitted-variable bias in our regression, we identified two potentially important variables that may have an impact on the use of nature governance laws in practice, and
Fig. 2 Construction of the nature governance index (see further, Kingston et al., 2022)
ought therefore to be controlled (Gray & Shimshack, 2011). The first was Gross National Income (GNI) per capita. Studies show a positive association between GDP and higher levels of implementation of law, including environmental law (see, for example, Castiglione et al, 2015). In this instance, we employed GNI rather than GDP as, in the case of Ireland, this gives a more meaningful indicator of the Irish economy due to its exclusion of outflowing profits of foreign-owned multinationals (Central Statistics Office, 2022). The second was urbanisation: studies demonstrate that greater urbanisation levels may have substantial negative effects on levels of nature protection and biodiversity (Elmqvist et al, 2013). Data on GNI per capita was collected from the World Bank database. Data on levels of urbanisation, indicating the proportion of the population living in urban clusters and in urban centres as distinct from rural areas (thickly populated areas), were collected from Eurostat. Both control variables were collected for Ireland, France and the Netherlands from 1992 to 2015. The analysis described in the following sections was conducted using Stata 16.

4 Results

4.1 The NGI

We first present the independent variable part of the analysis. Figure 3 graphically depicts the development of the traditional and private environmental governance index from 1992 to 2015.

As Fig. 3 shows, for most jurisdictions, the strength of traditional governance mechanisms has remained relatively stable over the 23-year period for most of our studied jurisdictions. The exception is Ireland, where the strength of traditional governance increased significantly over this period, reflecting the fact that the nature governance regimes of these jurisdictions were not all at similar levels in 1992: the next 23 years saw major reforms in environmental legislation in Ireland. The relative stability of the studied traditional nature governance regimes from 1992–2015 stands in contrast to the considerable increase in the strength of private/Aarhus governance mechanisms across all jurisdictions during this period. For further discussion of these trends in the evolution of the nature governance rules “on the books”, see (Kingston et al., 2022).

4.2 The NGEIs

While space precludes graphical depiction of each of our NGEIs, certain of the data collected are of interest in their own right, even prior to the regression analysis. This is so, for

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4 We considered a number of other control variables as being of potential interest and relevance, including environmental attitudes in the population, and levels of respect for the rule of law. However, due to a lack of consistent and reliable data for the entire study period for these variables, the control variables of GNI and urbanisation were preferred.

5 Data was retrieved from: https://data.worldbank.org/indicator/NY.GNP.MKTP.PD. (accessed 12 Jan 2022).

6 Data was retrieved from: https://ec.europa.eu/eurostat/web/degree-of-urbanisation/data/database (accessed 15 October 2021).
instance, for the EU-led indicator covering the number of Article 258 TFEU infringement actions commenced against the Member States in question, depicted in Fig. 4.

These data show a clear peak in the commencement of such Article 258 TFEU proceedings against all three Member States between the years 1997 and 2003, from a low level prior to 1997, and reverting back to a low level from 2003 onwards. This peak is particularly pronounced for Ireland and France, but is also evident for the Netherlands. We discuss below the implications of these data, which show that the Commission has moved towards a “management” approach to environmental compliance (Eliantonio, 2018; Hoffman 2019) even within the field of nature law, reducing its use of formal legal proceedings. The Environmental Implementation Review system, created in 2016, is a more recent example of this phenomenon, as a further “soft” mechanism whereby biennial per-country reports on implementation performance are published with the aim of providing a “synthetic picture” of where each Member State stands, and thereby to “strengthen the EU’s compliance culture in the area of environmental policies” (European Commission, 2016). At the same time, the Commission is emphasising the need for Member States to provide access to justice pursuant to the Aarhus mechanisms and promoting the availability of recourse to the courts by non-State actors (European Commission, 2020b).

Turning to the non-State-led NGIs, we depict in Fig. 5 below the evolution in the number of proceedings brought by private parties (including ENGOs) before national courts where the Plaintiff sought to enforce EU nature law, between 1992 and 2015.

As Fig. 5 shows, there has been a marked increase in the number of private proceedings brought to enforce EU nature law across each of our three studied jurisdictions between 1992 and 2015.8 The upward trajectory is not, however, uniformly present year-on-year: within Ireland and France, in particular, one sees troughs and peaks, although the curve

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7 It should be recognised, however, that Commission-led enforcement is only one part of the public enforcement picture: the Commission relies not only on private enforcers, but also national and sub-national level public authorities to enforce EU nature law.

8 It should be noted, however, that the official legal databases listed above, which constituted our sources for the above data, differ slightly in the scope of the courts covered, due inter alia to the differences in the ways in which the court systems are organized in Ireland, France and the Netherlands. For instance, the Irish databases cover judgments handed down by the Superior Courts of Ireland, but not the Circuit Court or District Court (for which no written judgments are normally furnished). Conversely, the Dutch databases cover district courts (Rechtbanken) and higher courts. While such differences are therefore inevitable, there is therefore a need for some caution in attempting to directly compare the absolute numbers of cases brought in each country.
maintains its overall upward direction. As we discuss below, such troughs and peaks suggest that, even where nature governance rules become stronger, this may not necessarily lead to a consistent increase in their use in practice. Our panel data regression analysis further explores this phenomenon.

4.3 Regression analysis

4.3.1 Principal component analysis

As we have 14 NGEIs, we first performed principal component analysis (PCA) to reduce the overmuch dimensionality of the original outcome variables of interest. PCA is a multivariate technique that reduces the dimensionality of the data while retaining most of the variation in the dataset. It helps to reduce the number of variables in an analysis by describing a series of uncorrelated linear combinations of the variables that contain most of the variance (Abdi & Williams, 2010; OECD, 2005). We first standardised the 14 NGEI variables, and PCA with varimax rotation was conducted on the 6 State-led NGEIs, 3 EU-led NGEIs, and 5 Private Party-Led NGEIs, respectively. Components were then extracted from the PCA, applying the Kaiser rule (eigenvalue higher than one: see Kaiser, 1960) and steep elbows criterion (Ten Berge & Kiers, 1996). Scree plots are shown in Fig. 6 below.

We extracted the first component (PC1) from the State-led NGEIs PCA and the EU-led NGEIs PCA, and the first and second components (PC1 and PC2) from the Private Party-Led NGEIs PCA. Table 2 shows the percentage of variance accounted for within, and the eigenvalues of, each component extracted from each PCA. In the Private Party-Led NGEIs PCA, two components were extracted rather than one, as PC1 and PC2 each had an eigenvalue higher than one. The number of private national court proceedings brought to enforce EU nature law, the total number of national court judgments applying EU nature law, and the number of EU nature law-related appeals before national administrative bodies, are highly loaded on PC1. The number of cases taken before the Aarhus Convention Compliance Committee, and the number of access to environmental information appeals, are highly loaded on PC2. Detailed factor loadings for all PCs are shown in the Appendix. These four components are used as the dependent variables in the following regression analysis.
4.3.2 Panel data analysis

The two commonly used approaches for panel data analysis are the fixed-effects (FE) and the random-effects (RE) models. FE models treat the effect-size parameters as fixed but unknown constants to be estimated, and are typically used in conjunction with assumptions about the homogeneity of effect parameters. RE models treat the effect-size parameters as if they were a random sample from a population of effect parameters and estimate hyperparameters describing this population (Clark & Linzer, 2015; Hedges, 1983; Snijders, 2005). Compared with RE models, FE models may mean that regressors are correlated with individual-level effects, such that consistent estimation of regression parameters requires eliminating or controlling for the fixed effects (Bell & Jones, 2015; Cameron & Trivedi, 2009, p. 237).

The EF and FE models are often applied in short panels (few time periods and many individuals). Our NGEI-NGI dataset is, however, a long panel dataset with many time periods, and relatively few individuals ($t=24$, $n=3$). Cameron and Trivedi (2010, pp. 273–277) suggest two estimators in Stata to deal with such long panel datasets: *xtgls* and *xtregar*. *Xtgls* fits panel data linear models by using feasible generalised least squares. *Xtregar* fits cross-sectional time-series regression models when the disturbance term is first-order autoregressive (Baltagi & Wu, 1999; Reed & Ye, 2011). It offers a within estimator
for fixed-effects models and a generalised least-squares (GLS) estimator for random-effects models.

To determine which estimator to use in our analysis, we first performed the Wooldridge test (Drukker, 2003) for autocorrelation (Stata command: \textit{xtserial}), to examine whether our data showed autocorrelation. The results showed that autocorrelation was detected only within Private Party-Led NGEI PC1 ($p < 0.00$), while the other three datasets had no autocorrelation ($p > 0.05$). To be consistent across all three groups of NGEI analysis, we used \textit{xtgls} for our main analysis and \textit{xtregar} for our robustness check. The estimation results are presented in Table 3.

The results from Table 2 reveal that there are significant associations between the Private Governance and Traditional Governance Indices and all three categories of NGEIs. We outline these below, and return to discuss their policy implications in the conclusion.

In the case of State-led NGEIs, we found that the Private Governance Index is positively associated with State-led NGEIs: stronger private nature governance laws meant greater State enforcement. This indicates that, contrary to what is sometimes suggested, stronger laws on access to environmental information, public participation and access to justice in environmental matters did not result in lower levels of State enforcement of nature laws at the national level. This is an important finding which empirically reveals, to our knowledge for the first time, that \textit{by strengthening private nature governance laws, States may also in fact improve traditional State enforcement of nature laws on the ground}. State enforcement authorities may, for instance, feel motivated (or pressured) into applying EU nature laws more stringently in the knowledge that their actions could become public (through exercise of the right to access to environmental information) or where the public have made submissions on the matter (through exercise of the right to participate in environmental decision-making). Similarly, more stringent State enforcement may result where public bodies are aware of a heightened risk of litigation (through exercise of the right of access to environmental justice).
Conversely, stronger traditional governance laws did not consistently translate into greater State enforcement in practice. While this may appear counterintuitive at first sight, it in fact concords with prior scholarship showing that, while traditional governance laws may be strengthened for many reasons (including, for instance, to stave off complaints that the State is not taking nature protection sufficiently seriously), this does not necessarily mean that the frequency of sanction will increase in practice, or that the tougher sanctions available will in fact be frequently applied (see, for instance, Humphery-Jenner, 2013). Likewise, there may be a perceived regulatory rationale for enforcers to adopt a lighter-touch approach to enforcement in certain cases. For instance, enforcers may seek to adopt a compliance or management-based approach initially and escalate sanctions only in the event of repeated non-compliance (Gunningham, 2010). This confirms that the weakness in levels of implementation of the EU nature laws will not be solved by resorting to the “quick fix” of increasing the stringency of traditional governance mechanisms such as levels of maximum criminal penalties and civil fines.

Interestingly, therefore, our findings show that, while strengthening private governance laws significantly improved levels of State nature enforcement, strengthening traditional governance laws did not. Practically, this may mean that strengthening private governance rights may be more effective in improving State enforcement levels than increasing the stringency of traditional governance mechanisms such as levels of maximum criminal penalties or civil fines. This empirical finding adds an intriguing chapter to the current regulatory scholarship on private actors, where Börzel and Risse memorably conceptualised such actors as taking governance decisions within the “shadow of hierarchy” comprised by State law (Börzel and Risse, 2010). Our findings show, in fact, that the reverse is also true: a
shadow of heterarchy also exists, as bottom-up private governance mechanisms themselves encourage stronger State enforcement of EU nature laws.

For EU-led NGEIs, our results show very different patterns. We found a negative association between the Private Governance Index and EU-led NGEIs: stronger private governance laws meant less EU-led nature enforcement. This supports suggestions in the scholarship (e.g., Hofmann, 2019; Kingston & Alblas, 2020), discussed above, that the European Commission has shifted away from use of formal legal proceedings against Member States, as Member States have strengthened private nature governance laws.

Conversely, we found a positive association between traditional NGI and EU-led NGEIs. This may suggest a tendency of Member States to strengthen the “law on the books” (for instance, increasing maximum penalties for breach of nature law) as a rapid means of responding to enforcement action on the part of the European Commission. As our findings in relation to State-led NGEIs show, however, such strengthening of laws on paper does not necessarily translate into more robust State enforcement of EU nature law on the ground. Similarly, the fact that stronger governance laws do not imply less EU-level enforcement is unsurprising, given that Article 258 TFEU proceedings may target non-implementation of EU nature law in practice, not merely inadequate transposition in Member States’ law on the books.

For Private Party-led NGEIs, we found a negative association between the Traditional Governance Sub-Index and Private Party-led NGEI PC1. As PC1 denotes levels of private enforcement before national courts and by means of administrative appeals, this shows that weaker traditional governance laws “on the books” results in greater levels of private nature enforcement by means of access to justice. Private citizens and ENGOs conscious of weak or non-existent penalties for breach of the EU Habitats Directive are therefore taking matters into their own hands before the courts and administrative appeal bodies.

Conversely, we did not detect any statistically significant association between the Private Governance Sub-Index and Private Party-led NGEI PC1. Further, the Private Governance Sub-Index was negatively associated with PC2, largely representing the numbers of complaints brought before the Aarhus Convention Compliance Committee, and the number of access to environmental information appeals. This finding is also important, as it constitutes, to our knowledge, the first systematic empirical evidence of the disconnect between Europe’s revolution in private governance laws on the books, and the use of these laws in practice. The use of such private governance mechanisms in practice has not kept pace with their development in law. More private governance law has not consistently meant more action. Naturally, this begs the question what the cause(s) of such disconnect might be. We return to this question below.

Finally, our results also showed that GNI per capita and rate of urbanisation are positively associated with levels of private governance in practice (respectively, with Private Party-led NGEI PC1, and Private Party-led NGEI PC2).

Current scholarship suggests that higher GDP—or the more appropriate metric of economic activity used in our case, GNI—leads to greater State enforcement due to, for instance, better-resourced State enforcement agencies (e.g., Castiglione et al, 2015). Our

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9 We note that it could be argued, for instance, that lower figures of complaints to the ACCC might be interpreted as meaning that national private governance laws are more effective in practice, as in that case there may be no need for citizens to go to the ACCC, as an international body, to exercise their rights. This is a possible explanation for the negative association in the case of PC2, although it is not easily reconcilable with our data indicating limited effectiveness of national private governance mechanisms.
findings go beyond this and suggest that this positive effect of GDP/GNI also increases levels of private nature enforcement. This may reflect the fact that, often, exercising private governance rights under the Aarhus mechanism may be costly for the individual in practice. While the Aarhus Convention requires that accessing environmental justice must not be “prohibitively expensive”, the total costs of taking environmental litigation can still be substantial (European Commission, 2020b).

As concerns urbanisation, the positive association with private nature enforcement is arguably consistent with the evidence that greater levels of urbanisation tend to have a negative effect on nature conservation levels and biodiversity (Elmqvist et al, 2013). With greater urbanisation, therefore, there may be a greater environmental need, to which private parties respond by engaging in private nature enforcement. This brings with it, however, a need for caution. The evidence shows that, where those perceived as “city-dwellers”, who are not from the local countryside, become involved in private enforcement of the EU’s nature laws, this can at times have perverse effects and can crowd-out the intrinsic motivations of farmers and other landowners of protected areas (Kingston et al, 2021b). Such private enforcement must, therefore, be undertaken with care.

4.3.3 Robustness checks

We present results from a series of robustness checks in the Appendix, arrived at by using different panel data estimation techniques. These results are consistent with our previous analysis. Overall, therefore, having used different panel data models to investigate the relationships between the NGIs and NGEIs, we have confidence that our results are robust.

5 Conclusions and implications

In the battle to address Europe’s biodiversity crisis, fixing its implementation gap—the gap between EU nature law on the books, and on the ground—is vital. Europe’s private nature governance revolution, underpinned by the Aarhus mechanisms, is a core part of its response. This article breaks new empirical ground in understanding how those mechanisms have been working in practice, and their knock-on effects for traditional enforcement by the State. In developing the NGEIs, we create a methodological tool enabling, for the first time, quantitative measurement of the effectiveness of public and private nature governance in practice. In collecting data on the NGEIs, we create a novel dataset spanning three jurisdictions and 23 years, giving a unique insight into Europe’s “environmental democracy in action”. In regressing the NGEIs against the NGI, an original longitudinal index measuring the evolution in nature governance laws over this period, we reveal important new findings allowing a better understanding of not only how the EU’s private nature governance laws have been working, but also how they have impacted levels of traditional State-led enforcement.

We hope that our new methodological tool, the NGEIs, will be used and built upon by other scholars wishing to tackle the thorny issue of measuring the effectiveness of environmental law, and that it will spark future quantitative research into this vital area. Obvious possibilities might include expanding the countries studied to other EU Member States, or to other fields of environmental law such as air or water quality. While the task of accurately measuring law and its effectiveness is certainly complex and requires significant data
collection, this should not mean a rejection of quantitative approaches, or justify reliance solely on more traditional qualitative or doctrinal approaches. Rather, we hope that our work further encourages quantitative approaches as a valuable complement to qualitative and doctrinal legal research.

Beyond this, our work has at least three important theoretical and policy implications. First, our results tell a cautionary tale of Europe’s private nature governance revolution. While our results confirm the widespread embrace of private nature governance laws on the books across our studied jurisdictions from 1992–2015 (Fig. 3), they also provide, to our knowledge, the first systematic empirical evidence that these enhanced rights for citizens are not being consistently used in practice (Table 2). To take access to justice as an example, while we certainly found an increase in cases brought by private parties to enforce EU nature law before national courts (Fig. 5), this increase was bumpy and, in the case of Ireland and France, figures still remained at relatively low levels (Figs. 5a and b). Overall, as we discuss above, the use of private nature governance mechanisms in practice has not kept pace with their development in law. Further, data on levels of use of the Aarhus mechanisms were often difficult to access, leading to a basic lack of transparency on the success of these new governance mechanisms, a situation itself incongruous with the aims of the Aarhus Convention.

In terms of policy lessons, these results underscore the danger in overreliance on the Aarhus mechanisms to fill the gaps left by under-enforcement by State and/or EU authorities. Specifically, they highlight the fact that passing private nature governance laws is far from the end of the story for policymakers wishing to engage a potential citizen “watchdog” environmental enforcement army to complement public enforcement.

Naturally, this raises the question what the cause(s) of such disconnect, or “governance implementation gap”, might be. While this goes beyond the scope of our present quantitative findings, the qualitative literature to date suggests multiple, at times complex, reasons why the legal rights to enforce EU nature law conferred upon private parties are, oftentimes, going unused. In other work, based on interviews with private individuals and ENGOs and other stakeholders from across the same Member States as were studied for the present article, we explore these reasons in depth (Kingston et al., 2022). Our conclusions were that strengthening private nature enforcement rules “on the books” may be ineffective, or even counterproductive, depending upon the broader regulatory conditions at play. Rather, in order for private nature governance rules to be really effective, policymakers should seek to maximise certain non-legal magnetising factors for voluntary environmental enforcement (by, for instance, ensuring that ENGOs have sufficient financial resources to operate, and showcasing instances where citizen/ENGO enforcement action has successfully made a difference). They should also seek to minimise certain repelling factors for such voluntary environmental enforcement (by, for instance, acting to prevent citizens/ENGOs from retribution for their involvement in nature enforcement, and reducing informational barriers to environmental enforcement), insofar as possible.

Second, concerning EU-level enforcement, our results confirm a shift away from the use of formal Article 258 TFEU infringement proceedings by the European Commission in the field of nature law in recent years, from a peak in such use between 1997 and 2003 (Fig. 4). This is consistent with the Commission’s broader change in approach to its own role in environmental compliance. While Member States’ authorities have always been seen as the first port of call for enforcement of EU environmental law, the past decade has seen a conscious embrace of management-based compliance strategies, where Article 258 TFEU legal proceedings are employed only as a last resort in strategically important cases.
In parallel with this shift, the Commission has focused on the need for Member States to properly implement the Aarhus mechanisms, enabling citizens to become environmental enforcement “watchdogs” (European Commission, 2020b) and unleashing European environmental democracy in action. In revealing the inconsistencies in use of the Aarhus mechanisms in practice, even where those mechanisms are implemented in law, our results suggest there is a need for circumspection and prudence if the Commission is to rely upon private nature enforcers as (part of) the solution to the EU’s nature law implementation gap. This finding is significant for future scholarship considering the appropriate role of private enforcement in the EU’s environmental enforcement toolbox.

Third, our results reveal for the first time that, despite these inconsistencies in usage of the Aarhus mechanisms in practice, passing private governance laws can in fact improve levels of State enforcement of EU nature law in practice (Table 2). Fascinatingly, we found that, while strengthening private governance laws significantly improved levels of State nature enforcement, strengthening traditional governance laws did not. For policymakers seeking to increase enforcement of EU nature law on the ground, harnessing the shadow of heterarchy, by strengthening private governance rights, may therefore be a more effective means of doing so than simply ratcheting up existing traditional governance mechanisms such as levels of maximum criminal penalties or civil fines. We hope that our work inspires future scholars to further investigate exactly how this shadow of heterarchy may best be harnessed, to strengthen the effectiveness of environmental law.

Appendix

See Tables 4, 5, 6, 7.
Table 4 Outline methodology for constructing the nature governance effectiveness indicators

| NGEI                                                                 | Collection methodology                                                                 |
|---------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| **State-led NGEIs:**                                                 |                                                                                        |
| State-led proceedings to enforce EU nature law before national courts| Ireland: Data obtained by the research team from the Irish National Parks and Wildlife Service<br>France: Data collected via the French Aarhus implementation reports, which provide information on the number of State-led court actions to enforce environmental law<br>The Netherlands: Data obtained via the department of research within the Public Prosecutor’s office |
| Funding of Natura 2000 projects                                     | Ireland, France, The Netherlands: Data collected via the European Commission LIFE Program Environment website |
| Number of large infrastructure projects screened for appropriate assessment| Ireland: Data collected via An Bord Pleanála’s database<br>France: Data collected via the ‘Système d’Information du Développement Durable’ database<br>The Netherlands: Data collected via the Ruimtelijkeplannen database |
| Number of large infrastructure projects subject to appropriate assessment| Ireland: Data collected via An Bord Pleanála’s database<br>The Netherlands: Data collected via the Ruimtelijkeplannen database |
| Number of Notifications under Article 6(4) of the Habitats Directive | Ireland, France, The Netherlands: Data provided to the research team by the European Commission’s DG Environment – Nature Protection Unit |
| KM2 of sites designated as Natura 2000 sites                        | Ireland, France, The Netherlands: Data provided to the research team by the European Commission’s DG Environment – Nature Protection Unit and the European Commission’s DG Environment under Natura 2000 Barometer Statistics and the European Commission’s DG Environment – Nature Protection Unit |
| **EU-led NGEIs:**                                                   |                                                                                        |
| Number of Article 258 TFEU Nature infringement proceedings commenced by the European Commission against the Member State| Ireland, France, The Netherlands: Data provided to the research team by the European Commission’s DG Environment |
| Number of Nature Article 258 and 260 TFEU Judgments against the Member States | Ireland, France, The Netherlands: data obtained through the EurLex and Curia databases, and this number was verified through annual reports published by the European Commission |
| Number of CJEU Nature judgments (including preliminary references from the Member State’s courts) | Ireland, France, The Netherlands: data obtained through the EurLex and Curia databases |
| **Private (Non-State)-led NGEIs**                                   |                                                                                        |
| Number of decided cases before national courts where a private party seeks to enforce EU nature law | Ireland: Data collected via Justis and BAILLI databases<br>France: Data collected via the Legifrance database<br>The Netherlands: data collected via the Rechtspraak.nl and Uitspraken.nl databases |
| NGEI                                      | Collection methodology                                                                                                                                 |
|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| Number of decided cases before national courts where the Court applies EU nature law | Ireland: Data collected via Justis and BAIL.LI databases                                                                                                                                               |
|                                          | France: Data collected via the Legifrance database                                                                                                                                                      |
|                                          | The Netherlands: data collected via the Rechtspraak.nl and Uitspraken.nl databases                                                                                                                           |
| Number of appeals before national administrative bodies relying on EU nature law      | Ireland: Data collected via An Bord Pleanála database                                                                                                                                                   |
|                                          | France: Data was collected via the Legifrance database                                                                                                                                                     |
|                                          | The Netherlands: data collected via the Rechtspraak.nl and Uitspraken.nl databases                                                                                                                           |
| Number of cases taken by private parties against the Member State before the Aarhus Convention Compliance Committee concerning nature | Ireland, France, The Netherlands: Data collected via the communications on the ACCC website                                                                                                             |
| Number of appeals concerning access to environmental information concerning nature    | Ireland: Data obtained from information published on the Office of the Commissioner for Environmental Information (OCEI) website                                                                    |
|                                          | France: Data obtained through the Commission d’Accès aux Documents Administratifs ‘base d’avis’ public database                                                                                           |
|                                          | The Netherlands: Data obtained through access to environmental information requests sent to all Dutch provinces and relevant ministries                                                                 |
Table 5  Nature governance index coding protocol

I. Traditional nature governance index

| 1. Criminal penalty with custodial sentence | Possibility of criminal penalty with custodial sentence = 6; No possibility = 0 |
|                                           | Maximum sentence from < 6 months to + 6 years = Graduated scale of between 1–6 applied; Unspecified = 0 |
| 2. Criminal penalty with fine             | Possibility of a criminal penalty with a fine = 5; No fine = 0 |
|                                           | Maximum fine from €1 (or national currency equivalent) to + €1 million = Graduated scale of 0.5–5 applied; None specified = 0 |
| 3. Criminal penalty with possibility of damages | Possibility of a criminal penalty with damages = 4; No possibility = 0 |
| 4. Civil fine                             | Possibility of civil (non-criminal) fine/penalty = 3; No possibility = 0 |
| 5. Administrative fine                    | Possibility of an administrative fine/penalty in the case of breach; No possibility = 0 |
|                                           | Maximum administrative fine €1 (or national currency equivalent) to + €1 million = Graduated scale of 0.2–2 applied; None specified = 0 |
| 6. Financial incentive                    | Financial incentive for pro-environmental behaviour = 1; None = 0 |
|                                           | Maximum incentive €1 (or national currency equivalent) to + €1 million = Graduated scale of 0.1–1 applied; None specified = 0 |

II. Private governance index

A. Access to Information Sub-Index

| 1. Implementation of Aarhus Convention | Created to implement the Convention = 1; No/unclear = 0 |
| 2. Aim                                | Aim of increasing access to information = 1; No/unclear = 0 |
| 3. Public/privately held information  | Applies to public & privately held information = 1; Only public or private = 0.5 |
| 4. Legal right                        | Creates legal right of access = 5; No/unclear = 0 |
| 5. Beneficiary                        | Information available to public in general without need to request; to public in general upon request; to only certain members of the public upon request; Graduated scale of between 1 and 0 applied |
| 6. Time limits                        | Clear timeline for provision = 1; None = 0 |
|                                           | Information to be provided as soon as possible; 1 month or less after a request; 2 months or less after a request; +2 months after a request. Graduated scale of 1–0 applied |
| 7. Cost                               | No charge for access = 1; Charge = 0 |
|                                           | Charge of €20 + €60; Graduated scale of 1–0 applied |
| 8. Scope of exceptions                | Graduated scale of 1–0 applied according to breadth of exceptions to right accorded |
| 9. Format                             | Information to be publicly available online = 1; Not specified = 0 |
| 10. Appeal                            | Graduated scale of 1–0 if decision can be challenged by court / court or administrative body / not subject to challenge |
Table 5 (continued)

II. Private governance index

| 11. Cost of appeal | No charge = 1; Charge = 0  
Graduated scale of 1–0 if cost of appeal is < € 20 to + € 60 |
| 12. Legal right | Creates legal right of participation = 5; No/unclear = 0  
Graduated scale of 1–0 applied according to scope of projects/activities covered (broader, equal to or narrower than Directive 2003/35/EC) |
| 13. Scope of rule | Graduated scale of 1–0 applied according to scope of beneficiaries (broader, equal to or narrower than Directive 2003/35/EC)  
Graduated scale of 1–0 applied according to timeline for participation (broader, equal to or narrower than Directive 2003/35/EC) |
| 14. Beneficiary | Created to implement the Convention = 1; No/unclear = 0  
Aim of increasing public participation = 1; No/unclear = 0 |
| 15. Deadline | Aim of increasing public participation = 1; No/unclear = 0  
Graduated scale of 1–0 applied according to level of charge applied |
| 16. Cost of public participation | Legal duty to take observations into account = 1; None = 0  
Legal duty to inform participating public of decision = 1; None = 0 |
| 17. Impact of observations | Created to implement the Convention = 1; No/unclear = 0  
Aim of increasing access to justice = 1; No/unclear = 0 |
| 18. Duty to inform the public | Graduated scale of 1–0 applied according to whether substantive right, sufficient interest, or broader standing rule applied |
| 19. Legal standing for individuals | Graduated scale of 1–0 applied according to whether substantive right, sufficient interest, or broader standing rule applied |
| 20. Legal standing for ENGOs | Graduated scale of 1–0 applied according to whether substantive right, sufficient interest, or broader standing rule applied |
| 21. Substantive/procedural legality | Graduated scale of 1–0 applied according to whether solely procedural legality may be challenged, or substantive and procedural legality |
| 22. Availability of interim relief | Injunctive/interim relief available = 1; None = 0 |
| 23. Limitation period | Graduated scale of 1–0 applied depending on length of limitation period for bringing a claim |
| 24. Costs | More favourable costs regime for environmental claims = 1; None = 0 |
| 25. Discretion in costs | Graduated scale of 1–0 applied depending if applicants’ award of costs conditional on judicial discretion |
| 26. Protective Costs | Protective Costs Order possible = 1; Not possible = 0 |
### Table 5 (continued)

| II. Private governance index | Legal aid provided for environmental claimants = 1; Not provided = 0 |
|-----------------------------|---------------------------------------------------------------|
| 13. Legal aid               |                                                               |
| 14. Accessibility of information | Information on Access to Justice must be made available to public = 1; No such requirement = 0 |
| 15. Cost of information     | Decisions on environmental matters must be publicly accessible free of charge = 1; No such requirement = 0 |

### Table 6  
Nature governance index dataset, 1992–2015

| Year | International law traditional governance index | International law new governance index | EU law traditional governance index | EU law new governance index | IE traditional governance index | IE new governance index | FR traditional governance index | FR new governance index | NL traditional governance index | NL new governance index |
|------|-----------------------------------------------|---------------------------------------|------------------------------------|-----------------------------|-------------------------------|-------------------------|-----------------------------|---------------------------|-----------------------------|--------------------------|
| 1992 | 0                                             | 31.75                                 | 0.46                               | 6.98                        | 2.89                          | 16.76                   | 0.37                        | 20.93                     | 4.88                        | 14.14                    |
| 1993 | 1                                             | 31.75                                 | 0.93                               | 15.14                       | 3.96                          | 35.52                   | 0.63                        | 20.93                     | 4.88                        | 14.14                    |
| 1994 | 1                                             | 31.75                                 | 1.16                               | 29.72                       | 4.22                          | 40.59                   | 1.37                        | 22.23                     | 4.99                        | 146.69                   |
| 1995 | 1                                             | 35.85                                 | 1.16                               | 29.72                       | 4.71                          | 41.98                   | 2.55                        | 30.79                     | 5.4                         | 164.55                   |
| 1996 | 1                                             | 35.85                                 | 1.39                               | 35.97                       | 10.24                         | 59.11                   | 3.39                        | 33.07                     | 5.99                        | 166.82                   |
| 1997 | 1                                             | 37.35                                 | 1.39                               | 71.57                       | 11.11                         | 63.74                   | 3.77                        | 39.5                      | 6.28                        | 169.62                   |
| 1998 | 1                                             | 45.35                                 | 1.39                               | 74.91                       | 13.39                         | 98.37                   | 4.01                        | 45.49                     | 6.4                         | 189.65                   |
| 1999 | 1                                             | 49.35                                 | 1.39                               | 120.23                      | 13.39                         | 98.37                   | 4.25                        | 52.26                     | 6.98                        | 194.59                   |
| 2000 | 1                                             | 53.35                                 | 1.62                               | 138.26                      | 18.28                         | 110.28                  | 6.2                         | 87.06                     | 6.98                        | 199.67                   |
| 2001 | 1                                             | 114.15                                | 1.62                               | 188.12                      | 18.55                         | 126.12                  | 7.14                        | 137.41                    | 7.1                         | 199.67                   |
| 2002 | 1                                             | 114.15                                | 3.93                               | 195                         | 18.81                         | 139.64                  | 7.31                        | 142.36                    | 7.86                        | 206.78                   |
| 2003 | 1                                             | 136.8                                 | 4.63                               | 198.8                       | 20.24                         | 169.87                  | 7.63                        | 166.38                    | 8.21                        | 206.78                   |
| 2004 | 2                                             | 166.7                                 | 4.86                               | 232.12                      | 22.12                         | 191.7                   | 8.23                        | 195.62                    | 8.32                        | 206.78                   |
| 2005 | 2                                             | 197.8                                 | 5.78                               | 287.57                      | 23.68                         | 191.7                   | 9.69                        | 260.09                    | 8.56                        | 307.7                    |
| 2006 | 2                                             | 207.25                                | 5.78                               | 329.8                       | 23.68                         | 209.63                  | 12.79                       | 298.93                    | 8.5                         | 323.1                    |
| 2007 | 2                                             | 214                                   | 6.94                               | 335.27                      | 26.17                         | 219.87                  | 13.1                        | 311.38                    | 8.5                         | 326.44                   |
| 2008 | 2                                             | 280.9                                 | 6.71                               | 382.68                      | 26.17                         | 266.45                  | 14.27                       | 339.9                     | 8.5                         | 324.48                   |
| 2009 | 2                                             | 346.45                                | 6.71                               | 439.6                       | 27.18                         | 313.39                  | 15.31                       | 344.21                    | 10.59                       | 333.05                   |
| 2010 | 2                                             | 381.9                                 | 6.71                               | 457.95                      | 37.29                         | 426.09                  | 17.51                       | 419.15                    | 8.62                        | 336.91                   |
| 2011 | 2                                             | 431                                   | 6.71                               | 486.84                      | 39.37                         | 493.95                  | 16.72                       | 434.46                    | 8.62                        | 344.01                   |
| 2012 | 2                                             | 436.75                                | 6.71                               | 512.13                      | 39.78                         | 486.3                   | 17.9                        | 503.4                     | 8.62                        | 346.81                   |
| 2013 | 2                                             | 436.75                                | 7.17                               | 540.56                      | 39.7                          | 506.27                  | 18.22                       | 535.55                    | 8.62                        | 338.9                    |
| 2014 | 3                                             | 468.8                                 | 7.17                               | 563.27                      | 39.08                         | 502.61                  | 17.72                       | 564.31                    | 8.85                        | 339.95                   |
| 2015 | 3                                             | 468.8                                 | 7.17                               | 563.27                      | 39.17                         | 517.1                   | 17.48                       | 574.35                    | 9.64                        | 339.82                   |

Since we coded different numbers of laws for each jurisdiction, to make the indices comparable, all the indices were normalised. We only used Irish, French and Dutch traditional and new governance indices in the panel analysis.
### Table 7  Factor loading

| Factor | State-led NGEI | EU-led NGEI | Non-state-led NGEI PC1 | Non-state-led NGEI PC2 |
|--------|----------------|-------------|------------------------|------------------------|
| No. of state-led court action | 0.38 | 0.36 | 0.57 | -0.01 |
| EU funding | 0.30 | 0.66 | 0.57 | -0.01 |
| No. of large projects screening | 0.46 | 0.66 | 0.57 | 0.03 |
| No. of large projects appropriate assessment | 0.47 | ACCC | 0.08 | 0.71 |
| Km² of designated sites | 0.47 | 0.34 | |
| No. of notifications of compensatory measures under article 6(4) of the habitats directive to the commission | |

Loading scores higher than 0.3 are shown in bold

### Table 8  Robustness checks

| NGEI category | NGI | Model 1 random effect with AR(1) | Model 2 fixed effect with AR(1) | Model 3 random effect | Model 4 fixed effect |
|---------------|-----|----------------------------------|----------------------------------|-----------------------|----------------------|
| State-led NGEIs | Private governance NGI | 2.110*** | 2.186*** | 2.496*** | 2.458*** |
| | Traditional governance NGI | -1.391** | -1.720** | -1.163* | -2.194*** |
| EU-led NGEIs | Private governance NGI | -1.037* | -1.166* | -1.035** | -1.043** |
| | Traditional governance NGI | 1.034 | 0.818 | 1.271* | 0.522 |
| Private party-led NGEIs PC1 | Private governance NGI | -0.234 | -0.243 | -0.241 | -0.349** |
| | Traditional governance NGI | -0.071 | -0.131 | -1.102* | 0.203 |
| Private Party-led NGEIs PC2 | Private Governance NGI | -0.034 | -0.088 | -0.202 | -0.207 |
| | Traditional Governance NGI | 1.059* | 1.107 | 1.768*** | 2.066** |

Coefficients are reported. Logged GNI per capita and rate of urbanisation are included as controls for all models, but they are not reported.

Significance level: *$p<0.05$, **$p<0.01$, ***$p<0.001$
We present below the results from Models 1 and 2, as panel regression models when the disturbance term is first-order autoregressive (State command: \texttt{xtregar}). As discussed in the main body of the article, it suits panel data with many time periods and relatively few individuals (Cameron & Trivedi, 2009). It offers a GLS estimator for random-effects models (Model 1) and a within estimator for fixed-effects models (Model 2). We also present below the results from linear models with random effect (Model 3) and fixed effect (Model 4) (\texttt{xtreg re/fe}), though these models fit better with short panels (fewer time periods and many individuals) (Table 8).

Some general patterns emerge from Table 4. For State-led NGEIs, we found positive association between the Private Governance NGI and State-led NGEIs across all four models. The effect directions and significances are in line with our previous analysis. For EU-led NGEIs, all four models revealed negative effects from the Traditional Governance NGI and positive effects from the Private Governance NGI, which is also consistent with our hypothesis and previous analysis. For Private Party-led NGEIs, positive associations between the Traditional Governance NGI and PC2 were detected from all four models. These are also consistent with our previous analysis.

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