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## Globalization's limits to the environmental state? Integrating telecoupling into global environmental governance

Andrea Lenschow<sup>a\*</sup>, Jens Newig<sup>b</sup> and Edward Challies<sup>b</sup>

*<sup>a</sup>Institut für Sozialwissenschaften, Fachbereich Kultur- und Sozialwissenschaften, Universität Osnabrück, Osnabrück, Germany; <sup>b</sup>Research Group Governance, Participation and Sustainability, Leuphana Universität Lüneburg, Lüneburg, Germany*

Globalization entails increased interdependence and interconnectivities among distal regions and social-ecological systems. This global interregional connectedness – telecoupling – gives rise to specific sustainability challenges, which require new governance solutions. Moving beyond ‘scaling-up’ governance to address global environmental problems, and exploring the implications of telecoupling for state-led environmental governance, ways the state can effectively address telecoupled environmental issues both within and beyond national borders are addressed, drawing on the example of soy trade between Brazil and Germany. This builds on recent contributions to the literature on governance of interregional ecological challenges to elaborate potential policy and governance options, ranging from classical bilateral, multilateral, and international agreements, to information-based, economic, and hybrid governance modes. While telecoupled environmental problems create governance challenges related to scale, knowledge gaps, coordination, and state capacity, the state has an important role to play. To explore this further, interdisciplinary inquiry is required that includes but moves beyond the state.

**Keywords:** teleconnections; telecoupled systems; sustainability governance; interregional connectedness

### Introduction

Undoubtedly, environmental governance and policy is highly influenced by global interdependencies. Whereas in early phases, emerging ‘environmental states’ have been successful in cleaning up their environments (Meadowcroft 2012), complex global interactions have led observers to question the adequacy of nation state-led environmental action (Elliott 2004), and point to the growing importance of transnational and private or civic governance. In doing so, however, the political science literature has tended to suggest that addressing global issues (e.g., climate change or biodiversity loss) merely entails upscaling

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\*Corresponding author. Email: [andrea.lenschow@uni-osnabrueck.de](mailto:andrea.lenschow@uni-osnabrueck.de)

governance from the local or national to the global level. In this view, prevailing in international relations scholarship, global problems must be governed by global institutions (Biermann and Dingwerth 2004).

Globalization research has highlighted the importance of intensifying linkages between people and places, or what economic geographers and international relations theorists have termed 'global interconnectedness' (McGrew 1997, Held *et al.* 1999, Sheppard 2002). Yet, rather more recently, a rapidly growing community of interdisciplinary land-change and social-ecological systems scholars have begun to study 'teleconnections' or 'telecoupling,' which connect social-ecological systems across distant regions (Young *et al.* 2006, Adger *et al.* 2009, Kissinger and Rees 2010, Duit *et al.* 2010, Seto *et al.* 2012, Liu *et al.* 2013, 2015, Meyfroidt *et al.* 2013, Yu *et al.* 2013, Moser and Hart 2015). This work has thus begun to acknowledge the importance and specificity of regional interconnections, wherein actions in certain parts of the world impact quite specifically on the sustainability of other, spatially distant places and systems. This approach draws on the concept of positive or negative environmental spillovers (Stewart 1992), which can have significant impacts beyond adjacent areas, affecting spatially remote localities and regions. An analysis of such telecoupling can identify key mechanisms by which spillovers are spatially 'displaced.' In light of this, sustainability problems are often neither confined within local or regional borders, nor 'global' in the sense of affecting the whole of the planet.

Given these specific interregional teleconnections, it is arguably the nation state (or subnational jurisdictions) that will have to play a crucial role in governing emerging environmental problems. Clearly, broadly international or global institutions would be either much too unspecific, or it would overburden the international community to tackle the myriad of telecoupled problems on a global level. At the same time, 'territorially rooted institutions [at local, regional, or state level] are constantly being stretched to engage with issues which escape their jurisdictions or infiltrate their frontiers' (Meadowcroft 2002, p. 171). We propose here to move beyond the question of 'who governs and at which scale' and shift attention to governance approaches and policies that might bridge the spatial 'disconnect.' With this, we follow Liu *et al.* (2013, 2015), who identify a need for further research on the policy and governance implications of telecoupling for environmental sustainability, and Kissinger *et al.* (2011) who suggest a helpful framework to classify possible governance approaches. In this context, we argue that the state will remain a central starting point for discussions of (global) environmental governance, implying that governance need not be beyond, but rather with, the state (Barry and Eckersley 2005, Bulkeley and Jordan 2012, Compagnon *et al.* 2012).

We suggest drawing on the recent works on telecoupled global environmental (un-)sustainability issues to enrich the debate on global environmental politics and governance. We address the question of how the state can, given specific interregional challenges for environmental protection, including telecoupling

between distant regions, maintain control and effectively address such challenges both within and beyond its borders. What policy and governance options, including but also going beyond the classical bilateral, multilateral, and international agreements, may aid this, given ubiquitous transboundary environmental challenges?

We attempt to address these mounting issues by first elaborating on the importance of global telecoupling for the debate on (global) state-led environmental governance. We illustrate our point through the example of soy production and trade between the regions of Rio Grande do Sul (Brazil) and Lower Saxony (Germany). Building on this case and drawing on recent contributions to the literature on the governance of interregional ecological challenges, we then reflect on the (potential) impact of global patterns of interconnectedness on public authorities at state and regional levels and their ability to govern toward environmental sustainability. We build on primary empirical research for our main case study that establishes the environmental impacts of telecoupling at the regional level and explores governance responses that have been tried or discussed by stakeholders. On this basis, we identify a need to explore further the governance question and the role of, and challenges for, the national state. We conclude by outlining perspectives for interdisciplinary inquiry that include but also move beyond the notion of the state.

## **Telecoupling and problems of environmental sustainability**

### ***The classical view on globalization and sustainability***

‘Globalization’ is often said to have unsustainable implications. Environmental degradation, social injustice, and economic vulnerability have all been attributed to increasing global interconnectivity (Sachs 1999, Vercelli 2006, Harris 2006, Young *et al.* 2006, Krapivin and Varotos 2007, Newell 2012). This raises important questions about the definition of sustainability in light of globalization processes, and the design of governance institutions to address multifaceted global sustainability challenges. Much current research, however, adopts an overly simplistic conceptualization of globalization and sustainability and tends to disregard scholarship in neighboring fields.

Within the mainstream debate on the environmental pillar of sustainability, economic globalization is often identified as a primary cause of unsustainable development, assuming that globalized economies (global trade, investment, and financial markets) subordinate environmental concerns to economic imperatives (Hoffmann-Riem 2011, pp. 71–72). The consequences of ‘unrestrained global competitiveness’ (Mol 2001, p. 72) include increased pollution and resource depletion and a regulatory ‘race to the bottom’ (Lazer 2001, Rudra 2008) in pursuit of investment and economic growth. An ‘apocalyptic view of global environmental change’ (Mol 2001, pp. 78–79) appears to characterize one side of the mainstream debate over globalization and sustainability. For example,

Sonnenfeld (2008, p. 341) writes: ‘never before has the commoditized exchange and consumption of goods and services been so great – with large accompanying risks, health and environmental impacts, and regulatory strains, gaps, and gaping holes.’ In contrast, other strands of research either question the validity of the negative diagnosis, for example by identifying policy diffusion and convergence at advanced levels of regulation (Holzinger *et al.* 2008, Jörgens *et al.* 2014) or even point to ‘positive’ environmental impacts of economic globalization, suggesting that economic liberalization promotes economic growth, which, along with the spread of ‘good governance’ and liberal democracy, increases the efficiency of resource use and optimizes the global distribution of environmental costs and benefits (Bhagwati 2007).

Much of the debate, however, suffers from at least two major interrelated conceptual limitations. First, ‘globalization,’ ‘sustainability,’ and ‘environment’ are treated in highly aggregated terms, and are construed as undifferentiated and monolithic phenomena (e.g., see Vercelli 2006, Thai *et al.* 2007, Eakin *et al.* 2014). Even if one focuses analysis on a single dimension of sustainable development (e.g., concentrating on environmental effects), there remains a danger and tendency of overly aggregated analysis, which is inconsistent with empirical reality, and cannot support explanation and understanding of the variety of impacts in social-ecological systems (Challies *et al.* 2014). Thus, globalization might contribute to sustainable modes of production and environmental protection in one sector or in one region at the expense of another sector or region. Even within one sector or region, or for one group of actors, positive and negative effects of globalization might co-exist. Second, globalization tends to be understood in terms of segregated territorial spatial logics (Amin 1997), wherein local, national, and global territorial scales exist in mutual exclusion and opposition. Depending on the level of analysis chosen, governance responses to globalization tend also to be discussed exclusively on the international, national, or local level in terms of their respective effectiveness and legitimacy, ignoring the interdependency of governance processes even outside formal multi-level governance systems. Such an understanding precludes a relational conceptualization of globalization as ‘a process of linkage and interdependence between territories’ (Amin 1997, p. 124), where territories and scales are overlapping and mutually influential (Swyngedouw 1997, Yeung 2002). The same necessarily holds for governance decisions taken at all levels. For instance, not only production processes, but also policies might trigger systemic displacements of activities or impacts in distant places (Kissinger *et al.* 2011).

### ***Telecoupling or interregional connectedness: a more realistic picture of globalization and sustainability***

Despite the prevalent juxtaposition of either the global or the national/regional level in global governance research, we acknowledge that some globalization research has highlighted the importance and specificity of regional interconnections (Held *et al.*

1999, Sheppard 2002) or teleconnections/telecoupling (Young *et al.* 2006, Adger *et al.* 2009, Kissinger and Rees 2010, Duit *et al.* 2010), wherein actions in certain parts of the world impact specifically on other, spatially distant places (see Figure 1).

Most notably, global interregional connectedness associated with globalizing production and trade has been addressed by economic geographers and sociologists in literature on global value chains (Hughes and Reimer 2004, Bair 2009) and global production networks (Hess and Yeung 2006). However, this literature has tended to disregard environmental sustainability questions, often remaining focused on firm-level analyses of supply-chain management and coordination. While attention is gradually turning to the role of social and environmental sustainability standards in global governance (Ponte *et al.* 2011), the governance implications of securing environmental sustainability in global value chains and production networks require further research (cf. Liu *et al.* 2015).

As to terminology, Liu *et al.* (2013) propose to distinguish between three processes of linking distant regions: teleconnections (natural phenomena, first described in climatology), globalization (social and economic phenomena), and telecoupling (coupled social and natural phenomena). While these definitions can certainly be debated, we adopt the term ‘telecoupling’ to refer to phenomena in which natural and/or socioeconomic processes link distant regions in the sense of global interregional connectedness.

### ***Governance of globally telecoupled sustainability problems***

The proliferation of global networks of production and trade poses important challenges for effective environmental state governance, as power in the global economy has shifted to a certain extent toward networked private sector actors. New approaches to environmental governance are therefore required, in theory and in practice (Scholte 2010). From the perspective of the nation state, this implies either the emergence of ‘front runners’ in environmental matters, whose strategies then – horizontally – diffuse to others, or a – vertical – upscaling to the international arena (Biermann and Dingwerth 2004). Indeed, much research conducted to this end, continues to call for ‘global governance’ (Speth and Haas 2006, Carter 2007, Sonnenfeld 2008) to replace or augment national-level government (Brown 2009, Lowe and Wilkinson 2009). Such calls originate in a classical approach to the ‘global nature of “high consequence risks”, [which] leads to the need to pool sovereignty in institutions of effective global governance’ (Hay 2008, p. 595).

Two main strands of research appear relevant to conceptualize and address globally interconnected sustainability issues, thus moving beyond an upscaling of national-level government. While the multilevel governance (MLG) debate addresses the questions of who governs and at which scale, the literature on global environmental governance and regimes addresses the instruments and policies through which to govern and their effectiveness.

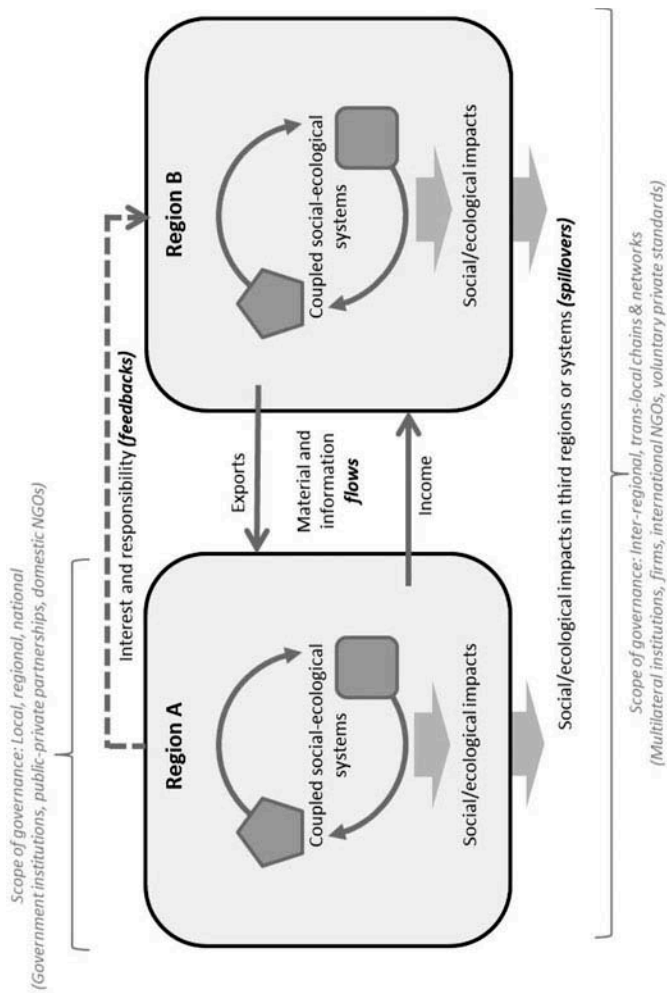


Figure 1. Telecoupling and environmental sustainability.  
Source: Adapted from Challies *et al.* (2014, p. 35), building on Kissinger and Rees (2010, p. 2618); Munroe *et al.* (2014, p. 18); Liu *et al.* (2013, pp. 2–3); Eakin *et al.* (2014, p. 147).

MLG analyzes the interaction of governing institutions and actors at various scales, focusing on questions of democratic legitimacy in contemporary governance. MLG research identifies political structures and processes that challenge or bypass state territorial bodies, and thereby examines the social and political interdependencies that exist between individual territories. Drawing on research on polycentricity, 'Type II' MLG (Hooghe and Marks 2003) focuses on diffuse, multipolar governance apparatus that have emerged in part through globalization and supraterritorialism. The key contention is that governance of social-ecological systems or networks may be conducted from many 'centers' rather than one central point of control. Such distributed, semi-autonomous centers may be found at subnational and supranational levels, as polycentric modes of governance do not privilege particular scales or administrative levels, but are conceptualized as cross-scalar (Olsson *et al.* 2006). The concept of polycentricity may therefore inform environmental governance in light of globalization processes that are witnessing, first, a transformation in the role of the state and increased prevalence and power of networks of nonstate actors in contemporary governance, and second, the rise of cross-scalar networks for the governance of complex relations of global interconnectivity (see, e.g., Ansell *et al.* 2012). These important global shifts – in the distribution of power and the deployment of scale – must be taken into consideration in research seeking to understand contemporary challenges and opportunities for global environmental governance.

The literature on global environmental governance and regimes (Young 2008, Biermann *et al.* 2012), while less concerned with the multilevel and scalar organization of governance, addresses global policy instruments and their effectiveness. Key recommendations include to negotiate new and strengthen existing international environmental treaties, and to 'upgrade' UN environmental organizations such as UNEP and UNCSD. While important insights into the effectiveness of single policy instruments or large regimes, as well as the role of private actors in transnational rule making (Pattberg 2006), have emerged from this literature, the focus clearly has been on the 'global' level of governance, thus disregarding the more complex phenomena of interregional connections and other multi-scalar issues.

Questions of governance of global environmental flows have been approached by environmental sociologists (e.g., Castells 1996) looking to reconcile social system and network theories with empirical analyses of global material and biophysical flows. This integrative approach provides important insights into the 'social interactions, dynamics and power relations governing these material flows [and] the non-material (e.g. financial and informational) flows that parallel them' (Mol and Spaargaren 2006, p. 54). A key objective in this is to identify the modern governance institutions within which the logics of (more or less sustainable) environmental flows are embedded. Rather than mapping neatly onto combinations of public, private, and civic institutional actors, global environmental flows (associated with cross-border production and trade, global commodity chains, and capital and information flows) are increasingly governed by a



variety of hybrid forms and networked coalitions of actors (Swyngedouw 2005). While these governance arrangements are broader and potentially more inclusive than hierarchical modes of governing, they also tend to be more fragmented and differentiated (Meadowcroft 2002). This is particularly evident in the rapid rise of private governance mechanisms (including sustainability standards and certifications, and corporate responsibility), which overlap and interact with public regulation of global networks (Ponte *et al.* 2011). In exploring the sustainability implications of material flows across global commodity chains, analysis of the interaction of multilevel public regulation and networked private and civic governance is essential.

### ***Reflections on the role of the state***

The political science and environmental sociology literatures on environmental governance have only touched upon the complex issues of global interregional connectedness. The question remains as to what extent and under what conditions the environmental state can effectively respond to these challenges arising outside the national (or regional) territory. In our literature review on governing 'global' environmental sustainability issues, we have identified two distinct points of departure. First, the actor-centered perspective is important for this discussion in the sense that here the role of the state (and of public actors more generally) in a globalized environment is problematized: hierarchical, networked, and polycentric constellations across levels of governance are identified – sometimes as a new phenomenon that may be interesting in itself, sometimes in terms of governance effectiveness (and legitimacy). A second strand approaches governance from an instrumental (i.e., policy) perspective, treating the actors responsible for developing and executing the instrument as secondary or epiphenomenal.

Here, we depart from the second strand. Studying 'the capacities of [environmental] states to realize particular kinds of goals,' the concept of *policy instrument* – referring to 'the relevant means that a state may have at its disposal' (Skocpol 1985, p. 18) – is central. Thus, in our first attempts to reflect on the role of the state in responding to issues of regional interconnectivity as outlined in our case, we will consider the implications of various policy responses to the exposure to interregional connectedness for the role of the state. In other words, we focus on a problem constellation of regional interconnectedness and approach the role of the state from a problem-solving perspective. We depart from a framework offered by Kissinger *et al.* (2011), who assume high – and increasing – levels of regional ecological interconnectedness due to modern, highly differentiated societies and global economic relations. Furthermore, they establish a link between this diagnosis and available policy responses. They do not discuss the role of the state, although implicitly they focus on policy options of national states; here we attempt to extend this analysis.

Kissinger *et al.* suggest a helpful classification of the effects of regional ecological interconnectedness that can aid the analysis of policy implications. They distinguish four types of interregional impacts:

- Interregional pollution relates to deliberate as well as unintended transboundary pollution as it is widely recognized in the literature (e.g., analyzing phenomena such as acid rain, ozone depletion, transboundary trade of [hazardous] waste, etc.).
- Transboundary impacts of local ecological change refer to ‘spillovers’ from local environmental degradation or improvements to levels of environmental sustainability in other countries or in global terms (e.g., effects of deforestation for global climate change).
- Interregional ecological footprints focus on the impact of regional consumption patterns on levels of sustainability in regions supplying relevant goods/materials, that is, reference is made to the globalization of commodity chains and the ecological burden imposed on exporting countries in order to satisfy consumers unaware of the ecological costs created by their demands.
- Finally, they identify policy-driven systemic interregional impact displacement, where economic or environmental policies in country/region A produce – typically unintended – adverse effects in country/region B due to new demands for raw materials or products, changing patterns of foreign investment, or the relocation of production sites.

### **Empirical illustration of telecoupling between Rio Grande do Sul, Brazil, and Lower Saxony, Germany: soy production and trade**

To illustrate the phenomenon of interregional telecoupling and its implications for the role of states in governing for sustainability, we consider the soy trade between the regions of Rio Grande do Sul (Brazil) and Lower Saxony (Germany). Trade in soy between the two regions has increased dramatically over the past decade, with significant economic, social, and ecological implications for both regions (see below). Intensive meat production in northwestern Germany is highly dependent on Brazilian soy as a basis for livestock feed, while Brazilian soy producers rely on European export markets – particularly Germany – for their product (Grenz *et al.* 2007).

The interdependence of these two spatially distant regions is less aptly captured by notions of amorphous globalization, and better analyzed in terms of specific and historically situated interregional connectedness or telecoupling. As such, this case is intended to exemplify the dynamics of a wider phenomenon, which could be approached with reference to a number of different case studies and network analyses of global interregional connectedness and environmental impacts. For example, studies have explored the extraction of phosphorus in Morocco for intensive agricultural production in various areas in Northern

Europe (e.g., Childers *et al.* 2011, Neset and Cordell 2012); iron ore (e.g., from Western Australia) for steel production in China (e.g., Yellishetty *et al.* 2010); and cotton from West Africa for European markets via global textile networks (e.g., Glin *et al.* 2012, Quark 2012). In presenting our case, we do not aim to test propositions on globalization or the environmental state, but rather our initial ‘map’ of governance responses shall serve as a point of departure for wider, systematic exploration.

### ***Economic interdependence and environmental impacts of soy trade***

Soybean is an important commercial crop due to its relatively high fat and protein content. The majority of soybean globally is processed for vegetable oil, and the main by-product of this industry, soybean meal, is the basis of most processed animal feeds. Global production has increased more than sixfold over the last four decades (Grenz *et al.* 2007), and Brazil has led this expansion. About half of Brazil’s annual production of around 81 million tons is directly exported, making soy a mainstay of Brazil’s export-oriented agricultural sector. Meanwhile, the European Union (EU) is a major importer, and in Germany, more than 80% of imported soy is consumed in the raising of pigs, poultry, and cattle (Grenz *et al.* 2007).

The distribution of environmental impacts varies along the soy commodity chain, but there are implications for both producing and consuming regions and for the integrity of the interregional commodity chain itself (see Table 1). In producing regions, soy production is associated with soil and water degradation, loss of biodiversity, proliferation of GMOs, and destructive infrastructure

Table 1. Environmental implications of the interregional soy trade.

| Germany  | Brazil  | Transregional/global   |
|--|---|--|
| Ammonia emissions to air   | Soil erosion and nutrient depletion           | Biodiversity loss and deforestation                          |
| Nitrogen runoff to water   | Biodiversity loss                             | CO <sub>2</sub> emissions from production and transportation |
| Over-nitrification increases susceptibility of crops to pests and environmental stresses | Pesticide contamination of soil and waterways | Genetic risk   |
| Impairment of buffer, storage and filtering capacities of soils                          | Nutrient runoff to waterways                  |  |
| Agrobiodiversity loss  | Groundwater depletion                         |  |
| Bioaccumulation of pharmaceuticals   |   |  |

Note: Own compilation based on Lanje (2005), Grenz *et al.* (2007), Kessler *et al.* (2007) and Velten (2009).

projects (Fearnside 2001, Kessler *et al.* 2007). In consuming regions (where soy is imported for animal feed), these trends undermine the sustainability of agricultural production and pose challenges for corporate responsibility in the agricultural sector (Reichenbach 1998). Moreover, the soy-dependent intensive livestock model has its own direct local impacts, including soil and water pollution, greenhouse gas emissions, bioaccumulation of pharmaceuticals, dietary and human health impacts, and loss of agrobiodiversity (Kessler *et al.* 2007, Mose *et al.* 2007, Steinfeld *et al.* 2010).

The regions of Rio Grande do Sul and Lower Saxony have particular significance in the global soy complex. Within Germany, Lower Saxony is the most important agricultural region (Lanje 2005). Current levels of meat production in the region, however, are entirely dependent on imported soy for animal feed (Reichert and Reichardt 2011), and Brazil is the second most important supplier (Osório-Peters 2003).

Rio Grande do Sul is an important and long-established agricultural production region, and benefits from comparatively good infrastructure (including the large container port of Rio Grande). Soy production has shaped the agricultural sector in the region since the 1970s (Kessler *et al.* 2007), and regional soy production amounts to approximately 12.5 million tons annually. The environmental externalities of extensive soy production in the region, however, are significant. The soy sector is reliant on significant inputs of fertilizers and agrichemicals and a wide range of local and international service providers (Lanje 2005). Agrichemical pollution and nutrient runoff have led to soil and water degradation, biodiversity loss, deforestation, and land concentration (Kaimowitz and Smith 2001, Fearnside 2001). The controversy surrounding genetically modified (GM) soy is particularly stark in Rio Grande do Sul, which is the largest production area of GM soy in Brazil (Lanje 2005).

Brazil is Germany's most important trade and investment partner in Latin America. Germany is a major investor in Brazil, and the second-largest investor in Rio Grande do Sul, with firms such as Stihl, Siemens, EPCOS, Lanxess, and Thyssen Krupp having a presence. Germany is also the sixth-largest importer of products (almost entirely soybean meal) from the region. In the political arena, there are important areas of cooperation between Germany and Brazil, through involvement in multilateral fora and bilateral initiatives. In particular, under the strategic partnership between the EU and Latin America, Germany and Brazil are cooperating to increase the latter's progress on the Millennium Development Goals, and to develop renewable energy resources (Faust 2006). The interregional connections and interdependencies associated with the soy chain, combined with the complex implications of environmental externalities and spillovers, make the two regions particularly suited to the investigation of environmental statehood in the face of globalization.

***Effects of regional ecological interconnectedness and their policy implications***

Building on the framework proposed by Kissinger *et al.* (2011), we now classify the forms of ecological interconnectedness in our case and map actual and potential state-led governance responses (see Table 2).

Four types of interregional impacts – interregional pollution, transboundary impact of local ecological change, interregional ecological footprint, and interregional impact displacement – are to different degrees observable in the example of soy production and consumption connecting Rio Grande do Sul with the Weser-Ems region in Lower Saxony. Our evidence is based on preliminary field research conducted in 2008–2009.

Depending on the extent to which we adopt a critical stance with regard to GMOs, we can detect deliberate as well as inadvertent transboundary ‘pollution.’ Clearly, the interregional soy chain entails a deliberate transfer of a controversial product. Final consumers of soy-fed meat, which may or may not be recognizable with respect to its precise origin and production methods, are potentially affected and have only limited options to avoid exposure. Other forms of transboundary pollution include, for instance, eutrophication of transboundary waters due to runoff from intensive livestock production in Germany, and the loss of global biodiversity following from production methods in Brazil and Germany, although it is also possible to subsume these phenomena under interregional ecological footprints (see below).

The second type of interregional impact involves local ecological change creating impacts at a distance. Hence, social and economic change in Germany may have shaped changing meat consumption patterns, driven changes in local agricultural production and land use, and allowed for the intensification of animal production locally, while increasing global demand for soy. This, finally, has contributed to the intensification and extension of soy production in Brazil with ecological consequences there.

The concept of interregional footprints directs analytical (and normative) attention toward patterns of consumption. High (and rising) demand for meat in Germany cannot be met from German production alone, and creates the demand for imported soy. Hence, the acreage needed to support total food production in Germany far exceeds the land available.

Finally, Kissinger *et al.* (2011) consider policy choices and their interregional impact displacement effects. ‘Non-sustainability’ is here traced back to political decision making. For example, US energy policy, responding to increases in oil prices, promoted the use of ethanol. This resulted in local production switching from soy to maize, and created market opportunities for Brazilian soy producers, who converted land (including forest) accordingly, with adverse effects on global carbon emissions and biodiversity. Various EU policies (e.g., the Renewable Energy Directive, the Biofuels Directive) are likely to create similar displacement effects – a point that has long been recognized by the European Environment

Agency, which has devoted considerable effort to understanding and accounting for the (intended and unintended) effects of EU policies (EEA 1999, 2001).

While these four types of interregional ecological impacts appear clearly distinguishable, upon closer consideration, they arguably provide different perspectives on multifaceted patterns of regional telecoupling with not only distant but also non-linear relations between cause and effect. These different perspectives, focusing on processes of ecological change, political choices, and production and consumption patterns, may also suggest different conceivable policy responses and new allocations of responsibility among state-based actors at various levels, as well as between state and nonstate actors.

Based on the classification by Kissinger *et al.* and our field and literature research, we now reflect on various policy responses that appear suitable for the Brazil–Germany soy case, and explore the implied role of the state. This exercise is one in identifying explorative–strategic scenarios in the sense of Börjeson *et al.* (2006). Discussing first insights from existing policy responses of the Brazilian and German states, we will also seek to understand to what extent state action tends to make explicit the interregional links, or whether we rather witness a ‘down-scaling’ of the issue to the national level; that is, we will inquire

Table 2. Linking potential policy responses to telecoupled environmental interrelations.

| Identified policy responses                                    | Interregional pollution | Interregional impacts of local ecological change | Interregional extension of ecological footprints | Policy-driven systemic displacement of activities or impacts among regions |
|--|-------------------------|--|--|--|
| Military power/economic land grab                              | +                       |  | +  |  |
| Bilateral and multilateral conventions                         | +                       |  | +  | +  |
| Voluntary or obligatory reporting, labeling, and certification | +                       |  | +  |  |
| Sustainable trade agreements                                   |                         |  | +  |  |
| Technology and knowledge transfer                              | +                       | +  | +  |  |
| International and bilateral financial support                  | +                       | +  |  |  |
| Compensation payments  |                         | +  |  |  |
| Economic instruments, environmental taxes                      |                         | +  | +  | +  |
| Full cost accounting   | +                       | +  | +  | +  |
| Collaborative and network governance                           | +                       | +  | +  | +  |

Note: Adopted with modification from Kissinger *et al.* (2011).

into the politicization of the interregional connection. This, in turn, has consequences for the legitimacy of governance by the environmental state.

*Military power* has not been a legitimate option in this case, as it is politically inconceivable that Germany would occupy Brazil either to prevent future production of GM soy (interregional pollution) or to secure access to soy production sites and hence internalize its ecological footprint. Although the German dependence on soy imports is considerable, there is no sign that international supply is insecure, so economically there are limited incentives to engage in land grabbing (Zoomers 2010). In case land grabbing becomes an issue in future, a state-centered analysis would focus on the role of the Brazilian state, which might intervene either to regulate the activities of foreign investors or to prevent land grabbing and protect Brazilian landowners. Either way, the mutual economic dependence between Brazil and Germany would enter the Brazilian political discourse; solutions to problems of ecological sustainability, however, are not the focus.

*Bilateral and multilateral conventions* are familiar as attempts to engage in international standard setting or regulation. In this example, an international convention might set rules on the authorization and scope of use of GM technology. Considering the high level of both scientific and interstate disagreement on the values or dangers implied in this technology, a multilateral convention setting binding rules may be difficult (Gruère 2006). The considerable difficulty in reaching internal agreement even on supranational regional scales (EU or NAFTA) renders agreement between these regional entities even less likely. Yet, a publically or privately sponsored voluntary agreement might offer a substitute in organizing a common *reporting and labeling regime*. *Labeling* might be equally relevant to limit the ecological footprint of German meat production. In order to achieve that, Europe-wide or global certification schemes for sustainable meat – establishing common rules for the use of pesticides and fertilizers, prevention of soil erosion and deforestation, regulating regional commodity chains, and ensuring acceptable working conditions, and so on – might be an option (e.g., Lanje 2005, Lenzen *et al.* 2012). Importantly, such global or unilateral (voluntary or obligatory) labeling efforts do not explicitly focus on interregional linkages – the reason for their omission from the discussion by Kissinger *et al.* – but rely on the assumption of changing demand patterns due to greater product transparency. From an environmental state perspective, conventions and regimes typically amount to an internationalization of governance structures, also beyond regionally interconnected scenarios. They may be state-led, but privately organized (voluntary) labeling regimes are also possible, thus limiting state activities and unburdening the state of having to regulate all details. In either case, they respond to weaknesses at the national level due to the transnational nature of the problem, but are likely to encounter their own problems, for instance, in ensuring compliance with common rules (Chayes and Chayes 1993, Young 1999, Brown Weiss and Jacobson 1998).

Apart from regional or international labeling regimes, unilaterally imposed obligatory labeling is already being requested in the EU, where GMO-based production has to be declared on all (imported) products (European Commission 2003). It was the hope that such a rule would quickly spill over to international economic partners, inducing the reorganization of production elsewhere. In other words, the unilateral strengthening of environmental statehood might facilitate the spread of more environmentally sustainable production patterns via regionally interconnected pathways. This is most realistic in the context of sizable markets. At the same time, unilateral action may always risk trade disruption imposed by negatively affected countries (cf., ongoing trade agreement negotiations between the EU and the USA). Furthermore, restrictions on or reductions of imports on these grounds could also see unsustainable exports diverted to other less discerning markets.

Ecological labeling and certification schemes as just discussed may have a wide range of intended and unintended implications. In our case, in order to ensure that the Brazilian agricultural sector does not suffer from such measures, the *global and European trade* limitations on Brazilian processed agricultural products – including meat – would need to be removed. Past reforms of EU Common Agricultural Policy have contributed to a more favorable framework for meat imports from outside the EU compared with a previously highly protectionist policy. Yet, production in Europe continues to be subsidized compared with global competitors (Sarzeaud *et al.* 2008). To avoid policy-driven displacements, not only state-level policies but also European policies and global economic and environmental regimes require better coordination and more systemic evaluation instruments. Such instruments aim to avoid unintended side effects of Green policy on environmental protection, food security, or socioeconomic structures. The integration of analytical tools such as material flow, life cycle, or input–output analyses in policy impact assessment might develop better insights into interregional ecological footprints and policy-driven displacements (Kissinger and Rees 2010) triggered by narrowly focused environmental statehood.

*Technology and knowledge transfer* are typically pursued to reduce the ecological footprint of highly industrialized countries such as Germany on less developed or economic transition countries (such as Brazil) or to limit the interregional impact of local ecological change. The focus might lie on production methods (e.g., use of fertilizers and pesticides), land use, or product choices (e.g., GM vs. non-GM soy). For instance, in Rio Grande do Sul, steps have been taken to encourage so-called precision farming – optimal use of natural (e.g., water) and chemical resources in farming to limit the risk of nitrogen runoff, emissions to air, or water scarcity. The required reorganization into user communities might deliver additional positive economic effects. Yet, such reforms are both technology intensive and intrude in established local production structures, and hence call for technological, administrative, and social advice and facilitation (see Amado and Santi 2007). In the context of the bilateral German–



Brazilian Economic Conference, the former German agricultural minister, Renate Künast, proposed a joint working group on agribusiness to mitigate unsustainable impacts of the enlargement of soy production areas in terms of land use, soil and water pollution, and working conditions (Lanje 2005, p. 51). While the German contribution should not be mistaken as altruistic, it seems to follow not a typical short-term but rather a long-term mutual gain perspective, explicitly engaging with the structure and ecological effects of regional interconnectedness. The effectiveness of such indirect environmental statehood – aiming at changes in national consumption (of soy) by facilitating changes among foreign (Brazilian) suppliers through soft information or incentive based instruments – deserves critical analysis. Hypothetically, it is most effective if the interregional contacts are deep (impact on Brazilian side) and the economic interdependence substantial (behavioral change on German side).

*International or bilateral financial support* might go in the same direction as technological and knowledge transfer, although typically support is more narrowly targeted and certain forms of assistance are extended on a conditional basis. For instance, ‘debt for nature swaps’ (Hansen 1989) might be negotiated in such settings and *compensate* the Brazilian state for nature protection schemes through *payments* in the form of debt relief. The assumption is that the Brazilian state might pass on the deal to private economic actors who commit to, for instance, setting aside land in return for a compensation payment (a mechanism introduced in the EU Common Agricultural Policy as part of its ‘greening’ efforts). The European Emissions Trading Scheme (ETS), linked to the Clean Development Mechanism (CDM), follows a similar ‘exchange logic’ in the sense that here European polluters may pay part of their ‘debt’ (allowances to pollute owed to the ETS authorities) in the form of officially recognized climate protection measures financed in the developing world. Both formats might often suffer from problematic oversight (or misplaced trust in the cooperation of foreign state or private actors who are the addressees of these support mechanisms – problems that might diminish in well-established interregional networks), but supposedly they are efficient means by which to reduce environmental harm in international settings.

Many economists consider *economic instruments* such as resource depletion or pollution taxes, export taxes (e.g., to cover environmental costs from transportation), or tradable allowances for harvesting, extraction, or emissions the most cost-efficient instruments to move toward *full-cost accounting* following the polluter pays principle (Hanley *et al.* 2007). However, on the international or interregional level, such instruments might fail due to issues of sovereignty (taxes) or given the enormous demands on data collection and processing implied in allowance trading schemes. Yet, at the national level, we could imagine unilateral economic incentives applying also to interregional trading partners (e.g., ‘Green’ quota or fees) and discouraging the import of less sustainable products (or outdated production methods). The hurdle in such instances might be international trade rules favoring free trade over unilateral measures that could

be interpreted as protectionist. Nevertheless, there are options for Green exceptions in the World Trade Organization that in the past provided a context for reforms of the European agricultural policy regime (Lenschow 1998, WTO 2012). In other words, the capacity of environmental states to extend their impact to the interregional level depends also on favorable international frameworks and rules, hinting at the multilevel nature of effective environmental statehood.

*Collaborative and network governance* – not mentioned by Kissinger *et al.* (2011) – has increasingly been considered for inter- and transnational co-ordination of environmental issues (Warning 2006, Newig *et al.* 2010, Duit *et al.* 2010), partly within the sphere of government(s), partly involving private and civil society actors. Within such structures, knowledge on environmental cause-and-effect relations as well as on the societal acceptability of certain norms can be brought together, enabling deliberative processes involving societal learning, negotiation, and bargaining. Thus, transnational networks can overcome ‘the institutional inertia that is typically found in political settings with many actors of divergent interests, most notably on a global international level’ (Newig *et al.* 2010). Initiated by environmental NGOs and multinational corporations, transnational ‘partnerships’ have formed around sustainable soy for Brazil, one of which is the Round Table on Responsible Soy (Hospes *et al.* 2012, Schouten and Glasbergen 2012). These initiatives, mainly excluding governmental actors, have had limited success, arguably due to the voluntary character of private governance arrangements (Schouten and Glasbergen 2012). It seems that what is missing is the ‘shadow of hierarchy’ in which these private networks operate, hence another need for ‘bringing the state back in.’

## Conclusions

Here, we have presented a first attempt to harness the potential of recent studies on globally telecoupled sustainability challenges for global environmental politics, notably from the viewpoint of state governance. The environmental state’s capacities to govern for sustainability are clearly challenged by processes of ‘globalization.’ These processes involve complex forms of mutual interdependency across distant regions, which we refer to as telecoupling. Such interconnections are certainly not domestic as such, but nor are they ‘global’ in the sense of affecting, say, dozens of countries (as would be the case for climate change or biodiversity loss). Taking as its point of departure either a fully global arena of governance (global environmental governance) or a multilevel perspective, which disregards policy instrumentation, the political science literature still has difficulties coming to grips with such specific globalizing phenomena and related policy responses. Particularly helpful for structuring the debate has been the recent contribution by Kissinger *et al.* (2011). While providing useful categories for conceptualizing policy responses to (different forms of) interregional connectedness, however, little reference is made to established discourses in political science.

Overall, we find that a range of policy and governance options is potentially available to address ‘local’ and ‘global’ environmental problems in the context of interregional telecoupling. At least in the case of soy production and trade between Rio Grande do Sul and Lower Saxony, it has not proven easy to treat separately the four types of interregional linkages, as sometimes they merely focus on different stages in a long sequence of causes and effects. We did, however, detect limits to unilateral state action, both in terms of effectiveness (due to inability to escape the pressures of interconnected economic relations, and due to the creation of new [unintended] side effects), and in terms of legitimacy (due to violations of international political and economic norms like state sovereignty or nondiscrimination). From a European or German perspective, the state’s role as ‘protector’ of the environment (Compagnon *et al.* 2012) is clearly constrained by international economic rules advocating openness. Only in the event of a crisis (such as the 2013 rotten-meat scandal in Lower Saxony) might a window open for restrictive measures (e.g., the new EU proposal on obligatory product labeling). In the Brazilian context, environmental sustainability has tended to be traded off against economic opportunities on the world market. Yet, regional authorities appear open to international support and do not rule out an open sustainable development discourse, which creates opportunities for interregional policy action.

Indeed, our case did reveal some bilateral activities addressing directly issues of interregional interconnectedness. These include technical assistance and financial support with Germany as the ‘facilitator’ (Compagnon *et al.* 2012), but do not address environmentally problematic German structures of livestock production or meat consumption. Apart from assistance, we also find discussion fora that aim to create awareness among producers, but even more so among consumers, of the German role in creating unsustainable structures and practices in Brazil. So far, this policy discourse, addressing a range of voluntary and obligatory, public and private, specific and general informational instruments on different geographical scales – ranging from policy evaluation, economic auditing to product labeling (Lanje 2005) – has been quite limited to an expert audience.

From our analysis, a number of implications emerge for environmental statehood which we present here as hypotheses that would warrant further and systematic testing.

First, the specific forms of global interregional connectedness (*unlike* other phenomena of globalization) do not necessarily imply an upscaling of environmental statehood to the ‘global’ level. While international organizations or regimes may offer some options to regulate environmental effects between interregionally connected places, they may be too unspecific or suffer from familiar problems of insufficient oversight. Also, it would overburden the international community to tackle the myriad telecoupled problems on a global level. The recognition of telecoupled phenomena thus would call for strong nation states as initiators of policy instruments to bridge telecoupled regions.

Second, this diagnosis leads us to imagine a multitude of specifically tailored policies addressing different interlinkages with spatially distant regions. We can only speculate as to whether this implies greater challenges to the state's administrative, institutional, and legislative capacities. This could occur because a great number of specifically tailored 'solutions' for such phenomena have to be crafted. This puts additional burdens on producing coherent policies. On the other hand, this could facilitate effective governance, where each 'solution' is targeted at a limited phenomenon rather than having to capture 'globalization' in its entirety.

Third, as networks of private and civil society actors emerge to govern telecoupled environmental problems, the state may appear to lose sovereignty and relevance further. As the example of voluntary action on responsible soy trade shows, however, it is precisely the regulatory action by the state that would provide the 'shadow of hierarchy' that might enable effective private and non-governmental action.

Fourth, the issue of legitimacy of state action responding to globally telecoupled phenomena emerges if policies are to address environmental effects in distant regions. Who is to participate in political decision making aimed at governing telecoupled ecological challenges? Both transparency and some level of institutionalization in governance toward sustainability in telecoupled regions may be important steps – two aspects that also contribute to greater effectiveness of state intervention.

Much remains to be done in order to test these propositions more systematically. In-depth and comparative empirical research on a larger number of cases of telecoupled sustainability challenges would be useful in order to identify governance and policy options and institutional systems that can effectively and legitimately govern such phenomena, as well as the pressures and opportunities facing the state. Although some of the governance and policy options discussed above have been in use for some time, we suggest that the concept of telecoupling allows us to shed new light on global interconnectedness phenomena and 'globalization.' With this contribution, therefore, we hope to stimulate further research in this field, which might foster conceptual integration of telecoupling and global environmental governance, and thereby help to identify viable options for contemporary governance for sustainability.

### Disclosure statement

No potential conflict of interest was reported by the author.

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