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The scalar politics of sustainability:
Bioenergy sustainability criteria and the rescaling of environmental governance in Europe

Abstract

The European Union relies heavily on bioenergy production to fulfil self-imposed renewable energy targets, but there are serious doubts regarding the overall sustainability and carbon mitigation capacity of bioenergy. As part of the 2009 Renewable Energy Directive, bioenergy sustainability criteria were introduced to provide a verification framework, safeguards and transnational standards for sustainable bioenergy production. Even though and because the criteria have not been established to their full extent, energy biomass sustainability has emerged as an object of constant environmental governance rescaling, where elements, actors and knowledge from different governance levels are entwined. This paper employs a scalar politics approach to statements regarding biomass sustainability criteria. Policy documents are analysed on the basis of spatial, jurisdictional and temporal scaling to provide insights about scalar dynamics and mismatches. The governance of bioenergy sustainability could be improved through better understanding and acknowledgement of the different scalar aspects of issues as well as the processes of rescaling.

Keywords: Scalar politics, Bioenergy, Environmental governance, Rescaling

Introduction

The sustainability of bioenergy has emerged as an enduring governance issue during the last two decades as part of the shift away from fossil fuels and towards more sustainable energy production systems. The climate and energy policies mobilised by the European Union (EU) and spearheaded by the Renewable Energy Directive (RED) (Official Journal of the European Union 2009), have created a constantly growing demand for biomass in the energy sector, which materialises in global production, trade and refinement chains, situated land use practices and nested systems of governance. The use of bioenergy has increased by three quarters over the last decade and counts for 63.1% of the total renewable energy production. Consequently, the EU has become the main arena to address global sustainability concerns, like the negative carbon balance of liquid biofuels, land-grabbing and indirect land use change caused by the expansion and intensification of biofuels – though there are profound disagreements regarding the success and appropriate design of these policies.

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To manage complexities and provide safeguards against potentially adverse effects of bioenergy production, sustainability criteria for liquid biofuels were included in RED. As the directive was refined, the criteria were expanded to include energy production from solid and gaseous biomass – most notably the energy biomass from forests – but the plans are just starting to materialise. There has been a prolonged period of policy consultations, advocacy campaigns, knowledge production and public debate on whether, how and by whom the sustainability of forest-based bioenergy should be governed. The forest as a material object of sustainability concerns becomes increasingly fluid depending on the epistemological frames of actors, such as energy producers, biomass traders, forest owners, NGOs and scientists. Furthermore, bioenergy sustainability issues cross spatial scales and institutional levels, giving the debate a profoundly scalar form and connecting sustainability concerns to shifting hierarchies and territorialities of global environmental governance.

In this paper, I approach the bioenergy sustainability criteria debate from the perspective of rescaling environmental governance (Cohen & McCarthy 2015). The case illustrates the dynamics of governance, where transnational and local governance dimensions emerge in prolonged tension with national fixes (see Mansfield 2005). Methodologically, I apply the approach of scalar politics, in which rescaling practices are not directed to scale per se, but rather mobilise material and discursive scalar claims in defining and contesting policy issues and the objects of governance (MacKinnon 2010). Rescaling takes place simultaneously on spatial, jurisdictional and temporal scales, which may be incompatible despite a common reference point – potentially leading to 'scaling challenges' (see Cash *et al.* 2006). The empirical analysis focuses on documents published by forest industry actors, NGOs, forest owner associations and energy producers making claims about and demands on sustainability criteria. The following research questions guide the empirical analysis:

1. How are biomass sustainability criteria linked to the institutional rescaling of environmental governance?
2. What are the central scalar issues related to the biomass sustainability criteria?
3. How do actors frame jurisdictional, spatial and temporal scalar aspects of bioenergy governance?

This article is structured into four sections. The first focuses on the conceptualisation of scalar politics in environmental governance literature with particular focus on governing forest carbon. The subsequent section introduces the main steps of EU sustainability criteria development as well as the data and methods used. The third section is divided into three parts which analyse the jurisdictional, material and temporal scaling of the sustainability criteria. The final section concludes the paper by providing a more detailed conceptualisation of the scaling practices and estimations of the political development of biomass carbon governance in the EU.

Rescaling environmental governance

The shifting dynamics of global environmental governance have rejuvenated interest in geographical scales leading to calls for a more nuanced sense of spatial hierarchies (Bulkeley 2005). The structures of environmental governance are being rescaled up, down and out of state-centred structures towards international, subnational, extra-governmental and 'natural' nodes – linked to the reduction and revision of the role of the state as an 'obstacle' to efficient governance (see Cohen & McCarthy 2015). The international nature of climate change has drawn special attention to the hybrid, nonhierarchical and network-like modes of governance on the global scale that both challenge and complement the centrality of the state in policy analysis (Bulkeley & Stripple 2014).

Initially, mainly natural science driven science-policy interactions framed and stabilised the atmosphere as a depository for greenhouse gases, a target for climate policy efforts and related institutionalised mitigation, and adaptation practices (Miller 2004). However, making the ubiquitous idea of climate change identifiable and governable in diverse contexts by heterogeneous groups of actors has demanded new socio-material governance concepts, such as national carbon sink, carbon credit and personal carbon budget (Lövbrand & Stripple 2011). These governmental techniques and practices build on the commodification of carbon as a moveable and manipulable object that can be located in different contexts (Oels 2005), and demand the active participation of scientists in building standards

and measures to, "allow carbon to be compared, traded, emitted or sunk in socio-economic and policy terms" (O'Lear 2016, 9). Furthermore, governmental technologies have been central to the emergence of 'new carbon economies', where the valuation of carbon emissions, offsets and sinks are inherent aspects of all economic and societal dynamics (Boyd *et al.* 2012).

Forests have also been the target of 'governmentalisation' as crucial components of the global carbon metabolism verified and monitored by statistical analyses, remote sensing technologies and carbon cycle modelling (Baldwin 2003). The Kyoto protocol and especially the LULUCF (land use, land use change and forestry) sector, as a component monitoring afforestation, deforestation and reforestation, have been central, though highly contested mechanisms (Lövbrand 2009). However, forests are far from being a singular governance object – there are 240 different definitions for forests in the International Panel for Climate Change's LULUCF special report (IPCC 2000: 63) – which has resulted in the downplaying of complexities and spatial variations through the application of "loose" definitions of forests that enable potentially destructive forest management practices from carbon mitigation and biodiversity perspectives (Gutiérrez 2012: 111-115; Lövbrand 2009). Furthermore, the demarcation of land use based emissions in the LULUCF sector has enabled the definition of bioenergy as a 'carbon neutral' energy source, a compromise that has been deemed a 'critical climate accounting error' since the calculative practice ignores emissions from land use changes and the combustion of biomass (Haberl *et al.* 2012).

The loose governance framework of forest carbon has, in practice, become a source of contestation and re-framing as governmental techniques materialise in different governance scales. For example, stump removal for bioenergy use in Finland has constantly been a target for diverging stakeholder views and media representations as the carbon neutrality and biodiversity effects of the practice are debated. The case can be interpreted as a trans-scalar test for European clean energy ambitions as EU-wide agendas materialise through interconnected governance 'loops' on different levels (Kortelainen & Albrecht 2014). Furthermore, the effects of intensive bioenergy use on soil carbon remain an issue of public and scientific interest, which casts another shadow over bioenergy practices (see Repo et al. 2012). In this context, bioenergy sustainability criteria emerge as a potential governmental technique to verify the sustainability of biomass utilisation practices.

The governance rescaling of forest bioenergy is a complex and contested venture that demands new governmental interventions and techniques, such as sustainability criteria. Furthermore, in scalar politics there are several scaling dynamics in place simultaneously. Cash et al. (2006) have identified seven categories of scales (spatial, temporal, jurisdictional, institutional, management, networks and knowledge) where scaling takes place. Regarding the scalar politics of sustainability criteria, most of the knowledge claims refer to the first three categories, which form the analytical framework of this paper. However, the other four categories are worthy of more explicit future analysis. Spatial scales refer to the 'natural' scales of the phenomena that can be measured, identified and stabilised through different epistemic practices and devices. Jurisdictional scales refer to the nested, hierarchical scales of governance structures and take the form of official frameworks (see Cohen & McCarthy 2015). Finally, temporal scales refer to the embedded temporalities of the phenomena that affect the urgency and design of the societal scaling of environmental governance. Furthermore, scaling challenges can emerge between different scaling practices as well as scalar mismatches between social and ecological scales that may cause socio-environmental consequences, political contestation and dysfunctional governance (Cash et al. 2006; Cumming et al. 2006).

Scalar politics are material-discursive actions where dominant approaches are challenged and alternative ventures opened (MacKinnon 2010). Rescaling analyses often diverge from the nation level, but it is useful to see nations as dimensions of scalar processes and practices (Mansfield 2005). Traditional hierarchies of power are challenged and complemented by epistemic communities consisting of experts who share a common understanding of the scientific and political nature of a particular problem, advocacy networks that include a broad range of actors bound together by shared values, common discourse and exchange of information as well as 'the global civil society' (Bulkeley 2005, 879-880) that operate across scales and gain legitimacy and power from heterogeneous sources. Politically, actors may strategically utilise scale frames and counter scale frames to link overlooked and subordinate perspectives of environmental governance issues and reconstruct material-discursive connections (Kurtz 2003). In practice, the configurations of scalar politics may become very complex as different

sources of legitimacy and knowledge blend together, as evidenced by the design of the European emission trading scheme (Bailey 2007).

The practices and actor positions in the rescaling process can be interpreted through the scalar politics framework (MacKinnon 2010). First, the scale itself should not be considered as ontologically given 'levels' or mere epistemological devices; rather, they are a dimension of political projects (Mansfield 2005). Politically relevant issues also emerge across scales and are trans-scalar by nature. Second, actors deploy scales strategically as they struggle to 'fix', 'jump' or 'undo' scales as material expressions of power relations (Gonzales 2006). Actors use classifications and discourses to make rescaling seem, "natural, normal and legitimate" (Ibid.: 838). Third, pre-existing scalar structures – though always emergent – are central to grounding actors, practices and networks as well as shaping scalar projects (Brenner 2001). By contestation and reproduction of power, the scalar projects are thus always in relation to established scales. Finally, new scalar arrangements and configurations emerge during the interaction between inherited structures and emergent projects (MacKinnon 2010: 31-32). These projects may privilege specific scalar constructs and reshape existing arrangements, giving the scales permanence in the process.

These four principles of actor positions and the permanence of scales are central to the designs of and interventions in the biomass sustainability criteria, as we will see below.

Analysing sustainability criteria

A brief history of sustainability criteria

The EU renewable energy targets constitute the main rationale behind the sustainability criteria. The objective is to increase the share of renewable energy sources to 20% by 2020 through national targets (Official Journal of the European Union 2009). The European Commission (EC) developed the sustainability criteria for liquid biofuels as a component of RED to tackle heated and persistent debates over negative carbon balances, land use competition with food production and effects on biodiversity hotspots (the main administrative steps are summarised in Table 1). For the transportation sector, liquid biofuels and bioliquids must meet the sustainability criteria regarding carbon balance, land use and social effects of biomass production to be compliant with the national targets and eligible for financial subsidies (Ibid.). In the impact assessment, the majority of stakeholders also called for a binding sustainability framework for solid biofuels, but the EC deemed a voluntary framework and the 'business-as-usual' approach sufficient (EC 2010).

However, the EC continued to prepare binding sustainability criteria for solid biomass because public critiques of the negative impacts of increasing bioenergy use hindered the renewable energy policy agenda. In August 2013, an EC working draft of the sustainability criteria directive was leaked to the public and caused significant discussions at the European level as well as in member states. The main contribution of the directive would have been to extend the scope of the existing sustainability criteria to solid biofuels and introduce a stand-level monitoring system. The proposal, however, was quickly dismissed as 'a weak attempt' on one hand and 'operationally problematic' on the other. The draft failed to address concerns over the sourcing of whole trees for energy use and to recognise the dispersed nature of ownership and production chains of solid bioenergy compared to the more centralised structure of liquid biofuels. Consequently, the proposal never materialised and the EC took a more cautious approach in the enforcement of voluntary criteria and carried out public consultations over the following years (EC 2014; 2016a).

In November 2016, the EC published a sustainable energy package that included a proposal for a revised version of RED beginning in 2020 as well as results of the public consultation on monitoring and assessment of bioenergy sustainability (EC 2016a; EC 2016b). The documents note the high level of divergence in opinions regarding bioenergy sustainability, while proposing new risk-based sustainability criteria as an extension of the preceding sustainability criteria framework to cover all aspects of biomass, including the use of bioenergy in heating, cooling and electricity production in addition to the transportation sector. The year 2017 is dedicated to political evaluation of the clean energy framework as the European Parliament discusses the revisions, which adds a layer of political opportunism and scalar politics to the process.

Table 1. Main administrative steps in the development of the EU sustainability criteria framework.

Year	Document	Effect on sustainability criteria development
2009	Directive 2009/28/EC	Renewable energy directive constituting the initial sustainability criteria framework for liquid biofuels (Articles 17 and 18)
2010	EC (2010) COM/2010/11	The Commission impact assessment and consultation of biomass sustainability introducing non-binding sustainability recommendations for solid biofuels
2013	Leaked directive proposal	Draft directive suggesting sustainability criteria for solid and gaseous biomass used in electricity and heat production
2014	EC (2014) SWD/2014/259	Commission staff working document assessing the emergence of different national and industry-led sustainability criteria frameworks
2015	EC (2015) COM/2015/80	Commission Energy Union strategy announcing the aim of updated bioenergy sustainability policy as part of the post-2020 renewable energy package
2016	Public consultation 10.2.-10.4.2016 EC (2016a) SWD/2016/418	Consultation questionnaire of 955 replies to gather Europe-wide stakeholder opinion on the demands to revise the post-2020 bioenergy policy
2016	EC (2016b) COM/2016/767	Proposal for renewable energy directive revision for the post- 2020 period introduces extension of sustainability criteria to all bioenergy types
End of 2023	Review date	Suggested date for reviewing the new governance framework for sustainability effects of biomass utilisation and LULUCF requirements

Data and methods

Empirically, this paper builds on the document analysis of claims and framings of the sustainability criteria by key advocacy organisations operating in close proximity with the European Parliament and Commission in Brussels, but which also utilise networks in member states.[1] The debate has been the most vocal during the periods following the leaked directive proposal in 2013 and the consultation period leading up to the announcement of the clean energy package in 2016, which are also the key junctions in this analysis. However, document searches were also conducted for the period beginning with the establishment of RED in 2009. The most active discussants were identified qualitatively in a preliminary study, leading to interest in trans-scalar networks of epistemic communities and advocacy groups, and excluding nation state actors from the analysis.[2] The initial data set of 56 reports, position papers and press releases found in the public sphere was further narrowed by focusing on 29 documents that make explicit claims on the sustainability criteria.[3] Though the majority of the analysed documents are collaborative attempts by larger configurations of actors, the NGO BirdLife Europe, the bioenergy market association AEBIOM and the private forest owner association CEPF are singled out as the most vocal actors. Overall, 30 individual actors (associations and organisations) were listed as official publishers of the documents in the final analysis.

The document analysis was conducted by qualitative methods using content analysis (see Krippendorff 2004) with a focus on scalar claims. The analysis was conducted in three steps: first looking for political claims about biomass sustainability criteria, second analysing the content regarding institutional-jurisdictional, spatial and temporal scales of governance (see Cash et al. 2006) and, finally, combining these analyses into more general categories presented in the following section.

Scalar politics and the governance of bioenergy sustainability

Jurisdictional scaling: below, above and across

> *The interpretation and implementation of the criteria is potentially more critical than the criteria themselves.* (AEBIOM & EBA 2011)

On the surface, there is a relatively wide consensus over the jurisdictional framework of bioenergy sustainability. The EU's RED, encouraging nation states to reduce fossil fuel consumption, is the primary motivation behind increasing bioenergy use. Consequently, 60-65% of the EU's renewable energy consumption is covered by different types of bioenergy, though there are great variations between member states. Especially Nordic and Eastern countries utilise forest resources to provide bioenergy, while Western member-states rely more on biomass imports and agricultural production. From the perspectives of overall motivation and biomass trade, the EU appears to be a natural 'fix' as the jurisdictional scale of bioenergy sustainability, but this perspective has been challenged throughout the sustainability criteria debate. EU governance has been 'bent' from different perspectives, which are labelled here based on the direction of their rescaling, as below, above and across.

First, the European forest owner and forestry professional associations have been strong advocates of rescaling from below since the initial consultation on RED in 2010. However, the leaked directive draft in 2013 made these groups more vocal as forest owners declared an EU-wide mandatory sustainability criteria a violation of the common principle that sustainable forest management is a matter of national decision making (see EC 2013: 5-6, 17). In their collective commentary, forest owner associations stated:

> *We are concerned that the draft text exceeds the boundaries of the EU's competence in forestry. The Commission has no mandate to set up the rules that restrict and intervene in well-established and accepted sustainable forest management practices in the Member States. Instead, the Commission should take into account already existing instruments that deliver sufficient proof of sustainability of biomass from forests at a regional/national scale.* (De Schorlemer et al. 2013: 1).

Evidently, the jurisdictional design of the sustainability criteria should remain loose and flexible, so national legislation retains its precedence. However, the design of mandatory criteria poses a second, potentially more harmful, jurisdictional obstacle in the form of increasing administrative burden on economic actors. The mandatory scheme would burden local landowners, a very heterogeneous group, with the verification of carbon balance and land use effects. Also, from the forest management perspective, energy production represents a small share of overall operations. The obligations from energy production would potentially complicate wood provision for other activities, which makes voluntary approaches more favourable.

Second, some actors, especially NGOs and associations advocating for biomass trade, have been actively bending the EU legislative framework up as part of the international climate governance regime. Increasing renewable energy demand in Europe is linked to global biomass trade, and NGOs have been actively producing evidence on and uncovering the harmful situated practices of biomass harvesting and wood pellet production, especially in the United States, Russia and Asia (BirdLife

1. Parallel analysis of 66 documents was conducted on the national level in Finland, but was utilised in observatory fashion rather than as focus of analysis.

2. In addition to document analyses, the framing of the topic is backed up by four qualitative semi-structured interviews with actors operating in the near proximity of European Parliament offices in Brussels done in late 2013 and analysis of 24 articles published by web-journals EurActiv (http://www.euractiv.com/) and European Voice (http://www.politico.eu/) published about sustainability criteria between 2012-2015.

3. The data was collected through searches on the stakeholder (BirdLife Europe, EEB, AEBIOM, EurElectric, Eustafor, CEPF, Joint Research Centre) webpages using topic words "sustainability criteria", "carbon debt" and "carbon balance" – and snowballing the initial results by following the linked documents. The search was narrowed down by excluding documents dealing only with liquid biofuel sustainability criteria and documents that did not explicitly address the sustainability criteria.

Europe 2016). According to this argument, it is necessary to provide binding guidelines for bioenergy sustainability in the EU, with imported biomass subject to stricter monitoring of carbon balance and land use practices. Furthermore, strict jurisdictional design would potentially have a trickle-down effect on the global design of carbon governance, such as potential revisions to the UN's LULUCF criteria. Regarding transnational and national policy challenges, the joint NGO position paper on post-2020 bioenergy policy states:

> *[T]he current EU and international policy frameworks are not fit for this purpose. For instance, the EU Life Cycle Assessment methodologies still exclude important categories of emissions, e.g. from the landuse sector. Many countries also exclude the land use sector from their carbon accounting, while others include such emissions but measure them in a way that does not capture all emissions, especially from forest management. Given that the rise in bioenergy use is driven by both badly designed carbon accounting frameworks and policies promoting renewable energy, additional safeguards are needed in both policies to ensure that bioenergy significantly reduces greenhouse gas emissions.* (BirdLife International 2016)

Furthermore, the NGO-driven approach to jurisdictional scaling of the sustainability criteria includes another angle. Several statements call for "rigid" and "ambitious" sustainability frameworks to cover the shortcomings of existing legislative structures (NGO recommendations 2015; Transport & Environment 2016; BirdLife International 2016). EU-level legislation would provide pressure and direction for national legislations to provide more safeguards and tools to take into account issues, such as carbon balance and soil carbon fluctuations. The critical approach of NGOs thus aims to take advantage of the nested governance structures of European governance to open up national fixes of sustainability definitions and forest management practices. The approach strategically dismisses the complexities of the existing multi-level governance structures to represent the EU-scale as the primary level of governance.

Finally, there is a horizontal approach to rescaling criteria across the levels of governance, where neither national/regional nor the transnational nodes of jurisdictional rescaling gains primacy. Although the energy sector has been central in developing voluntary measures of biomass sustainability, they are active in critiquing 'siloed' definitions of sustainable biomass that the voluntary-based approach encourages (AEBIOM & EurElectric 2013; AEBIOM 2016a). First, the existence of distinct national sustainability frameworks creates an unnecessary barrier for international biomass trade that potentially hinders overall use of bioenergy and achievement of renewable energy targets. For biomass traders, state boundaries are becoming as big a disturbance as sustainability verification in the first place. Second, voluntary approaches reinforce artificial categories of different product types, where biomass is evaluated on the basis of its end use rather than its growth environment and harvesting practices. In practice, the same wood can be utilised in construction, pulp production and different forms of energy use, but the sustainability requirements may differ based on the end use. Also, the same wood chips may end up, for example, in electricity production or lignocellulose-based biofuels, where the sustainability requirements differ. Third, the lack of a clear sustainability signal postpones the resolution of public debates, which is not beneficial to the energy biomass markets and position of the traders in the long run. Bioenergy actors have thus become advocates of a binding and harmonised EU-wide biomass sustainability framework, but unlike other actors in debates they don't have strong opinions regarding the material implications of the criteria.

In the RED2 draft, there are elements of the different positions and the document is positioned between the binary poles of voluntary and binding as well as transnational and national. The suggested framework is binding on the European scale, but implementation must be carried out on the basis of national legislations. The draft also utilises the 'risk-based approach' championed by biomass traders and approved of by forest owners (AEBIOM 2016b; Union of European Foresters 2017). We will now turn to the material definitions of bioenergy sustainability.

Spatial scaling: land use, end use and beyond

Bioenergy is a materially slippery object of governance because it is located at the intersection of different societal demands and concerns. Furthermore, the spatial scaling of the issues is tied to

the different material and socio-environmental underpinnings of, among others, energy production, forest management, biodiversity concerns and biomass trade. They are partially compatible, but often conflicting, and may become sources of scalar mismatches in governance frameworks (Cummings et al. 2006). The number of spatial framings of bioenergy sustainability with effects on the rescaling of governance is potentially unlimited, but here I focus on three: land use, end use and beyond.

First, NGOs have put extensive effort into providing evidence of negative impacts and situated land use practices of energy biomass production (BirdLife Europe 2016). However, rather than pointing out individual failures by bioenergy businesses or campaigns to save specific vulnerable areas, the argument is more comprehensive. Summarised in BirdLife Europe's polemic Black Book of Bioenergy (Ibid.), the NGO's critical position shows that the growing overall demand of biomass in energy use produces unsustainable practices, whether it be stump removal in Finland, old-growth forest logging in Russia and Slovenia or causing biodiversity loss in Italy and France. The NGO's point is that there are also sustainable forms of bioenergy:

> *Not all bioenergy is bad – good bioenergy exists. The best potential for sustainable bioenergy lies in different kinds of biomass residues and wastes that do not have existing uses. The parts of crops left behind on the field after harvesting, manure or by-products from forest industries such as bark or sawdust – all these types of biomass are suitable for bioenergy. After all, 'waste not; want not'. Unfortunately, it is a sad – yet undeniable – fact that there is far less scope for utilising bioenergy sustainably than was initially hoped.* (BirdLife Europe 2016: 4)

The argument moves beyond establishing sustainability criteria since dedicated biomass production for energy, whether in forests or fields, is deemed unsustainable. As a more comprehensive governance tool, NGOs call for the establishment of a European level cap for bioenergy as part of the clean energy framework (NGO recommendations 2015). In this scenario, sustainability criteria would have to ensure:

> *that land management practices contribute to biodiversity and environmental objectives and prevent further negative environmental impacts including carbon stock decreases in soils and ecosystems, biodiversity loss, soil erosion, depletion of water resources and loss of soil health due to increased use of synthetic fertilizers, pesticides and herbicides.* (Ibid.: 8)

The criteria would thus have to fulfil a comprehensive list of requirements and be mobilised rigorously on the local land use level rather than on the national basis of the current framework. Furthermore, the list covers simultaneously aspects of agricultural and forest biomass production, which might cause operational adversity in practice.

While opposing all forms of stand-level verification schemes, forest owners also view the sustainability criteria from a land use perspective. In this approach, national forest management legislations, market-based forest certification tools (FSC, PEFC) and bioenergy actors' voluntary sustainability criteria provide sufficient sustainability guidelines. Though generally opposing binding criteria, forest owner associations view bioenergy sustainability criteria as a potential way to increase the turn-over of underutilised forest resources, if they meet existing sustainability standards (CEPF & Eustafor 2012). From this perspective, contemporary forest management practices are ecologically sustainable, but economically problematic since the annual growth in forest biomass is not used effectively.

Second, energy sector actors have been actively framing sustainability criteria from the perspective of market development. The initial proposals for developing bioenergy sustainability criteria based on end use – such as liquid biofuels, electricity, heating or cooling – could potentially become a serious obstacle for transnational biomass trade. The purpose of the criteria would be to fade out the spatiality of biomass production by providing sustainability safeguards and guarantee the role of energy biomass as a tradeable commodity on transnational markets. To counter the threat of an operational definition of sustainability, biomass traders promote a distinction between agricultural and forest-based sustainability criteria (AEBIOM 2016a).

The concept of 'cascade use principle' also surfaced as a potential solution in the 2013 sustainability criteria debate, especially regarding the use of roundwood in energy production. The core idea is to establish and enforce product hierarchies of forest products as well as promote the re-use and recycling of products and materials, making energy use effectively the lowest and least value-added category. In response, biomass and forestry operators dismissed the idea as artificial because hierarchies emerge on

an economic basis and claimed that energy biomass should not be considered as a low-value product because of its capacity to replace fossil fuels and create jobs (AEBIOM et al. 2013). NGOs have interpreted the cascade principle from a critical perspective as an additional argument to support a cap on bioenergy use and enhance the framing of bioenergy as the lowest level of the product and waste hierarchy (Transport and Environment et al. 2015; see also NGO recommendations 2015). Although strict implementation of the cascade principle could provide sustainability guarantees, especially regarding the energy use of roundwood, it does not extend to issues related to biomass production practices and only partially addresses carbon balance. The end use perspective demands criteria that consider critical land use issues.

Finally, the spatial scaling promoted by NGOs also reaches beyond land use effects and end use monitoring, and calls for a more detailed carbon accounting approach across the entire bioenergy sector. The problem is related to the current carbon neutrality assumption of bioenergy, which could be corrected with more science-based approaches. From a strict carbon accounting standpoint, especially the burning of stumps and roundwood is seen as more harmful than the burning of fossil fuels:

> *The current climate policy framework also ignores the greenhouse gas emissions released from biomass burning, and falsely credits bioenergy for producing zero carbon emissions. In some cases, bioenergy can be worse than the fossil fuels it replaces for avoiding dangerous climate change* (Ibid.: 16)

The proposal would potentially subject all bioenergy to ubiquitous methods of carbon accounting and verification. Though directed at the sustainability criteria, the critique is directed towards the UNFCCC definitions of bioenergy and the LULUCF framework, which do not take into account actual emissions and shrinking carbon storages (Fern 2016). The problem is not unique to bioenergy production, but it is the sector where the issues are most visible. For economic actors, LULUCF is a delicate issue because the entire bioenergy sector is built on the carbon neutrality principle. Moreover, addressing carbon emissions on the basis of bioenergy sustainability criteria includes the risk of double-counting the carbon in overlapping governance systems (AEBIOM 2016c). In practice, actors have generated wide support on national level estimates complemented by risk-based safeguards, which does not leave room for more rigorous accounting of carbon fluctuations.

The three practices of spatial scaling are neither contradictory nor incompatible by default, but they are grounded on different epistemological assumptions. The land use approach prioritises situated contexts, where forests are utilised, jobs get created and carbon emitted; the end use approach prioritises markets as the space of flows, where biomass needs undisturbed passage; and the carbon science framework overlooks all other scalar contexts as it positions bioenergy in the calculative ontology of global carbon governance. Connecting the spatialities of local land use practices, transnational trade flows and ubiquitous carbon calculations is a highly complex task for a sustainability criteria framework to accomplish.

Temporal scaling: sink, debt & storage

> *Even if the carbon stocks of the forest are allowed to fully recover, there is a time delay between the release of CO2 into the atmosphere and the re-growth of the forest necessary to reabsorb released carbon, creating 'carbon debt'.* (NGO recommendations 2015: 5)

The final aspect of scaling bioenergy sustainability criteria is connected to the temporality of biomass production, especially carbon cycles in forests and soils. These carbon fluctuations can be measured from different perspectives that position the sustainability of bioenergy in relation to global climate change governance. In practice, these positions can be approached through the concepts of carbon sink, carbon storage and carbon debt.

Carbon sinks have been mobilised as a core flexibility mechanism of the UNFCCC (see Lövbrand 2009). By definition, advancing re-forestation increases biogenic carbon stock and carbon emissions in other sectors can subsequently be increased. Over time, the concept of carbon sink has departed from its official technical definition as the establishment of new forested areas. For example, biomass actors have used the concept of sink to compare the mitigation potential of sustainably managed young forests

and 300-year old forests, noting that the sink of young forests is at least ten times greater than that of old-growth forests (AEBIOM, WBA & ABA 2013). Furthermore, European forests are aging since the total amount of forests has been growing for 50 years and the annual amount logged is about 65% of the growth (Union of European Foresters 2017). This can be framed as a risk from the mitigation perspective since the growth pace of sinks slows down over time and forests may eventually turn into carbon sources if they are not properly managed. Accordingly, carbon sinks are not just a device of flexible carbon mitigation, but an additional dimension in analysing the biogenic carbon circulation. From a temporal perspective, the sink approach expands the current carbon flow in forests over a linear future perspective to provide a calculative object for forest management and carbon mitigation practices.

Carbon debt is another important concept that opens different temporal horizons. Debt marks the time frame that combusted carbon requires to be absorbed back into the biogenic cycle. Critical arguments by NGOs point out that combusted biomass will take too long to be absorbed by growing biomass to have a mitigating influence on climate change (NGO recommendations 2016). For some materials and processes, such as industrial side products, waste streams or certain logging residues, the time frame is manageable in a few decades. For others, such as stump removal or roundwood combustion, the time frame to achieve carbon neutrality requires at least a century, often longer. Additionally, these types of wood also take longer to decompose in nature and thus form a temporal carbon sink. Discourse over carbon debt has mainly surfaced to challenge the hegemonic assumption of carbon neutrality and ignorance regarding time gaps, but also as a way of including the evaluation of changing soil carbon stock in the governance agenda (Ibid.).

Concepts, carbon sink and debt, have gained normative capacities in framing the climate change mitigation in relation to land use practices. Growing forests act as sinks by storing atmospheric carbon in wood and soil, while they release it after harvesting. The assumption of biomass carbon neutrality builds on the naturalisation cyclic definition of carbon fluctuations through forest growth and harvesting cycles. More radically, the carbon debt approach emphasises the potential to undo some atmospheric damage through better protection of existing carbon storages and thus increasing the overall amount of biologically stored carbon. The concepts are not mutually exclusive though they have been contrasted in the sustainability criteria debates. The official discourse is, nevertheless, moving beyond juxtapositions and emphasising carbon storage as a more neutral, middle ground concept (EC 2016a).

Overall, there are different dynamics affecting the temporal scaling of bioenergy sustainability. First, the questions of actual emissions and time lag are coming to attention and may lead to the redefinition of bioenergy in near future. However, potential new definitions will face strong opposition. Second, and related to this, the reference years used greatly affect how carbon emissions are calculated. An emission reduction frame of 20 years is significantly different from 50, 100 or 300 years. And finally, the role of past emissions and carbon already accumulated is an aspect of climate change that has not yet been seriously considered. The reductions of atmospheric carbon will probably be achieved through the configuration of several approaches, but forests will logically be a part of them in some capacity.

Discussion: Rescaling what, rescaling how?

Rescaling the bioenergy policy

Following wide scale public consultation and lengthy discussions in 2016, the European clean energy package emerged and it sides strongly with forest owner perspectives and existing sustainability legislations (see EC 2016b). The sustainability criteria framework applies a risk-based approach and provides binding minimum requirements for transparency and monitoring, but favours existing national legislations and sustainability criteria in implementation, and fails to call for governance harmonisation on the European scale. The framework design stresses the administrative burden, while dismissing radical calls for a cap or strong product hierarchies. The resolution has been described as a "pragmatic approach" because it does not depart greatly from the existing system (AEBIOM 2016b).

From the rescaling perspective, the European level framework returns some of the disseminated power to national states (see Mansfield 2005). By favouring the role of existing national forestry legislations and sustainability safeguards, the resolution further legitimates the role of forest governance

in climate and energy policy contexts. The potential re-interpretation and calibration of local situated practices or global carbon mitigation concerns will need to go through national level considerations, which differ between the member states. In the long run, the resolution may create space for increasing carbon sinks and storage, as other alternatives in energy production and the transportation sector become more attractive. For energy and biomass trade actors, the resolution is less than optimal because it fails to advance the sector's international status in practice.

Furthermore, what is at risk in the risk-based approach is still relatively open. Baldwin (2003) has correctly noted that representations of forests as sites of carbon storage in the climate change context give them active political agency. However, this agency can move in different directions since the risk of the rapid destruction of carbon storage areas is as real as the mishandling of logging residues or the burning of whole trees. As Gutiérrez (2012) notes, all biogenic carbon will evidently return to the atmosphere. Thus, the risk-framing by forestry actors is a powerful tool also from the climate mitigation standpoint since the carbon that is embedded in the industrial production chain or economically managed forest stands seems much more governable than the carbon that is slowly released in old-growth forests. From the perspective of governmentalised forestry, rescaling back to the local level fails to come to terms with commodified carbon.

An additional layer of analysis is tied to the purpose of the sustainability criteria. In practice, the criteria are designed to guide the eligibility of production with national subsidy systems and national renewable energy targets. These subsidies have been the main reason behind the expansion of bioenergy markets since the early 2000s and they are thus at the core of the economic framing of the sustainability criteria. Evidently, the initial space of governance rescaling has been narrower than the stakeholders – or the European Commission in 2013 directive draft – have intended. Furthermore, the renewable energy framework constitutes a simultaneous double-movement of rescaling on the European transnational level, but simultaneously emphasising hegemony of detached nation states.

Actors and practices in scalar politics

The debate gains a more nuanced image from the analytical framework of scalar politics. The rescaling of governance is not primarily the rescaling of jurisdictional scales since the nested and tangled governance hierarchies are slow to change. Rather, as pointed out by MacKinnon (2010), scales are used strategically to raise discussions over important policy issues, such as soil carbon fluctuations, biodiversity loss or transnational biomass trade, and the permanence of existing governance levels is extremely difficult to 'bend' or 'undo'. Thus, the strategic mobilisation of jurisdictional, spatial and temporal scales is also connected to more general climate governance definitions of bioenergy and forest carbon cycles.

In practice, the actors have mobilised epistemological underpinnings of biomass sustainability that are partially compatible. However, there are also profound mismatches related to the spatial scaling of the phenomenon and the jurisdictional rescaling of existing governance structures. The issue of temporal scaling, however, is more closely related to the valuation of carbon in its different forms and is thus setting societal 'yard-sticks' for mitigation efforts. Table 2 summarises actor positions and scaling practices in general. The categories are not strict and individual actors may re-align and network over the boundaries on specific issues and concerns.

First, 'forest on the move' emphasises the role of forest biomass as a tradeable commodity with the ability to sequester biomass in growth. The actors in this frame see the imperative of developing bioenergy as a way of reducing society's fossil fuel dependency and as a source of sustainable living. Furthermore, harmonised and well-designed sustainability criteria are critical to flawless market operation, while a more rigorous design or unnecessary administrative boundaries would be problematic. Thus, the perspective is future-oriented and counts on increasing levels of biomass utilisation. Second, the 'forest as the sum of trees' perspective emphasises existing economic forest management practices as the basis of sustainable bioenergy production. Bioenergy has garnered more attention than its economic role and should not become the defining factor of overall activities. Moreover, the established practice of temporal logging cycles should provide the basis for carbon neutral energy production and sustainability criteria ought to support this. Issues of administrative burden and compromising national hegemony over natural resources are the most serious threats. Additional accounting systems

Table 2. The practices of scalar politics

	Forest 'on the move'	Forest 'the sum of the trees'	Forest 'in the detail'
Sustainability concern	Functioning of trans-national energy markets	Management of forests; administrative burden	Biodiversity loss; effects on biogenic carbon stocks
Jurisdictional scaling	EU-level; providing motivation for increased renewable energy use and biomass trade	National/regional; forestry and natural resource management as national practice	Transnational/global; policy intervention to produce rigorous safeguards and a bioenergy 'cap'
Spatial scaling	Operational scaling of biomass as tradeable commodity	Forest as an object of management practice	Safeguards for land use practices and science-based carbon accounting
Temporal scaling	Market generation based on EU renewable energy frameworks	Increasing carbon stock in growing young trees; cyclic forestry based on carbon neutrality	Carbon debt approach connected to past emissions and urgency of climate change
Production of knowledge	Economic knowledge of market disturbances caused by regulatory barriers and discontinuities	Statistical estimates and scientific modelling of annual forest growth	Evidence-based suggestions; carbon cycle modelling on actual emissions and soil dynamics
Stakeholders	Energy producers, biomass traders	Forest owners, forestry professionals	Environmental NGOs, parts of scientific community

would consequently disturb the hegemonic position of the cyclic temporality of forest growth practices. Third, the 'forest is in the detail' summarises the demand to seriously redefine contemporary modelling and estimations based on frameworks for sustainability criteria. Here, documented harmful land use practices should become the starting point for criteria design under a European wide cap for bioenergy. Furthermore, the scientific carbon accounting techniques available ought to provide more detailed monitoring of actual carbon emissions caused by the whole bioenergy production chain. To have an actual effect, the ambition level of the sustainability criteria has to be increased in conjunction with cuts to national and economic practices.

Conclusion

The political struggle over the biomass sustainability criteria illustrates the complexity of rescaling processes in environmental governance. Although there is a relative consensus of tackling sustainability concerns on the European level, the existing scalar structures and material underpinnings of the issues linked to biomass sustainability have made it operationally problematic. First, the governance system of the sustainability criteria is designed as an adjustment to foundational flaws in applied renewably energy policy on the EU level. Second, the existing socio-material and economic fixes render scales resistant to rescaling and bending attempts. Finally, sustainability concerns are profoundly immiscible and thus prone to reproduce scalar mismatches. In practice, the loose and risk-based approach currently applied will facilitate path-dependencies in bioenergy utilisation, but maintains sustainability issues as a persistent part of public debates. Furthermore, following the UNCCC Paris Agreement, discussions on land use governance in climate change mitigation will increase concerns over the sustainability of biomass for energy use. The next round of the sustainability criteria debate is on the horizon with potentially realigned scalar dynamics.

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