Environmental governance in globally telecoupled systems: Mapping the terrain towards an integrated research agenda

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ABSTRACT

Environmental governance is increasingly challenged by global flows, which connect distant places through trade, investment and movement of people. To date, research on this topic has been dispersed across multiple fields and diverse theoretical perspectives. We present the results of a systematic literature review of 120 journal articles on the environmental governance of global flows and their environmental impacts, employing the notion of telecoupling as a common analytical lens.

Six themes emerged, which can guide a comparative and policy-relevant research agenda on governing global telecoupling: (1) advancement of problem-centered research (as opposed to studying existing governance arrangements), (2) displacement of environmental burdens from Global North to South from a telecoupling perspective, (3) environmental governance of telecoupling between Global South countries, (4) policy coherence in governing global flows, (5) cross-scalar interactions between private and public governance and (6) combinations of governance arrangements to effectively address environmental problems in telecoupled settings.

1. Introduction

Global flows of goods, services, information, people, and capital increasingly cross national and continental borders, connecting distant places and actors in complex ways. However, the proliferation and intensification of global flows has not been a uniform or homogenizing process. Rather, it has been highly uneven, generating different sustainability outcomes in different places. As global interlinkages and interdependencies increase, 'local' changes often need to be understood as being shaped by multiple distant drivers. For example, consumption of palm oil-based cosmetics, foods and detergents in Europe drives deforestation and transboundary pollution in several Southeast Asian countries where palm oil is produced (Saswattecha et al., 2015; Pacheco et al., 2017). Such processes have long been studied from diverse disciplinary perspectives by scholars who have sought to trace global flows and interconnections, and understand how their impacts have been governed. For example, global commodity chain research has drawn attention to actors and conventions that constitute economic chains and networks linking distant places, while research in the field of

global environmental governance has focused on governance mechanisms, such as environmental regimes, that have emerged to tackle a range of transboundary and global environmental impacts.

In recent years, the world of cross-scalar flows, and associated social and ecological impacts has been described and explored by a growing interdisciplinary sustainability science community via the concept of 'telecoupling' (Friis and Nielsen, 2019; Liu et al., 2013). Increasingly invoked as an analytical concept or heuristic, telecoupling offers a view on globalization that foregrounds particular connections, flows and actors, as well as specific place-based outcomes and impacts (Eakin et al., 2014; Newig et al., 2019), while recognizing that these are embedded in dynamic global networks.

The concept of telecoupling offers a useful analytical reference point for this systematic review because it "provides a common language, logical consistency, systematic approach, and holistic guidance for researchers and others who work on different types of distant interactions" (Liu et al., 2013, p. 8). Its ability to work across disciplinary boundaries and break up the complexity of global connectivity into identifiable units of analysis, while explicitly acknowledging the relational and

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networked character of human-environmental change, makes this concept a very suitable tool for synthesizing research on environmental impacts and their cross-scalar drivers and feedbacks (Friis and Nielsen 2017a). Indeed, the telecoupling concept, given its "uniquely integrative" character (Liu et al., 2013, p. 8), has emerged in response to a need for more integrative interdisciplinary research to address wicked problems of sustainability (Nielsen et al., 2019). The goal of an integrated research agenda is to connect different analytical perspectives and enable interdisciplinary analysis, rather than to merge or 'solve' diverging perspectives (Friis 2019). The concept of telecoupling is one among several concepts that have been deployed to study linkages among distant places in a globalized economic system. Other concepts like translocality (see, e.g., Radel et al., 2019), leakage (see, e.g., Meyfroidt et al., 2018) and unequal ecological exchange (see, e.g., Jorgenson 2016; Frey et al., 2018) are also used to investigate the social and environmental implications of global interdependencies. The telecoupling concept has often been used in combination with these related concepts (e.g., Dorninger et al., 2021). In this study, we consider telecoupling a point of departure for fostering an interdisciplinary dialogue between researchers using different but compatible concepts and terminologies for studying similar empirical phenomena. Originally developed in land systems science, telecoupling appears particularly applicable to focusing attention on environmental effects of distant human-nature interactions, which is increasingly the concern of interdisciplinary sustainability research.

We maintain that research examining governance in relation to telecoupled systems needs to recognize and build on prior and ongoing work in multiple neighboring fields. The general phenomenon of telecoupling, and aspects thereof, have been studied from a range of disciplinary perspectives employing different theoretical framings and terminologies. Much of this work has also engaged with governance in, of, and for telecoupling (Newig et al., 2019). Taking stock of this work is challenging, as it does not comprise an easily delineated body of literature, and is in fact rather diverse and fragmented. This review seeks to 'map' the terrain of this literature in an integrated manner, by bringing together different streams of research, and by highlighting commonalities and gaps in order to stimulate research across these divisions. Indeed, we sought to capture a wide variety of literature by searching across diverse research fields and disciplines, but we do not claim to have comprehensively taken stock of all relevant literature.

This article thus analyzes a wide range of work across disciplines dealing with the governance of environmental impacts of globally telecoupled flows. We conducted a systematic review to identify literatures addressing environmental governance in relation to the phenomenon of telecoupling, while assuming that this literature would use diverse terminology to describe the phenomenon (possibly, but not necessarily including the term 'telecoupling'). With this study, we offer a first systematic empirical mapping of the literature addressing environmental governance in global flows, as well as the geographical areas, actors and governance instruments implicated in the studied flows. We also delineate the environmental impacts of global flows, and consider potential governance challenges in addressing them. In order to chart the breadth of approaches in the literature, we map the scholarly field of environmental governance in global telecoupling and identify key theoretical lenses employed in the literature.

The article is structured as follows: Section 2 presents our analytical framework and defines key concepts used in this study. Having explained our methodology in Section 3, Section 4 presents the results of our systematic review on the scholarly field, global flows, environmental impacts and governance. Section 5 discusses the key findings from our analysis while also outlining an agenda for future research.

2. Analytical framework

In this study, we examine governance in relation to telecoupled flows and their environmental impacts. Our analytical framework, depicted in

Fig. 1, follows two main logics: First, it integrates the three key dimensions of our analysis: (1) global flows connecting distant places, (2) environmental impacts of global flows, and (3) governance responses in place to tackle the environmental impacts of global flows. Second, our framework reflects three distinct governance perspectives identified in relation to global telecoupling: governance (a) inducing telecoupling, (b) coordinating telecoupling, and (c) responding to telecoupling.

We are interested in global flows linking distant places, which we describe as instances of 'telecoupling' (Liu et al. 2013, 2019; Friis 2019). Telecoupling means that human-induced socio-ecological changes in one place produce socio-ecological effects in geographically distant places due to their interconnectedness through global flows. These global flows can be commodity- or product-based such as agricultural and forestry products, but they can also involve movements of people or financial flows. We identify "sending systems" as those from which flows emanate, such as sites of production of goods and services or extraction of resources, and "receiving systems" as those to which flows are directed, such as sites of consumption or disposal (Liu et al. 2013, 2019; Friis and Nielsen 2017b). In addition, we consider "spillover systems" as those systems that are incidentally connected through flows between other systems (Liu et al., 2018), for instance, due to trade diversion or transit. Although we conceptually isolate flows and telecoupled systems, we acknowledge that in reality flows are dynamic with no clear start or end point, as are the wider global networks of which they are a part.[1] Telecoupled interactions typically involve a multitude of spatially dispersed actors such as investors, producers, suppliers, traders, consumers and regulators, all of whom are implicated in multiple other networks, which makes it difficult to assign responsibilities for remedying environmental harm associated with unsustainable patterns of production and consumption (Burch et al., 2019).

Globally telecoupled flows often give rise to negative social impacts such as changes in livelihood opportunities and food security (Eakin et al., 2017) and environmental impacts that manifest either at a local scale in sending, receiving and/or spillover systems (e.g., deforestation and water pollution), or at a global scale (e.g., greenhouse gas (GHG) emissions to the atmosphere).

We focus on governance responses to negative environmental impacts of globally telecoupled flows. We define governance as encompassing "the totality of interactions among societal actors aimed at coordinating, steering and regulating human access to, use of, and impacts on the environment, through collectively binding decisions" (Challies and Newig, 2019; Newig et al., 2020). We are concerned with the instruments through which governance is conducted, its geographical scale, and whether it intervenes in specific places or rather targets flows. 'Place-based' governance arrangements consist of more territorial forms of governance, in particular, national or sub-national environmental governance, including, for example, land-use planning, impact assessment procedures and emission standards (see e.g. Sikor et al., 2013). In contrast, 'flow-centered' governance targets key flows, for example by addressing particular value chains through certification schemes, tax incentives, tariffs or import bans, and the like (see e.g. Liu et al., 2018, p. 65).

Building on Newig et al. (2019), our analytical framework integrates three different perspectives on how governance relates to telecoupling (marked with dotted arrows in Fig. 1). In the first instance, governance induces telecoupling by creating political, institutional and economic conditions that enable and promote the development of global flows and interconnections. For instance, the favorable mining regulations adopted by Argentinian governments in the 1990s and the early 2000s led to increased investments by North American companies in the

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[1] We acknowledge that telecoupling research necessarily simplifies reality, as all research on global networks and systems does – facing the trade-off between being comprehensive and taking in a larger system, or narrowing the scope of analysis to focus on a sub-set or part of the system.
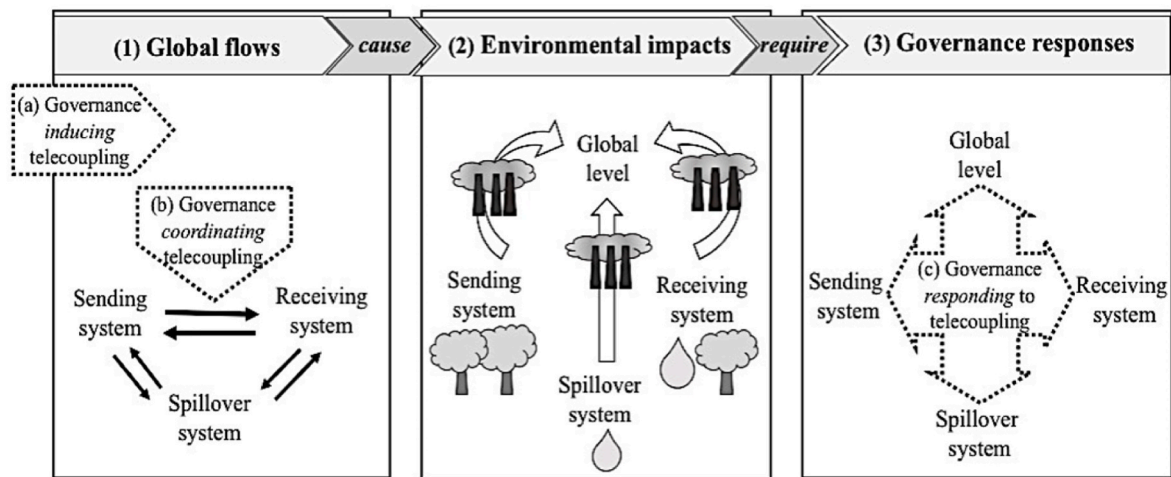
Fig. 1. Analytical framework: (1) Global flows (2) cause environmental impacts, which are addressed by (3) governance responses. The dotted arrows indicate three perspectives on governance in relation to global telecoupling: Governance (a) inducing telecoupling, (b) coordinating telecoupling, and (c) responding to telecoupling.

Argentinian mining sector, which resulted also in an expansion in the number and size of mining projects for the extraction of gold, silver, copper and lithium for export (Forget 2015). Second, governance may also relate to within-chain management to coordinate and organize commodity and value chains (Newig et al., 2019). Research on global value chains has mainly dealt with the structures and functions of chains and technical managerial activities, such as the improvement of intra-firm and inter-firm collaboration with the aim of improving operational efficiency (Richey et al., 2010; Bush et al., 2015). Third, governance may respond to the negative environmental impacts of telecoupling. This aligns with what is commonly referred to as environmental and sustainability governance (Newig et al., 2019). One example of such a perspective on governance is the EU Timber Regulation No. 995/2010 (EUTR), adopted to regulate timber on the EU market and to address deforestation, biodiversity loss and GHG emissions resulting from illegal timber trade (Sotirov et al., 2017). Although these three perspectives suggest distinct analytical categories, they can overlap empirically. For example, a trade agreement can reduce tariffs on certain commodities (i.e., inducing telecoupling), but also include a sustainability chapter to mitigate potential social and environmental impacts (i.e., responding to telecoupling).

In this systematic review, we focus on this third perspective on governance of telecoupling, honing in on the ways in which governance helps to counteract environmental issues that arise due to global flows. Building on our previous research (Newig et al., 2020), we identify several particular challenges that governance initiatives are likely to face: (1) Governance actors may face knowledge deficits in their efforts to govern long-range commodity flows because of a lack of transparency and accountability in global commodity chains. (2) Actors that are networked across distant territories may have divergent interests due to a lack of proximity and history of cooperation, which works against collaboration in governance initiatives. (3) The high number of actors and jurisdictions involved in telecoupled flows, and the complexity of relationships among them, gives rise to high transaction costs, which hamper not only cooperation but also the implementation of bilateral and multilateral agreements (Jager 2016; Schilling-Vacaflor et al., 2021; Newig et al., 2020). (4) Transnational private governance and multi-stakeholder initiatives addressing the impacts of telecoupling have been criticized for having a weak legitimacy base (Black 2008; Oosterveer 2018) in terms of the openness and inclusiveness of decision-making processes and a lack of transparency in the auditing of corporate initiatives. (5) Policy incoherence and fragmentation may also arise given likely differences between policies in sending and receiving

systems, as well as inconsistencies with higher-order policy such as World Trade Organization (WTO) rules. For instance, while the EU has adopted policies to address deforestation embodied in trade, sustainability clauses in trade agreements like the developing EU-MERCOSUR agreement have often been weak or unenforceable (Kehoe et al., 2020).

3. Methods

We followed the PRISMA guidelines for systematic reviews and meta-analyses (Moher et al., 2009)[2], as illustrated in Fig. 2. A literature search was conducted in Scopus, using a search string specified in Appendix A (see Supplementary Material). This search string was designed to be encompassing, and included broad keywords in order to capture a wide array of publications that have approached the topic from different disciplines such as economics, environmental sciences
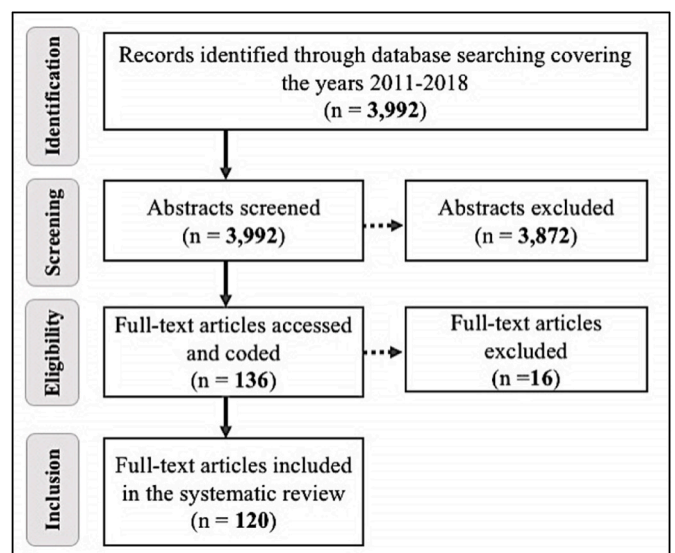
Fig. 2. Selection process of the systematic literature review.

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[2] Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA). For details, see http://prisma-statement.org/.

and social sciences, thus allowing for different framings, concepts and terminology. We did not limit our search to articles that explicitly used the term 'telecoupling', but also included articles referring, for example, to 'globalization', 'global flows', 'global commodity chains' and 'global production networks'. However, for inclusion in our sample we required every publication to address all three main aspects of our study: (1) global flows, (2) environmental impacts, and (3) governance responses. Our study covers academic peer-reviewed articles written in English and published in Scopus-listed academic journals in the years 2011–2018. We excluded grey literature due to methodological difficulties with its identification and systematic inclusion (Adams et al., 2017), and uncertainties with the quality assessment of grey literature (Lawrence et al., 2015).

Three researchers screened the abstracts, eliminating any that did not refer to: (1) a flow crossing international borders, (2) an environmental problem, and (3) environmental governance instruments. We excluded 3872 abstracts that did not meet our criteria. Ambiguous cases were discussed among the researchers until agreement on inclusion or exclusion was reached. During the coding process, we eliminated a further 16 articles, which, on closer reading of the full texts, did not meet our review criteria. The total number of articles included in the final review was 120.

We accessed and coded the 120 full-text articles using a coding scheme that operationalized our analytical framework (see an overview in Table 1 and an operationalization of the codebook in Appendix B in the Supplementary Material). The coding scheme was iteratively tested and revised with six research assistants, who conducted the coding. Coders were trained in five consecutive workshops, which involved a series of coding pilots in order to increase inter-coder reliability. Two coders read and coded each article independently, before meeting and discussing their coding, and potentially amending or revising their results. While we aimed for inter-coder agreement on the basic parameters of the study (e.g., identification of flows and geographical areas described), we allowed for deviations in coding regarding variables that required more subjective evaluation of the text (e.g., the three perspectives on governance of telecoupling). These variables were then consolidated by averaging the independent codings. While for many variables our original scale was limited to 0 (absence of a phenomenon) and 1 (presence of a phenomenon identified by two coders), our consolidated scale also includes the value of 0.5 (presence of a phenomenon identified by one coder). This approach acknowledges that coding is an interpretative endeavor in which we view other scholars' work through our own analytical lens (See Table 1).

4. Results

We analyze the scholarly field in terms of researchers involved in, and theoretical lenses applied. On this basis, we present a mapping of what has been studied in relation to telecoupling in terms of global flows, their environmental impacts and their governance. Although our literature search revealed a rich corpus of literature addressing these aspects, we identified relatively few studies that consider them together. Compared with the wealth of studies that describe global flows and connections, only 120 of the articles we identified met the inclusion criteria, in investigating governance of the environmental implications of telecoupled flows.

4.1. Mapping the scholarly field on environmental governance in global telecoupling

A broad range of disciplines, including political science, human geography and economics, have similarly studied the phenomenon of telecoupling, examining global flows, their environmental impacts, and governance responses. In our sample of 120 articles, a majority (70 articles) analyses the effectiveness of environmental governance instruments in different global flows, often highlighting a variety of

Table 1
Variables and dimensions covered in the codebook.

Category	Variables and dimensions
General information	Authors, title, year of publication, journal
	Theoretical lens (es)
Global flows	Flow(s)
	Geographical scale of studied flow(s)
	Geographical area(s)[3] and countries involved
	Direction of telecoupling
Environmental impacts	Nature of environmental impacts
	Geographical scale of environmental impacts
	Nature of environmental impacts per system
Governance	Perspectives on governance
	Governance challenges
	Governance instruments
	Governance actors and addressees
	Place and directionality of governance
	Spatial scale of governance

[3] In our analysis we applied eleven geographical areas based on the categorization by O.T. Ford (available at: http://the-stewardship.org/research/reference/world-region.htm): North America, Caribbean and Latin America, South America, Europe, Middle East and North Africa, Sub-Saharan Africa, Russian sphere, Central Asia, South Asia, East Asia, Southeast Asia, Australia and Pacific. We introduced an additional "global" category to capture those global flows where sending and/or receiving systems were unspecified.

governance barriers to improving environmental conditions (e.g., complexity and lack of traceability in global value chains, policy incoherence, weak legal frameworks in producer countries, lack of enforcement). Yet, scholarship on environmental governance in global telecoupled flows remains rather fragmented. To visualize the fields of scholarship we used the software package VOSviewer to derive and display bibliometric networks[3] and trace the relationships among authors and articles included in the review (see Figs. 3 and 4). Co-authorship and co-citation networks are used here as proxies for collaboration and exchange among research communities addressing environmental governance in global telecoupling.

Fig. 3 shows authors' 'relatedness' based on the strength of co-authorship links between all authors of the 120 reviewed articles. A total of 339 nodes (authors) are displayed. Colored shading of nodes refers to the publication year of co-authored articles. While articles co-authored by several authors increase in number over the years, no overarching clusters emerge, reflecting a relatively low degree of collaboration across co-authors and suggesting a fragmented landscape of co-authorship among the authors of the articles included in our review.

Fig. 4 provides an analysis of citations among the 120 reviewed articles according to whether articles cite one another (visualized with the name of the first author and year of publication of the article). Here, we see that only very few articles (displayed as blue-colored clusters) cite each other, indicating little collaboration and exchange among the scholarly fields addressing environmental governance in global telecoupling.

To further delineate the field of scholarship engaging with environmental governance of telecoupling, we also reviewed the theoretical framing adopted in each study. In so doing, we coded for theoretical lenses, building on those identified in Newig et al. (2020), and also incorporated additional theoretical framings that emerged in the course of coding. Overall, we identified ten theoretical lenses framing the reviewed studies, which we acknowledge are not exhaustive, but which are helpful in assessing which scholarly communities have devoted attention to governance aspects of telecoupling phenomena.

[3] Available at https://www.vosviewer.com/.
[4] We acknowledge that Figs. 3 and 4 do not display all labels for the nodes shown. As VOSviewer aims to avoid overlapping labels, names are visible only for some of the nodes (Van Eck and Waltman, 2017).
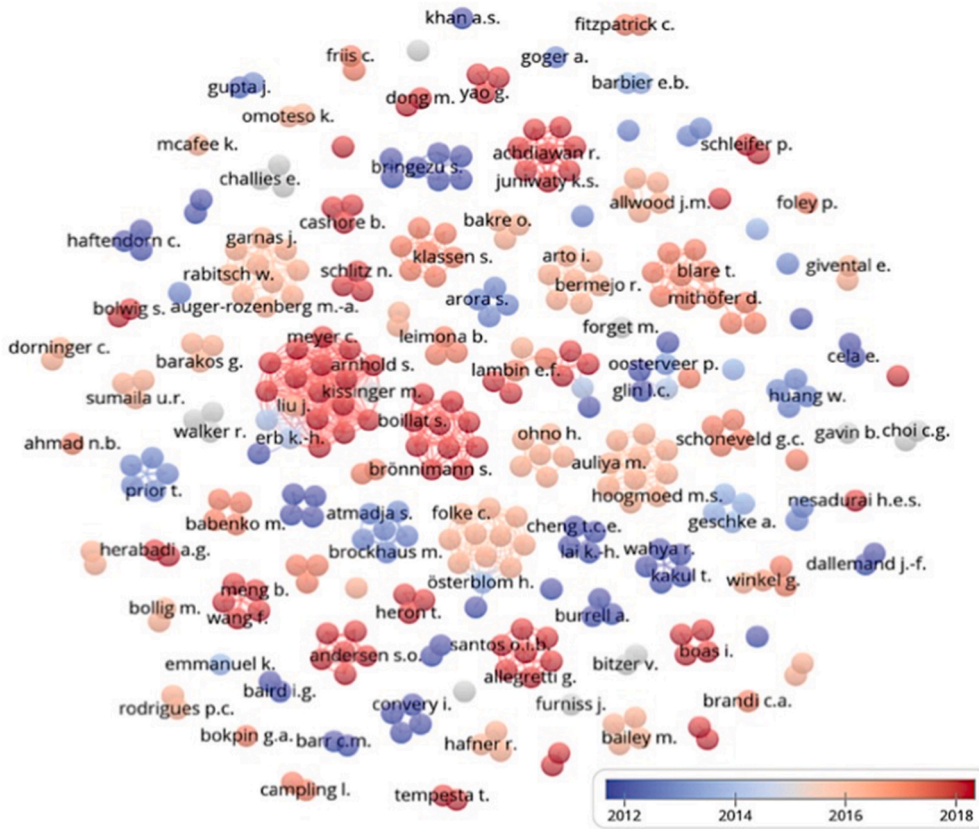
Fig. 3. Co-authorship network of reviewed articles. Authors (nodes) are connected if they have co-authored work.[4].
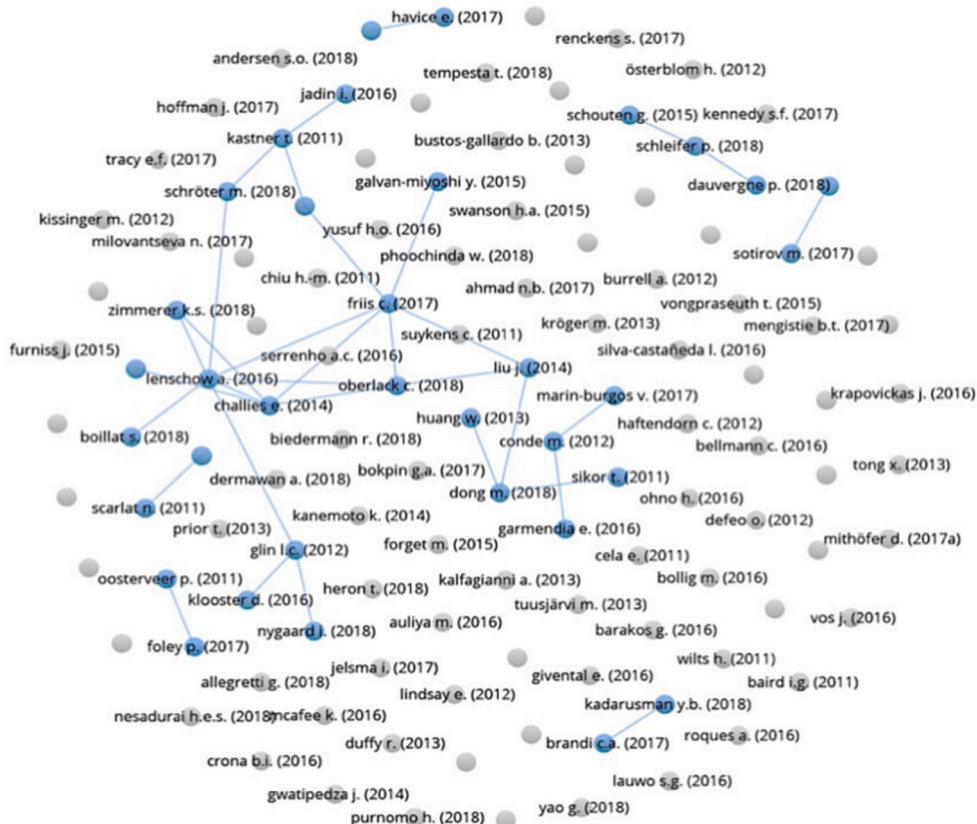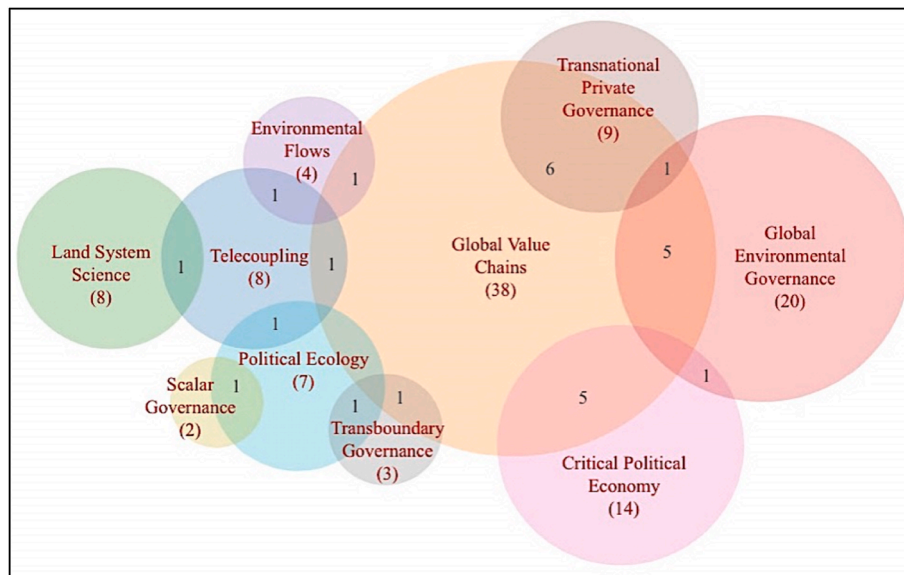

Fig. 4. Citation network of reviewed articles. Articles (nodes) are connected if they cite each other.

Fig. 5. Incidence of theoretical lenses employed in the studied articles. Multiple lenses could be employed per article. Figures in brackets depict the total number of times a theoretical lens was identified across the 120 articles. Figures in overlapping areas indicate the number of times the respective lenses were identified together in one article.

The following theoretical strands are depicted in Fig. 5: Global environmental governance, focusing on governance arrangements beyond nation state boundaries, including international environmental governance institutions and regime formation; Transboundary governance, studying governance arrangements across neighboring nation states; Transnational private governance, examining governance of flows via private certification, standards, and voluntary commitments; Global value chain research, concerned with coordination (by primarily private actors) of production-consumption across distal regions; Environmental flows literature, taking a sociological perspective on places and flows, as well as governance challenges; Critical political economy literature, concerned with revealing (in)justice in global interconnections through detailed description of production chains and their environmental impacts; Scalar governance literature, addressing spatial fit/misfit between governing institutions and the spatial scale of problems to be governed; Land system science, integrating place-based and flow-based phenomena to understand multiscalar governance approaches; Political ecology, focusing on power and (in)justice in the distribution of environmental impacts and their governance; and Telecoupling, conceptualizing global connections as flows among sending and receiving systems, which pose a number of environmental governance challenges.

As Fig. 5 shows, the main theoretical lenses identified in the reviewed articles are Global Value Chains (38 coded instances) and Global Environmental Governance (20), followed by Critical Political Economy (14). Fig. 5 also depicts many overlaps among theoretical lenses, where the theoretical framing of the reviewed articles combines more than one lens. This may be interpreted as further evidence of the heterogeneity of the literature, and reflects the multi-disciplinarity of the research area.

As another indication of the heterogeneity of the research area, we find that the 120 articles are spread across 77 different, mostly multidisciplinary journals, the five most frequent outlets being Global Environmental Change (eight articles), Geoforum and Resources, Conservation and Recycling (five articles each), and Sustainability (four articles) (for details, see Appendix C in the Supplementary Material).

4.2. Environmental governance challenges of telecoupling

As outlined above, telecoupled flows likely pose considerable

challenges for environmental governance, which potentially affect the management of complex value chains, the multitude of governance actors and jurisdictions involved, and the policies promulgated by sending and receiving systems in telecoupled flows. We tested whether globally telecoupled flows, in our sample of studies, would be more prone to governance challenges than regional or transboundary flows, as posited in Newig et al. (2020). Indeed, we find that in studies on global (inter-regional) flows, roughly twice as many governance challenges (1.2 per paper) were described as in studies on transboundary[5] flows (0.7 challenges per paper) or on intra-regional flows (0.6), as detailed in Fig. 6. This is in line with our expectation that governance of inter-regional/global linkages is more challenging than governance in more local/regional settings. Looking in detail at the governance challenges identified, we find that policy incoherence and fragmentation, and diverging interests are the main governance challenges observed. With the exception of knowledge deficits, all governance challenges are far more prevalent in articles on inter-regional/global flows. This suggests that an absence of geographical proximity in inter-regional/global flows is associated with (1) diverging interests among the involved governing entities; (2) higher transaction costs for reaching joint governance agreements where there is no history of prior collaboration; (3) a weak legitimacy base of transnational governance arrangements; and (4) policy incoherence and fragmentation, given likely differences in policies between sending and receiving systems as well as with higher order policy.

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[5] Transboundary flows between neighboring countries were included in our review insofar as they reached across a distance, i.e. a non-contiguous landscape and social-ecological system. Flows were characterized as 'intra-regional' if they occurred between non-neighboring countries with one of the following geographical areas: North America, Caribbean and Latin America, Europe, Middle East and North Africa, Sub Saharan Africa, Russian Sphere, Central Asia, South Asia, East Asia, Southeast Asia, Australia-Pacific. Flows that combine more than one of these regions were characterized as inter-regional/global.

[6] Articles may refer to flows on multiple geographical scales: 13 articles mention two geographical scales, and 7 articles mention three geographical scales.
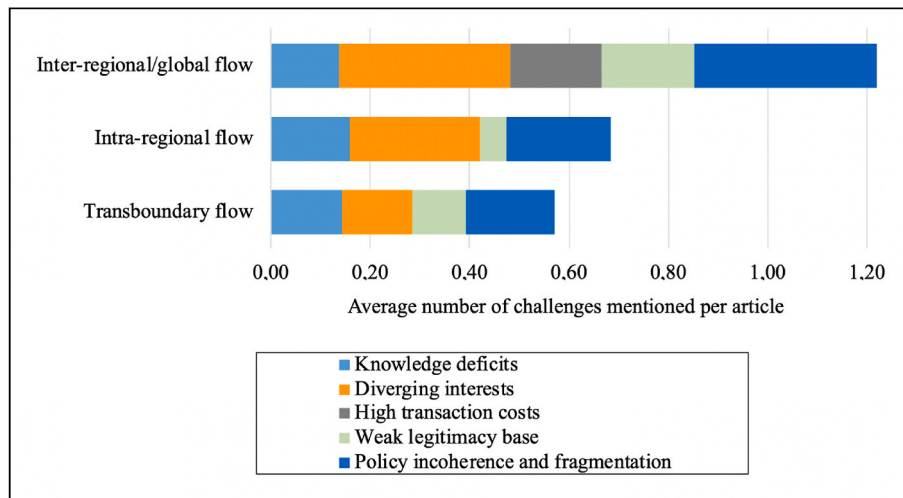
Fig. 6. Governance challenges arising with different geographical scales of flows. Note that all three scales count as 'telecoupled' flows according to our definition of flows crossing at least adjacent jurisdictions in different countries. While the majority of articles (112) examine inter-regional/global flows, 19 articles report on intra-regional flows, and 14 articles report on various forms of transboundary flows.[6].

4.3. Nature of telecoupled flows

The reviewed literature examines a multitude of global flows (see Fig. 7). The majority of these are flows associated with trade in, for example, forestry products, machinery and electronics, metals and minerals, and palm oil. Trade in animal products, horticulture products, fossil fuels and wastes is also often studied. This focus on traded products aligns with the predominance of global value chain conceptual framings in the literature (see section 4.1). Fewer articles investigate flows such as financial flows and movements of people as tourists or migrants. Commodity- and product-based flows are usually the primary focus (main flow in Fig. 7). Furthermore, flows that involve movements

of people or financial resources are often discussed only as secondary flows (additional flow).

The studied global flows can be further analyzed according to their directionality, in the sense of whether their origin (sending system) and destination (receiving system) are in the Global North or the Global South, as shown in Fig. 8. In our review of the literature, we find that flows largely originate in countries of the Global South and are directed to countries in both the Global North (66 instances for main flow, and 18.5 for additional flows) and the Global South (43.5 instances for main flow, and 18 for additional flows). Among the articles addressing South-South flows, several focused on the growing demand from emerging markets like China and India for palm oil produced in Indonesia and
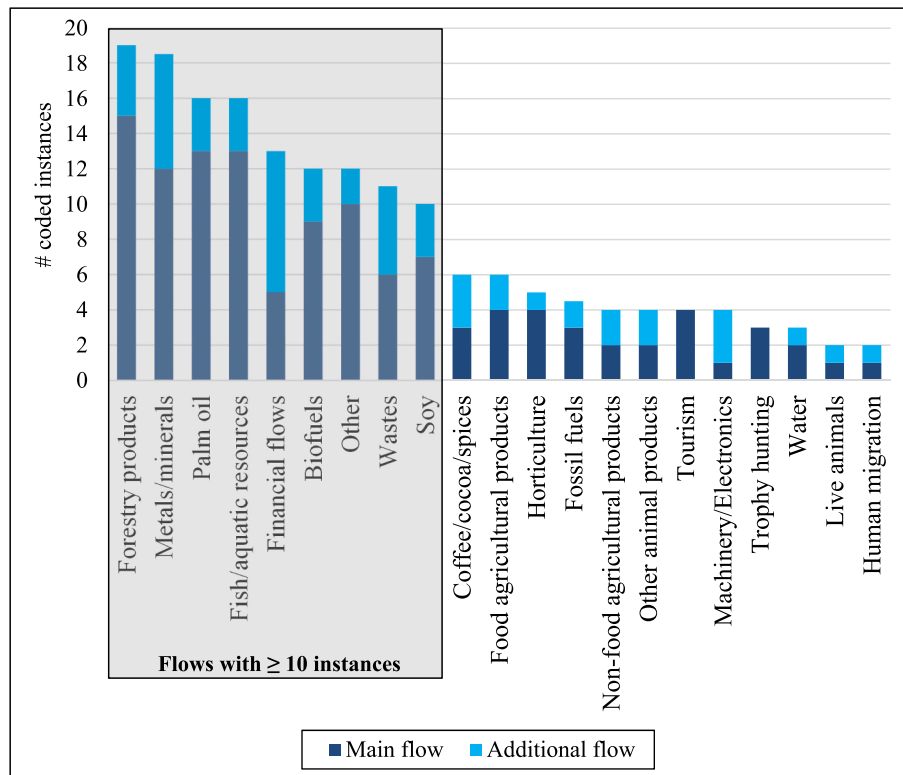
Fig. 7. Frequency of telecoupled flows studied (as main flows and additional flows).
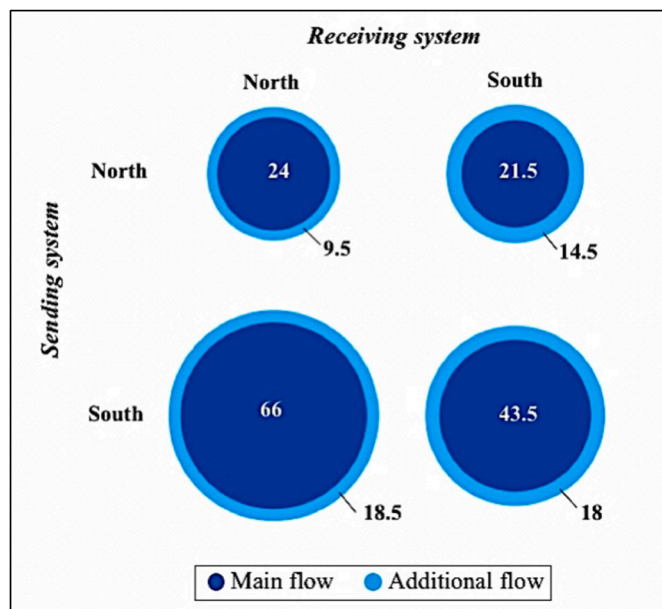
Fig. 8. Directionality of global flows from sending to receiving systems in the Global North or Global South. Multiple directions could be identified per flow category. Figures indicate the total number of times a particular directionality was identified across the 120 articles. Partial numbers (i.e., with 0.5) reflect instances identified by only one coder (for more detail, see section 3 on Methods).

Malaysia. While Dauvergne (2018) examines the politics of palm oil certification, Schleifer and Sun (2018) investigate conditions for certification uptake in emerging economies, and Brandi (2017) focuses on the effectiveness of smallholder certification for environmental outcomes. The literature thus presents complementary insights into similar phenomena related to telecoupled commodity flows. Flows originating from countries in the Global North are less prominent in the literature, but those that do feature are directed to countries of both the Global North and the Global South, as in the case of the global trade in metals from Japan to China, Europe and North America (Ohno et al., 2016).

Some of the below analyses focus on the eight most frequently studied flows, highlighted in grey in Fig. 7 as flows with 10 or more

reported instances. Data for these flows was analyzed using descriptive statistics, whereas incidences of the remaining flows are too small for systematic comparison.

4.4. Environmental implications of telecoupling

Global flows often produce negative environmental impacts. Building on definitions provided in European policy documents (European Union, 2017) and in the literature (Lowe et al., 2005), we identify eight broad types of environmental impacts mentioned in the reviewed articles. These relate to land use, biodiversity, water quantity and quality, soil condition, air quality, GHG emissions, habitat integrity and species dynamics (for an operationalization of these impacts see Appendix B).

Fig. 9 shows that the large majority of the reviewed articles focus on impacts occurring in the sending systems of the selected flows (with a total of 283.5 coded instances), while less attention is paid to impacts in receiving systems (56.5 instances). This may be because impacts in receiving systems are either not occurring, less severe, unspecified, or even positive. With regard to the latter, for instance, Swanson (2015) illustrates how the import of Chilean salmon to Japan has enabled increased conservation of Japanese salmon, demonstrating how, in turn, conservation in one place may rely on displacing environmental burdens to distant places. Among the environmental impacts studied in receiving systems, land use appears to be a prominent issue in relation to most flows. Flows of fish and aquatic resources affect species dynamics and habitat integrity, while biofuels trade particularly affects GHG emissions in receiving systems.

4.5. Governing telecoupling

Previous literature has discussed a wide variety of governance instruments across globally telecoupled flows. By governance instruments we refer to "a set of mechanisms that are used to achieve a particular policy goal" (Biggs et al., 2021, p. 485). These 'tools of governance' may take a variety of forms such as legally binding public policies, economic and fiscal instruments, information- and communication-based instruments and voluntary instruments (Steurer 2011; Challies et al., 2019). Legislation and regulation, which originate at different levels of governance and include EU legislation (e.g., the EU's Renewable Energy Directive) and national legislation (e.g., the US Lacey Act on fish, wildlife and plants), are by far the most studied governance instruments, as shown in Fig. 10. Other relevant public instruments are economic and
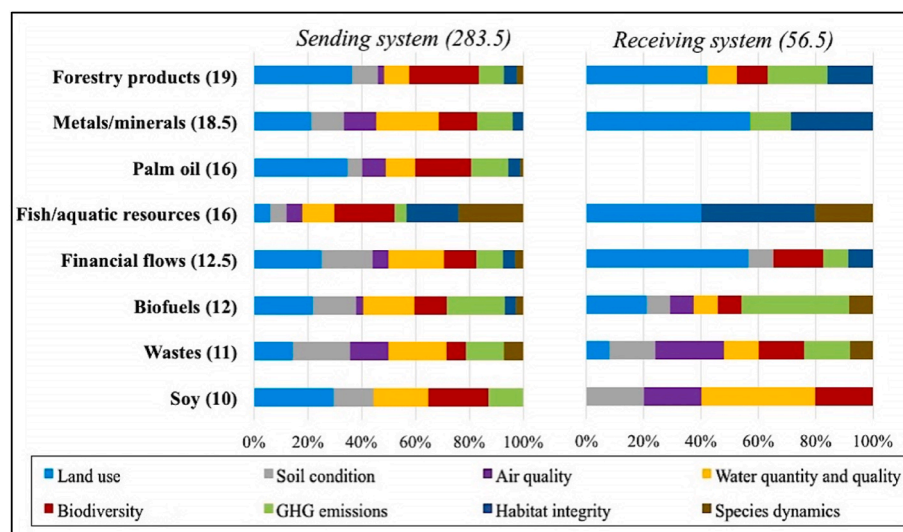

Fig. 9. Studied environmental impacts in sending (left) and receiving (right) systems for selected flow categories. Numbers in brackets on the y-axis indicate the total coded instances per flow, while numbers in brackets next to 'sending' and 'receiving' systems indicate the coded instances per system type in the selected flow category. Coding allowed for selection of multiple environmental impacts per flow category and system.
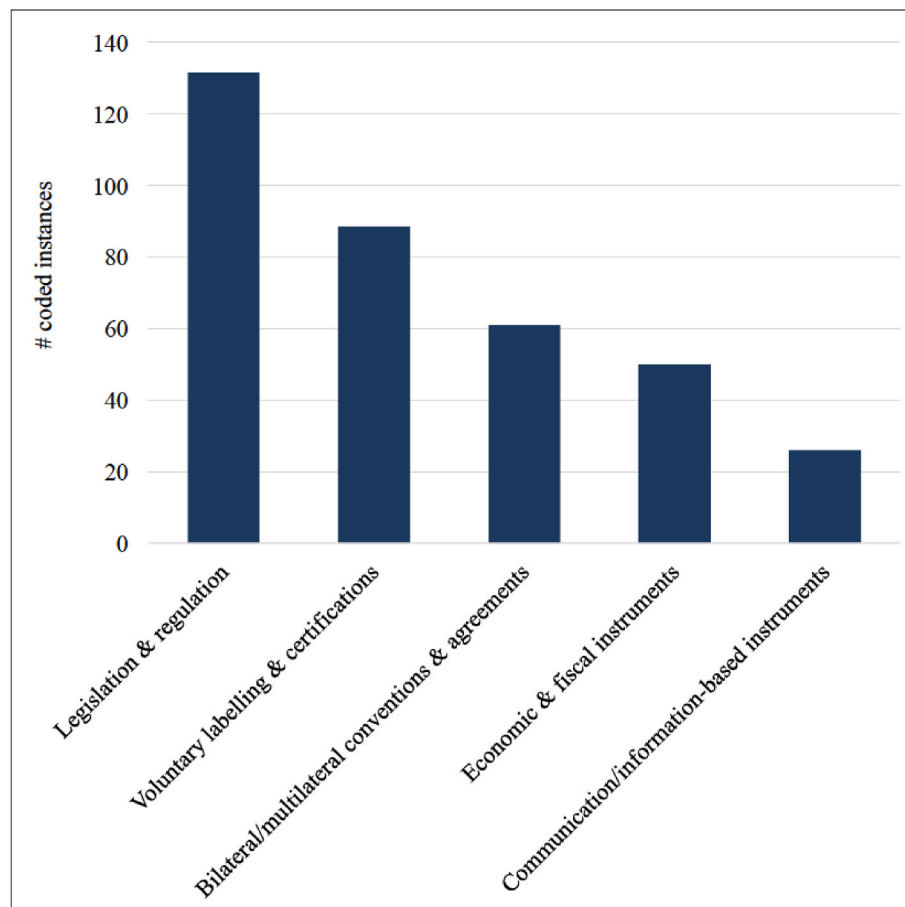
Fig. 10. Governance instruments studied in the 120 reviewed articles. Multiple instruments possible per article.

fiscal instruments (e.g., the Reduced Emissions from Deforestation and Degradation (REDD+)) mechanism addressing forest carbon and conservation), and bilateral and multilateral conventions and agreements (e.g., the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, aimed at regulating trade in hazardous wastes). Communication and information-based instruments, like the Soja Plus program,[7] which provides training and capacity building on environmental regulation and impacts to Brazilian soy producers, are less widely studied.

Furthermore, Fig. 10 shows that voluntary labelling and certification instruments are also prominently studied in the reviewed literature. These instruments include, for example, standards and certification schemes and multi-stakeholder initiatives initiated by businesses and civil society organizations like the Forest Stewardship Council (FSC)[8] and the Roundtable on Sustainable Palm Oil (RSPO)[9].

In assessing how categories of governance instruments map onto individual flows, we observe several patterns, as shown in Fig. 11. Although it is unclear whether such patterns reflect an uneven choice of instruments across flows or researchers' preferences, we find that articles addressing wastes, biofuels and forestry products tend to examine legislation and regulation, such as the German ElektroG (Elektro-und Elektronikgeräte-Gesetz) law on waste from electronic and electric equipment, the EU Renewable Energy Directive, and the Lacey Act. Labelling and certification appears to be virtually absent in articles studying waste flows. Moreover, articles on soy and palm oil flows tend

to focus on voluntary labelling and certification initiatives such as the Round Table on Responsible Soy (RTRS) and the RSPO.

Several of the reviewed articles on palm oil have highlighted how voluntary labelling and certification initiatives for palm oil, such as the RSPO, are often designed to govern South-North trade in accordance with consumer demands in developed countries, and may thus be limited in their ability to address palm oil markets in developing countries (Dauvergne 2018; Schleifer and Sun 2018). Likewise, existing forestry sustainability certification initiatives, driven by consumer demands and Northern firms primarily in the US and the EU, may not secure environmental protection of forestry trade between African timber suppliers and Chinese manufacturers (Huang et al., 2013). Given the increasing importance of Chinese firms in the African timber trade, Huang et al. (2013) argue that these firms will be mostly concerned with their domestic market rather than applying consumer driven/Northern standards to the value chain.

Despite a perceived roll-back of the state, and a stronger role played by corporations and civil society groups in the social and environmental governance of flows (Lenschow et al., 2016), our results highlight that public instruments still play an important role in the environmental governance of telecoupled systems. For instance, in response to deforestation driven by agricultural expansion, the Argentinian government issued the national Law on Minimum Standards for Environmental Protection of Native Forests in 2007, which promotes forest conservation through territorial zoning and regulation of agricultural expansion (Krapovickas et al., 2016). Similarly, the EU Forest Law Enforcement Governance and Trade (FLEGT) action plan aims to reduce illegal logging in exporting countries by strengthening sustainable and legal forest management and trade in producing countries (Huang et al., 2013; Maryudi and Myers 2018; Sotirov et al., 2017). Research has also begun

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[7] For details, see www.sojaplus.com.br/en/sobre.
[8] For details, see https://fsc.org/en/about-us/25-years-of-fsc.
[9] For details, see https://www.rspo.org/about.
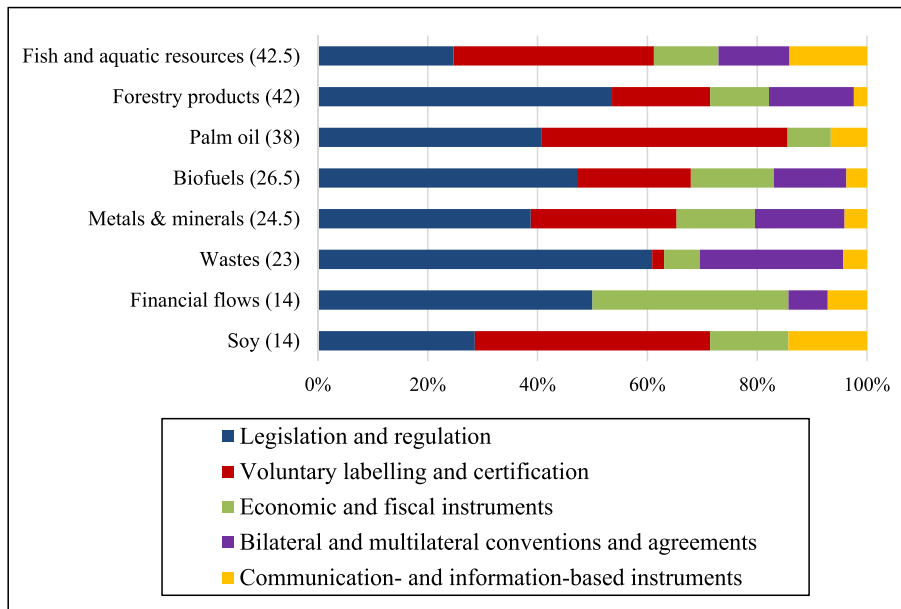
Fig. 11. Governance profile of selected flows. Numbers in brackets denote the total number of coded instances for all governance instruments identified in each selected flow category. Multiple instruments could be selected in one article per flow. This stacked bar chart illustrates the relative distribution of governance instruments per flow, meaning that the bars allow us to compare how prominently a certain governance instrument features in the governance profile of a given flow.

to examine emergent 'Southern' public standards like the Indonesian and Malaysian Sustainable Palm Oil standards (ISPO and MSPO), which may have the potential to become important governance responses to South-South telecoupling. Schouten and Bitzer (2015, p. 176) argue that "Southern actors are beginning to take up a new governance role by developing their own standards in issue areas where Northern standards have tended to dominate". This sees public sector actors in the Global South integrating more locally relevant interpretations of sustainability into flow-based governance instruments.

The role that public actors play in governing global flows is further
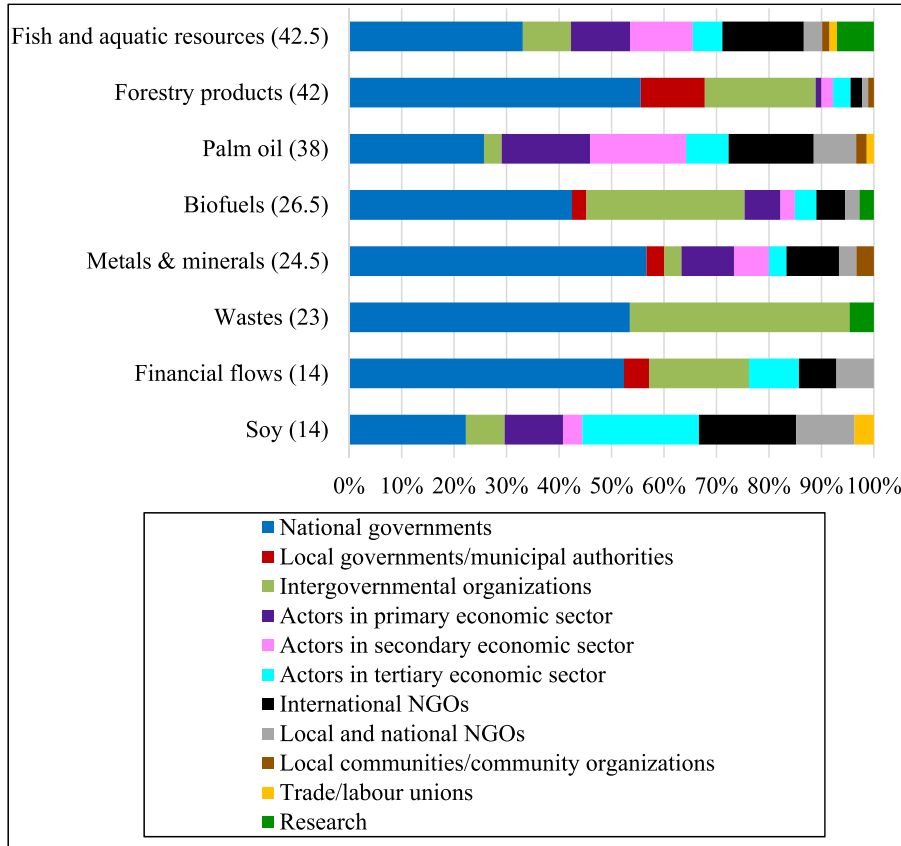
Fig. 12. Key actors in the governance of selected flows. The numbers in brackets denote the total number of governance instruments identified in relation to the respective flow category.
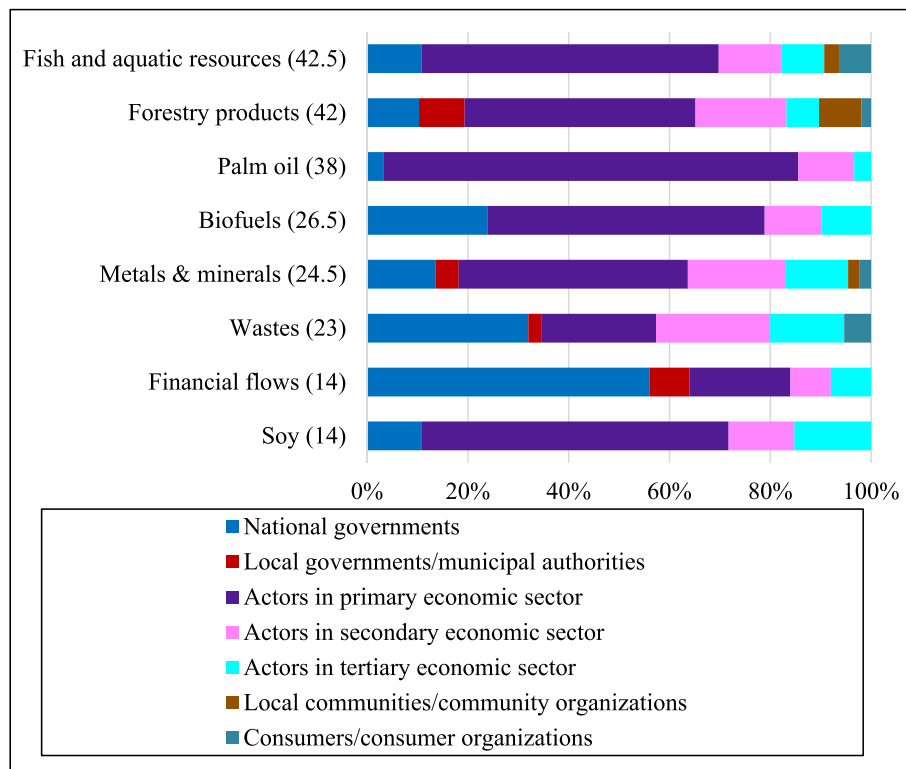
Fig. 13. Key addressees in the governance of selected flows. The numbers in brackets denote the total number of governance instruments identified in relation to the respective flow category.

shown in Fig. 12, which displays the main actors involved in the governance of selected flows. National governments are important actors in governing global flows where public governance instruments such as legislation and regulation have been prominently studied (e.g., wastes, biofuels, forestry products), but also in those flows where labelling and certification are particularly important (e.g., palm oil, soy). Actors in the primary economic sector, such as producers, are particularly relevant for governing flows of fish and aquatic resources, where labelling and certification instruments are prominent. In relation to palm oil flows, international non-governmental organizations (NGOs) such as the World Wide Fund for Nature (WWF) have played important roles, with WWF being one of the initiators of the RSPO (see also footnote 9), for example.

When focusing on the main addressees of governance instruments identified for the selected flows, public actors were less prominently studied than private businesses, as reflected in Fig. 13. Here, actors in the primary economic sector are particularly connected with those flows where labelling and certification are prominent governance instruments (e.g., fish and aquatic resources and palm oil), but also where public instruments are equally relevant (e.g., biofuels, forestry products, soy and metals and minerals). Actors in the secondary economic sector, such as manufacturers, are also relevant addressees in relation to flows of forestry products, fish and aquatic resources, metals and minerals, palm oil and wastes. National governments are relevant addressees in relation to the governance of financial flows and waste flows, while local governments and municipal authorities are particularly relevant addressees in relation to flows of forestry products.

As mentioned above, we conceptualize three different perspectives on how governance relates to telecoupling. By far most often, perspective 3 (governance responding to telecoupling) was studied with a total of 173.5 instances in the reviewed articles addressing the eight selected flows. Perspective 1 (governance inducing telecoupling) was examined in 61 instances, and perspective 2 (governance coordinating telecoupling) was found only in 16.5 instances. Fig. 14 focuses on these

three perspectives as they relate to governance instruments (left) and selected flows (right) studied in the literature. Here we can observe that some public governance instruments, especially economic and fiscal instruments, are inducing telecoupling. An example of how governmental actors can actively promote development of telecoupled agricultural supply chains can be seen in South American soybean-producing countries that are promoting soy production in Southern Africa though free trade agreements and development cooperation, and most notably technology transfer projects (Gasparri et al., 2016). Likewise, policy changes in a particular country can trigger the emergence of telecoupled systems. For instance, Liu (2014) states that China's entry into the WTO and associated liberalization of tariffs in the forest products sector, as well as the implementation of major national conservation programs in China, has increased China's imports of forestry products, driving both negative environmental impacts in exporting countries, and conservation of forests in China. Moreover, governance as communication and information-based instruments occurs relatively often to coordinate telecoupling. For example, tuna processors and the WWF established the International Sustainable Seafood Foundation in 2009 to coordinate and extend environmental governance practices throughout the tuna value chain (Havice and Campling 2017).

The governance of telecoupling is particularly complex, as different jurisdictions are involved and diverse flow-based and place-based forms of governance interact. Given the global nature of telecoupled flows, we might expect that governance occurs primarily at the global level, addressing both sending and receiving systems. However, this is not necessarily the case, as shown in Fig. 15. We do find that global governance interventions can target particular systems, such as the sending system (see arrow B on the left side of Fig. 15). For instance, waste flows (bar B, right side) are often governed from global to sending systems such as in the case of the 1989 Basel Convention on Transboundary Movement of Hazardous Wastes and their Disposal. Governance from global to receiving systems (arrow E) is less prominent and often occurs in combination with governance from global to sending
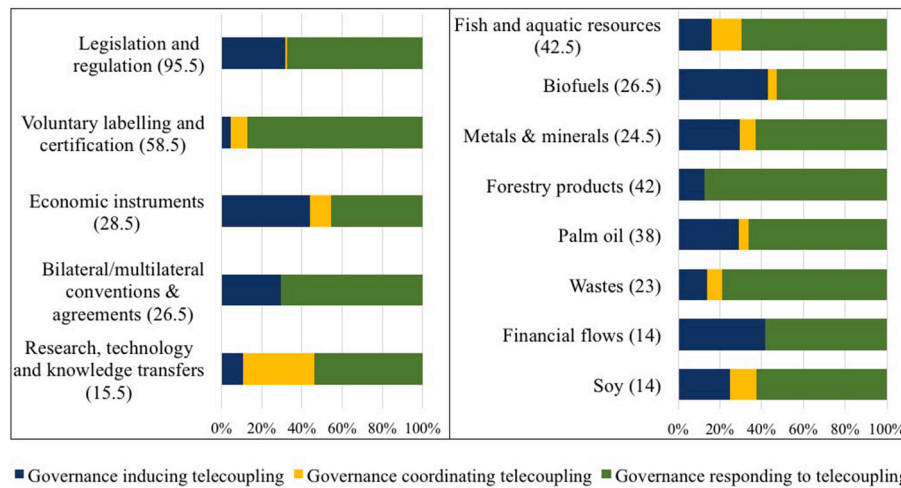
Fig. 14. Governance instruments by type i.e., inducing, coordinating or responding to telecoupling (left), and in relation to selected flows (right). Numbers in brackets indicate the number of coded instances per governance instrument in the selected flows (left) and the number of governance instruments in relation to the respective flow (right).
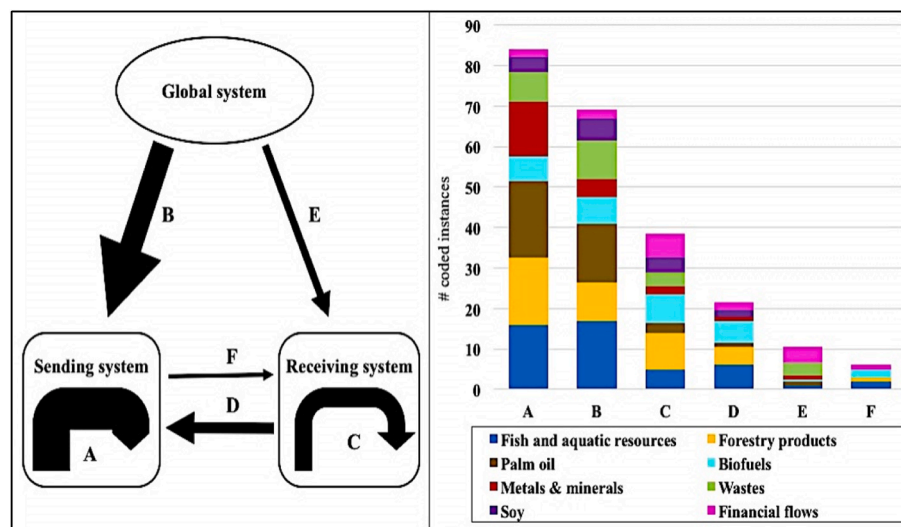

Fig. 15. Place and directionality of governance in selected flows. Left: Arrows depict whether governance interventions in a given system aim to create an impact cross-system (arrows D & F and B & E), or within a system (arrows A & C). Right: bars depict the variety of flows to which governance intervention types A-F apply.

systems. An example is the Extractive Industries Transparency Initiative,[10] a global standard that governs flows of metals and minerals, specifically of lithium, in both sending (i.e., South America and Australia) and receiving (i.e., Europe) systems (Prior et al., 2013).

Most of the reported governance interventions occur as place-based responses to global governance initiatives within the sending system (arrow A), and to a lesser extent within the receiving systems (arrow C). As an example of the latter, Foley (2017) investigates the case of the Iceland Responsible Fisheries certification program, and illustrates how Iceland established an alternative to global multi-stakeholder initiatives, such as the Marine Stewardship Council (MSC), within its jurisdictions. Other examples of place-based governance are the Chilean Salmon Task Force established in 2008 to coordinate and monitor the salmon industry (Bustos-Gallardo 2013), the Natural Forest Conservation Programme established in China in the late 1990s to restore and conserve natural forests (Liu 2014), and the ISPO and MSPO public standards on the

production of sustainable palm oil (Dauvergne 2018).

A governance intervention enacted in one place can directly target distant places that are outside the formal jurisdiction of the governance actor introducing the intervention (arrows D and F). A notable example of governance intervention from receiving to sending systems (arrow D) can be found in the EU Regulation to prevent, deter and eliminate illegal, unreported and unregulated fishing (Bellmann et al., 2016), which targets fish and aquatic resources trade (see bar D). Interestingly, governance interventions from sending to receiving systems (arrow F) often co-occur with interventions from receiving to sending systems (arrow D), such as the bilateral dialogues established between the EU and Brazil on environmental protection in biofuels trade (Renckens et al., 2017).

A key challenge for research on governance of telecoupling lies in the need to be attentive to global, macro-level drivers of local environmental change, while also identifying and assessing governance approaches and their consequences on the ground. In this sense, several of the articles reviewed here highlight the often complementary, reinforcing or conflicting interactions between public and private, as well as

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[10] For more information, see https://eiti.org/who-we-are.

place-based and flow-based governance approaches. For instance, Schleifer and Sun (2018) emphasized that the Chinese government played an important role in promoting private sustainability standards for palm oil by adopting a policy on green consumption, which led some government agencies to partner with private standard-setting organizations, paving the way for eco-certification in the Chinese palm oil market. Lauwo et al. (2016) examined corporate social responsibility in the mining sector in Tanzania, and found that the government had established legal and regulatory frameworks on enhanced public accountability, ethical business practices and corporate disclosure. Yet, since the Tanzanian government lacked the necessary financial, legal and administrative resources to enforce these, NGOs have sought to fill the remaining regulatory gap. In contrast to this complementary role of state and non-state actions, public and private actors' interests can also conflict, leading to the undermining of governance institutions as in the example of the Indonesian Palm Oil Pledge (IPOP) (Dermawan and Hospes 2018). In 2014, several large palm oil producing companies made zero-deforestation commitments by signing the IPOP, but Indonesian politicians and government agencies openly criticized the IPOP for posing a danger to smallholders, not acknowledging government rules and priorities and functioning as an illegal cartel, which ultimately led to the dissolution of the IPOP in 2016 (ibid.).

5. Discussion and conclusions

In recent years, research addressing a variety of global flows connecting geographically distant places, examining their environmental impacts, and discussing their implications for environmental governance, has expanded. Based on the 120 articles reviewed here, we observe that the number of articles published per year has almost doubled between 2011 (12 articles) and 2018 (22 articles). Despite the fact that the majority of the reviewed articles study similar problems related to the lack of effectiveness of existing governance instruments in different global flows, scholarship in this broad field seems to be only tenuously connected, given the low number of mutual citations and co-authored articles, and the wide variety of theoretical lenses adopted. This poses obstacles to the cumulation of knowledge in this field. The heterogeneous nature of research on this topic may of course be valuable in advancing understanding, starting from diverse, but complementary theoretical and disciplinary perspectives to investigate economic, political, social and ecological drivers and responses to telecoupled flows. On the other hand, it may be timely to identify opportunities to more strongly integrate the various strands of research exploring the governance of telecoupling, to develop a common language for shared concerns, and to establish wider collaborations to study how telecoupling can be governed towards sustainability. Rather than merging or bridging the diverging theoretical perspectives, research might usefully harness the productive tensions between various approaches (Nielsen et al., 2019). In this sense, other conceptual frameworks that consider the linkages between multiple places, such as translocality or land use leakage, provide opportunities for cross-fertilization between different theoretical frameworks and could be employed to investigate the economic, environmental, social and cultural dynamics underpinning global commodity flows (Güneralp et al., 2013; Meyfroidt et al., 2018). The concept of translocality, for example, highlights the changeable character of (social) networks, which need to be actively created and maintained (Schapendonk 2015). This also points to the role of traders in global supply chains and the persistence of trade relationships (Grabs and Carodenuto 2021; Reis et al., 2020; Leijten et al., 2022). Although the telecoupling framework suggests that commodity flows have a clearly identifiable start and end, this may be hard to observe in reality, due to a lack of transparency and traceability in global commodity supply chains (Gardner et al., 2019). Teasing out the specific strengths of different conceptual frameworks will help the research community progress towards a more realistic and nuanced understanding of (governing) distant human-nature relationships. We hope that this study

helps pave the way towards a more integrated research agenda on the governance of telecoupled phenomena and more intensive collaboration and scholarly exchange as this research field continues to consolidate.

Our review identifies six cross-cutting themes and governance challenges emerging from our literature review, which, in our view, have not been investigated in detail but constitute promising avenues for advancing research on the topic. First, we found that previous research has largely evolved around the analysis of certain flows and prominent governance initiatives such as soy and palm oil and the two roundtables on Responsible Soy (RTRS) and Sustainable Palm Oil (RSPO). In contrast, flows not yet targeted by such initiatives have remained underresearched – even though they have significant environmental impacts. In general, the global trade in non-consumer-facing commodities, such as sand, phosphorus and uranium, has received little attention with regard to governance, even though these commodities often have harmful local environmental impacts (Torres et al., 2017; Nesme et al., 2018; Larsen and Mamosso 2014). We contend that to understand the governance implications of telecoupling, it is necessary to pursue a problem-centered approach, starting from the environmental impacts of telecoupled flows, rather than examining existing governance instruments and institutions in the first instance. On this basis, research would be well positioned to investigate which governance arrangements are in place to tackle these environmental problems and how they function and perform in practice.

Second, efforts to decouple economic growth and environmental degradation may drive telecoupling. The literature reviewed in this study recognizes that global flows reach around the world ever more rapidly, making it increasingly possible to shift environmental burdens from one place to another – usually from countries of the Global North to countries of the Global South. The majority of the studied flows originate in countries of the Global South, as shown in Fig. 8, where negative socio-ecological impacts predominate (Fig. 9), and are directed towards places of consumption in the Global North. Previous research has recognized the risk that decoupling of economic growth from resource use and/or emissions in the Global North may lead to the displacement of environmental impacts to distant places in the Global South (e.g., Dauvergne 2010; Wiedmann and Lenzen 2018; Jiborn et al., 2018; Sanyé-Mengual et al., 2019). This dynamic lends itself to analysis from a telecoupling perspective, yet studies on telecoupling have often only implicitly acknowledged how processes of decoupling in one jurisdiction may result in the creation or intensification of telecoupling between that jurisdiction and distant places. Given the urgent need to better understand and address diverse sustainability impacts that manifest in sending and receiving systems as well as globally, future research that studies interrelated impacts at opposite 'ends' of telecoupled flows and in spillover systems is needed.

A third aspect to emerge from our review is that effective environmental governance of telecoupling between countries of the Global South will likely become more important for global environmental sustainability, given the rapidly growing demands for natural resources and raw materials from emerging markets in the Global South. Most of the global flows reported in the reviewed articles originate in countries of the Global South and, although the majority of them are directed towards the Global North, South-South trade is becoming ever more important (Fig. 8). For instance, China is nowadays the main importer of beef and soy from Brazil, while India and China are the main importers of palm oil from Indonesia.[11] Since South-South telecouplings are a growing phenomenon, with China and Brazil leading the way (Gasparri et al., 2016), governance responses need to be adapted or developed to effectively address these new developments. As outlined in section 4, existing Northern consumer-driven governance initiatives like labelling and certification may be less relevant and effective in countries of the Global South, where consumer demand for social and environmental

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[11] See TRASE database at: https://trase.earth.

standards is (at least currently) comparatively lower than in markets of the Global North. These trends highlight the need for further research into emergent environmental governance arrangements in the Global South, which could provide more tailored and appropriate solutions to sustainability problems in the Global South and present alternatives to governance initiatives developed in the Global North.

Fourth, while previous research has described the growing role of private initiatives in the governance of global flows, this review shows that national governments and public policies such as legislation and regulation continue to play a crucial role as illustrated in Figs. 11 and 12. On the one hand, state actors from sending and receiving systems assume important roles in addressing the negative environmental impacts of global flows in telecoupled systems. With reference to the emergence of supply chain regulations from receiving systems, including new mandatory due diligence policies, scholars have even declared a 'return of the state' in the governance of global commodity chains (see Partzsch 2020; Schilling-Vacaflor and Lenschow 2021). On the other hand, our study has highlighted the importance of examining the state not only in its role in addressing sustainability problems, but also in its role in inducing and exacerbating telecoupled phenomena and their negative externalities. To enhance the effectiveness of environmental governance in global telecoupling, it will be crucial to ensure better policy coherence between different policy fields such as investment, trade and environmental policies. For example, in the case of the European Green Deal, improved effectiveness will mean inclusion of stringent measures to avoid displacement of the impacts of largely unsustainable European consumption to distant places, and the associated social and ecological costs (Fuchs et al., 2020).

Fifth, the emergence of transnational forms of governance reflects how regulatory scales increasingly transcend national territories and borders. While this is of course not an entirely recent development, attempts to govern globally telecoupled flows have exacerbated this situation. In telecoupled systems, authorities tasked with addressing a particular environmental problem may have no jurisdiction over the underlying cause of the problem (Ingold et al., 2019). This gives rise to a situation in which telecoupled systems are often governed by institutions and actors at multiple levels. In other words, governance of telecoupling tends to be polycentric (Oberlack et al., 2018), which gives rise to problems of policy coherence. Our study shows that diverse governance instruments often co-exist in relation to particular flows (Fig. 11), and interact across different levels of governance (Fig. 15). This highlights the need to pay close attention to the potentially reinforcing or counteracting interactions between different public and private governance instruments and across levels of governance. Moreover, many articles from our review mention the importance of the interactions between place-based and flow-based governance, without discussing specific patterns of interaction in detail. Thus, the multiple ways in which place-based and flow-based governance interventions – with their potentially territorially distant causes and effects – can interact, makes the governance of telecoupled systems a highly challenging and complex task that merits further in-depth and comparative research as well as the development of new concepts and theories.

Sixth, and finally, our review identifies rather different governance patterns across flows. For instance, recalling Fig. 11, state regulation and bi- and multi-lateral agreements dominate the governance of waste flows, whereas voluntary agreements and certification stand out in the governance of fish and soy flows. Future research should seek to confirm whether these observations reflect the empirical reality of governance across flows, or merely point to the uneven nature of research clusters. Given that different governance patterns are likely required to address different flows, we suggest that there is a need for comparative research in telecoupling governance. On the one hand, such research might test for flow-specific functional needs, for example, whether the toxicity of waste influences governance choices. On the other hand, inquiry might usefully be directed towards the social, political, cultural or economic foundations influencing the demand and supply of governance, such as the role of consumers, market structure, or the framing of problems as regionally specific or shared. At present, we know relatively little about what explains patterns of

hard versus soft governance, publicly- or privately-led governance, or the dominance of the local, national or international level in governance across different flows. Ultimately, such inquiries will inform decision-making on (combinations of) governance arrangements that may best address environmental problems in complex telecoupled settings.

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Declaration of competing interest

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Appendix A. Supplementary data

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References

Adams, R.J., Smart, P., Huff, A.S., 2017. Shades of grey: guidelines for working with the grey literature in systematic reviews for management and organizational studies. Int. J. Manag. Rev. 19 (4), 432–454. https://doi.org/10.1111/ijmr.12102.

Bellmann, C., Tipping, A., Sumaila, U.R., 2016. Global trade in fish and fishery products: an overview. Mar. Pol. 69, 181–188. https://doi.org/10.1016/j.marpol.2015.12.019.

Biggs, R., de Vos, A., Preiser, R., Clements, H., Maciejewski, K., Schlüter, M., 2021. The Routledge Handbook of Research Methods for Social-Ecological Systems. Taylor & Francis, p. 526.

Black, J., 2008. Constructing and contesting legitimacy and accountability in polycentric regulatory regimes. Regulation & Governance 2, 137–164. https://doi.org/10.1111/j.1748-5991.2008.00034.x.

Brandi, C.A., 2017. Sustainability standards and sustainable development – synergies and trade-offs of transnational governance. Sustain. Dev. 25 (1), 25–34. https://doi.org/10.1002/sd.1639.

Burch, S., Gupta, A., Inoue, C., Kalfagianni, A., Persson, A., Gerlak, A.K., Ishii, A., Patterson, J., Pickering, J., Scobie, M., van der Heijden, J., Vervoort, J., Adler, C., Bloomsfield, M., Djalante, R., Dryzek, J., Galaz, V., Gordon, C., Harmon, R., Jinnah, S., Kim, R.E., Olsson, L., Van Leeuwen, J., Ramasar, V., Wapner, P., Zondervan, R., 2019. New directions in earth system governance research. Earth System Governance 1, 100006.

Bush, S.R., Oosterveer, P., Bailey, M., Mol, A.P., 2015. Sustainability governance of chains and networks: a review and future outlook. J. Clean. Prod. 107, 8–19.

Bustos-Gallardo, B., 2013. The ISA crisis in Los Lagos Chile: a failure of neoliberal environmental governance? Geoforum 48, 196–206. https://doi.org/10.1016/j.geoforum.2013.04.025.

Challies, E., Newig, J., 2019. What is 'environmental governance'? A working definition. Sustainability Governance Blog. https://sustainability-governance.net/2019/06/14/what-is-environmental-governance-a-working-definition/. (Accessed 30 April 2021).

Challies, E., Newig, J., Lenschow, A., 2019. Governance for sustainability in telecoupled systems. In: Friis, C., Nielsen, J.Ø. (Eds.), Telecoupling. Exploring Land-Use Change in a Globalised World. Springer International Publishing, Cham, pp. 177–197.

Dauvergne, P., 2010. The Shadows of Consumption: Consequences for the Global Environment. MIT press, Cambridge, Massachussetts.

Dauvergne, P., 2018. The global politics of the business of "sustainable" palm oil. Global Environ. Polit. 18 (2), 34–52. https://doi.org/10.1162/glep_a_00455.

Dermawan, A., Hospes, O., 2018. When the state brings itself back into GVC: the case of the Indonesian palm oil Pledge. Global Policy 9 (October), 21–28. https://doi.org/10.1111/1758-5899.12619.

Dorninger, C., Hornborg, A., Abson, D.J., Von Wehrden, H., Schaffartzik, A., Giljum, S., Engler, J.O., Feller, R.L., Hubacek, K., Wieland, H., 2021. Global patterns of ecologically unequal exchange: implications for sustainability in the 21st century. Ecol. Econ. 179, 106824. https://doi.org/10.1016/j.ecolecon.2020.106824.

Eakin, H., DeFries, R., Kerr, S., Lambin, E.F., Liu, J., Marcotullio, P.J., Messerli, P., Reenberg, A., Rueda, X., Swaffield, S.R., Wicke, B., Zimmerer, K., 2014. Significance of telecoupling for exploration of land-use change. In: Seto, K.C., Reenberg, A. (Eds.), Rethinking Global Land Use in an Urban Era. MIT Press, pp. 141–161.

Eakin, H., Rueda, X., Mahanti, A., 2017. Transforming governance in telecoupled food systems. Ecol. Soc. 22 (4).

Foley, P., 2017. The territorialization of transnational sustainability governance: production, power and globalization in Iceland's fisheries. Environ. Polit. 26 (5), 915–937. https://doi.org/10.1080/09644016.2017.1343767.

Forget, M., 2015. Territorial trajectories within a new centre for the globalised mining industry: the Andes of northern Argentina. Journal of Alpine Research| Revue de géographie alpine. https://doi.org/10.4000/rga.3024, 103-3.

Frey, R.S., Gellert, P.K., Dahms, H.F. (Eds.), 2018. Ecologically Unequal Exchange: Environmental Injustice in Comparative and Historical Perspective. Springer. https://doi.org/10.1007/978-3-319-89740-0.

Friis, C., 2019. Telecoupling: a new framework for researching land-use change in a globalised world. In: Friis, C., Nielsen, J.Ø. (Eds.), Telecoupling. Exploring Land-Use Change in a Globalised World. Palgrave Macmillan, Cham, pp. 49–67. https://doi.org/10.1007/978-3-030-11105-2.

Friis, C., Nielsen, J.Ø., 2017a. On the system. Boundary choices, implications, and solutions in telecoupling land use change research. Sustainability 9 (6), 974.

Friis, C., Nielsen, J., 2017b. Land-use change in a telecoupled world: the relevance and applicability of the telecoupling framework in the case of banana plantation expansion in Laos. Ecol. Soc. 22 (4) https://doi.org/10.5751/ES-09480-220430.

Friis, C., Nielsen, J.Ø. (Eds.), 2019. Telecoupling. Exploring Land-Use Change in a Globalised World. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-030-11105-2.

Fuchs, R., Brown, C., Rounsevell, M., 2020. Europe's Green Deal offshores environmental damage to other nations. Nature 586, 671. https://doi.org/10.1038/d41586-020-02991-1.

Gardner, T.A., Benzie, M., Börner, J., Dawkins, E., Fick, S., Garrett, R., Godar, J., Grimard, A., Lake, S., Larsen, R.K., Mardas, N., McDermott, C.L., Meyfroidt, P., Osbeck, M., Persson, M., Sembres, T., Suavet, C., Strassburg, B., Trevisan, A., West, C., Wolvekamp, P., 2019. Transparency and sustainability in global commodity supply chains. World Dev. 121, 163–177.

Gasparri, N.I., Kuemmerle, T., Meyfroidt, P., le Polain de Waroux, Y., Kreft, H., 2016. The emerging soybean production frontier in Southern Africa: conservation challenges and the role of south-south telecouplings. Conservation Letters 9 (1), 21–31. https://doi.org/10.1111/conl.12173.

Grabs, J., Carodenuto, S.L., 2021. Traders as sustainability governance actors in global food supply chains: a research agenda. Bus. Strat. Environ. 30 (2), 1314–1332.

Güneralp, B., Seto, K.C., Ramachandran, M., 2013. Evidence of urban land teleconnections and impacts on hinterlands. Curr. Opin. Environ. Sustain. 5 (5), 445–451.

Havice, E., Campling, L., 2017. Where chain governance and environmental governance meet: interfirm strategies in the canned tuna global value chain. Econ. Geogr. 93 (3), 292–313. https://doi.org/10.1080/00130095.2017.1292848.

Huang, W., Wilkes, A., Sun, X., Terheggen, A., 2013. Who is importing forest products from Africa to China? An analysis of implications for initiatives to enhance legality and sustainability. Environ. Dev. Sustain. 15 (2), 339–354. https://doi.org/10.1007/s10668-012-9413-1.

Ingold, K., Driessen, P.P., Runhaar, H.A., Widmer, A., 2019. On the necessity of connectivity: linking key characteristics of environmental problems with governance modes. J. Environ. Plann. Manag. 62 (11), 1821–1844. https://doi.org/10.1080/09640568.2018.1486700.

Jager, N.W., 2016. Transboundary cooperation in European water governance – a set-theoretic analysis of international river basins. Environmental Policy and Governance 26 (4), 278–291. https://doi.org/10.1002/eet.1717.

Jiborn, M., Kander, A., Kulionis, V., Nielsen, H., Moran, D., 2018. Decoupling or delusion? Measuring emissions displacement in foreign trade. Global Environ. Change 49, 27–34. https://doi.org/10.1016/j.gloenvcha.2017.12.006.

Jorgenson, A.K., 2016. Environment, development, and ecologically unequal exchange. Sustainability 8 (3), 227. https://doi.org/10.3390/su8030227.

Kehoe et al, 2020. Inclusion, transparency, and enforcement: how the EU-mercosur trade agreement fails the sustainability test. One Earth. https://doi.org/10.1016/j.oneear.2020.08.013.

Krapovickas, J., Sacchi, L.V., Hafner, R., 2016. Firewood supply and consumption in the context of agrarian change: the Northern Argentine Chaco from 1990 to 2010. Int. J. Commons 10 (1), 220–243. https://doi.org/10.18352/ijc.609.

Larsen, R.K., Mamosso, C.A., 2014. Aid with blinkers: environmental governance of uranium mining in Niger. World Dev. 56, 62–76. https://doi.org/10.1016/j.worlddev.2013.10.024.

Lauwo, S.G., Otusanya, O.J., Bakre, O., 2016. Corporate social responsibility reporting in the mining sector of Tanzania: (Lack of) government regulatory controls and NGO activism. Account Audit. Account. J. 29 (6), 1038–1074. https://doi.org/10.1108/AAAJ-06-2013-1380.

Lawrence, A., Thomas, J., Houghton, J., Weldon, P., 2015. Collecting the evidence: improving access to grey literature and data for public policy and practice. Aust. Acad. Res. Libr. 46 (4), 229–249. https://doi.org/10.1080/00048623.2015.1081712.

Leijten, F., Reis, T.N., Sim, S., Verburg, P.H., Meyfroidt, P., 2022. The influence of company sourcing patterns on the adoption and effectiveness of zero-deforestation commitments in Brazil's soy supply chain. Environ. Sci. Pol. 128, 208–215.

Lenschow, A., Newig, J., Challies, E., 2016. Globalization's limits to the environmental state? Integrating telecoupling into global environmental governance. Environ. Polit. 25 (1), 136–159.

Liu, J., 2014. Forest sustainability in China and implications for a telecoupled world. Asia and the Pacific Policy Studies 1 (1), 230–250. https://doi.org/10.1002/app5.17.

Liu, J., Hull, V., Batistella, M., DeFries, R., Dietz, T., Fu, F., Hertel, T.W., Izaurralde, R.C., Lambin, E.F., Li, S., Martinelli, L.A., McConnell, W.J., Moran, E.F., Naylor, R., Ouyang, Z., Polenske, K.R., Reenberg, A., de Miranda Rocha, G., Simmons, C.S., Verburg, P.H., Vitousek, P.M., Zhang, F., Zhu, C., 2013. Framing sustainability in a telecoupled world. Ecol. Soc. 18 (2), 26. https://doi.org/10.5751/ES-05873-180226.

Liu, J., Dou, Y., Batistella, M., Challies, E., Connor, T., Friis, C., Millington, J.D.A., Parish, E., Romulo, C.L., da Silva, R.F.B., Triezenberg, H.A., Yang, H., Zhao, Z., Zimmerer, K.S., Huettmann, F., Treglia, M.L., Basher, Z., Chung, M.G., Helzberger, A., Lenschow, A., Mechiche-Alami, A., Newig, J., Roche, J., Sun, J., 2018. Spillover systems in a telecoupled Anthropocene: typology, methods, and governance for global sustainability. Curr. Opin. Environ. Sustain. 33, 58–69. https://doi.org/10.1016/j.cosust.2018.04.009.

Liu, J., Herzberger, A., Kapsar, K., Carlson, A.K., Connor, T., 2019. What is telecoupling? In: Friis, C., Nielsen, J. (Eds.), Telecoupling. Exploring Land-Use Change in a Globalised World. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-030-11105-2_2.

Lowe, A.J., Boshier, D., Ward, M., Bacles, C.F.E., Navarro, C., 2005. Genetic resource impacts of habitat loss and degradation; reconciling empirical evidence and predicted theory for neotropical trees. Heredity 95 (4), 255–273.

Maryudi, A., Myers, R., 2018. Renting legality: how FLEGT is reinforcing power relations in Indonesian furniture production networks. Geoforum 97 (March), 46–53. https://doi.org/10.1016/j.geoforum.2018.10.008.

Meyfroidt, P., Chowdhury, R.R., de Bremond, A., Ellis, E.C., Erb, K.H., Filatova, T., Garrett, R.D., Grove, J.M., Heinimann, A., Kuemmerle, T., Kull, C.A., Lambin, E.F., Landon, Y., le Polain de Waroux, Y., Messerli, P., Müller, D., Nielsen, J.Ø., Peterson, G.D., Verburg, P.H., 2018. Middle-range theories of land system change. Global Environ. Change 53, 52–67.

Moher, D., Liberati, A., Tetzlaff, J., Altman, D.G., Grp, P., 2009. Preferred reporting Items for systematic reviews and meta-analyses: the PRISMA statement (reprinted from annals of internal medicine). Phys. Ther. 89 (9), 873–880. https://doi.org/10.1371/journal.pmed.1000097.

Nesme, T., Metson, G.S., Bennett, E.M., 2018. Global phosphorus flows through agricultural trade. Global Environ. Change 50, 133–141. https://doi.org/10.1016/j.gloenvcha.2018.04.004.

Newig, J., Lenschow, A., Challies, E., Cotta, B., Schilling-Vacaflor, A., 2019. What is governance in global telecoupling? Ecol. Soc. 24 (3) https://doi.org/10.5751/ES-11178-240326.

Newig, J., Challies, E., Cotta, B., Lenschow, A., Schilling-Vacaflor, A., 2020. Governing global telecoupling toward environmental sustainability. Ecol. Soc. 25 (4), 21.

Nielsen, J.Ø., Friis, C., Niewöhner, J., 2019. Beyond integration: exploring the interdisciplinary potential of telecoupling research. In: Friis, C., Nielsen, J.Ø. (Eds.), Telecoupling. Exploring Land-Use Change in a Globalised World. Springer International Publishing, Cham, pp. 339–355. https://doi.org/10.1007/978-3-030-11105-2_18.

Oberlack, C., Boillat, S., Brönnimann, S., Gerber, J.-D., Heinimann, A., Ifejika Speranza, C., Messerli, P., Rist, S., Wiesmann, U., 2018. Polycentric governance in telecoupled resource systems. Ecol. Soc. 23 (1) https://doi.org/10.5751/ES-09902-230116.

Ohno, H., Matsubae, K., Nakajima, K., Nansai, K., Fukushima, Y., Nagasaka, T., 2016. Consumption-based accounting of steel alloying elements and greenhouse gas emissions associated with the metal use: the case of Japan. Journal of Economic Structures 5 (1), 3. https://doi.org/10.1186/s40008-016-0060-9.

Oosterveer, P., 2018. Global environmental networks and flows addressing global environmental change. In: Environment and Society: Concepts and Challenges, vols. 95–118. Springer, Cham. Magnus Boström and Debra J. Davidson.

Pacheco, P., Gnych, S., Dermawan, A., Komarudin, H., Okarda, B., 2017. The Palm Oil Global Value Chain: Implications for Economic Growth and Social and Environmental Sustainability. Working Paper 220. Bogor, Indonesia. CIFOR. https://www.cifor.org/publications/pdf_files/WPapers/WP220Pacheco.pdf. (Accessed 18 May 2021).

Partzsch, L., 2020. Alternatives to Multilateralism: New Forms of Social and Environmental Governance. The MIT Press, Cambridge, MA. https://doi.org/10.7551/mitpress/12610.001.0001.

Prior, T., Wäger, P.A., Stamp, A., Widmer, R., Giurco, D., 2013. Sustainable governance of scarce metals: the case of lithium. Sci. Total Environ. 461–462, 785–791. https://doi.org/10.1016/j.scitotenv.2013.05.042.

Radel, C., Jokisch, B.D., Schmook, B., Carte, L., Aguilar-Støen, M., Hermans, K., Zimmerer, K., Aldrich, S., 2019. Migration as a feature of land system transitions. Curr. Opin. Environ. Sustain. 38, 103–110.

Reis, T., Meyfroidt, P., zu Ermgassen, E., West, C., Gardner, T., Bager, S., Croft, S., Lathuillière, M.J., Godar, J., 2020. Understanding Trade Stickiness to Improve the Sustainability of Global Commodity Supply Chains. Available at SSRN: https://ssrn.com/abstract=3508883. or. http://dx.doi.org/10.2139/ssrn.3508883.

Renckens, S., Skogstad, G., Mondou, M., 2017. When normative and market power interact: the European Union and global biofuels governance. J. Common. Mark. Stud. 55 (6), 1432–1448. https://doi.org/10.1111/jcms.12584.

Richey, R.G., Tokman, M., Dalela, V., 2010. Examining collaborative supply chain service technologies: a study of intensity, relationships, and resources. J. Acad. Market. Sci. 38 (1), 71–89.

Sanyé-Mengual, E., Secchi, M., Corrado, S., Beylot, A., Sala, S., 2019. Assessing the decoupling of economic growth from environmental impacts in the European Union: a consumption-based approach. J. Clean. Prod. 236, 117535. https://doi.org/10.1016/j.jclepro.2019.07.010.

Saswattecha, K., Kroeze, C., Jawjit, W., Hein, L., 2015. Assessing the environmental impact of palm oil produced in Thailand. J. Clean. Prod. 100, 150–169. https://doi.org/10.1016/j.jclepro.2015.03.037.

Schapendonk, J., 2015. What if networks move? Dynamic social networking in the context of African migration to Europe. Popul. Space Place 21 (8), 809–819.

Schilling-Vacaflor, A., Lenschow, A., 2021. Hardening Foreign Corporate Accountability through Mandatory Due Diligence in the European Union? New Trends and Persisting Challenges. Regulation & Governance. https://doi.org/10.1111/rego.12402.

Schilling-Vacaflor, A., Lenschow, A., Challies, E., Cotta, B., Newig, J., 2021. Contextualizing Certification and Auditing: Soy Certification and Access of Local Communities to Land and Water in Brazil, vol. 140. World Development, p. 105281. https://doi.org/10.1016/j.worlddev.2020.105281.

Schleifer, P., Sun, Y., 2018. Emerging markets and private governance: the political economy of sustainable palm oil in China and India. Rev. Int. Polit. Econ. 25 (2), 190–214. https://doi.org/10.1080/09692290.2017.1418759.

Schouten, G., Bitzer, V., 2015. The emergence of Southern standards in agricultural value chains: a new trend in sustainability governance? Ecol. Econ. 120, 175–184. https://doi.org/10.1016/j.ecolecon.2015.10.017.

Sikor, T., Auld, G., Bebbington, A.J., Benjaminsen, T.A., Gentry, B.S., Hunsberger, C., Izac, A.-M., Margulis, M.E., Plieninger, T., Schroeder, H., 2013. Global land governance: from territory to flow? Curr. Opin. Environ. Sustain. 5, 522–527.

Sotirov, M., Stelter, M., Winkel, G., 2017. The emergence of the European Union Timber Regulation: how Baptists, Bootleggers, devil shifting and moral legitimacy drive change in the environmental governance of global timber trade. For. Pol. Econ. 81 (March), 69–81. https://doi.org/10.1016/j.forpol.2017.05.001.

Steurer, R., 2011. Soft instruments, few networks: how 'New Governance' materializes in public policies on corporate social responsibility across Europe. Environmental Policy and Governance 21 (4), 270–290.

Swanson, H.A., 2015. Shadow ecologies of conservation: Co-production of salmon landscapes in Hokkaido, Japan, and southern Chile. Geoforum 61, 101–110. https://doi.org/10.1016/j.geoforum.2015.02.018.

Torres, A., Brandt, J., Lear, K., Liu, J., 2017. A looming tragedy of the sand commons. Science 357 (6355), 970–971. https://doi.org/10.1126/science.aao0503.

European Union, 2017. Environmental Impact Assessment of Projects: Guidance on Scoping. EU Publication Office. https://doi.org/10.2779/71339.

Van Eck, N.J., Waltman, L., 2017. Citation-based clustering of publications using CitNetExplorer and VOSviewer. Scientometrics 111 (2), 1053–1070. https://doi.org/10.1007/s11192-017-2300-7.

Wiedmann, T., Lenzen, M., 2018. Environmental and social footprints of international trade. Nat. Geosci. 11 (5), 314–321. https://doi.org/10.1038/s41561-018-0113-9.