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Biofuels and Global Change: The Need for a Multilateral Governance Framework

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Abstract

The demand for biofuels has expanded rapidly worldwide due to increased interests in energy security, climate change mitigation, and rural development. The increasing production of and trade in biofuels have had immense consequences worldwide, e.g. massive land-use changes impacting on forests, biodiversity and climate, and important socio-economic impacts such as land evictions, competition with food production, and food insecurity. Even though individually each of these issues has received attention in the literature, biofuel governance discussions remain rare. This article identifies this gap through a broad and systematic literature review, which adds to a more rapid policy review that examines the existing biofuel governance framework at the international level. Our examination reveals that governance is scattered in many bilateral and some supranational frameworks. However, a structured framework is seen as important because: (a) the driving forces for biofuels are largely global; (b) the impacts of biofuel trade are beyond the governance capacity of countries or non-state actors; (c) the issue has a complex North-South dimension, as most impacts take place in developing countries while most demand is in the North; and (d) there are a number of conflicting views on biofuels which need to be resolved democratically.

Keywords: Biofuels, Bioenergy, Global Change, Global Environmental Governance, Multilateral Policy Framework, North-South Relations

1. Introduction

Biofuels have become a promising but contentious alternative to fossil fuels. Interests in climate change mitigation, rural development, global and national energy security have been

extremely powerful drivers boosting biofuel[1] production (Koh and Ghazoul, 2008). Global biofuel output jumped from 4.4 billion liters (bl) in 1980 to about 80bl in 2008, almost a 20-fold increase (Murray, 2005; FO Licht, 2008). This expansion has, however, raised a number of environmental and socio-economic controversies. It is now known, for example, that some forms of biofuel production increases rather than reduces greenhouse gas emissions (Searchinger et al., 2008). Likewise, biofuel may well help mitigate rural poverty, but it can also lead to land conflicts and further concentration of ownership and capital in the agricultural sector (Cotula et al., 2008). As such, biofuels pose as many opportunities to be explored as risks to be avoided, and the outcomes depend largely on *how* biofuels are produced, i.e. on the policies and development strategies adopted (Sagar and Kartha, 2007; Koh and Ghazoul, 2008).

That lends a prominent role to the *governance* of biofuel production and development (cf. Section 3). The concept of governance has become central to policy studies, and it has been key to the analyses of global environmental issues (Biermann and Pattberg, 2008). However, analyses on the governance of biofuels have been very scarce. Our systematic review of peer-reviewed publications and an *ad hoc* search for relevant reports and papers in other journals reveal a major gap in the analysis of biofuel governance.[2] Governance journals have published little on the subject despite its increasing policy relevance, and peer-reviewed studies on the political aspects of biofuel development remain rare. The relatively few policy-focused articles (compared to a huge overall number of biofuel publications) often deal with specific instruments (e.g. certification schemes) but without discussing how these particular tools would fit in a broader framework of biofuel governance. This article thus contributes to a new, urgent and timely effort to understand the biofuel issue as a global change phenomenon, and therefore to analyze it from a global environmental governance perspective.

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[1] Biofuel is any fuel or energy sourced from organic matter (biomass), hence the use of *bioenergy* as a synonym. Biofuel, however, may refer specifically to the liquid fuels used in transportation (see, e.g., Sagar and Kartha, 2007; Rhodes and Keith, 2008). Its major types are ethanol, conventionally extracted from starch- or sugar-rich plants (e.g. corn, sugarcane) and used as a substitute for gasoline, and biodiesel, produced from animal fats or vegetable oils (e.g. palm oil, rapeseed oil) and used in the place of conventional diesel. It is on these liquid fuels that this article focuses, as they have experienced most expansion as well as received most investments, political attention, support and criticism.

[2] This survey covered articles published in international peer-reviewed journals related to environmental policy or governance between 2002 and 2008. It was based on an online search on the website of each selected journal for the key terms "biofuel", "ethanol", "biodiesel", "biomass and energy" and "biomass and fuel" throughout the titles, keywords or abstracts of the articles published during that period (see the Appendix for a list of journals surveyed and their number of biofuel publications).

The article is structured as the following. It first configures biofuels as a global issue and discusses a number of environmental, socio-economic, and political questions arising from its rapid expansion (Section 2). Section 3 examines the policies and institutions in place, dealing with global biofuel expansion. Finally, Section 4 analyses the challenges that the biofuel issue poses to governance and reflects upon different design options for a multilateral biofuel architecture.

2. Large-scale Biofuel Expansion as a Global Change Phenomenon

2.1 Introduction

The rapid expansion of biofuel production worldwide has created significant changes for both the natural environment and human populations. As showed in the introduction of this article, biofuel production has had a 20-fold increase since 1980. Although much of that can be attributed to productivity gains, there have been also an expansion of biofuel crops and, controversially, the increasing use of food and feed crops for biofuel manufacturing. The impacts and outcomes of this expansion have been great, as this section demonstrates. It first addresses biophysical issues surrounding the biofuel topic, then it discusses socioeconomic and political matters arising, and finally looks at the international level to briefly analyze biofuel expansion from a North-South perspective.

2.2 Biophysical Changes

Biofuel impacts on the natural environment can be numerous and complex. The most noted one, its potential to replace fossil fuel and reduce greenhouse gas (GHG) emissions, is a key driver of expansion (cf. Goldemberg and Guardabassi, 2009). But studies have showed that ethanol and biodiesel also provide for a cleaner combustion during use, as they release less harmful gases, such as SO_2, CO, than their fossil fuel counterparts (Fulton et al., 2004; Goldemberg et al., 2008).

Nevertheless, the whole biofuel life-cycle must be examined in order to assess its overall impact on the atmosphere and on climate change. For example, cultivation of the feedstock (i.e. the crop or raw material from which the biofuel is extracted, e.g. sugarcane) may utilize fossil energy in the form of fertilizers, pesticides or machinery, reducing the GHG-emission gains (Koh and Ghazoul, 2008). In addition, methane (CH_4) and particularly nitrous oxide (N_2O) emissions from intensive agriculture have further impacts to account for, as they have

24 and 296 times the global warming potential of CO_2, respectively (Crutzen et al., 2007). Finally, land-use changes clearing vegetation or releasing soil carbon stocks create massive GHG emissions, which create an upfront cost that biofuels need centuries to pay[3] (Fargione et al., 2008; Searchinger et al., 2008). Therefore, the emissions account balance of biofuels must take all its life-cycle into account.

Environmental impacts, however, are not restricted to the atmosphere. Feedstock cultivation through intensive monoculture spreads the various environmental impacts associated to that production model (e.g. biodiversity loss, soil acidification and nutrient depletion, pollution from fertilizer and pesticide residues) (cf. Altieri, 2000; Tilman et al., 2002). Though feedstock cultivation occupied only 1% of the world's arable land in 2004 (or 13.5 million ha), this area is expanding fast as governments set new or increase existing targets of biofuel production and consumption (IEA, 2006; FAO, 2008; see 3.2). For example, the area planted with sugarcane in Brazil increased by 20% just between 2005 and 2006, reaching alone 7Mha (MAPA, 2007).

Biofuel expansion also creates new challenges to watershed and water resources management, as it consumes on average 70 to 400 times more water than energy production from fossil or other renewable sources (excluding hydro-power) (Gerbens-Leenes et al., 2009). Even though most feedstock cultivation can be rain-fed, irrigation is sometimes applied even when unnecessary as a way to increase productivity (EPE, 2008).

Finally, with the possible introduction of novel biofuel crops, which do not compete with food production, new environmental challenges may also be created. For instance, the introduction of exotic species as feedstocks, such as fast-growth grasses and jatropha, requires careful attention from an ecosystems conservation perspective. Such newer feedstocks, selected for their high water-use efficiency, rapid growth, no known pests or diseases, among others, have the exact same features that coincidentally make them also very likely to become invasive species (Raghu et al., 2006; Achten et al., 2008).

2.3 Socio-Economic Changes

Biofuel expansion has triggered a number of rapid changes in rural areas, as well as in local, regional, national and global food markets (Eide, 2008). While the potential for rural

[3] That could go from 134 tons of CO_2-equivalent emitted/ ha in the case of corn-ethanol replacing central grassland in the United States (taking 93 years before it would obtain any net GHG emission saving) to 3 453 tons emitted/ha in the case of oil palm biodiesel replacing peatland rainforest in Southeast Asia (taking 423 years before achieving any net GHG reduction) (Fargione et al., 2008).

development through bioenergy exists, land issues, labour issues, and food security impacts all deserve attention.

Biofuel expansion has already led to several cases of (1) traditional land rights' violation (e.g. in Colombia) (Ziegler, 2007); (2) more severe land conflicts (e.g. in Brazil) (Assis and Zucarelli, 2007); and (3) increased concentration of land ownership in places where inequality is already glaring (e.g. Africa) (Cotula et al., 2008). Even when lands are acquired legally and with compensation, traditional farming systems are also replaced by industry-owned monocultures with the loss of cultural practices, traditional livelihoods (e.g. pastoralists), agro-biodiversity (e.g. plant varieties used in traditional polyculture systems), and the disempowerment of the small farmer (Sagar and Kartha, 2007; Assis and Zucarelli, 2007; Cotula et al., 2008). If such trends were already in place before, the rush for biofuels has both intensified and accelerated them (*ibid*).

Disempowered farmers who lost their occupation or were displaced may immigrate or join shantytowns of swelling cities in the developing world, or become paid workers in industrial agriculture (Bryant and Bailey, 1997; Vandermeer and Perfecto, 2005). The creation of jobs is indeed a key promise of biofuel expansion, particularly in labour-intensive agriculture such as sugarcane and oil palm (cf. Domac et al., 2005; Petrobras, 2007). However, working conditions are often degrading and offer little job security (Sawyer, 2008; Renner, 2008; WRM, 2008). Frequently such workers are exploited, threatened, and exposed to unacceptable risks such as the utilization of highly hazardous pesticides forbidden in developed countries (*ibid*).

Beyond rural areas, biofuel production interferes with food production, competing for land, water, and other resources, as well as diverting production to other ends. Moreover, when a crop cultivated for food or feed is also used for biofuel manufacturing, its prices tend to increase with the demand (FAO, 2008). While this may benefit producers, it hampers the access to food of those who cannot afford it anymore, increasing the number of food-insecure in the world (Sagar and Kartha, 2007; FAO, 2008). At the local level, farmers who have replaced locally-oriented food production for feedstock cultivation might also find themselves more vulnerable to volatile market prices and to price hikes. Recently, exposure to these price fland-use changetuations has contributed to add more than 100 million people to the pool of food insecure populations – a number which now exceeds 1 billion (FAO, 2009).

2.4 Global Equity and North-South relations

A third dimension of these global changes is how biofuel expansion affects global equity and North-South relations. The Global South is perceived as much better endowed to produce biofuels due to more suitable climes, soils, available land and cheaper labour costs (Mathews, 2007). Meanwhile, most biofuel consumption is expected to occur in the North, where production is increasing but will likely remain insufficient to meet its consumption targets (FO Licht, 2006; EPE, 2008). This increasing demand for imports is matched by the willingness of large companies and governments in the South to meet it, and this situation has led to a number of commercial agreements on South-North biofuel trade (e.g. the EU-Africa bioenergy partnership, cf. Charles, 2008). This demand-and-supply matching should indicate a global win-win situation, but the rapid expansion of large-scale production in the South is creating a number of challenges that affect primarily developing countries: deforestation, land conflicts, loss of traditional farming, etc.

Despite that greater vulnerability, Southern participation in setting a global biofuel agenda remains much smaller than Northern (cf. Section 3). Even when Southern participation occurs, it is often through the large actors who aim to benefit from biofuel expansion, not those who are affected by its downsides (e.g. small farmers, rural communities) (Pinto et al., 2007; Ernsting, 2007). Some suggest that such an emerging configuration could easily turn into a new form of colonialism, with Southern production being (again) based on commodity export to the North and controlled by few powerful actors (e.g. GFC, 2006). Even if this critique is not accurate, the greater risk to which Southern populations and environments are exposed demands due participation of those involved actors. And for that, an inclusive and structured forum for global biofuel governance seems needed.

2.5 The Need for a Multilateral Biofuel Governance Framework

Given this whole spectrum of outcomes, biofuel is not an issue to be left to the market only, but one which calls for appropriate governance structures. We argue that, for a series of reasons, multilateral biofuel governance at the global level is necessary to complement national and sub-national ones. These reasons are:

(1) Biofuel key driving forces (i.e. climate change mitigation, energy security, rural development) all have important global elements. Fossil fuel replacement with renewables is being implicitly stimulated by the United Nations Framework Convention on Climate Change

(UNFCCC). Fossil fuel depletion is also a global issue and, equally, the pursuit of national energy security cannot be decoupled from international relations (e.g. political conflicts, interests in reducing import-dependence from certain countries or regions). Finally, biofuel agriculture (particularly in the developing world) is largely motivated by consumption targets in other countries and the prospects of increasing exports (e.g. Brazilian sugarcane, cf. Smeets et al., 2008; Southeast Asian palm oil, cf. Koh and Wilcove, 2008).

(2) The environmental outcomes of biofuel production cannot be tackled by individual countries alone. Its impacts on climate change, the demands it places on natural resources such as water, and the cumulative impacts of land-use change all have an obvious global dimension.

(3) Individual countries also have limited ability to deal with the socio-economic outcomes of biofuel expansion (e.g. effects on agricultural commodity markets and global food security).

(4) The biofuel discussion appears to have the characteristic of a typical North-South issue where one bloc seems to benefit at the cost of major social, political and environmental upheavals in the other bloc.

(5) There are a number of conflicting views on biofuel production. The need to have a governance framework that ensures not only efficiency but also equity, legitimacy, accountability, and representation of all parties concerned is essential if we do not wish to create new problems while solving existing ones.

Each of these elements provides reasons to structure a global governance framework on biofuels. Considered all together they make it, if not essential, at least very important. Global, however, does not necessarily mean universal (i.e. negotiations among all countries), but at least a structured, multilateral framework where different biofuel perspectives and issues can be brought on and dealt with in an accountable and legitimate way by multiple countries and non-state actors.

3. The State of Biofuel Governance in the World

3.1 Introduction

In face of mounting controversies around biofuel expansion, a number of policies and governance structures have been put in place to deal with impacts and to steer biofuel development sustainably. Meanwhile, several countries have continued to promote

conventional biofuel production through their national policies. This section analyzes these two trends, examining the examples of major world biofuel producers and consumers. It then overviews major attempts to establish international governance mechanisms on biofuels, and finally examines the current context of global (non)governance on biofuels.

3.2 National and Supranational Biofuel Agendas – examples from the United States, Brazil, and Europe

With the emergence of climate change in the global political scene, many countries have rushed to draft agendas of renewable energy use, such as biofuels. In this case, interests in replacing fossil fuel consumption and increasing energy security clearly added to economic and political interests in expanding domestic agricultural production and giving incentives to farmers. This originated a number of policies which have now become commonplace worldwide: biofuel blending mandates creating mandatory markets, tax exemptions, direct payments to farmers and manufacturers, and sometimes tariff barriers to imported biofuels (FAO, 2008; EPE, 2008).

In the United States the corn agro-industry has long been under heavy criticism, in general and for ethanol production in particular. Relatively low GHG emissions savings (Groom et al., 2008); a highly consolidated complex where grain corporations dominate and leave little room for smaller actors (Heffernan, 2000); and impacts on global staple-food prices (OECD and FAO, 2008) have all lowered the socio-environmental profile of corn-ethanol. Yet, the US has adopted aggressive production and consumption expansion plans: an output increase from current 33 billion liters (bl) to 136bl in 2022, and the replacement of 20% of its gasoline consumption by ethanol by 2017 (USA, 2007). Subsidies of US$0.51/gallon paid to processors and a US$ 0.54/gallon tariff barrier on imported ethanol complement the incentives (USA, 2008). But, as second-generation technologies (e.g. cellulosic ethanol) are not expected to play a significant role within that time span (Robertson et al., 2008), increases will inevitably come from conventional production, furthering known impacts rather than reducing them.

Brazil is the second largest biofuel producer in the world. Together, the South American country and the US account for about three-quarters of all biofuel production in the world (FAO, 2008). Brazilian sugarcane-ethanol production is pointed as much more efficient than corn (Groom et al., 2008). Nevertheless, large-scale sugarcane plantations have been associated with indirect land clearing in the Amazon and in the Brazilian *Cerrado* (high-

biodiversity wooded savannah) (Sawyer, 2008); sugarcane-ethanol production uses immense quantities of freshwater (~15 litres per litre of fuel, just during processing) (EPE, 2008); and land conflicts due to monoculture expansion have increased significantly (Assis and Zucarelli, 2007). Sugarcane expansion in Brazil is, in addition, aggravating land ownership consolidation in a country historically marked by inequality (*ibid*)[4]. Despite these issues, Brazil aims to double its ethanol production capacity (to 55bl) by 2017 and to have 25 new sugarcane-ethanol plants being installed each year (EPE, 2008). Though minor modifications are being gradually adopted (e.g. the phasing-out of sugarcane pre-harvest burning in some states), the conventional agenda based on large-scale sugarcane production remains the same.

Sustainability concerns have made few changes in the agendas of biofuel-producing countries, as seen in the American and Brazilian cases. Net biofuel-importers, on the other hand, have taken some more audacious steps to ensure the sustainability of biofuel production. The United Kingdom and the Netherlands, most notably, have created a number of sustainability assessment criteria to be used for biofuel certification. These requirements filtered into EU-wide policy and have provided a key reference for the analysis of biofuel sustainability (see Table 1).

Table 1 – European sustainability criteria for biofuel production (BP)

[4] For instance, large landowners control as much as 75% of all sugarcane in São Paulo state, where the Brazilian production is concentrated (Goldemberg et al., 2008).

Biofuel Issue	UK Standard [a]	Netherlands – Criteria [b]	EU requirements [c]
Climate change mitigation	Carbon-rich areas shall not be converted for feedstock cultivation;		
	Suggested minimum of 40% GHG emissions savings [d] (increasing 5% each year)	Mandatory minimum of 30% GHG emissions savings (gradual increase towards a 80-90% minimum by 2017);	Mandatory minimum of 35% GHG emissions savings (increasing to 60% minimum in 2017);
Biodiversity conservation	Biodiversity-rich areas shall not be destroyed or damaged by BP;	Biodiversity-rich areas shall not be converted for BP	
		BP at least 5km far from areas recognized as High Conservation Value or as "Protected" by the government	
Water, soil and air conservation	No soil degradation, contamination or depletion of water sources, or air pollution	Best conservation practices on soil, water and air quality; Compliance with the Stockholm Convention on pesticide use or stricter domestic law; No use of water from non-renewable sources; No burning allowed in BP;	*No specific requirement* The European Commission (EC) must report bi-annually on the national measures taken on air, water and soil protection
Land ownership issues	No adverse impacts on land rights and community relations	Official and carefully described land-use, with the consent of original users; Respect for the customary law of indigenous peoples	*No specific requirement* Bi-annual EC report on land rights in the producing country
Labour standards	No adverse impact on workers rights and working relationships	Compliance with the Universal Human Rights Declaration and ILO's Principles concerning Multinational Enterprises and Social Policy	*No specific requirement* Bi-annual EC report on national ratification and implementation of ILO conventions
Socio-economic development	*No specific requirement* The Renewable Fuels Agency (RFA) may report on this to the Secretary of State	BP must contribute to local prosperity; Required reporting on how the BP affects the local population and contributes to local economic development	*No specific requirement* Bi-annual EC report on "the impact on social sustainability [...] and wider development issues"
Food security	*No specific requirement* The RFA will monitor indirect impacts on food prices	*No specific requirement* The Dutch government can request a report on land-use change patterns, land and food prices in the region	*No specific requirement* Bi-annual EC report on "the impact of the EU biofuel policy on the availability of foodstuffs at affordable prices"

[a] DFT, 2008, the British Renewable Transport Fuel Obligations (RTFO) and their sustainability requirements
[b] Cramer et al., 2007, the final report of the project group "Sustainable production of biomass", chaired by Prof. dr. Jacqueline Cramer, current environment minister of the Netherlands
[c] European Parliament, 2008
[d] This calculation must account for emissions from the full life-cycle of the biofuel, then compared to those of the fossil fuel replaced. However, accounts vary due to different methodologies used (each of these schemes has a different one). Currently, the EU relies on data from its own Joint Research Centre.

The EU requirements were adopted as a safeguard to its new mandatory target of a 10% minimum share of renewables in its transport sector by 2020, which clearly stimulates export-

oriented biofuel production worldwide. The criteria, however, are mostly limited to biophysical aspects of sustainability. Socio-economic issues such as local development, equity, and food security receive little attention, even if some were previously present, for instance, in the Dutch criteria. The issue of indirect land-use change has also been dangerously neglected – not even reporting on it has been demanded. As some critics suggest, without addressing indirect land-use change any certification effort is meaningless (Searchinger et al, 2008; FoE Europe, 2008) [5]. Finally, although these criteria aim to apply to foreign producing countries as well as to Europe, they have been drafted without Southern participation. As such, they have not allowed developing countries to voice and express their own views and concerns on biofuels. For these to be voiced, it becomes increasingly clear that international initiatives are needed.

3.3 International Biofuel Governance Initiatives

Several international agreements are in place in areas which relate more or less to biofuels, such as climate, energy, and agriculture. But no multilateral agreement or framework is in place to deal specifically with the challenges posed by global biofuel expansion. International efforts try to fill this gap have been in three main forms.

First, multilateral organizations such as the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), the Food and Agriculture Organization of the United Nations (FAO), and the UN-Energy interagency mechanism have all addressed some of the biofuel issues in reports and studies. However, their action has been mostly limited to analysis and recommendations, and no legal instrument or framework on this issue has emerged under their aegis. The International Energy Agency (IEA), from the Organisation for Economic Co-operation and Development, has had a more participative role; it has engaged directly in drafting sustainability criteria for biofuel trade certification through its IEA Bioenergy division and, more specifically, its *Task 40* working group.

Newly-established forums and partnerships have also been created to govern biofuel development and to promote it worldwide. The most prominent example is probably the

[5] Among biofuel exporters to Europe, the largest impacts of sugarcane expansion (e.g. deforestation) in Brazil occur indirectly through cattle-ranch displacement; in Malaysia and Indonesia (exporters of palm oil biodiesel), much rainforest conversion into plantations is to meet growing demands for cooking oil in emerging Asian countries, which do not apply sustainability requirements (Koh and Wilcove, 2007). As such, how likely is it that palm oil from directly-converted rainforest will be used for such other purposes while a minor fraction, from areas already established or which followed destruction, is used to meet the EU demands? Certification might well become irrelevant without addressing these larger, complex issues.

Global Bioenergy Partnership, launched in 2005 by the Group of 8+5 countries. This institution was born with the declared objective of promoting the 'continued development and commercialization of renewable energy', and of supporting 'wider, cost-effective, biomass and biofuels deployment, particularly in developing countries where biomass is prevalent'[6]. As such, a focus on international biofuel trade becomes clear. In 2007, some of the same countries (Brazil, United States, China, India, and the European Commission, among others) also established the International Biofuel Forum, again with the aim of expanding biofuel production and global biofuel trade (UN Press Briefing, 2007).

Finally, there have been new initiatives to address exclusively the sustainability issues of biofuel production. These have most often been in the form of multi-stakeholder roundtables, where environmental and socioeconomic criteria for sustainable production are drafted and discussed. The main aim of these initiatives has been the trade certification of biofuel production – sometimes with focus on specific crops, such as in the cases of the Round Table of Responsible Soy and the Roundtable of Sustainable Palm Oil, and sometimes trying to be universally applicable, as the Roundtable on Sustainable Biofuels (RSB).

These various international biofuel governance initiatives, however, are still limited in their scope, representation, and effectiveness at addressing environmental and socio-economic impacts. The scope of these initiatives has been, as described, most often the expansion of biofuel markets. Cooperation among countries has been mostly on research and technological development, and not on addressing the impacts of biofuel expansion such as food insecurity or deforestation. Alternative modes of biofuel production such as local development promotion through local energy production have been largely overlooked. Even the initiatives which aim to make biofuel production sustainable, such as the certification initiatives, only follow the conventional modes of production, and do not explore or try to develop the potentials of alternative models.

It can be argued that such a focus follows the representation within those institutions created to govern biofuels internationally. The IEA, as an OECD organization, has an obvious "Northern" agenda which prioritizes the energy needs of developed countries – therefore their focus on export-oriented biofuel production in Southern countries, and not on their local needs. The G8+5 initiative, as well, naturally represents mainly the interests of that group of countries. And even the multi-stakeholder groups, such as the Roundtable on Sustainable

[6] See http://www.globalbioenergy.org/aboutgbep/en

Biofuels, also have a skewed representation favouring larger actors from the industry sector and from developed countries. As an illustration, out of the 21 RSB steering-board committee members, only five are from developing countries; of these, three are representatives of giant industry groups such as the Brazilian PETROBRAS and the sugarcane producers union of that country. Clearly, the interests of the affected majority are very much underrepresented.

A structured framework of global biofuel governance, where multiple views on biofuel could be taken on board, remains absent. The existing international efforts are not aligned in terms of a multi-level governance approach, where policy frameworks at national through to global levels are mutually influential and supportive. Initiatives have been springing but remain scattered, and countries continue to pursue their particular biofuel agendas irrespective of its global consequences. Biofuel thus remains an area of "non-governance", i.e. a sector where disputes prevail and institutions have not yet been agreed upon (cf. Dimitrov, 2006; Underdal, 2008). In this case, the result have been disputes between countries (e.g. over trade barriers), actors pushing for policies that best meet their (self) interests (e.g. industry groups pushing for higher consumption targets and lower sustainability restrictions), and the further expansion of conventional production with insufficient attention paid to the sustainability or equity of the process. The next section expands this governance discussion, and reflects upon possible institutional designs and multilateral biofuel policy frameworks.

4. Insights for a multilateral biofuel governance framework

4.1 Introduction

Global environmental governance has been recognized as essential to deal with the increasingly global nature of our socio-economic dynamics and environmental challenges (Gupta, 2002; Biermann and Pattberg, 2008). Though there are different readings of the term, a key one refers to building and coordinating the institutional structures that allow us to address global issues which go beyond the individual capacity of states or other actors (Gordenker and Weiss, 1996; Smouts, 1998). Clearly, these structures need to be both equitable and effective at tackling sustainability issues. The argument here is that biofuel expansion is one of the most pressing among such issues – and increasingly so – and yet it has lacked such a global governance framework with representation from directly and indirectly affected countries and non-state actors. This gap contrasts strikingly with the global nature of

biofuel development. The section thus gives further thoughts on how the issue could be addressed, with strengths and weaknesses of the different alternatives.

4.2 Biofuel requires multi-sector, multi-level, and multi-actor governance

First, biofuel is not just an energy strategy; it connects food and agriculture, trade, climate, and conservation issues as well and their distinct policy regimes. Biofuels have been key in the international climate negotiations (especially with respect to the Clean Development Mechanism[7]), in renewable energy policy agendas (cf. MAPA, 2006; European Parliament, 2008), in the discussions over global trade and agricultural development (cf. Mathews, 2007; FAO, 2008), as well as in the elaboration of strategies to conserve biodiversity and highly-valued ecosystems (cf. Sawyer, 2008; Nepstad et al., 2008). Policies in each of these different areas must avoid conflicts and look for synergies, what calls for multi-sectoral coordination in biofuel governance.

Second, biofuel governance also requires multi-level coordination. International policy initiatives, however incipient, have already recognized that they cannot succeed without cooperating with national and sub-national governments and with actors working at the local level (cf., e.g., RSB, 2008). This type of coordination is widely recognized as a need in global environmental governance, both for the successful implementation of international policies (e.g. certification schemes) and to ensure harmony and create synergy between different levels of regulatory activity (Jasanoff and Long Martello, 2004; Biermann and Pattberg, 2008).

Third, coordination among different actors and parallel policy-making systems is necessary. This (a) prevents duplication of efforts, (b) avoids policy conflicts (e.g. with WTO rules), and (c) creates synergy among agendas. Articulating multiple actors would also allow them to better use the resources required for effective participation in the governance process (cf. Oberthur, 2002). Finally, it would bring multiple biofuel perspectives on board (e.g. food and energy sovereignty views, which have been largely overlooked in major debates[8]).

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[7] The "Clean Development Mechanism" (CDM) of the United Nations Framework Convention on Climate Change (UNFCCC) allows developed countries to obtain emissions reductions credits by financing, *inter alia*, renewable energy projects in the developing world.

[8] These eminently (though not exclusively) Southern concepts are mostly promoted by community actors and civil society organizations. They suggest that local communities and their countries have the right and should be empowered to define their agriculture and energy production systems (e.g. policies, development strategies), focusing first on local needs, and using transparent and inclusive decision-making (Moreno and Ortiz, 2007).

4.3 Reflecting upon options of institutional design

While the need to further coordinate sectors, actors and levels in biofuel governance is clear, it remains an open question which institutional design could work best. Biofuel can be treated either as a separate (focused) issue or within a larger policy area such as energy or agriculture. Energy would be the most likely candidate, but its global governance is diffuse and scattered through a number of UN agencies, and UN-Energy (an interagency mechanism) has limited authority to promote such governance. The newly-established International Renewable Energy Agency (IRENA) may be promising, but major biofuel producing countries such as Brazil, China and Indonesia have not yet signed to it (as of November 2009). Plus, biofuel is strikingly different from other renewables. Its influence on other sectors such as agriculture is far greater, and framing biofuel as an energy matter could result in insufficient attention paid to issues such as food security, impacts on rural communities, and land policies. Framing biofuel within agriculture could be another option, and it would gain from the existing infrastructure of the strong FAO. However, agricultural trade policy frequently falls in deadlocks and this is regarded as an obstacle to biofuel development (Mathews, 2007), plus this could distance biofuel from overarching renewable energy policies.

A different option would be to create one or more policy frameworks collaboratively, having biofuel as a focused issue. This could prove more challenging as it would be necessary to articulate different areas and institutions (with their existing policies) in order to ensure synergy and avoid conflicts (or biases). In this case, either a single or multiple policy frameworks would have weaknesses and strengths.

Concerning effectiveness, multiple parallel policy frameworks facilitate innovation, competition and the testing of different policy instruments (Busch and Jorgens, 2005). However, as Biermann and Pattberg (2008, p. 285) state, "lack of uniform policies may jeopardize the success of the policies adopted by individual groups of countries or at different levels of decision-making". This suggests that, if multiple frameworks are used, their compatibility must be ensured, and eventually it would be necessary to work on the equivalence of sustainability certificates, for example.

Concerning equity and power distribution, both options deserve attention. Multiple frameworks can prevent the concentration of power and to that extent may make it easier for developing countries to influence the process (cf. Gupta, 2002). On the other hand, some

argue that in a fragmented system powerful actors have more room to use their disproportionate influence and pre-empt policy processes (cf. Benvenisti and Downs, 2007).

Table 2 summarizes weaknesses and strengths of these different alternatives. In the end, what seems reasonable to suggest is that biofuel governance would gain substantially from the development of a more structured process where the views of different actors are taken on board and where some attempts are made to discuss, if not harmonize competing approaches.

Table 2 – Options of institutional design for multilateral biofuel governance

Type	Strengths	Weaknesses
Biofuel within a broader area	Lower transaction costs from using existing institutions	Bias towards that specific area
Energy	Easily integrated in renewable energy policy; Greater attention to assess liquid biofuels against other bioenergy	Little infrastructure to gain from in global energy governance; Countries could regard biofuel as a national security issue and make multilateral negotiations harder; Agriculture-related issues could be overlooked
Agriculture	Attention to food and rural issues; Strong FAO infrastructure; Eventual benefits from international agriculture agreements (e.g. trade)	Vulnerable to the hurdles and impasses of agricultural trade negotiations; Risk of prioritizing agriculture-based biofuels and overlook other bioenergy; Energy-related issues could be overlooked
Biofuel as a focused issue	Lower risk of bias to one area	Higher transaction costs, little gains frome existing infrastructure
Single policy framework	Lower risk of duplicating efforts; One single set of rules to harmonize with existing law (e.g. WTO); Focused attention and resources from multiple parties	Risk of bias favouring actors, issues or ideological starting points; Lower flexibility and adaptiveness; Likely to have more parties, harder to reach an agreement
Multiple parallel frameworks	Easier innovation and testing of different policy instruments; Less power concentration, smaller actors can more easily influence the	Higher risk of duplicating efforts (e.g. sustainability certificates); The success of policies may be jeopardized by other group of countries;

	process	Powerful actors may more easily influence the process

5. Conclusions

The global phenomenon of biofuel expansion has brought about a number of complex environmental and socio-economic issues such as uncertain impacts on climate change, increased resource use, impacts on agriculture and on both local and global food security. As such, biofuel is not an issue that can be left to the market only or to *ad hoc* policy decisions of like-minded countries; it needs policy regulations to ensure sustainability. And since biofuel driving forces, its impacts (e.g. on the atmosphere, global hydrology, commodity markets) and expansion trends are all global, a multilateral biofuel governance framework seems necessary.

However, to date biofuel remains largely an instance of non-governance, without institutional arrangements or policy frameworks that have been agreed upon internationally. National and supranational biofuel agendas remain expansion-oriented (e.g. largely providing policy-incentives to production, such as blending mandates) and clearly motivated by vested interests in increasing revenues and conquering markets for their companies. International cooperative efforts have also moved in that direction through commercial partnerships, while regulatory activity falls short of the sector's global expansion. International regulatory initiatives are still fragmented and innocuous. Their efforts are often duplicated, conflicts with established law (e.g. WTO rules) remain unaddressed, and they have also shown biases towards conventional, large-scale export-led agriculture models and Northern agendas. These biases are incompatible with the fact that that most impacts of biofuel expansion are felt by small farmers and rural communities in the South.

In this context of mounting and cumulative impacts being insufficiently addressed, the need for a multilateral biofuel policy framework seems clear. The concerns raised by biofuels bring a unique opportunity to rethink the production systems and global governance of both energy and agriculture. This biofuel discussion should give impetus for a broader discussion on global energy governance in general, which remains limited. And, in agriculture, sustainability standards being conceived for biofuel could well apply to the rest of the sector, where activities of much larger scale are not nearly as scrutinized.

Appendix

2009 Amsterdam Conference on the Human Dimensions of Global Environmental Change. 'Earth System Governance: People, Places and the Planet'.

Biofuel publishing in the peer-reviewed environmental policy and governance literature

	Peer-reviewed journal	Period	Articles on biofuel
1	Agriculture, Ecosystems & Environment	2002 – 2008	16
2	Annual Reviews: Environment and Resources	2002 – 2008	4
3	Biological Conservation	2002 – 2008	2
4	Biofuels, Bioproducts and Biorefining	2007 – 2008	100+
5	Biomass and Bioenergy	2002 – 2008	300+
6	Carbon & Climate Law Review	2007 – 2008	1
7	Climate Policy	2002 – 2008	3
8	Climate Change	2002 – 2008	12
9	Energy Policy	2002 – 2008	100+
10	Environmental Science & Policy	2002 – 2008	2
11	Forest Policy and Economics	2002 – 2008	0
12	Global Environmental Change: Human and Policy	2002 – 2008	1
13	Global Environmental Politics	2002 – 2008	0
14	Global Governance	2002 – 2008	0
15	Governance	2002 – 2008	0
16	Human Ecology	2002 – 2008	1
17	International Environmental Agreements	2002 – 2008	1
18	Journal of Environmental Management	2002 – 2008	5
19	Natural Resources Forum	2002 – 2008	3
20	Philosophical Trans. of the Royal Society: B	2002 – 2008	3

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