Biofuel Governance in Brazil and the EU

Sarah L. Stattman

Propositions

1. By legally mandating that biofuels should be *sustainable*, the EU has created a potential instrument for other commodities.
   (this thesis)

2. Successful private sustainability certification requires strong states.
   (this thesis)

3. A focus on agricultural productivity distracts from the pursuit of sustainable agriculture.

4. Successful academics practice the adage 'less is more'.

5. Energy and agricultural interlinkages are the most crucial sustainability nexus of the future.

6. Introducing school lunches in the Netherlands offers a major opportunity for shifting towards a 'planetary diet'.

Propositions belonging to the thesis, entitled

Biofuel Governance in Brazil and the EU

Sarah L. Stattman
Wageningen, 15 April 2019

Biofuel Governance in Brazil and the EU

Sarah L. Stattman

Thesis Committee

Promotors

Prof. Dr A.P.J. Mol
Professor of Environmental Policy
Wageningen University & Research

Dr A. Gupta
Associate Professor, Environmental Policy Group
Wageningen University & Research

Other members

Dr F. de Castro, University of Amsterdam
Prof. Dr P. Pattberg, VU Amsterdam
Prof. Dr H.A.C. Runhaar, Wageningen University & Research
Dr G. Schouten, Erasmus University, Rotterdam

This research was conducted under the auspices of the Graduate School for Socio-Economic and Natural Sciences of the Environment (SENSE).

Biofuel Governance in Brazil and the EU

Sarah L. Stattman

Thesis

submitted in fulfilment of the requirements for the degree of doctor

at Wageningen University

by the authority of the Rector Magnificus,

Prof. Dr. A.P.J. Mol,

in the presence of the

Thesis Committee appointed by the Academic Board

to be defended in public

on Monday 15 April 2019

at 1.30 p.m. in the Aula.

Sarah L. Stattman
Biofuel Governance in Brazil and the EU,
160 pages.

PhD thesis, Wageningen University, Wageningen, The Netherlands (2019)
With references, with summary in English

DOI: https://doi.org/10.18174/472916
ISBN: 978-94-6343-918-3

Acknowledgements

This PhD is the end of a long journey. The project started in 2009 and over the course of writing this thesis, many people in different ways have helped and supported me. Not only with the research, interviews and contacts at various times and locations, but also with background support for a process that took longer and was more complicated than I originally anticipated. I would like to take this opportunity to say thanks to many of them.

My interest for the topic originated from looking for a subject for my MSc thesis in 2007. During a debate in 'Hotel de Wereld' in Wageningen, I met Prem Bindraban who (quite spontaneously) invited me to join his research sabbatical in Brazil. Just two-and-a-half weeks later our adventure in Brazil began. During this trip we visited many people and projects varying from farmers, researchers, government officials and multi-stakeholder initiatives. We discovered the broad variety of the country and its very kind people. Therefore, thank you Prem for this amazing opportunity! It has been the basis of insights and information that has been invaluable in the whole process. Also, muito obrigada, Catarina Pezzo. We met during my first trip when you were appointed to show me around the WUR campus in Piracicaba and were finishing your own thesis. I am glad we have stayed in touch and met each other again in Brazil and the Netherlands where I could return the favour of hospitality.

I would like to continue by expressing my gratitude to my promotors Arthur Mol and Aarti Gupta for their continuing support and persistence. Arthur Mol gave me the chance to pursue my research interest as a PhD student at the Environmental Policy group. His supervision and feedback always improved the quality of my work and in spite of a bumpy road, he has remained patient and allowed me to finish this thesis in my own time. I am also incredibly grateful to Aarti Gupta, because she has kept me going (one way or another). Without her guidance and support this project would probably never have been finished. Thank you!

Many thanks also to ENP colleagues and fellow PhD candidates. You inspired me during many presentations and countless hallway discussions. Therefore, I would like to thank: Peter Oosterveer, Jan van Tatenhove, Simon Bush, Gert Spaargaren, Dries Hegger, Bettina Bluemling and Judith van Leeuwen. Also my fellow PhD students, most of whom have already graduated some time ago: Michiel de Krom, Hilde Toonen, Dorien Korbee, Alexey Pristupa, Jennifer Lenhart, Carolina Machiel, Elizabeth Sargant, Eira Carballo Cardenas and Marjanneke Vijge. Corry Rothuizen, thank you for your welcome office and support in all practical matters. Outside the chair group, I would like to thank Lena Partzsch and Kassia Wantanabe. Also thanks to Otto Hospes, my supervisor in the beginning of this project. You made it possible to get started on this PhD and to pursue my interest in Brazil.

Much gratitude also goes to my friends and colleagues at the City of Amsterdam, who gave me valuable background support during the last four years. Bas van den Heuvel, Niek Knol, Marcella van Heyningen, Annemarie Honig, Hanneke Bresser and Noortje Smit thank you for your support and understanding.

A very special thanks to my close friends Miriam van Groen, Els Hegger and Eva van den Broek. We shared our first fieldwork experience during our (strategically chosen) pub-research in Exeter. Since then we have moved in many different directions, geographically and career wise. Still, I hold our friendship dearly and I am glad that Miriam and Els can be my paranymfs to share this special graduation moment with me. Also my other friends who have supported, cheered and advised me over the years. Thank you so much for the opportunity to either talk to you or to find distraction, especially Nienke Holl, Leonoor Akkermans and Michele van den Berg.

Finalising the thesis would not have been possible without the continuing support of my kind and wonderful family and in-laws. My mother Ellen, even though you might not have always known it, your support and additional babysitting made it possible to continue working. Furthermore thank you for brainstorming with me on the cover design. Also, thank you to Milo, Joke and Jaap, Paulien, Liselot and Hans for all your support over the years. For some reason, more than once, I had to cope with deadlines during our holidays, but these holidays were also precious moments where I could shift focus to important things in life, including family time.

Last but certainly not least, Bas, I thank you for sticking to my side during this whole process. For your continuing support and for providing me with much needed distraction when needed, and of course for our amazing daughter Nikki, the loveliest distraction at all times.

Amsterdam, March 2019

Table of contents

List of figures

List of tables

List of textboxes

Abbreviations

ANFAVEA	National Association of Motor Vehicle producers (Associação Nacional dos Fabricantes de Veículos Automotores)
ANP	National Petroleum Agency (Agência Nacional do Petróleo)
AoA	Agreement on Agriculture
B2	Blend of 2% biodiesel with diesel (the figure represents the percentage of biodiesel added to diesel, i.e. B20 consists of 20% biodiesel)
BNDES	National Bank for Economic and Social Development (Banco Nacional de Desenvolvimento Econômico e Social)
CEN	European Committee for Standardisation
CNPE	National Agency of Energy Politics (Conselho Nacional de Política Energética)
CTA	Aerospace Technical Center (Centro Técnico de Aeronáutica)
DAP	Statement of eligibility for the National Program for the Strengthening of Family Agriculture (Declaração de Aptidão ao PRONAF)
EC	European Commission
EU	European Union
FAO	Food and Agriculture Organization
FQD	Fuel Quality Directive
GHG	Greenhouse Gas
ILUC	Indirect Land Use Change
IAA	Institute of Sugar and Alcohol (Instituto do Açucar e Álcool)
ISCC	International Sustainability and Carbon Certification
ITA	Technological Institute of Aeronautics (Instituto Tecnológico de Aeronáutica)
MAPA	Ministry of Agriculture, Livestock and Food Supply in Brazil (Ministério da Agricultura, Pecuária e Abastecimento)
MDA	Ministry for Agrarian Development in Brazil (Ministério do Desenvolvimento Agrário)
NGO	Non Governmental Organisation

OECD	Organisation for Economic Co-operation and Development
Petrobras	Brazilian Petroleum (Petróleo Brasileiro S/A)
Pbio	Petrobras Biofuels
PIS	Program of Social Integration (Programa de Integração Social)
PAA	Food Acquisition Program (Programa de Aquisicao de Alimentos)
PNPB	National Plan for the Production of Biodiesel in Brazil
PNAE	School Nutrition Program (Programa Nacional de Alimentacao Escolar)
PRONAF	National Program for Strengthening Family Agriculture (Programa Nacional de Fortalecimento da Agricultura Familiar)
RED	Renewable Energy Directive
RSB	Roundtable on Sustainable Biofuels
RSPO	Roundtable on Sustainable Palm Oil
RTRS	Round Table on Responsible Soy
SFS	Social Fuel Stamp (Selo Combustível Social)
UN	United Nations
WTO	World Trade Organization

1 Introduction

1.1 Statement of the problem

This thesis is about the governance of liquid biofuels (bioethanol and biodiesel), with a focus on Brazil and the European Union (EU). Biofuels have been on the national governance agenda of some countries since the 1970s but emerged on the global governance agenda in the late 1990s, in response to the twin challenges of the search for energy security and addressing climate change. Biofuel policies are being implemented by (interdependent) states across the globe with the ambition to (partly) replace fossil fuels for transport with renewable alternatives.

Biofuels are solid, liquid or gas fuels derived from biomass sources such as starch, sugars, fat, wood, or waste (Figure 1.1). Global (governance) attention has focused mostly on liquid biofuels, the subject of this study. Classifying categories of biofuels is subject to debate, but mostly liquid biofuels are classified in three generations. So-called first-generation biofuels are derived either from sugar or starch from food crops such as sugarcane or corn which are converted to bioethanol; or from vegetable oils (soy, rapeseed, palm) or animal fats which are converted to biodiesel. Second-generation biofuels are derived from ligno-cellulosic (woody) sources or organic waste streams, while third-generation biofuels are produced from algae (Johnson et al., 2012) (see Textbox 1.1 for a more elaborate biofuels typology).

This thesis focuses on first-generation liquid biofuels because they are produced on a large scale for transport fuel and are under intense scrutiny with regard to sustainability and potential competition with food security (Dam et al., 2010; FAO, 2008; Johnson et al., 2012). The sustainability debate on biofuels exploded around 2007-2008, as the demand for biofuels grew rapidly even as food prices increased substantially. This led to very intense global debates about food versus fuel use of (energy) crops, whereby the major concern was that biofuel for the developed countries would undermine the availability of food in poorer regions by driving up the prices (Rice, 2010; Searchinger, 2009; Zuurbier and van de Vooren, 2008). Also, the assertion that biofuels can reduce greenhouse gas (GHG) emissions, compared to the use of fossil fuels, is under continuous scrutiny.

As a result, the environmentally friendly connotation of such biofuels in the early years of their development faced sustained critiques because of an array of (perceived) negative effects arising from their production and use. These effects included increased deforestation and land clearing, accusations of land-grabbing, expansion of agricultural areas at the cost of nature conservation and undermining of food security by diverting crops for fuel rather than food (FAO, 2008; Wilkinson and Herrera, 2010). In addition, it became clear that not all these effects are equally relevant for all liquid biofuels. Instead, effects depend upon biomass source and other contextual factors, resulting in efforts to distinguish sustainable biofuels from non-sustainable biofuels. However, what constitutes sustainable biofuels remains heavily contested, partly because different understandings and assessments have varying implications for access to a growing global market for biofuels.

This thesis examines the global governance of sustainable biofuels, with a specific focus on Brazil and the European Union (EU), as major players in the production, trade and/or use of first-generation biofuels. Stimulation of biofuels use is largely driven by mandatory blending targets or other fiscal incentives that are set by governments. The EU, one of the largest markets for biofuels, is leading in the attempt to promote global trade in "sustainable" biofuels (Dam et al., 2010). Brazil, as a leading producer and strong proponent of a global biofuels market and a key exporter to the EU, has to engage with the EU sustainability imperatives that now dominate global biofuel trade and governance debates (Garcez and Vianna, 2009; Goldemberg et al., 2008; Mol, 2010).

Brazil is one of the few countries with long-established domestic biofuel policies and programs. Domestic biofuel policies in Brazil are intrinsically linked to other social policies and environmental policy ambitions. For example, food, fuel, and feed systems in Brazil show clear interdependencies regarding claims on land and feedstock use, which have contributed to the difficulty of debating, operationalizing and implementing sustainability in biofuel governance. Since the mid-2000s, the government has also expressed the ambition to be a leader in global biofuel markets. While Brazil is often believed to be able to dictate biofuel developments within its borders, its authority to continue to do so, given a rapidly evolving global biofuel trade and governance context, is becoming less evident and needs to be re-examined.

The characteristics of biofuel production add to this governance complexity. As mentioned above, there exist different types and generations of biofuels based on production methods and use of feedstock (Textbox 1.1 and Figure 1.1). The large variability of feedstock options means that there are many different crops, production regions, agricultural methods, and conversion techniques to consider. Together these elements make biofuels a complex and challenging issue-area to govern, both domestically and in an international context.

Diverse objectives (environmental and social) are thus sought when using biofuels, which in turn are linked to existing multiple commodity chains with very different characteristics. As biofuels also cut across different policy domains like agriculture, energy, environment, social and economic development, it becomes clear that many different public and private actors are shaping the landscape of biofuels governance. There is a vast and expanding conglomerate of state and non-state initiatives involved in the governance of biofuels over the past few years (Dam et al., 2008; Pacini and Assunção, 2011; Scarlat and Dallemand, 2011). This adds to the complexity of the governance challenge, with multiple sectors, multiple actors, and multiples sites of governance.

In short, biofuels are a complex case of sustainability governance, where governance is both needed and very challenging, and where notions of sustainability remain contested. Therefore, it becomes important to understand how governance of biofuels has been approached, and how existing approaches to sustainability have fared, and whose notion of sustainability is shaping global biofuel trade and markets. The thesis looks at this through in-depth analysis of biofuel governance arrangements in the EU and Brazil, and their interactions with each other.

Textbox 1.1 Types of biofuels

First generation biofuels are "conventional" biofuels. There are two main types of first-generation biofuels used for transport: ethanol and biodiesel. Ethanol is used in regular car engines and replaces gasoline either in blends or used pure for adapted engines. It is made by the fermentation of plants with a high-level of sugar (e.g. sugarcane) or starch (e.g. corn). Biodiesel is most often used for trucks or commercial transport vehicles and is blended with diesel. It is most commonly made from vegetable oils or animal fats (e.g. soy or palm oil). The sugars and vegetable oils are relatively easily extracted using conventional technologies. Sustainability concerns are related to competition with food use of the resources and (indirect) land use change due to the large scale that is required to meet current demand.

Second generation biofuels are "advanced" biofuels that are made from several types of biomass. This can be lignocellulosic biomass, woody crops, agricultural waste products, and even animal fats. Chemical and physical treatments are required to extract the required fuel, which requires more advanced technological systems to produce transport fuels. Competition with food production is less apparent, but second-generation biofuels still require the use of agricultural products and land.

Third generation biofuels are also "advanced" biofuels that are produced from algae. Depending on the used conversion technique various forms of fuels can be produces. Currently, this type of biofuels is produced at a limited scale. Expectations are high, because algae fuel would not compete or interfere with other uses of biomass resources and would require only limited land compared to first and second-generation biofuels.

Source: developed by author based on International Renewable Energy Agency (2014); Renewable Energy Policy Network for the 21st Century (2014); Smeets et al. (2008a)

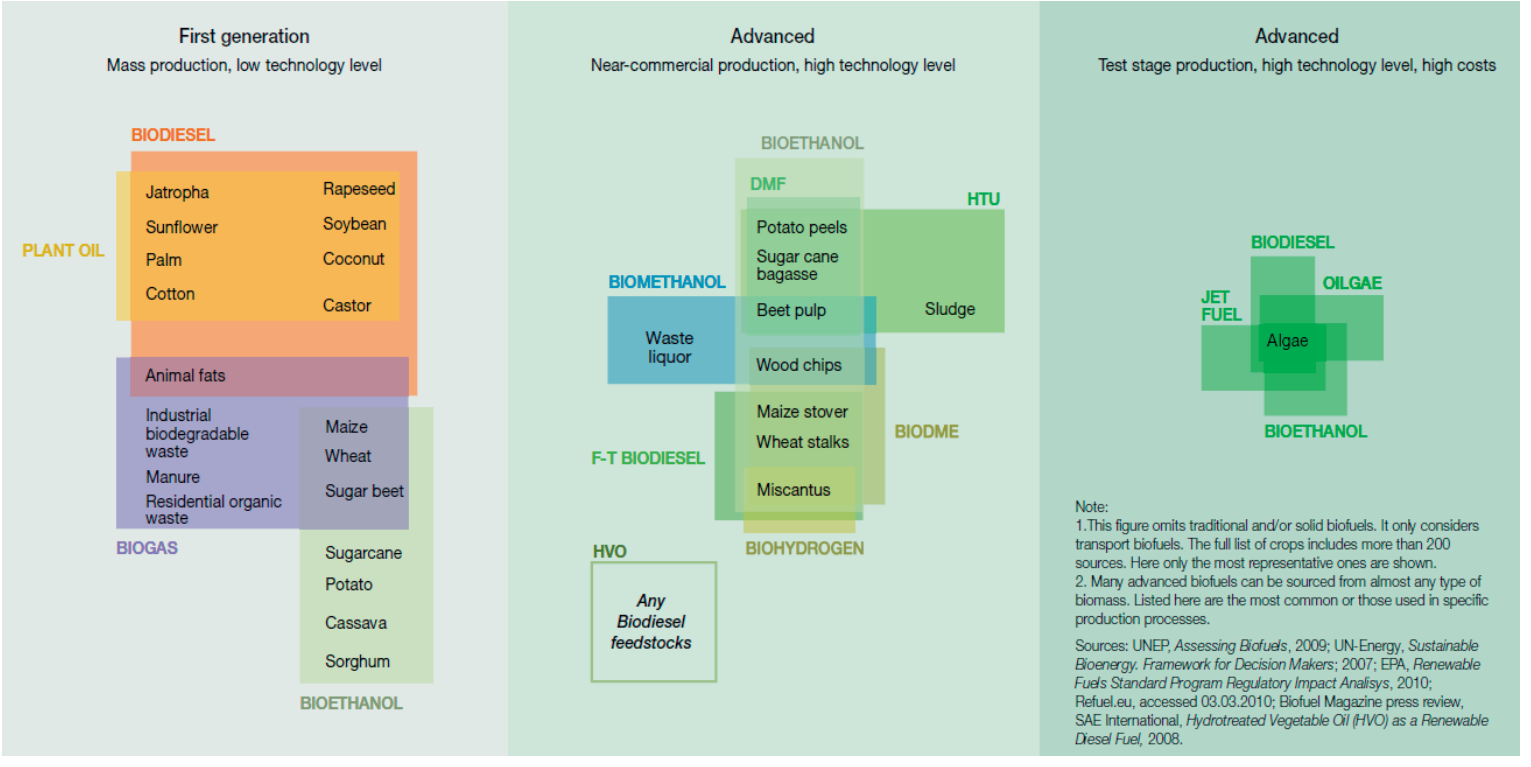


Figure 1.1 The enlarged biofuel family

Source: Cartographer: Nieves Lopez Izquierdo (Izquierdo, 2012)

1.2 Sustainable biofuels: evolving developments and debates

This section describes the current state of policy-driven biofuel production, trade and market developments, and how they are related to sustainability discussions (section 1.2.1). It then discusses unique characteristics of biofuels that pose governance challenges (section 1.2.2) and diverse actors now engaged in biofuel governance, both state and non-state (section1.2.3).

1.2.1 Development of 'sustainable' biofuel markets: from local to global commodities

This section provides a brief overview of global biofuel production and trade data, as well as policy developments in major biofuel producing countries, and how diverse sustainability considerations have come to the fore. In 2018, energy for transport sector made up 32% of total energy consumption on a global scale. Within this global scale around 3.1% of total global energy consumption for transport comes from renewable sources of which 2.8% comes from biofuels and the remaining 1.3% constitutes of electricity sources (REN21, 2018 p. 38). The percentages may appear low, but they indicate that in a relatively brief time period, biofuels have moved from being a focus of domestic policies to becoming a global commodity (REN21, 2015). Of this, the US and Brazil constitute 80% of biofuel production (IEA, 2017; REN21, 2018 p. 72). Other key producer countries include Germany, Argentina and China (REN 2017). The largest users of ethanol and biodiesel are the USA, Brazil, and the EU (for an overview, see Table 1.1 on global biofuel production data).

The demand for and thus the production of liquid biofuels is almost completely policy-driven, where governments implement policies to enable, stimulate and mandate biofuel production and use. Without governmental policy intervention, liquid biofuel production and markets would not have increased and expanded so rapidly (see also Figure 1.2 and Figure 1.3). Below, policy trends and production patterns in key biofuel producing countries and regions, including the US, Brazil and the EU are highlighted. In tracing these developments, it can also be noted how these trends have been shaped by diverse sustainability considerations.

Table 1.1 Biofuels Global Production, Top 15 Countries and EU-28, 2017

Country	Ethanol	Biodiesel (FAME)	Biodiesel (HVO)	Change relative to 2016
		Billion litres		
United States	60.0	6.0	1.7	1.7
Brazil	28.5	4.3		0.3
Germany	0.9	3.5		0.0
Argentina	1.1	3.3		0.5
China	3.3	1.0		0.2
France	1.0	2.3		-0.3
Thailand	1.5	1.4		0.5
Indonesia	0.1	2.5		-0.3
Canada	1.7	0.5		0.1
Netherlands	0.3	0.4	1.3	0.1
Spain	0.5	1.3		-0.2
Poland	0.2	1.0		0.0
Singapore	0.1	0.0	1.3	0.1
India	0.8	0.2		-0.2
Colombia	0.3	0.6		0.0
EU-28	4.1	11.8	3.5	-0.3
World Total	105.5	30.7	6.5	3.5

Source: REN21, 2018, Renewables 2018 Global Status Report (Table R15 REN21, 2018 p. 206)

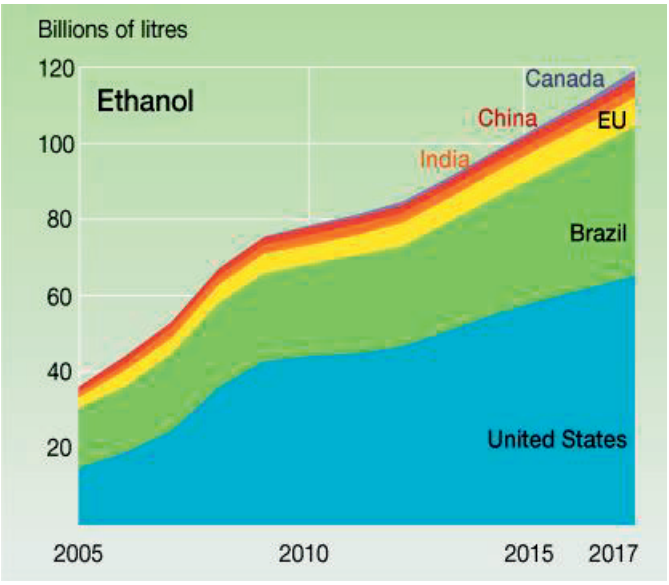


Figure 1.2 World production trends bioethanol by region

Source: Cartographer Riccardo Pravettoni, UNEP/GRID-Arendal (http://www.grida.no/resources/6187), based on OECD-FAO (2008, pp. 71–72)

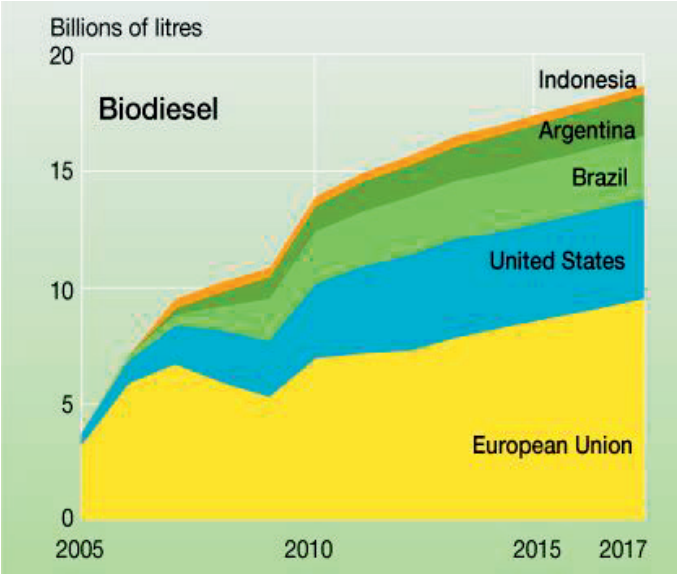


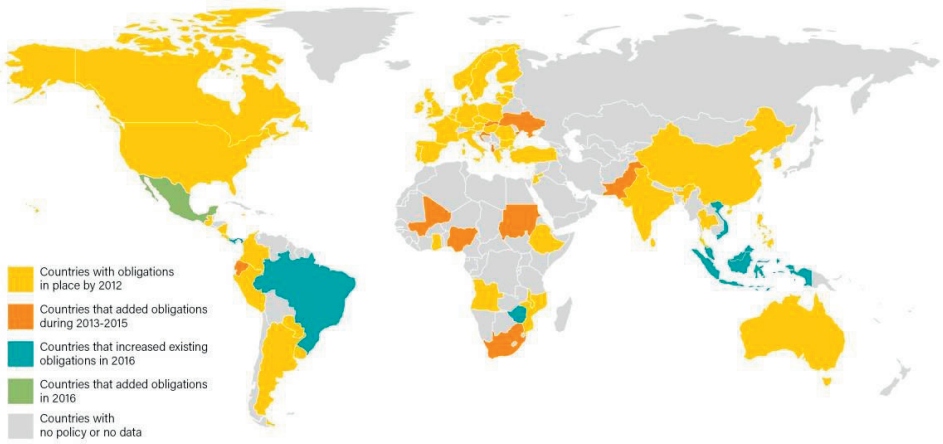
Figure 1.3 World production trends biodiesel by region
Source: Cartographer Riccardo Pravettoni, UNEP/GRID-Arendal (http://www.grida.no/resources/6187), based on OECD-FAO (2008, pp. 71–72)

The **USA** started with the large-scale use of biofuels when the Energy Policy Act of 2005 passed the US Congress. This Energy Policy Act actively encouraged the use of biofuels, such as ethanol and biodiesel. It continues to be the largest producer of biofuels in the world, with domestic agricultural policies and federal renewable fuel standards supporting continued production (REN21, 2017). Biofuel policies in the USA market are strongly linked to agricultural policies and support. These policies are implemented under the Renewable Fuel Standard, which is a federal program that puts in place a minimum volume of renewables to be used, while also focusing on reducing import of fossil fuels in order to achieve more energy independence. For first generation biofuels, derived from feedstock (like corn), a reduction of 20% greenhouse gas emissions has to demonstrated in the life cycle analysis. For more advanced biofuels, this percentage increases to 50-60% (REN21, 2017).

Brazil began stimulating ethanol production and use as a transport fuel in the mid-1970s. It subsequently started with a large-scale biodiesel program in 2004. The country is the second largest producer of biofuels (after the United States) (REN21, 2017). Domestic policies called for blending ethanol with gasoline at levels of 27% in 2018 (this number generally fluctuates between 20-25%, based on sugarcane harvests, and is set by government regulation). Domestic production and use of biodiesel is encouraged through obligatory blending targets that increased from 5% to 7% in 2014. The ambition is to go to 10% by 2019. Special to the Brazilian biodiesel program have been initiatives to stimulate social sustainability in order to include family agriculture production into the biodiesel production chain.

The **EU** began developing biofuel policies in 2003 and set the target of having 5.75% biofuels in transport fuels by 2010. It quickly increased these ambitions with development of the Renewable Energy Directive (RED) 2009/28/EC that requires that 20% of all energy use in the EU come from renewable sources by 2020, which includes at least 10% of all energy in road transport fuels. In addition, standards are set about the required GHG reduction levels compared to fossil fuels in the Fuel Quality Directive 2009/30/EC. Ongoing sustainability concerns have led to additional requirements for biofuels from lands with high biodiversity or carbon stock, which has resulted in an elaborate system to monitor these sustainability requirements.

Many other countries have also created mandatory blends or fiscal incentives to encourage use of biofuels during the period 2000 – present, the period covered by this thesis (see also Figure 1.4 and Figure 1.5). Both ethanol and biodiesel production have almost tripled during this time. We turn next to how evolution of a global biofuel market and the addition of sustainability concerns, sketched above, has resulted in the need for governance of sustainable biofuels.



Note: Figure shows countries with biofuels obligations in the transport sector. Countries are considered to have policies when at least one national-level policy is in place; these countries may have state/provincial-level policies in place as well. Bolivia, the Dominican Republic, the State of Palestine and Zambia added obligations during 2010-2012 but removed them during 2013-2015.

Figure 1.4 Countries with biofuel obligations for transport
Source: REN21 Renewables 2017 Global Status Report - Policy database (2017. figure 48)

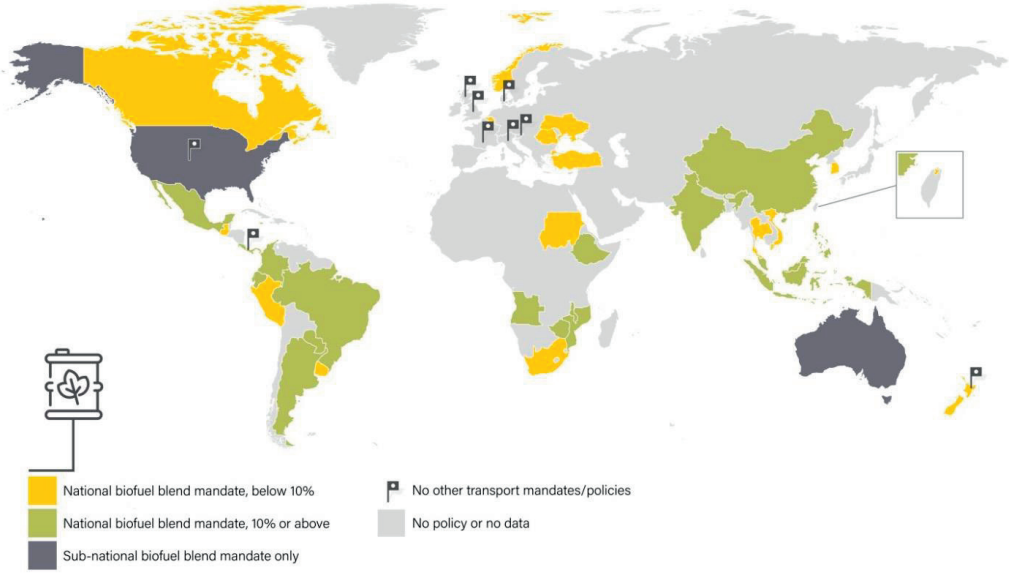


Figure 1.5 National and Sub-National Renewable Transport Mandates, End-2017
Source: REN21 Renewables 2018 Global Status Report - Policy database (2018, figure 14)

1.2.2 Governing sustainable biofuels: whose notion of sustainability?

As described above, the growing production, trade and demand for biofuels worldwide has rapidly brought a variety of sustainability concerns to the fore. The policy driven obligatory blending targets, in combination with limited production in certain key regions (at first), actively stimulated the increase of transborder biofuel trade. The blending targets have also led to enormous investments of multinational companies and financiers in biofuel production globally. The fact that these first-generation biofuels can be made from a broad range of food crops e.g. soy, palm oil, and sugar cane, which were already being traded at a global scale, accelerated this development even more. Biofuels (both ethanol and biodiesel) derived from different commodity crops each raise different sustainability questions.

All these characteristics of 'sustainable biofuels' pose some unique governance challenges. A key concern has been that use of biofuels competes with food production, because many crops used for first generation biofuels play an important role in the food and feed industry (soy, palm oil, corn, sugar cane). With this development, food, feed, and fuel markets (and their chains, actors, and systems) get increasingly interconnected at national and global levels (see Figure 1.6 for a graphic depiction).

Through subsidies and obligatory blending targets, the price of biofuels increases, which creates incentives for farmers to sell feedstock to the biofuel industry rather than the food market. Food and feed producers argue that this creates unequal competition on the feedstock market and a rise in

consumer food prices (Bindraban and Zuurbier, 2007). This illustrates that the impact of biofuel policies not only affects the energy sector, but also has consequences for adjoining commodity markets. This cross-sector impact has consequences for the way biofuels are sought to be governed, because the range of actors and policy domains involved creates increasing governance complexity and contested sustainability objectives.

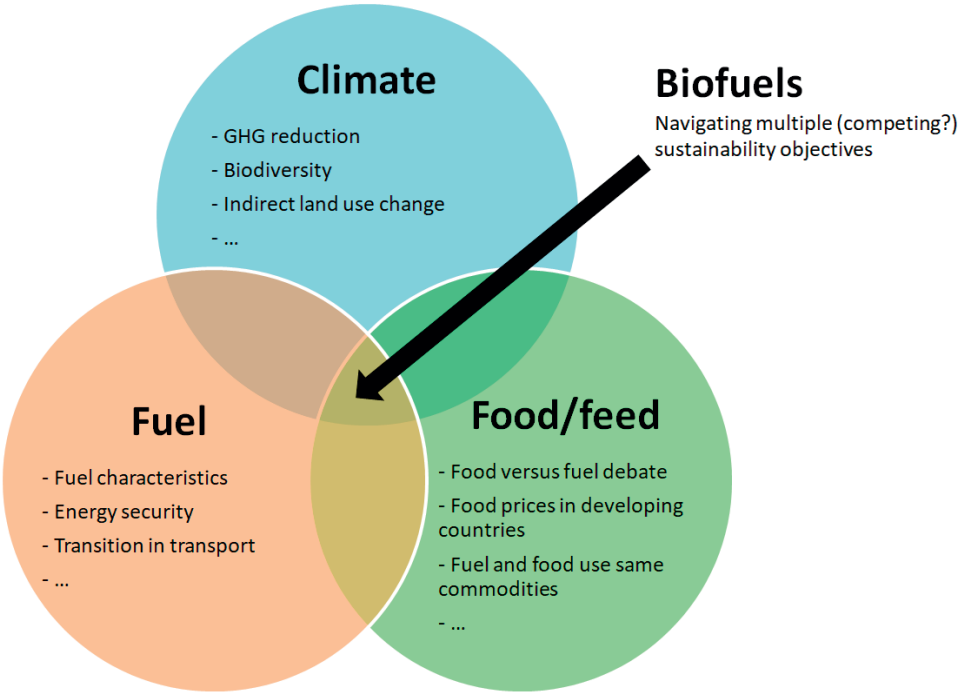


Figure 1.6 Sustainable biofuels at the intersection of multiple and overlapping policy domains
Source: developed by author

1.2.3 Multiple actors negotiating sustainability

The rapid growth in a policy-driven biofuel market over the last two decades has stimulated a wide range of actors to become involved in biofuels production. Oil companies have become interested in agriculture, while food companies have developed an interest in energy production. In addition, many social and environmental organizations have also become involved, partly because the increased demand for agricultural products was seen as an opportunity for the economic development of farmers or the use of abandoned land.

Multiple actors are thus now also involved with determining sustainability standards for sustainable biofuels. Civil society organizations, corporate industry, governments and academia are all involved with initiatives or certification schemes that aim to measure biofuel sustainability. All these (private and public) actors are formulating principles, standards and criteria for sustainable biofuel production and set up governance arrangements accordingly, which are implemented at various levels: local, national, global. Countries are now seeking ways to develop and implement sustainability criteria, but also need to consider how they, as public governors, deal with the private certification standards and their impact. Producers face the consequences of this confusion, because each standard uses its own criteria, mechanisms, requirements.

The EU and international organizations are using their own or a combination of other schemes to identify and define what sustainable biofuels are. Whose notions of sustainability will come to shape global biofuel production and trade is thus an important question, also because there are winners and losers implicated in different notions of sustainability.

1.3 Research objectives and questions

The overarching research objectives of this thesis are to, first, analyze how biofuels have been governed in the EU and Brazil over time, and what notions of sustainability are embodied in these evolving governance arrangements. It also then analyzes whether and how the EU has sought to export its own notions of sustainability beyond its borders, and to what extent it has succeeded in doing so.

These research objectives lead to the following two main research questions:

1. How have biofuels been governed in the EU and Brazil over time, and what (conflicting or converging) notions of sustainability are embodied in these evolving governance arrangements?

2. How has the EU sought to export its notions of sustainability beyond its borders, with particular focus on Brazil, and (how) has it succeeded in doing so?

Analyzing these questions also yields insights into other complex and challenging areas of global sustainability governance.

1.4 Conceptual lens: the state in a changing sustainability governance context

This section discusses how the nature of global (environmental) governance is changing, with consequences for the role of the state vis-à-vis non-state actors in shaping governance trajectories and aims. As has been extensively documented in recent years, in an era of economic globalization, the practices and nature of global governance are changing (Andonova, 2010; Sassen, 2006; Spaargaren and Mol, 2008). Especially in sustainability governance, a large number of state and non-state actors are active (Falkner, 2003; Rosenau, 2007). In the sphere of biofuel governance, however, the role of the state remains crucial, given that states have created market demand for biofuels by

setting obligatory biofuel transport blending targets, thereby creating a rapidly accelerating market for this new commodity.

Biofuel policies, until a decade ago, used to be a state and domestic affair. But the growing global interest in biofuels, paired with the sustainability ambitions, has changed the governance landscape in this realm as well. Increasingly, the rise of non-state actors is impinging on the authority of state (Cashore, 2002; Pattberg and Stripple, 2008; Ponte, 2014; Ponte and Daugbjerg, 2015; Schouten and Glasbergen, 2012). These non-state actors operate across multiple levels, including beyond national jurisdiction. This development is discernible in various fields, including fisheries, forestry, food crops and other agricultural domains (Auld and Gulbrandsen, 2009; Cashore et al., 2007; Chan and Pattberg, 2008; Schouten and Glasbergen, 2012). This broad involvement of a variety of actors in governance practices and arrangements is now widely described as a horizontal shift in governance. Simultaneously also a vertical shift is taking place, due to the increasing connectedness between local and global governing initiatives (Kersbergen and Waarden, 2004; Leeuwen, 2010).

In spite of horizontal and vertical shifts in governance, the state remains crucial (Sassen, 2006), even as collaboration between state and non-state actors is on the rise. Non-state or private authority operates not always in contrast or competition with state authority. It is also possible that private authority needs the support of the state to legitimize and execute its actions and decision-making power (Cutler et al., 1999, p. 5). This can be witnessed in public-private partnerships, i.e. collaborations between state and non-state actors that present forms of hybrid governance authority.

A prominent issue in governance debates in recent years has thus been how hybrid forms of governance function, and how they shape the operationalization of sustainability (Mol, 2010; Ponte and Daugbjerg, 2015; Smeets et al., 2008b). In particular, global trade rules might make it difficult for states to discriminate imports of biofuels based on their production methods and regions, whereas non-state authorities are not restricted by such constraints in seeking to shape sustainability requirements (Maciel, 2015). As a consequence, non-state actors might be able to implement stricter or different sustainability guidelines with the (in)direct support of the state (Daugbjerg and Swinbank, 2014; Ponte, 2014). In this way, hybrid governance can potentially enhance or add sustainability dimensions. But such hybrid sustainability requirements can also generate controversies and debates, depending upon their impact on specific production circumstances.

In sum, the theoretical assumptions underlying this thesis are: (i) the nature of global governance is changing; (ii) this has consequences for the role of the state due to the involvement of non-state actors; (iii) it does not necessarily mean the decline or the abandonment of state governance and authority, but it involves a reorientation of the state vis-à-vis other governing actors; (iv) there might be shifts in authorities in these new forms of hybrid governance; and (v) these developments have implications for how sustainability is being operationalized, and whose notions of sustainability come to shape biofuel markets and use. Figure 1.7 depicts these theoretical propositions, and the analytical lens used in this thesis to answer the two research questions.

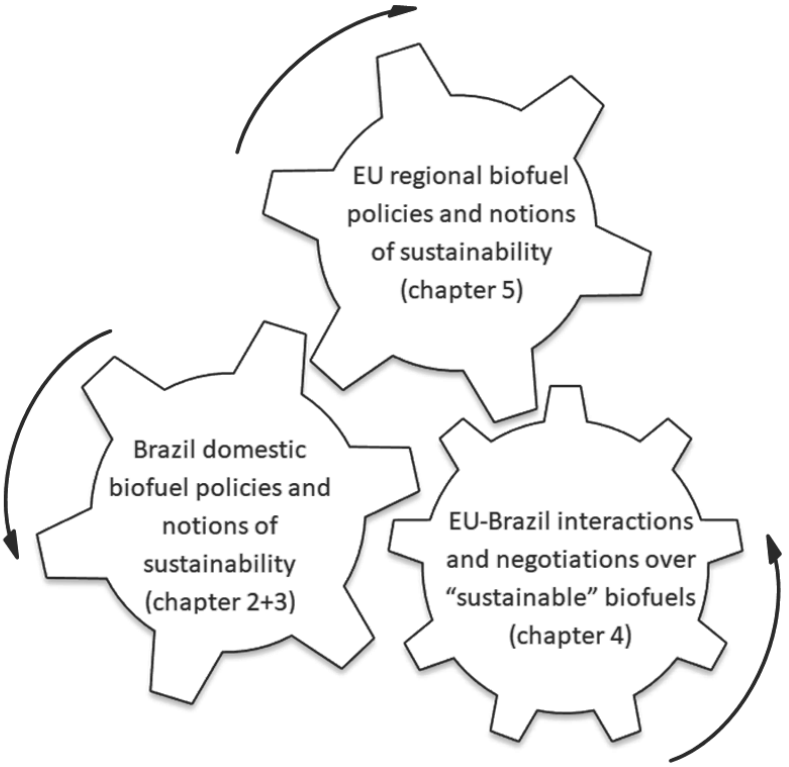


Figure 1.7 Analytical lenses: interacting spheres of governance authority
Source: developed by author

1.5 Research methodology and methods

This section explains the research methodology, methods and research design, including data collection and analysis techniques.

1.5.1 Research design and case study approach

This research undertook a multilevel, comparative case analysis of biofuel governance in Brazil and the EU, and interactions across these. A case study approach was selected as the most suitable methodological approach to execute the study. A case study is most relevant to answer 'how and why' questions in a constantly evolving policy domain, and particularly so in non-experimental settings, wherein the researcher has no control over events (Yin 2009). A case study approach is also most suitable when the objective is to understand and explain complex, real world phenomena embedded in specific institutional, political, economic, cultural and social contexts. Case studies can be single or multiple. This thesis employs a multiple case-study approach that is most suited to address how biofuels are being governed over time in specific, multilevel, intersecting jurisdictional contexts, and the notions of sustainability embodied herein.

1.5.2 Case selection

Brazil and the EU are selected as the case study foci because, as is outlined in more detail in the problem statement above, they are major players in the production, trade and/or use of first-generation biofuels. The EU is one of the largest markets for biofuels and was one of the early leaders in the attempt to promote production, consumption and global trade in "sustainable" biofuels. Brazil is one of the few countries with long-established domestic biofuel policies and programs. It is a leading producer of biofuels, and a strong proponent of a global biofuels market. Given that it is also a key exporter to the EU, it has to engage with the EU sustainability imperatives that have dominated global biofuel trade and governance debates over the last decade. The selection of the EU and Brazil thus facilitated a multilevel, comparative analysis of shifting biofuel sustainability policies in these two domains, and the role of the state herein, thus allowing the overarching research objectives of this thesis to be addressed.

1.5.3 Data collection and analysis

Data for this thesis was collected in the period 2007-2018. For a case study approach, the most widely used and appropriate data sources include, inter alia, primary documents or grey literature (e.g., reports, working papers, government documents and white papers, NGO position papers and evaluations), archives, interviews and surveys, direct observation and participant observation (Yin 2009). This thesis utilizes all these data sources, with a predominant focus on three qualitative techniques of data collection: in-depth interviews, document analysis and participant observation.

Interviews: The first method of data collection was interviewing key-informants with support of open and semi-structured questionnaires (see Appendix III for some examples). A wide-range of formal and informal interviews were held in multiple regions and governance arenas. The interviewees varied from policy makers in Brazil and the EU, members of international institutions, members and observers of private governance initiatives, producers of biofuels, farmers (small and large scale) in Brazil, members of cooperatives, researchers, and representatives of civil society organizations in Brazil and the EU. A total number of 54 interviews were conducted (see Appendix I for a list of people interviewed, with date, place and function).

Document analysis: The second method of data collection was document analysis, including gathering information and triangulation with a variety of written data sources such as scientific articles, policy documents, research reports, statistics, legislation, and newspaper articles. These documents were used to understand the development of the biofuel debate over time, including how different notions of sustainability were debated and evolved over time in diverse settings. Document analysis also helped to identify the main actors and institutions to be approached for interviews.

Participant observation: The third data collection method was direct (participant) observations at field visits, meetings, conferences, and workshops (see Appendix II for an overview of attended meetings and conferences. I attended a total of 12 meetings, where I had different roles: as observer, participant or presenter. Some meetings were focused on biofuels in Brazil and the EU, whereas others were about energy transitions or academic workshops on governance challenges.

More specific data collection strategies are detailed in each of the four research chapters, as are the methods used to analyze the data.

1.5.4 Research validity

By using and triangulating multiple sources and approaches and having open conversations as well as (semi-) structured interviews, as much relevant data/information as possible was gathered, combined and cross-checked, also to secure internal validity of the analysis and findings. As outlined by Yin (2009), the internal validity drew on three principles underpinning data collection: use of multiple sources; generation of a database that can be used over time by the researcher and others; and building up a body of evidence. These three principles underpinned the selection of data collection techniques used in the thesis (interviews, document analysis and participant observation), in order to ensure triangulation, validity of the findings and quality control.

As discussed further in the concluding chapter 6, external validity of the thesis will be assured through distilling generalizable lessons from EU and Brazilian biofuel governance arrangements and the search for agreed sustainability criteria herein for biofuel governance in other countries, as well as going beyond the issue of biofuel governance to address broader sustainability challenges.

1.6 Outline of the thesis

This thesis is organized in six chapters, wherein this introduction (chapter 1) and the general conclusion (chapter 6). The four empirical chapters (2- 5) are publication-based chapters that answer specific elements of the main research questions (see Table 1.2 for a detailed overview).

Table 1.2 Biofuel Governance: Evolving notions of sustainability?

Chapters 2-5	Chapter 2: Governing biofuels in Brazil: A comparison of ethanol and biodiesel policies	Chapter 3: Social sustainability of Brazilian biodiesel: The role of agricultural Cooperatives	Chapter 4: Negotiating Authority in Global Biofuel Governance: Brazil and the EU in the WTO	Chapter 5: Toward Sustainable Biofuels in the European Union? Lessons from a Decade of Hybrid Biofuel Governance
Conceptual focus	Using knowledge of the policy (objectives), politics (actor constellations) and polity (institutional coordination) to understand the development of biofuel governance fields.	Looking at characteristics of agricultural cooperatives - as a hybrid form of governance – that are used by the state to achieve social sustainability and rural development.	Understanding which public spheres of authority play a key role in exporting notions of sustainability	Hybrid environmental governance, the role of the state herein, and its prospects to further sustainably goals
Empirical focus	A historical comparison of bioethanol and biodiesel policies, actors, and institutions in Brazil.	A focus on agricultural cooperatives in the northeast of Brazil and their connection to the Brazilian biodiesel program in order to achieve rural development.	An analysis of how Brazilian and EU biofuel policies relate to WTO trade legislation with identification of potential trade controversies and strategic governance moves.	Tracing 10 years of hybrid biofuel governance in the EU, and its contributions to achieving sustainability objectives
Specific question	Whether, to what extent and how the national biodiesel program developed in a similar way as ProÁlcool, regardless of the thirty-year time difference and the lessons learnt?	How and why cooperatives are successful in integrating small farmers into the biodiesel chain and what this cooperative-enhanced social inclusion actually means for family farmers?	How does the Brazilian state interact with two dominant sources of state-led, public authority: the EU and the World Trade Organization, in shaping trajectories of biofuel trade and governance?	What is the nature and outcome of the EU's experiment in hybrid biofuel governance with regard to sustainable biofuels? What lessons can be drawn for future policy directions?
Governance level(s)	Brazil	Brazil	Brazil, EU, WTO	EU, private certification initiatives

Source: developed by author

Chapter 2 demonstrates the processes of institutionalization that have shaped the biodiesel and bioethanol governance landscape in Brazil. It uses a historical approach to study the development of ethanol and biodiesel policies in Brazil. It demonstrates who the main initiators were, what kind of actor coalitions shaped the outlook of Brazilian biofuel governance and how this has changed through time. It also shows the relation between biofuel policies and other affiliated policy domains that co-shaped the governance landscape. In doing so, it contributes to a better understanding of how biofuels in Brazil have been governed over time, including evolving understandings of sustainability.

Chapter 3 focuses specifically on the social sustainability aspects of biodiesel production in Brazil by analyzing the role of agricultural cooperatives. This is a form of domestic governance hybridization between the state and a non-state actor. Special emphasis lies on the relation between state, cooperatives, and farmers to illustrate this form of hybrid biofuel governance and related evolving notions of sustainability and how they have been sought to be operationalized in Brazil.

Chapter 4 explores the role of the Brazilian state vis-à-vis two other dominant sources of international sources of biofuel governance authorities: the EU and the WTO. The rapid emergence of a global demand for sustainable biofuels created a gap wherein these different forms of authority needed to interact either by collaboration or by confrontation. In this chapter, EU and Brazil trade controversies over the definition of sustainable biofuels are discussed. This chapter illustrates the strategies used by the EU to seek to export its notions of sustainability beyond its borders to a biofuel producing country such as Brazil.

Chapter 5 shifts focus to analyzing, in depth, the last decade of evolving biofuel governance arrangements in the EU, including its efforts to create a market for and govern sustainable biofuels for the transport sector, even as debates over sustainability escalated. The chapter focuses, in particular, on analyzing the risks and benefits of the novel hybrid (public and private) governance arrangements developed by the EU. The findings of this chapter contribute to an ongoing debate about the merits of hybrid governance, and whether a hybrid approach helps strengthen or weaken sustainability objectives.

In concluding, Chapter 6 combines the insights of the four empirical chapters in order to answer the main research question. It sums up how biofuels have been governed in the EU and Brazil over time, and what notions of sustainability are embodied in these evolving governance arrangements. It also addresses how the EU has sought to export its notions of sustainability beyond its borders and whether it has succeeded in doing so. The thesis also highlights how these findings can be generalized beyond Brazil and the EU in shaping future biofuel governance.

2 Governing Biofuels in Brazil: A Comparison of Ethanol and Biodiesel Policies[1]

Abstract

Over the last decade Brazil has implemented a new and ambitious biofuel program: the National Program of Production and Use of Biodiesel (PNPB). When launching this program in 2004 the government stated that it wanted to avoid the same kind of geographical concentration, single crop focus, dominance of agribusiness, and exclusion of family farmers that have occurred with bioethanol production through the ProÁlcool policy since 1975. This paper compares the life histories of the bioethanol and the biodiesel policies of Brazil by analyzing their substantive policy content; the power and politics of actors that struggle for the design and implementation of the policies; and the polity in terms the organization and institutionalization of the policies. The paper concludes that both policies have become submerged by and dependent on the polity and politics of primarily the energy and agricultural sectors that operate as the two semi-autonomous governance fields. This submerging has shaped the substantive contents of biofuels policies, and explains why the 2004 biodiesel policy PNPB, in spite of its objectives for social inclusion and rural development, faces similar problems in implementation as its predecessor, the 1975 bioethanol policy ProÁlcool.

[1] This chapter has been published as: Stattman, Sarah L., Otto Hospes, and Arthur P J Mol. 2013. Governing Biofuels in Brazil: A Comparison of Ethanol and Biodiesel Policies. Energy Policy 61: 22–30. doi:10.1016/j.enpol.2013.06.005.

2.1 Introduction

In 2004 Brazil launched the National Program of Production and Use of Biodiesel (PNPB), aiming to include biodiesel into the national energy matrix. Brazil was not unique: many other governments also launched similar national biofuel programs to address national energy demand and supply over the last decade (Rothkopf, 2007; Sorda et al., 2010). However, unlike other governments it was not Brazil's first national biofuels program. Already in 1975 Brazil introduced the National Fuel Alcohol Program (ProÁlcool) and implemented it rather successfully over four decades: ethanol production increased from 594,985 m3 in the harvest of 1974/75 to a production of 27,604,120 m3 in the harvest of 2010/11 (MAPA, 2013).

ProÁlcool has been praised for its contribution to energy diversification and energy sovereignty of Brazil and the economic and developmental benefits it has brought to the Sao Paulo area (Hira and de Oliveira, 2009; Rovere et al., 2011). Yet, it has also been criticized for its geographical concentration of ethanol production in the Sao Paulo area and poor labor conditions in the sugarcane industry (Hall et al., 2009; Lehtonen, 2011). In addition, environmental concerns have arisen due to the large scale and capital intensive agriculture of sugarcane production (Hall et al., 2009, p.581). Debates about the energy and agricultural benefits versus the environmental and social concerns of ProÁlcool still continue today (e.g. Goldemberg et al., 2008; Walter et al., 2011; Watanabe et al., 2012).

The PNPB focuses on biodiesel rather than ethanol production. While it follows the footsteps of the ProÁlcool program, the PNPB deliberately aims to incorporate lessons from its predecessor in terms of objectives, implementation and outreach (Garcez and Vianna, 2009). The main governmental objectives of the PNPB are to contribute to energy diversification and energy sovereignty of Brazil by creating a market for sustainable biodiesel production that is viable, both technically (high fuel quality and supply) and economically, and with a strong focus on social inclusion of family farms and regional development (MDA, 2013a; Pousa et al., 2007; Rathmann et al., 2012). To support the aim of regional development (especially in the northeast of Brazil) special policy instruments, such as tax incentives and obligatory blending targets, have been included (as further explained in Section 2.4).

Research on PNPB has shown that in spite of these intentions the social inclusion of small-scale farmers, regional development (César and Batalha, 2013; Watanabe et al., 2012) and crop diversification (ANP, 2012; Padula et al., 2012) have proven to be very difficult. On the one hand the government continues with stimulation packages to promote these social and developmental goals, while on the other it increases obligatory blending targets of biodiesel to diesel ahead of schedule, which supports and triggers large scale commercial biodiesel industry in the Centre-West that produces primarily soy based biodiesel through capital intensive and large scale agricultural systems (MDA, 2013). Academic and NGO evaluations of the PNPB program conclude that it has not contributed much to economic inclusion of family farmers in vegetable oil chains (César and Batalha, 2010; Hospes and Clancy, 2011), that production did not disperse over the country towards the poorest regions, and that environmental sustainability is not a key issue in the implementation of the PNPB (given the dominance of soy oil with more than 90%; ANP, 2012). This all suggests that also the PNPB faces successes and shortcomings.

This paper aims to understand whether, to what extent and how the PNPB developed in a similar way as ProÁlcool, regardless of the thirty year time difference and the lessons learnt. We do this through a comparative analysis of the life histories of ProÁlcool, and PNPB, focusing on the (state and non-state) actor interactions and power, and the institutional ownership and embeddedness that have shaped the development, policy content and implementation of both programs.

Information has been collected between 2007 and 2011 through semi-structured interviews with government actors, industry experts, scientists, and civil society representatives in Brazil; participation in public meetings on both programs; and reviews of scientific articles, policy documents, newspaper articles and governmental communiqués.

The next section develops the concept of 'governance fields' to analyze biofuel programs and their life histories. Subsequently, the history and development of ProÁlcool (Section 2.3) and PNPB (Section 2.4) will be analyzed. The final part compares the two programs and draws conclusions on the future outlook of biofuel governance in Brazil (Section2.5).

2.2 Policy, politics and polity in governance fields

Policy domains are organized differently per country, but often include agriculture, economic affairs, trade, energy, transport and environment. Policy domains reflect what political authorities consider substantive and distinctive issues that require distinctive political and administrative action. Or, as defined by Burstein (1991: 327), policy domains are 'components of the political system organized around substantive issues'. The concept of 'semi-autonomous social fields' is useful to clarify that these policy domains are to some extent interdependent, and to some extent autonomous. The concept was originally coined by Moore (1973) to emphasize that every field of social life is neither fully governed by rules and actors 'emanating from the outside world', nor fully autonomous in following its own endogenous rules. The notion of semi-autonomy prompts us to relate the development of a new (for instance policy) field to existing (policy) fields and not to understand its emergence in a political or institutional vacuum.

The UN-Energy (2007: 4-6) indicates that at least four distinct policy domains or fields are shaping the development of liquid biofuels policies: energy, environment, agriculture and trade. When a new national biofuel policy emerges, one or more of these policy fields (ministries/departments with their substantive policies, rule-systems and state actors) may try to annex the new policy into their routines, mandate and/or portfolio. As a result, a biofuel policy may become subsumed in – and thus take on board major characteristics of – one of the existing policy fields. However, if a single policy field is unable to fully claim and determine the new biofuel policy, or when different domain holders and representatives agree to treat a new policy as a joint responsibility of multiple policy fields, biofuel policy may turn into a (often complex) interdepartmental (or inter-field) affair. A new policy may also start as a subsumed or an interdepartmental area and at a later stage – when it remains high on the public/political agenda – turn into a distinct policy field with its own domain holder, rule system and institutions.

These developments are of course not just state-internal affairs of national bureaucracies. Powerful private interest groups and sub- and supranational state actors have a major interest and influence in the structuration of new policy areas, through close interaction with state agencies that represent

existing fields. It that sense, governance field is a more adequate concept than policy field (e.g. Kersbergen and Waarden, 2004; Treib et al., 2007; van Leeuwen and van Tatenhove, 2010).

The concept of governance field as such does not explain whether, when and how new governance domains emerge or existing ones become subsumed in other governance fields. The concept of governance field could remain a rather static concept. To study the emergence of a national biofuel policy and how and to what extent it is shaped by and located in-between or within existing policy/governance institutions and fields, we need concepts to unpack the dynamics in governance fields. On the basis of an extensive review Treib et al. (2007) distinguish three different dimensions of governance in a domain or field: policy, politics and polity. Policy is about objectives, content and instruments of governmental programs. Politics is about constellations of private and public actors and about power struggles that shape policies. Polity is about institutional coordination mechanisms and division of competences between public (and private) actors in using instruments to realize objectives. The implication of this multidimensional notion of governance field is that one cannot understand the emergence, content and implementation of national biofuel policies without exploring biofuel politics and polity; that is, without the power struggles among public and private actors on the division of competencies and on how the coordination and institutions of biofuel policies are organized, also in relation to other governance fields.

From this conceptualization, one can conceptualize three different models of how newly emerging programs of bioethanol and biodiesel become 'institutionalized' in the existing organizational structure of semi-autonomous governance fields (see Figure 2.1): (1) as a new semi-autonomous governance field; (2) as a more or less coordinated 'sub-field', with similarities between the two biofuels programs in terms of policy, politics and polity, but hardly semi-independent from existing governance fields; (3) as two separate biofuel sub-fields with limited similarities between their policies, politics and polity. Figure 2.1 is schematic and limited to only two initial governance fields that may structure biofuels policies; also, bio-ethanol and biodiesel policies can be 'located' in one semi-autonomous governance field rather than at the junction of two or more existing fields.

Whether a governance fields becomes more or less autonomous over time and how existing governance fields capture or give room to a new emerging (biofuels) policy to evolve into a more or less semi-autonomous field remains an empirical question. In analyzing ProÁlcool and PNPB biofuel policies as governance fields we focus on how they evolve in terms of policy, polity, and politics through time: the 'life history' of governance fields. In this life history the policy refers to the content in terms of regulations and instruments that is developed and implemented within a certain timeframe. The politics refer to the relations, interdependencies and power struggles between the main actors in developing the policies, such as state agencies, NGOs, private companies, farmer organizations etc. The polity refers to the formal institutional arrangement of politics, that is the structure and institutions that are medium and outcome of politics. For a biodiesel and/or a bioethanol field to become a semi-autonomous governance field it would have to develop its own separate policy contents, a typical set of powerful actors and constellations that struggle for specific contents, and its own specific institutional structure; all three semi-independent from other governance fields, such as agriculture, energy or environment.

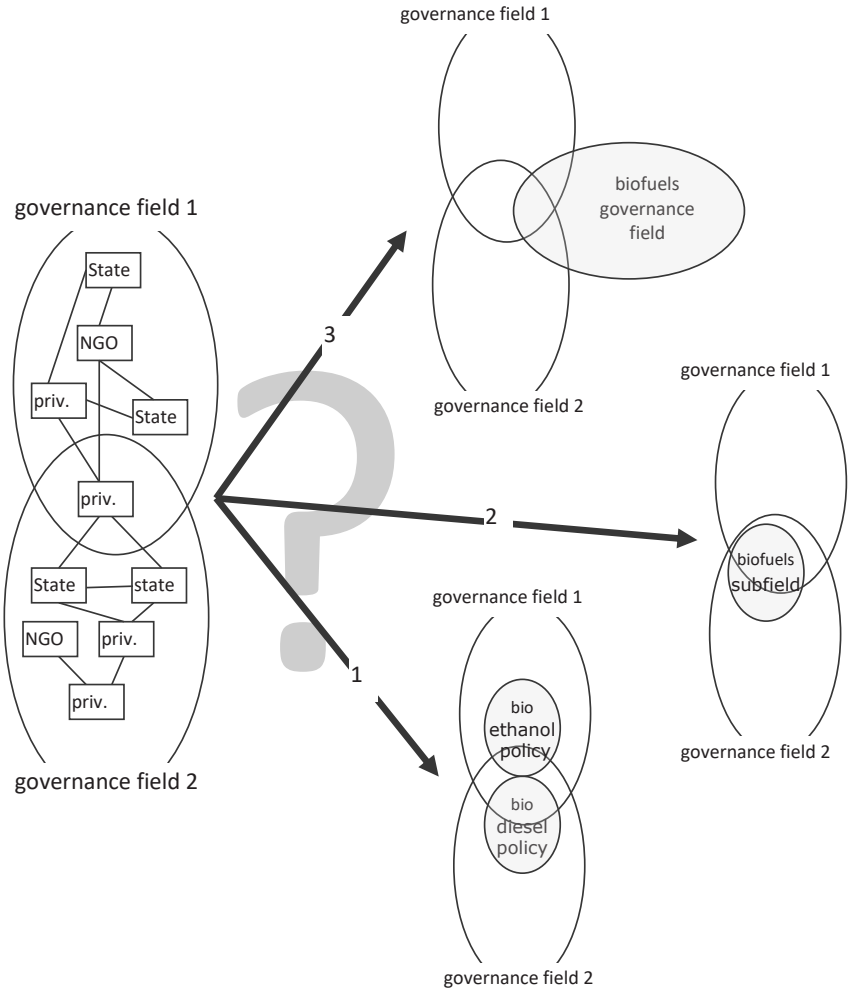


Figure 2.1 Conceptualizing the development of biofuels governance
Source: developed by authors

To be sure, development into a semi-autonomous governance field or not has no simple linear relation with success or failure of the field in reaching policy goals. Both as subsumed sub-field in another semi-autonomous governance field (e.g. agriculture), and as semi-autonomous biofuel governance field biofuel policy goals can be successfully achieved, or not. But the kind of policy goals set and implemented, as well as the main actors responsible for setting and implementing policy measures to reach goals will be different in each of the alternative routes of Figure 2.1.

2.3 The emergence and structuration of Brazilian ethanol policy

In this section the emergence and development of the governance of Brazilian ethanol is analyzed. We distinguish four phases: the period before the launch of the ProÁlcool policy, the ten year period following implementation of the policy, the years of decline, and the revival and growth of ethanol. These phases are identified based on changes in the politics (actor and power constellations) and substantial policies of the ethanol governance field (see Hira and de Oliveira, 2009; Rosillo-Calle and Cortez, 1998; Rovere et al., 2011).

2.3.1 Pre-ProÁlcool (–1975)

During the phase prior to the implementation of ProÁlcool actors became involved in ethanol and/or sugarcane production, experiments were held that shaped policy ideas and perspectives with regard to ethanol as transport energy, governmental involvement in sugarcane production emerged.

The first official ethanol policy in Brazil dates back to 1919 (Fischetti, 2008), when the Government of Pernambuco (northeast of Brazil) made ethanol an official fuel within that state. This policy followed a growing awareness among Brazilian policy makers at that time of the lack of domestic fossil fuel resources in a country with long transport distances and a growing economy. Fossil fuel imports led to large foreign debts, so alternatives had to be considered. From the start the role of the Brazilian state has been important in initiating policies for alternative fuels in Brazil. Already in 1903 the Brazilian president launched the idea of a stronger linkage between the sugar and ethanol industrial sectors for the production of ethanol fuels.

Governmental regulation of the sugarcane and ethanol sector began with the creation of three state institutions that were created between the 1920s and 1950s. The first important institute is the Sugar and Alcohol Institute (IAA—Instituto do Açucar e Álcool), created in 1933, which aimed to regulate the sugar and alcohol market by setting strict production quotas in order to keep prices at an adequate level. The quotas permitted every mill to produce a certain amount of sugar and kept prices under control, with two principal effects: in the northeast it prevented sugarcane producers from bankruptcy, and in São Paulo it increased sugar and ethanol self-sufficiency and modernization (Hira and de Oliveira, 2009). Second, innovative research institutes were established, such as the Technological Institute of Aeronautics (ITA—Instituto Tecnológico de Aeronáutica) and the Technical Centre of Aeronautics (CTA—Centro Técnico de Aeronáutica). These institutes formed the technological infrastructure that enabled Brazil in the 1970s to adapt a car engine to ethanol. Third, the national petroleum company Petrobras (PB—Petroleo Brasileiro S/A), established in 1953, gained authority to organize all the activities of the oil industry in Brazil on behalf of the government. These three state institutions (as the polity of the pre-ProÁlcool era) were developed in three rather autonomous governance fields: agricultural production and regional development (i.e. IAA), science

and technology (i.e. ITA and CTA), and energy (i.e. PB). Together these institutes increased the capacity of the state to control market developments with respect to ethanol in Brazil, but polity coordination was not always easy.

In 1964 the military seized power, which further stimulated centralized governmental control towards decreased dependency on fossil fuel imports, especially following the energy crises of the early 1970s (Rosillo-Calle and Cortez, 1998). Motivated by the rapid increase in fossil fuel prices in 1973 and 1974 a policy package that imposed a 10% blend of alcohol to gasoline was imposed in 1973 (Magalhães et al., 1991). Unfortunately problems arose with regard to the ethanol quality, due to varying blends per state and hence inconsistent ethanol quality (Fischetti, 2008). To increase ethanol use as fuel two developments took place, forming the background of the sugarcane-ethanol industry coalition: technological innovation and a geographical shift in ethanol production. Technological innovation was considered essential. Initially car engines were not adapted for ethanol use and many cars suffered from corrosion and high maintenance costs, which created aversion of car-owners against ethanol use (Veja, 1980). However, the car industry was able to solve these problems through the rapid emergence of a Brazilian based car manufacturing (national branches of Ford and General Motors), and increasing domestic innovation capacity facilitated the adaptation of car engines to ethanol.

A shift in ethanol production from the northeast to the São Paulo region was also crucial. Historically sugarcane farmers in the northeast used a plantation system based on unequal landownership and cheap slave labor. Even after the abolition of slavery (in 1888) very unequal landownership and work relations continued to exist (Lehtonen, 2011). In contrast, the farmers in São Paulo state, with a different historical background, relied more on innovative and technologically-advanced production methods. Gradually, the expansion of sugarcane to the state of São Paulo marked the increasing importance of this state and brought sugarcane farmers, ethanol producers and car engine innovators geographically close to each other and to the heart of economic development. Hence, while sugarcane production, regional development, technological innovation of cars, and energy were initially more or less autonomous governance fields (both with respect to state agencies and societal interests groups), in the early 1970s they were gradually moving towards geographical closeness and substantive interactions, but these new politics needed strong interventions to overcome sector interests.

When the former president of Petrobras, Ernesto Geisel, became President of Brazil (1974–1979), he – together with Minister of Mines and Energy Shigeaki Ueki (1974–1979), who later became president of Petrobras (1979–1984) – had the power (and the Petrobras knowledge and connections) to break the multiple resistance politics and reluctance against alternatives for fossil fuel (Petrobras, 2013). At this time the car industry, sugar producers, and some entrepreneurs became proponents of the ethanol program while Petrobras and the financial sector remained critical (Hira and de Oliveira, 2009).

2.3.2 Energy sovereignty and expansion (1975–1985)

By 1975 the proponents of an ethanol fuel program were able to create "ProÁlcool", the National Fuel Alcohol Program, through decree no. 76593 on November 14th in 1975. The new policy had four goals: one, reducing the demand for imported fuel and thus addressing the national security

concerns about energy dependence; two, stimulating the industry in the northeast by generating additional income opportunities for the sugar industry that suffered from low prices on the world market; three, increasing national income by better utilizing Brazilian resources; four, increasing the growth of agricultural and industrial domestic sectors (Hira and de Oliveira, 2009, p.2452; Rosillo-Calle and Cortez, 1998).

A three-step plan for the implementation of alcohol fuel was introduced: first, using a mixture of anhydrous alcohol to gasoline (up to 25%); second, conversion of gasoline engines to make the car fleet suitable for alcohol; and third, the use of special alcohol engines to run on hydrated alcohol with maximum efficiency (a 100% alcohol fueled car). This plan was carried out with policies that required Petrobras to buy a guaranteed amount of ethanol and that provided low interest loans, subsidized prices and production quota (Goldemberg et al., 2004; Hira and de Oliveira, 2009, p.2452).

Through ProÁlcool, alcohol production by sugar cane, cassava, or any other crop was stimulated. Between 1975 and 1985 the production of manioc (cassava) by small farmers in poor regions was stimulated in order to stimulate economic development. In this period about 8% of ethanol was produced from manioc by small farmers and local 'mini-distilleries', but this small scale manioc production suffered from crop diseases and could not compete with the large-scale and efficient production of the sugarcane sector (Hira and de Oliveira, 2009; Lehtonen, 2011). Hence, sugarcane became the dominant crop for ethanol production in Brazil, due to previous experiences, low sugar prices, high growing potential and economies of scale.

Initially the ProÁlcool program did not please conventional sugar mill owners. They argued that sugar was a more secure market, because IAA protected them from heavy price fluctuations through the existing quota system by buying for a guaranteed price. Also the idea of selling to Petrobras was not considered attractive, even though the government stipulated that Petrobras had to buy the entire production from mill owners and would be responsible for transport, storage, distribution, and mixing of alcohol. ProÁlcool also created resistance within Petrobras, because it saw ethanol as competition and it expected lower prices for gasoline. Also the automobile industry opposed ProÁlcool, because they were aiming for a 'world car' for a global market and did not appreciate Brazil's specific car engine adaptation needed for ethanol. However, the politics and power constellation of ProÁlcool was clear: the military regime accepted no frustration of and interference in the ProÁlcool program and forced sugar mill owners, Petrobras and car manufacturers to cooperate through top down implemented government policies. The polity of the program was also more a presidential than a ministerial one, preventing sectoral interests to frustrate collaboration. ProÁlcool was initially heavily subsided with approximately seven billion dollars between 1975 and 1989 (Fischetti, 2008).

At the start of ProÁlcool a food versus fuel discussion emerged, but this was soon dismissed as a false problem due to the large expansion opportunities of sugar cane (Magalhães et al., 1991). During the first phase of ProÁlcool the northeast kept receiving subsidies to keep up with the more efficient ethanol production in the state of São Paulo. The São Paulo region further modernized, resulting in land ownership concentration into the hands of industrialists and large-scale producers and in gradual displacement of smaller independent producers (Lehtonen, 2011).

Consumers were stimulated to use ethanol, by setting the price of hydrated alcohol at 64.5% of the price of gasoline. The oil price shock of 1978 got the remaining ProÁlcool critics on board. In September 1979, after severe pressure by the government, the National Association of Motor Vehicle producers (ANFAVEA— Associação Nacional dos Fabricantes de Veículos Automotores) signed a protocol in which car manufactures would develop technologies and produce vehicles that could run on pure hydrated alcohol. A purely ethanol fuelled passenger car came on the market in 1979 (Rosillo-Calle and Cortez, 1998). The market of alcohol cars grew rapidly, from 0.46% in 1979 via 26.8% of the sold vehicles in 1980, to 76.1% in 1986 (Fischetti, 2008; Veja, 1980). This rapid increase was celebrated and stimulated by public exhibitions, commercials, festivals and governmental campaigns. It lasted until the mid-1980s when problems started to arise on the ProÁlcool path.

2.3.3 Neo-liberalism and stabilisation (1985–2003)

With the end of the military dictatorship in Brazil in 1985, ProÁlcool became a controversial policy, because it was considered an unwanted heritage of the military regime. The politics of ProÁlcool changed dramatically. The Minister of Industry and Commerce, the IAA and ethanol producers in São Paulo were in favor of abolishing ProÁlcool. Northeastern producers (for the financial support they received) and the Minister of Mines and Energy wanted to continue with ProÁlcool. Major power struggles led to insecurity of governmental support, which resulted in consumer withdrawal, a fall in alcohol fueled car sales, and lost interest of the car industry. This came together with a strong fall in world market crude oil prices and a fall in the income of sugar mill owners (as ethanol prices were coupled to oil prices) (Magalhães et al., 1991; Rosillo-Calle and Cortez, 1998). This created a severe supply crisis, amplified by the demise of the sugar industry in the northeast as subsidies declined (see Figure 2.2).

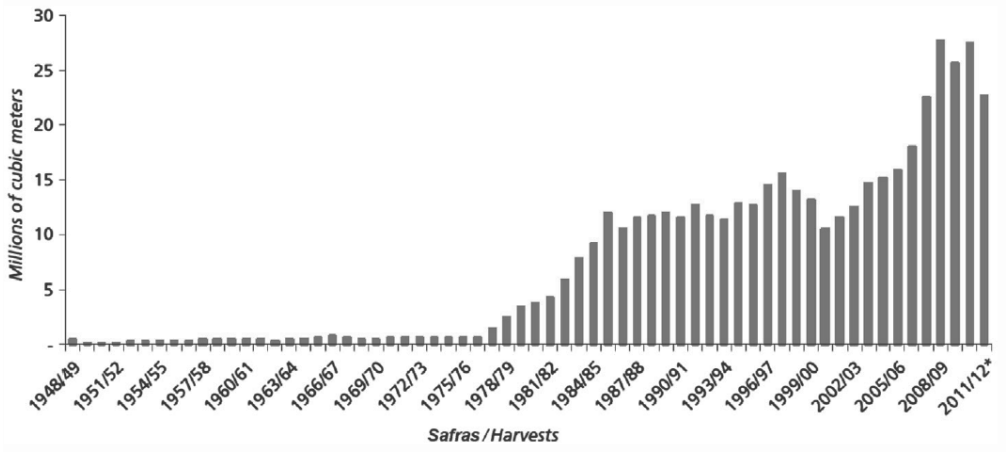


Figure 2.2 Ethanol production Brazil, 1948-2012 (million m3/year)
Source: MAPA (2013)

In the São Paulo region the decline of subsidies was less of a problem, because the industry's economies of scale and its mechanization reduced costs; hence, here blending of ethanol continued at a large scale (Lehtonen, 2011; Rosillo-Calle and Cortez, 1998). Altogether, the crisis transformed a highly subsidized national program into a profitable, geographically concentrated and increasingly privatized business. New problems emerged as environmental and farmer organizations started to emphasize the negative impacts of sugarcane production on the environment and on small (family) farmers who leased their land to sugarcane producers.

The 1990s are marked by attempts of the sugar industry to create a competitive sugar and ethanol market without governmental intervention. Although ethanol was still seen as a viable alternative if gasoline prices are above 30 USD/barrel, lack of consumer trust and continuation of technological problems regarding corrosion of car engines remained main challenges. In 1994 the central government again intervened through Plan Real, in which it stimulated and forced the sugar and ethanol industry to further improve their productivity (Rosillo-Calle and Cortez, 1998).

2.3.4 Revival, growth, and sustainability (2003–)

The current phase of ethanol use has been largely shaped by an innovation from the car industry that developed flex-fuel technology for car engines in 2003. Currently 90% of all car sales in Brazil are flex-fuel vehicles, which means they can run on any possible blend of ethanol to gasoline. Consumers were quickly attracted to the new cars, because they could benefit from cheap ethanol, without running supply risks as in the 1980s (MVO, 2009). Brazil still uses different mixes of anhydrous ethanol to gasoline depending on supply and demand. Since 2010 there have been two periods wherein the ethanol blend was reduced from 25% to 20% ethanol due to low supply as a consequence of drought and failed harvests (Jagger, 2013).

With 436 sugarcane plants that use 50% of its crushed sugarcane to produce 30 billion liters ethanol in 2010 (Figure 2.2), Brazil's production capacity is higher than domestic demand and its ethanol seeks new markets: USA, Europe, and Japan (Mol, 2010; Unica 2010 interviews, 2007). The USA has recently labeled Brazilian ethanol an ‘advanced biofuel’, meaning that it receives trade advantages because of its relatively limited environmental impact and production efficiency. The internationalization of the bioethanol sector also increased sustainability concerns in the ethanol business and the sugarcane industry (Goldemberg et al., 2008). Brazilian ethanol industry and government are still dominant actors within this globalizing biofuel arena in Brazil, but new (international) state and non-state actors question the social (working conditions) and environmental impacts of ethanol production in Brazil. For instance, civil society organizations monitor the working conditions, biodiversity, landownership, and greenhouse gas emissions (Repórter Brasil, 2010). And EU importers ask for sustainability certifications following the 2009 EU Renewable Energy Directive.

2.4 The emergence and structuration of Brazilian biodiesel policy

In this section the emergence and development of the governance of Brazilian biodiesel is analyzed. Three main phases can be distinguished based on changing politics and policies: first, the developments towards a biodiesel policy; second, the development and implementation of the PNPB; third, adaptations to the PNPB and the importance of the global context.

2.4.1 Pre-PNPB (1975–2004)

In the 1970s, while implementing ProÁlcool, the government also experimented with Pró-Óleo, a biodiesel program (Magalhães et al., 1991; Pousa et al., 2007; Rosillo-Calle and Cortez, 1998). The government used the same discourse and arguments: i.e. strengthening of energy sovereignty by diminishing fossil fuel imports. Contrary to the ethanol politics, where the government found a capable and ambitious partner in the sugar industry, the biodiesel program failed to create similar a political alliance between state agencies and non-state industries of oleaginous crops. This was also due to the fact that vegetable oil production was less stimulated at that time and its processing industry did not suffer from fluctuations on the world market like the sugar industry. Consequently the government did not succeed in creating a powerful political consortium and capacity for large scale biodiesel introduction, and the drop in petroleum prices in the mid-1980s stalemated the program.

The next attempt to introduce biodiesel took place in 2002 when a diesel substitution program was introduced by the Ministry of Science and Technology. This Próbiodiesel program focused on the conversion of soybean oil to biodiesel (Pousa et al., 2007). Although soybean oil is not an efficient biodiesel crop, it was available at large quantities and against relatively low cost. Table 2.1 lists yield characteristics of the different oil crops in Brazil.

Table 2.1 Characteristics of oleaginous crops in Brazil

Species	Oil origin	Oil contents (%)	Harvest (months/year)	Yield (tons of oil/hectare)
African palm	Nut	22.0	12	3.0 - 6.0
Coconut	Fruit	55.0-60.0	12	1.3 - 1.9
Babassu	Nut	66.0	12	0.1 - 0.3
Sunflower	Grain	38.0-48.0	3	0.5 - 1.9
Colza/canola	Grain	40.0-48.0	3	0.5 - 0.9
Castor beans	Grain	45.0-50.0	3	0.5 - 0.9
Peanut	Grain	40.0-43.0	3	0.6 - 0.8
Soybean	Grain	18.0	3	0.2 - 0.4
Cotton	Grain	15.0	3	0.1 - 0.2

Source: MAPA (2006); Stattman et al. (2008)

Soybean production in Brazil started in the 1970s in the SouthWest of Brazil and expanded to the Centre-West. Technological and agronomic knowledge led to higher productivity, which drove this expansion. A second driver for early expansion was market demand increase, because soy (consisting of oil and protein content) proved suitable for cattle feed and many other purposes. Fiscal incentives and infrastructure improvement further increased expansion into 'low value' lands in Mato Grosso (Dall'Agnol et al., 2004). Not unlike sugarcane, soybean expansion was characterized by large scale practices, monocultures, innovations, and strong linkages to the world market (Berkum et al., 2006; S L Stattman et al., 2008). Hence, at the start of the biodiesel program soy was widely available and was looking for market diversification due to suffering from fluctuating world market prices.

Soy farmers were already familiar with large scale commodity trading and had the ability to innovate and adapt quickly to new policies and conditions that would improve their market position. The Ministry of Agriculture of Brazil was also actively seeking for alternative markets for the soy farmers in the South- and Centrewest, which brought together a larger coalition of state and nonstate actors supporting biodiesel.

2.4.2 National Biodiesel Program (2004–2010)

The PNPB was launched by President Lula da Silva during his first term in office (Decree No. 5.297 on December 6, 2004). An Inter-ministerial Working Group on Biodiesel (GTIB), involving twelve different ministries, assessed the viability of introducing biodiesel into Brazil's energy matrix and designed federal laws no. 11.095-005 (on mandatory introduction of biodiesel into Brazil's energy matrix) and no. 11.116-05 (on the gradual increase of blending targets and movement from voluntary to obligatory blending). In October 2009 Brazil announced that taking effect in January 2010 it will raise the biodiesel to diesel content to 5% (B5), originally planned for 2013. Production in 2011 was almost 2.7 billion liters and the total capacity of the 70 plants was estimated at 5.5 billion liters per year (Figure 2.3). These production and capacity levels are more than enough to comply with the B5 mandate (MVO, 2009), which could result in Brazil becoming soon a net exporter of biodiesel.

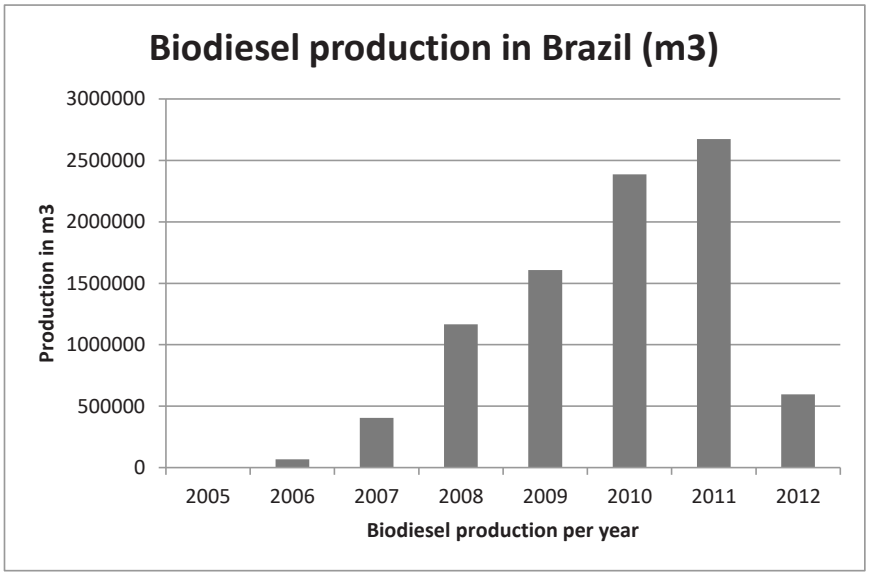


Figure 2.3 Biodiesel production in Brazil, 2005-2012 (million litres)

Source : figure is based on ANP (2012) (The numbers for 2012 are incomplete)

In learning from the ProÁlcool experience, the government based the PNPB on three pillars (environmental sustainability, social inclusion, and economic development) and a solid technological and knowledge base. Ministries involved with the PNPB all claimed in interviews that, contrary to

ProÁlcool, the PNPB was designed as a multi-crop program that should contribute to regional development, economic growth, social inclusion and environmental sustainability. Social inclusion is supported by the Social Fuel Seal (SFS) and a tax structure that benefits specific producers, production regions and types of raw material (César and Batalha, 2013; Garcez and Vianna, 2009). In practice, biodiesel companies need to be awarded the SFS by the Ministry for Agrarian Development (MDA) in order to be allowed to sell biodiesel on the Brazilian market. They will only be awarded the SFS when they buy a certain percentage of their biodiesel oils from small-scale family farmers. The required percentage differs per region (Table 2.2). There are no specific environmental criteria mentioned in the PNPB. The government officials argue that the general environmental laws of Brazil apply and that biodiesel does not need to comply with any additional or specific requirements. Stimulating diversification of oil crops is considered sufficient to prevent monocultures.

Table 2.2 Percentage family farmer feedstock necessary for obtaining SFS

Region	% harvest until 2009	% harvest 2009/2010	% harvest 2010/2011
Centre-West and North	10	10	15
North-East and Semi-arid	50	30	30
South-East and South	30	30	30

Source: Lei n. 11.116; MDA (2012a); Stattman and Mol (2014)

Already in the design of the policy program weaknesses with respect to social inclusion and sustainability could be spotted (Watanabe et al., 2012). In 2004 environmental organizations and labor unions formulated three social and environmental recommendations: (1) technologies used should support local resources and environmental sustainability, (2) crops of non-transgenic seeds should be stimulated, (3) production of seeds by family farming organizations of recently settled populations should be stimulated. None of these proposals, however, were incorporated in the PNPB (Garcez and Vianna, 2009). Instructions of the Ministry for Agricultural Development on the percentage of primary material acquired from family farmers were significantly lower than suggested originally in 2003 (Garcez and Vianna, 2009).

How was then the implementation? In Brazil biodiesel is produced from a variety of vegetable oils and animal fat. However, the crops that are specifically stimulated by the PNPB, such as castor oil from the northeast produced mainly by family farmers, have hardly contributed to total production (César and Batalha, 2010). Castor oil was specifically targeted due to its high oil content (Table 2.1) and the fact that family farmers in the northeast already had experience with the crop (on a small scale). From the onset strong tensions existed between family farmer inclusion and the interests of Brazilian agribusiness. The power and politics during implementation were clearly in favor of the agribusiness coalition, which was joined by state and non-state energy organizations. Five years after the launch of the PNPB biodiesel originated mainly from soy oil (78.8%), bovine fat (14.6%) and cotton seed oil (4.1%), and only for 2.6% of other resources (ANP, 2012). In spite of official intentions for diversification of feedstock resources, due to its availability and scale advantages soy oil had a preferential position in the PNPB from the start. Its production methods, i.e. large scale farming with

little demand for unskilled labor, monocultures, and excellent connection with commodity markets, made it into an attractive resource in spite of the low oil content per hectare. Other raw materials, such as Jatropha, castor oil and indigenous palm varieties with high oil content, could not keep up with the ambition for rapid expansion of biodiesel production and gained insufficient support from state actors to build up capacity. Vegetable oil produced from these indigenous oil crops has also a higher economic value, making it too expensive to be used for biodiesel (and more relevant for the cosmetics industry). In this way soy oil had no real competition. The strong presence of soy oil affected the regional spread of biodiesel production, which is now largely located in the centre-west of Brazil.

The dominance of energy production over social inclusion can also be found in the rather rapid increase of blending targets. At the start of the PNPB policy makers gave family farmers time to become included in the biodiesel production chain by introducing the SFS and by gradually increasing blending targets. At the same time these blending targets would provide the biodiesel industry with guaranteed sales. Debates between different stakeholders indicate that the industry is looking for higher blends whereas the percentage of biodiesel that comes from family farmers is still very low. This demonstrates the competition between the views on the PNPB as an energy program vis-à-vis as an agricultural development program. The SFS system did only marginally work because small famers do not have the capacity to negotiate favorable contracts and auctions were dominated by companies that are not located in areas with many family farmers. Hence, overall, the PNPB appeared to be influenced by the interests and ambitions of primarily the large soy farmers and the soy oil industry of the centre-west, and by the state and private energy organizations.

An interesting actor in this context is Petrobras. In the beginning of the PNPB Petrobras said it was only taking care of distribution of biodiesel. Within a short time frame, however, Petrobras invested and actively participated in the biodiesel market. When the social inclusion of small scale farmers was at risk, Petrobras was ordered by the government to take over projects which should make use of the feedstock of small farmers. Hence, Petrobras was allowed what it was declined during the ProÁlcool program: to create Petrobras Biofuels (PBio) in 2009. With that the polity of PNPB has moved in the direction of an energy institutional arrangement. PBio now focuses on all biofuels and is also buying ethanol mills. PBio is actively supporting family farmers in the production of biodiesel in the northeast, where it has been able to negotiate over 25,000 contracts since 2009 (Souza, 2011). Hence, PBio has become a very important player in fulfilling the social inclusion of family farmers in the PNPB. Still, the inclusion of small scale family farmers has proven to be very difficult, and the regional spreading is still a challenge. Since 2009 there have been adaptations to the PNPB to improve the social inclusion of family farmers, for instance through enhancing the role of agricultural cooperatives and of PBio. This seems to result in a rise in the number of family farmers participating in the PNPB (MDA, 2010).

2.4.3 Globalisation and sustainability (2010–)

To limit foreign interference, Brazil emphasized at several occasions that the PNPB is a national policy, organized and governed by a national polity. The Brazilian state sovereignty is, nevertheless, contested from various angles. First, the key feedstock, soybean, has been a global commodity for many years. Through its central role as the key resource in the PNPB, dynamics of global soy governance are ‘transposed' to the biodiesel sector. An example of this development is the Round

Table for Responsible Soy (RTRS), a global private partnership of civil society, industry and farmers aimed at increasing sustainability of soy production (Hospes et al., 2009). Governments cannot become a member of this partnership. The RTRS has been adapting its sustainability criteria to comply with European biofuel policy directives so that RTRS certified soy can also be used for European biodiesel.

Second, other national governments are also diversifying their energy matrix through the use of biofuels, and their blending obligations often go hand-in-hand with sustainability requirements (most notably the EU and the USA). Through requiring sustainability standards and defining what kind of production areas and conditions are sustainable these other states co-shape the outlook of the global biodiesel market, which may also have an effect on Brazilian biodiesel production. Third, global and national civil society organizations continue to stress the competition for land between food, biofuel and animal feed, regardless of counter claims of other organisations and academics (Mitchell, 2008; OECD, 2008; Veja, 2008). This puts especially first generation crop-based biofuel under continuous debate globally, endangering future global markets for soy-based biodiesel.

2.5 Comparison and conclusions

Comparing biodiesel to ethanol policies is not without controversy. Both policies have been carried out under different political regimes, during different times, and with slightly different objectives. In spite of these differences both programs have been implemented top-down by the national government, both rely on agricultural crops to produce liquid transport energy, both use similar policy instruments (blending targets, financial stimuli, technological innovation policy, agricultural development policy), and there are some similarities in combined objectives of energy security and rural development. Hence, in many ways, the development of the PNPB is similar to ProÁlcool, although it is of a younger age and occurring at a much faster pace. When launching its biodiesel policy in 2004 the government explicitly stated that it looked closely at ProÁlcool, to avoid the same kind of geographical concentration, the focus on a single crop, the dominance by agro-business as in the ethanol field, and the social exclusion of small-scale farmers.

In the formation period of ProÁlcool a military government had the ability to enforce its energy security program without much consultation with and consideration of stakeholders. In contrast, the Lula government consulted with different ministries and a variety of nonstate stakeholders. In the current era of globalisation a broader set of (international) actors are also involved in biodiesel politics. These differences in the politics and actors networks involved in designing the programs resulted in a biodiesel program that was on paper more conscious of the social dimensions and environmental impacts, compared to the bioethanol program. Still, in the implementation of both programs small scale production systems are marginalized, sustainability conditionalities are marginally applied, and regional spreading failed. In that sense, the structure of the PNPB with its stronger emphasis on social inclusion and rural development has proven very difficult to achieve. This means that the lessons drawn from the ProÁlcool program did result in a different policy design, but not in a different implementation and result of the biodiesel policy. We will explain this policy implementation convergence by analyzing the politics and polity of the ProÁlcool and the PNPB policies, and conclude on the question of an emerging semi-autonomous biofuel governance field.

Both programs have been strongly structured through the energy and agricultural governance fields. Developments in the ethanol and biodiesel sector are primarily driven by agri-business and energy industry; the transport, industry and trade governance fields have had a minor influence on the policies and politics of bioethanol and biodiesel and have primarily operated as facilitators; the environmental governance field has hardly influenced the course of development of the two programs. Even the current international demand for sustainable biofuels seems to have had little effect on local production circumstances. In this sense biofuels fall under regular environmental regulation, but do not have any specific status, which indicates that the environmental actors are not strongly represented in the governance field(s).

The key actors in both programs are very similar i.e. Petrobras, ANP, governmental departments and ministries of energy and agriculture; and they are using similar ideas, rules and experiments to develop the ethanol and biodiesel sectors. International developments, such as sustainability requirements on exports to the EU and the Round Table for Sustainable Biofuels, have further contributed to a similar development of both programs. As such one can identify a growing commonality in the policies, politics and polity of biodiesel and those of bioethanol. Yet, these similarities in actors, ideas, rule-systems and experiences have not resulted in the emergence of a semi-autonomous biofuel governance field. Powerful governmental and nongovernmental actors and institutions of especially the agricultural and energy sectors are dominating biofuel policies and programs, and no semi-autonomous biofuels institutions, powerful biofuel actors and domain holders, and important biofuel rule systems have emerged.

Biofuel policies and developments have been governed within the boundaries and through the politics and polity of existing energy and agricultural governance fields. This also means that biofuel policies reflect the interests of major agricultural and energy (state and nonstate) actors. Ethanol developments remain strongly linked with the sugarcane industry and the Ministry of Agriculture and biodiesel development is dominated by (state and non-state) soy interest representatives; and in both Petrobras and the Ministry of Energy have a major say. Over time, the dominance of the agricultural (state and private) actors and polity in structuring bioethanol developments has diminished and powerful energy actors and rule-systems have moved into the biofuel value chain, enlarging its influence. This process still continues, for instance where international oil companies, such as Shell, have become a member of the Roundtable on Responsible Soy, while Brazilian actors like Fetraf-Sul (representing small scale farmers) have decided to end their membership due to disagreements on the type of standards that needed to be developed.

Hence, we see two major developments in structuring biofuels governance in Brazil. First, we have witnessed a merging of bioethanol and biodiesel policy and politics and in the end also bioethanol and biodiesel polity. The policy contents, the actors, rule-systems and institutions of bioethanol and biodiesel are increasingly coming together. Second, instead of developing into one semi-autonomous governance field, biofuel policies and politics in Brazil remain a battleground in-between especially the agricultural and energy governance fields.

Figure 2.4 visualizes the process of developing what we could label a governance subfield on biofuels in Brazil, located in-between and dependent upon the two major semi-autonomous fields of agriculture and energy. The logics of these energy and agricultural orientated governance fields drive biofuel developments: an emphasis on quantity, a neglect of crop diversity and regional spreading,

power with the large scale (energy and agricultural) producers rather than with small scale family business, and a preference of energy security above environmental sustainability of energy sources.

Hence, by way of conclusion, the specific and increasingly similar politics and polity of the bioethanol and biodiesel programs explain the major similarities in the implemented policies of the two programs. We see the emergence of a sub-field of biofuels governance in-between those of agriculture and energy. The specific positioning of this subfield also 'determines' the powerful (state and non-state) actors involved, and the dominant rule-systems and institutions; and hence explains the shortcomings of contemporary biofuels programs in Brazil. It is unlikely that this subfield will develop in the short term into a semiautonomous biofuels governance field; a more likely scenario might be that other semi-autonomous governance fields (e.g. environment) enhance their influence on biofuel governance following especially the globalization of biofuels (trade).

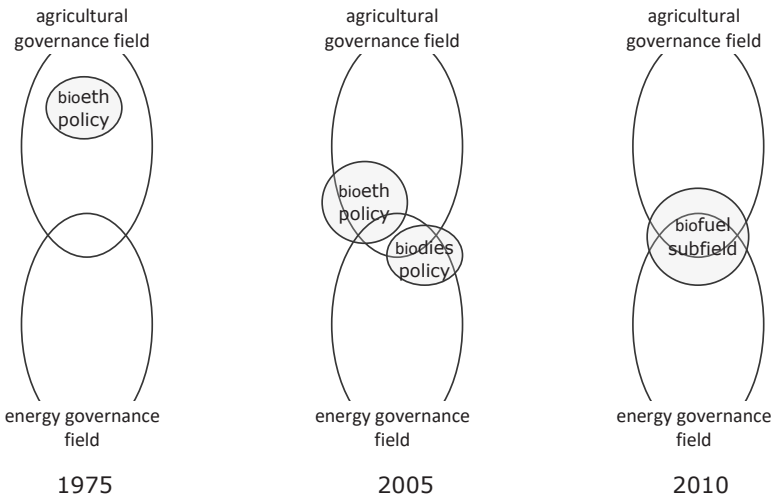


Figure 2.4 Historical development towards a biofuel governance subfield
Source: developed by authors

3 Social sustainability of Brazilian biodiesel: The role of agricultural cooperatives[2]

Abstract

Biofuels have been criticized in academic and activist circles not only for their environmental consequences but also for their social impacts on food availability and on small-scale family farming. Meanwhile (global) initiatives and policies have been developed to stimulate ''sustainable biofuels''. Brazil – a frontrunner in production and use of biofuels – aimed to combine biodiesel production with rural development. The biodiesel policy implemented in 2004 had two main objectives: to advance biodiesel as a transportation fuel and to foster the social inclusion of family farmers through participation in the biodiesel chain. Although participation of family farmers was low in the beginning, it increased substantially after a 2009 policy change that gave cooperatives a more prominent role. We analyze how, why and to what extent cooperatives are involved in integrating family farmers into the biodiesel chain and what this means for the social sustainability of biodiesel, taking the northeast state of Bahia as a case study area. The findings show that through the biodiesel policy, cooperatives—until then a marginal phenomenon in northern Brazil—increased their membership, were empowered and contributed to the economic development of a significant group of family farmers. However, these family farmers have not been substantially included in the biodiesel production chain itself. The biodiesel policy functions as a catalyst for rural (economic) development in which the cooperatives seem to achieve what governments were unable to achieve: the integration of specific categories of family farmers into agrarian development. Subsistence family farmers, in particular, have not been able to profit from this policy-driven, ''market-oriented,'' rural development model. Hence, it can be questioned whether this policy has made biodiesel more socially sustainable.

[2] This chapter has been published as: Stattman, Sarah L. and Arthur P J Mol. 2014. Social sustainability of Brazilian biodiesel: The role of agricultural cooperatives. Geoforum 54: 282–294. http://dx.doi.org/10.1016/j.geoforum.2014.04.001.

3.1 Introduction

Over the past decade, the worldwide embrace of biofuels as an alternative source for transportation energy has been heavily debated, globally as well as locally. This embrace of biofuels has various sustainability concerns following the (potential) adverse impacts of large-scale biofuel production and use. These adverse impacts may include not only increased deforestation, land consolidation, expansion of agricultural areas at the cost of nature conservation and greenhouse gas emissions through indirect land use change, but also social issues such as land ownership, food prices and access, and marginalization of small farmers. Hence, governmental policies to further enhance the production and use of biofuels have been and still are strongly debated and criticized for both their environmental sustainability and their social consequences for small-scale family farmers (Mol, 2010, 2007; Sorda et al., 2010).

One of the major challenges in this context of sustainable biofuels is the impact of indirect land use change on food production and landownership. The notion of indirect land use change has proven to be difficult to measure and the impact is very unpredictable. Nevertheless, the European Union (EU) has put in place an obligation to monitor the effects of indirect land use change from cropbased biofuels, without any clear indicators (Levidow, 2013). In September 2013 the EU parliament voted that in meeting the EU's target of 10% biofuels in transportation fuels only 6% could be food-based biofuels, in order to stimulate ''advanced biofuels'' that do not compete with food production; however, the proposal was rejected, just two votes short of a majority (EurActiv, 2013). This indicates that concerns about sustainable biofuels have risen to such a level that policy objectives might change in the future.

The EU debates show a growing awareness about the social and environmental impacts of biofuel, as do the increasing amount of governmental and other global (non-state) initiatives that stimulate sustainable biofuels (Scarlat and Dallemand, 2011). Some countries have begun to address the environmental impacts of biofuels, but few countries have formulated concrete policies to mitigate the social impacts of crop-based biofuel production (Dam et al., 2008; Smeets et al., 2008b), such as small farmers' being pushed from their land by agro-industrial investors and the competition of biofuel crops with food crops. Brazil – as a major user, producer and exporter of biofuels and biofuel crops – holds a key position in these global debates and how the future biofuels market will evolve (Garcez and Vianna, 2009; Goldemberg et al., 2008). Brazil is also one of the first biofuel producing countries to explicitly include social sustainability into its national biodiesel promotion policy.

The Brazilian government aims to combine biofuel blending promotion with social sustainability by protecting and enhancing the social and economic development of small-scale family farmers. These combined objectives became operational in the 2004 Brazilian biodiesel policy: the National Program of Production and Use of Biodiesel (PNPB). The PNPB has two main goals: to introduce and enhance biodiesel as a transportation fuel into the national fuel matrix and to foster the social inclusion of small-scale family farmers through their participation in the biodiesel value chain in the poorest regions of the country (MDA, 2010). The development and implementation of the PNPB led to two

main debates. First, policy measures for implementing the PNPB show tensions between the two goals; for instance, PNPB policy measures create a conflict between the participation and development of small-scale family farmers, the prevention of biodiesel domination by agro-industries, and the stimulation of sufficient biodiesel (crop) production. In the implementation of the PNPB, these conflicting goals remain a source of ongoing debate (Sarah L. Stattman et al., 2008; Stattman et al., 2013). The second debate concerns the implicit assumption in the PNPB that small farmer participation in the production of biofuels will result in desirable small-scale family farmer development. This interpretation and ambition of social inclusion have been contested for their narrow (economic) definition of social inclusion and their relationship to rural development (e.g., Hospes and Clancy, 2011; MDA, 2013b; Quiñónez et al., 2012).

The PNPB objective of small farmer social inclusion and rural development has been advanced with two main policy instruments: (a) the Social Fuel Seal (SFS), and (b) a special tax system. These instruments together are designed to facilitate and stimulate the inclusion and involvement of family farmers in the northeast (the poorest region of Brazil) in biofuel production, as opposed to the large-scale agricultural producers in the central west. The SFS is awarded by the Ministry of Agrarian Development (MDA) to biodiesel companies that buy a minimum percentage of their biodiesel feedstock from small farmers. Only companies that possess the SFS are allowed to bring their biodiesel onto the Brazilian biodiesel market. In addition to buying feedstock from family farmers, biodiesel companies are obliged by the SFS to deliver technical assistance and support to these family farmers. This means that they have to support small-scale family farmers in improving their agricultural systems and farming practices, resulting in their economic and social development as defined by the Brazilian government. The tax model supports this objective by reducing taxes depending on the region and type of crop; for example, family farmers in the northeast who produce castor or palm oil pay lower taxes than do large-scale farmers in the central west who produce soybean oil.

In spite of these policy measures, the involvement and ‘‘inclusion’’ of small farmers in biodiesel production lagged behind governmental expectations and targets in the early years of the PNPB. However, this changed with the biodiesel policy revision in January 2009, which, among other changes, enhanced the role of agricultural cooperatives in biodiesel feedstock production and marketing. From 2009 onward, cooperatives have appeared to function as key organizations between farmers, industry and government authorities in implementing the biodiesel social inclusion policy. This raises questions with regard to how and why cooperatives are successful in integrating small farmers into the biodiesel chain and what this cooperative-enhanced social inclusion actually means for family farmers. In focusing on the (changing) role of agricultural cooperatives in biodiesel production, we aim to contribute to the wider debates on the social sustainability of biofuels and on cooperatives in rural development.

Before introducing the research outcomes (Section ‘Bahian cooperatives participating in the PNPB’), the theoretical framework of cooperatives in rural development (Section ‘A role for cooperatives in rural development’) and the history of biodiesel promotion policy in Brazil are introduced (Section ‘The National Program of Production and Use of Biodiesel’). Section ‘Social inclusion’ analyzes how and with what consequences cooperatives have successfully advanced the social inclusion of family farmers in the biodiesel chain and is followed by conclusions.

3.2 A role for cooperatives in rural development

Currently, rural development policies are an important part of Brazil's social policies. In November 1999, the government even created a ministry to specifically support agrarian reform and the sustainable development of family agriculture (MDA, 2013c). This is very different from the period during the military dictatorship (1964–1984) when the focus was primarily on opening up new land in the Amazon region and settling farmers on public lands. Schneider et al. (2010: 231-235) distinguish three consecutive phases in post-military rural development policies. In the first phase (1993–1998), the government had a strong focus on agrarian issues such as unequal land ownership. Rural organizations and social movements, such as the Brazilian Landless Movement (MST) and the Land Pastoral Commission (CPT), emerged as important action and lobby groups. A first generation of rural policies for small family farmers was created to give these farmers access to credit and financial support, such as PRONAF (National Program for Family Agriculture). The creation of the MDA to facilitate these processes can also be considered an outcome of this first phase.

The second phase (1998–2005) can be characterized by social and compensation policies that aimed to increase the income and welfare of family farmers. During this phase, programs for food security and family spending, such as Bolsa Familia, were developed and implemented. In the third phase (2005–present), attention has shifted to fine tuning and improving existing rural development programs through changing their institutional design and better integrating different levels of government and other institutions. Schneider et al. (2010: 233) place the development of the biodiesel program in this last phase because it is a fine-tuned strategy of adding value to products from family farmers and of making markets accessible to them.

Two key elements of this third phase are relevant for our biodiesel analysis. First, rural Brazil can be characterized by significant regional differences, for instance, when considering socioeconomic indicators such as income, health, infant mortality and nutrition. The richer south and southeast regions score much better on these indicators than do the poorer north and northeast ones, although the inequality between these regions seems to be declining slowly (World Bank, 2013). These differences require rural development policies to be fine-tuned to different regions to be effective and this is also a core characteristic of this third phase with respect to biofuel policies. Second, one of the key institutional changes of the third phase seems to be the increased involvement of local agricultural cooperatives in rural development. Government agencies argue that cooperatives increase effectiveness and reduce the costs of rural development policies. In evaluating Brazilian rural development policies the Washington Office on Latin America (2013: 11-13) recently concluded that consultation with and the involvement of cooperatives and producer organizations had positive effects on rural development and on long-term policy effectiveness, although the participation of the most marginalized farmers remains limited.

3.2.1 Agricultural cooperatives as hybrid governance form

To explore the potential role of agricultural cooperatives in rural development and biodiesel policies, we turn to the cooperative literature. Economic organization scholars usually distinguish between markets, hierarchies and hybrids. Markets are forms of economic organization and coordination in which no hierarchy is used and contracts are the typical form through which markets organize inter-firm cooperation. Hierarchies, in contrast, use authority over decisions to coordinate and cooperate

economically. Hybrids are intermediate forms of economic organization. They are market-like in some dimensions and hierarchy-like in others. A wide variety of hybrid arrangements have been identified, including franchise agreements, partnerships, business networks, supply chains and cooperatives (e.g., Bonus, 1986; Makadok and Coff, 2009; Ménard, 2004). Ménard (2004: 348) concludes that ''there is indeed a great diversity of agreements among legally autonomous entities doing business together, mutually adjusting with little help from the price system and sharing or exchanging technologies, capital, products and services, but without a unified ownership. These characteristics are likely the minimum required to encapsulate the variety of hybrids''. Makadok and Coff (2009) offer a further-refined taxonomy of hybrid forms of governance using three dimensions: authority, ownership and incentives. Cooperatives can be viewed as a ''true hybrid'' because ''cooperatives blend market-like attributes with hierarchy-like mechanisms'' (Chaddad, 2012: 447).

Although this literature is very insightful regarding the unique forms of economic organizations between markets and hierarchies, it limits the role of cooperatives to a strong focus on transaction cost minimization as the explanation for their emergence and existence. Sociological studies also interpret cooperatives in terms of movements that organize landless people and peasants to articulate their interests in other economic organizations and government authorities (e.g., Altieri and Toledo, 2011). According to Ingalsbe and Groves (1989) the emergence of agricultural cooperatives should be understood not only by reference to economic conditions and logic but also public policy and governmental interests and logic. Government authorities can have various interests in supporting and advancing agricultural cooperatives because cooperatives can play a role in the pacification of rural (land) conflicts, in integrating peasants into markets to advance rural development and in rolling out government social and economic programs in peripheral areas. In the analysis of cooperative thought and history, little attention has been given to the relationship between cooperatives and government policies for rural development (Torgerson et al., 1998), but such a perspective is key in understanding the emergent role of cooperatives in Brazilian biodiesel policy. Of course, such a policy perspective does not render conventional economic organizational and sociological perspectives irrelevant.

3.2.2 Cooperatives in Brazilian rural development

In Brazil, agricultural cooperatives have always received special government attention. Even before the military dictatorship, the government made instrumental use of cooperatives to encourage frontier development by small farmers, to encourage market production, to further technological development and agricultural extension and to improve economies of scale (Chase, 2003). The more recent government ''use'' of cooperatives in biodiesel policy and rural development is in line with these historical developments.

Brazil is a large, unevenly developed country with different agricultural systems and different cooperative traditions. Academics such as (Bialoskorski, 2003) and cooperatives themselves distinguish among three ideal types of agricultural cooperatives, each with a specific approach towards rural development. ''Traditional cooperatives'' were initiated by (European) immigrants more than 100 years ago and were successfully promoted by the government for frontier rural development; currently, they are the older (more mature) cooperatives generally represented

through membership in the Brazilian Cooperative Organization (OCB)[3]. They are predominantly located in the southern regions of Brazil, have many members and are well organized in providing (access to) credit, technology and services to their members and representing member interests in governments and supply chains.

In the 1990s, a second group of cooperatives emerged representing an ''economics of solidarity'' (Bialoskorski, 2003). These cooperatives are rooted in a history of local labor and trade unions, such as the Movement of Landless People (MST) and the National Workers Federation for Family Agriculture (FETRAF[4]) (Abramovay et al., 2008). These cooperatives are not registered with the Brazilian Cooperative Organization because they do not recognize its authority (Bialoskorski, 2003: 5). Economics of solidarity cooperatives generally seek agricultural reform and more autonomy from and power in dealings with the government and agribusiness. This ''younger generation'' of cooperatives is still building its institutional structure and capacity and can be found in different regions of Brazil, especially in areas without a long-standing cooperative tradition (e.g., the north and northeast).

Finally, ''virtual or elite cooperatives'' do not necessarily possess significant assets or industrial plants and are not always associations of small farmers, but they form a (wealthy) economic network with a particular business strategy in agricultural markets (Bialoskorski Neto, 2001: 153; Chase, 2003). These cooperatives are driven by the globalization of commodity markets and adapt their strategies to international (niche) markets. They seek economies of scale, use advanced technological systems and operate on an exclusive basis (through high membership fees). These cooperatives can be found across the country.

In general, large-scale, highly efficient farmers who produce for worldwide commodity markets compose traditional or elite cooperatives. These farmers are often located in the central west or south of Brazil. Small-scale family farmers from the north and northeast who produce for their own livelihood and/or for local or regional markets are either members of economics of solidarity cooperatives or are not cooperative members at all. Historical factors and unequal landownership entitlements explain this geographic differentiation in types of cooperatives and why the level of organization of farmers in cooperatives has always been very low in the north and northeast (Lehtonen, 2011; e.g., Magalhães and Drouvot, 2009). Compared with those in the south and central west, cooperatives in the north and northeast often have low organizational capacity, social capital and trust (Kilham et al., 2010; Watanabe et al., 2012) and, more than incidentally, have a negative reputation among farmers because of corruption and their (government-related) roles in the political control of farmers (César and Batalha, 2010).

3.3 The National Program of Production and Use of Biodiesel

Brazil has a long history of using biofuels as an alternative to fossil fuels. The production and use of ethanol, to partly replace gasoline, increased strongly from the 1970s. In the 1970s, attempts were also made to introduce biodiesel, but owing to a lack of supply and infrastructure, this did not occur

[3] Organização das Cooperativas Brasileiras (OCB).
[4] Federação Nacional dos Trabalhadores e Trabalhadoras na Agricultura Familiar (FETRAF).

at a national level (Stattman et al., 2013). The 2004 National Program of Production and Use of Biodiesel (PNPB) marks the start of the growing production and use of biodiesel in Brazil.

The PNPB was formed as the result of an inter-ministerial negotiation among 14 different ministries. These negotiations led to the two main objectives of the PNPB: market creation and the social inclusion of family farmers. Market creation was encouraged through the decision that biodiesel should be gradually integrated into the Brazilian energy market through compulsory blending targets (biodiesel to diesel) that increase over time (i.e., B2-2% blend— between 2008 and 2011 and B5-5% blend—in 2012). Social inclusion was promoted through an auction, a social seal and a tax system that gave specific preference to biofuels produced by small holders in the northeast as opposed to large-scale agricultural producers in the central west and south of Brazil. These two policy lines of market creation and social inclusion are closely linked.

3.3.1 Design of PNPB social inclusion policy

The PNPB policy is designed to work as follows. Fuel companies are obligated to increase their blend of biodiesel to diesel on the domestic market. Hence, they have to buy biodiesel at national auctions that are organized by the National Agency for Petroleum, Gas and Biofuels (ANP). This national agency determines the quantity of biodiesel that can enter the Brazilian market, which will slowly increase as blending targets become higher (from B2 to B5 and further). These auctions create the demand for biodiesel and are simultaneously intended to stimulate investment and production in the early stages of the PNPB. Petrobras, the national oil company, buys this biodiesel sold through the auctions in advance and thus establishes a secure market for biodiesel-producing companies (Pousa et al., 2007). The social sustainability of the PNPB is organized through the Social Fuel Seal (SFS). This SFS can only be obtained by biodiesel producers if they purchase a percentage of their raw material from family farmers. The MDA defines who qualifies as family farmers and awards the SFS to biodiesel companies that can prove that they have (sufficient) contracts with family farmers. Only biodiesel producers that hold the SFS are allowed to bring their biodiesel to the auctions. In sum, this means that only biodiesel companies that buy a specified percentage of their raw material from family farmers are able to participate in the ANP auctions and thus bring their product onto the market to be purchased by fuel companies for blending. The required amount of family farmer feedstock that companies must buy varies per region and over time (Table 3.1).

The MDA determines who can register as a family farmer. Registration is possible at the farm or the institutional (e.g., cooperative) level. To qualify as a family farmer, the farmer must ask for DAP individual[5], based on proven land entitlements, the size of the area, the number of residents and the composition of work and income on the farm. Local administrative offices of labor or trade unions ensure the fulfillment of these criteria. A cooperative can ask for DAP Juridica when 70% of the members of the cooperative qualify as family farmers (until March 2010, this was 90%; Watanabe et al., 2012). Biodiesel companies that buy sufficient feedstock from individual family farmers or from cooperatives with DAP Juridica thus receive the SFS.

[5] DAP (Declaração de Aptidão ao PRONAF) is the statement of eligibility for the National Program for the Strengthening of Family Agriculture (PRONAF, 2013).

The necessity to receive the SFS is a key incentive for companies to buy their raw material from family farmers. In practice, this means that biodiesel industries need to develop contracts with family farmers because legal contracts rather than the actual transfer of feedstock into biodiesel production are the basis of qualifying for the SFS. In the early phases of the PNPB, these contracts with family farmers were negotiated with the help of local labor unions and cooperatives. These contracts do not just represent a commitment to buy raw material from the family farmers, but also include the signing of a technical collaboration agreement that requires the biodiesel industry to provide technical assistance and support to these farmers, e.g., providing assistance with logistics, providing new or better seeds, improving farming systems, supporting better infrastructure and sometimes even providing support with access to credit. In addition to the SFS system described above, the taxation system benefits biodiesel companies that buy raw material from family farmers who produce castor oil in the northeast versus companies that buy from large-scale soy producers in the center-west of Brazil.

Table 3.1 Percentage family farmer feedstock necessary for obtaining SFS

Region	*% harvest until 2009*	*% harvest 2009/2010*	*% harvest 2010/2011*
Centre-West and North	10	10	15
Northeast and Semi-arid	50	30	30
South-East and South	30	30	30

Source: Lei n. 11.116, MDA (2012b)

3.3.2 Stagnation and adaptation of social inclusion

The early years of the PNPB (2005–2009) showed rapid growth in biodiesel production, from 736 m^3 (2005) to 1,608,448 m^3 (2009) (ANP, 2012; Souza and Paulillo, 2010: 9). Figure 3.1 demonstrates that the majority of biodiesel production took place in the center-west and south of Brazil, despite policy incentives to increase biodiesel production in the poor north and northeast. Moreover, soy from larger farmers proved to be dominant, whereas castor, palm and other vegetable oils constituted only a marginal portion of biodiesel production (Leite et al., 2013; Wilkinson and Herrera, 2010). Only 37,000 family farmers were reported to be included in the biodiesel value chain in 2008, far below the government target of 200,000 (Wilkinson and Herrera, 2010: 758). These numbers increased to over 100,000 family farmers in 2010, but only 246 of them were located in the less developed northern region (César and Batalha, 2013).

The government related the complications with the implementation of the PNPB and its social sustainability policies to the fact that biodiesel companies had little experience with technical and development assistance projects for family farmers and lacked the agricultural knowledge needed to provide farmer assistance (César and Batalha, 2010; Garcez and Vianna, 2009; Hall et al., 2009). By the same token, family farmers had relatively small plots of land that were only partly available for biodiesel feedstock production. Family farmers also had limited experience with biodiesel crops, technical assistance and seed provision were not always appropriate or provided at the appropriate

time, resulting in low harvests (Kilham et al., 2010). Contracts between family farmers and the biodiesel industry proved difficult to enforce and were often ignored by family farmers because they lacked experience with commercial ventures, preferred to produce other (food) crops, favored local traders over regional biodiesel companies, and/or felt ill-treated by the industry regarding payments and seed delivery (Leite et al., 2013; Magalhães and Drouvot, 2009; Watanabe et al., 2012). Hence, contract compliance was poor and logistical and transaction costs were high.

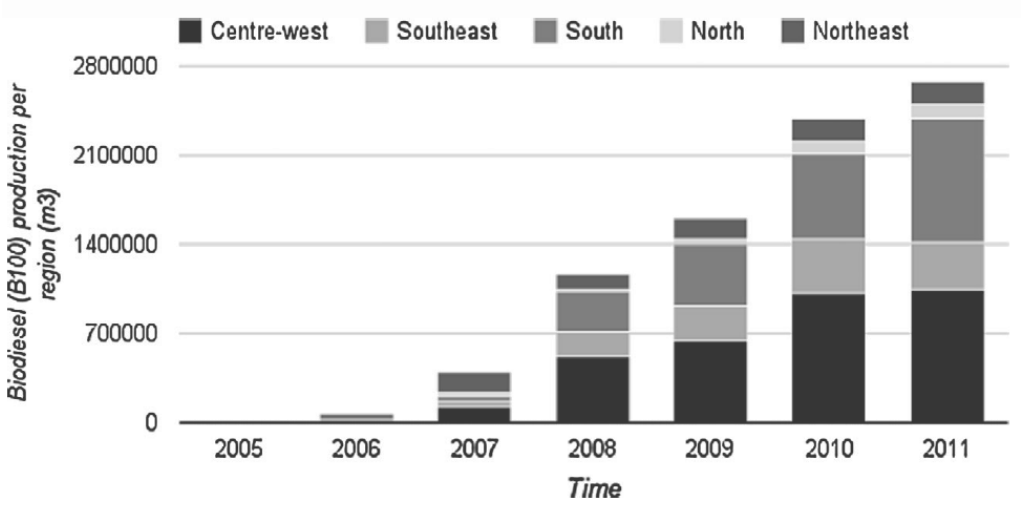


Figure 3.1 Biodiesel production (B100) per region from 2005-2011 (in m3)
Source: developed by authors based on statistics provided by ANP (2012)

These biodiesel policy implementation problems and the poor record of social inclusion prompted a policy adaptation in 2009 consisting of three major changes: (a) the minimum percentage of biodiesel feedstock obtained from small farmers decreased in the northeast and semi-arid regions from 50% to 30% (Watanabe et al., 2012: 4034; see also Table 1); (b) Petrobras (the national oil company) was allowed to establish a special biofuels branch, PBio, responsible for the inclusion of family farmers in the northeast and semi-arid regions, which completely changed the ‘‘buyers’’ market for biodiesel; and (c) the role of agricultural cooperatives changed from passive intermediaries to more active actors through new policy incentives (MDA, 2010). In this paper, we especially focus on the third change, i.e., the new position of agricultural cooperatives, and, to a lesser extent, on the second change.

3.3.3 Cooperatives and the restructuring of the PNPB after 2009

With the revised biodiesel policy of 2009, the Brazilian state actively supported the development of cooperatives as a way to enhance the social inclusion of family farmers in biodiesel feedstock production. The MDA stated that the formation and functioning of cooperatives were essential for the social success of the PNPB and the long-term sustainability of biodiesel production (MDA, 2010:

35). A key change was that biodiesel companies were now allowed to buy their biodiesel feedstock from agricultural cooperatives and would still receive the desired Social Fuel Seal as long as the cooperatives possessed DAP Juridica. To receive DAP Juridica, the cooperatives are required to inform the MDA about their business with family farmers, to play a main role in technical assistance and to become responsible for the biodiesel feedstock operations and transactions. In addition, the MDA actively stimulated cooperatives by supporting different cooperative projects (César and Batalha, 2013; MDA, 2012a) that linked biodiesel policy to other policies that supported family agriculture, such as the National Program for Strengthening Family Agriculture (PRONAF[6]), the Food Acquisition Program (PAA[7]) and the National School Nutrition Program (PNAE[8]). This new government strategy reflected the ambition of the government to create a more integrated approach toward rural development and is in line with earlier experiments from the 1940s through the 1960s, when cooperatives were used as instruments to enhance rural development and to align small (frontier) farmers into wider, state directed development trajectories. The policy intentions stated by the ministry reflect a multidimensional stimulation policy for cooperatives that aims to enable and mobilize their capacity to (MDA, 2010):

- Ensure that the socioeconomic benefits of the PNPB become available for family agriculture.
- Stimulate family farmers into further cooperation via cooperative membership.
- Make the benefits of PRONAF and DAP available to family farmers.
- Provide technical assistance and commercialization of oil crops and co-products produced by family farmers.
- Disseminate technical knowledge on oil crops and co-products among family farmers.
- Exchange experiences about technologies, production and commercialization of biodiesel crops.

Government agencies active in stimulating cooperatives in the northeast also include the national development bank and the main oil company, Petrobras (Magalhães and Drouvot, 2009). Initially, Petrobras was only responsible for providing logistical support and blending of biodiesel and was not, as in the ethanol/sugarcane industry (Stattman et al., 2013), involved in feedstock production. After failures to include sufficient family farmers in the PNPB, the government initiated the creation of Petrobras Biofuels (PBio), a biofuel and vegetable oil company, in 2009. This subsidiary of Petrobras was intended to support, in a not-for-profit manner, the biodiesel development in the north and northeast by improving the social inclusion of family farmers. PBio has the specific tasks of supplying seeds to family farmers, improving technical assistance, buying produced feedstock above market prices, reducing smallholder vulnerability, supporting local cooperatives and social movements in improving the bargaining power of family farmers (Bastos Lima, 2011). PBio now provides(or, more often, organizes the provision of) technical assistance, seeds (castor, soy, sunflower and palm), advice, and—together with regional governments (e.g., that of Bahiastate)—financial and organizational support of cooperatives. PBio claims—and this was supported by our

[6] Programa Nacional de Fortalecimento da Agricultura Familiar – this program offers projects and financial support to family farmers to support them to improve their livelihoods.
[7] Programa de Aquisicao de Alimentos – stimulates buying food products from family farmers.
[8] Programa Nacional de Alimentacao Escolar – School Feeding Law (Law. No. 11.947/2009): 30% of the food for school feeding programs must be purchased from local family farmers.

interviews—that in Bahia alone, it had contracts with over 25,000 farmers through cooperatives or family farmer associations in 2011 (Souza, 2011), indicating that PBio is succeeding at including northeast family farmers in the PNPB.

Figures provided by the MDA indicate that this shift in strategy has indeed increased the number of cooperatives that participate in the PNPB (Figure 3.2) and the number of family farmers involved (Figure 3.3). Both figures display the initial problems with the PNPB, showing a strong decline in 2007 and 2008 and significant increases following the policy revision of 2009. Until 2009, cooperatives in the north and northeast were only marginally involved in the PNPB, but since then, the numbers of involved cooperatives and farmers has rapidly increased. We will use research on cooperatives in Bahia to reveal what is behind this apparent successful engagement of north and northeast family farmers in Brazilian biodiesel policies and what that means for rural development.

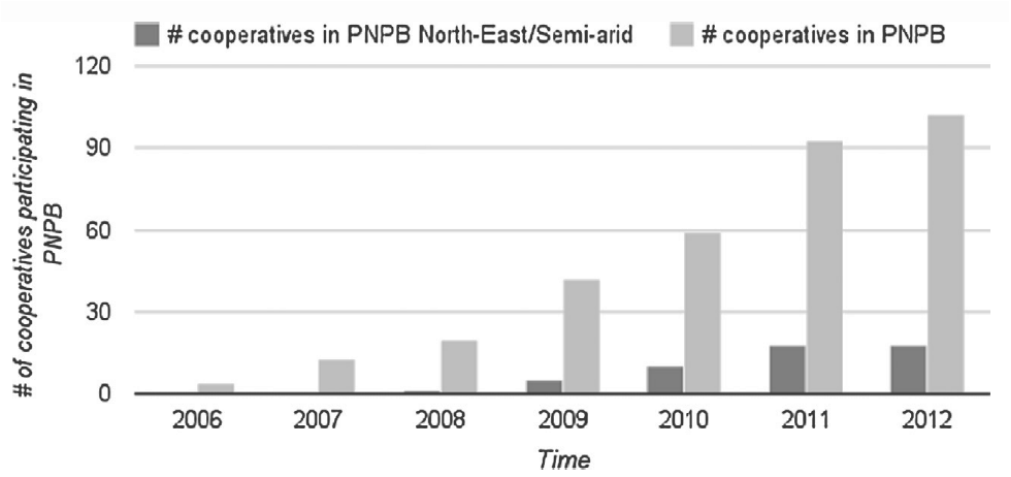


Figure 3.2 Overview of the number of family farmer cooperatives that participate in the PNPB, 2006 - 2012

Source: developed by authors, based on data from MDA (2013b, 2013c, 2013a, 2010)

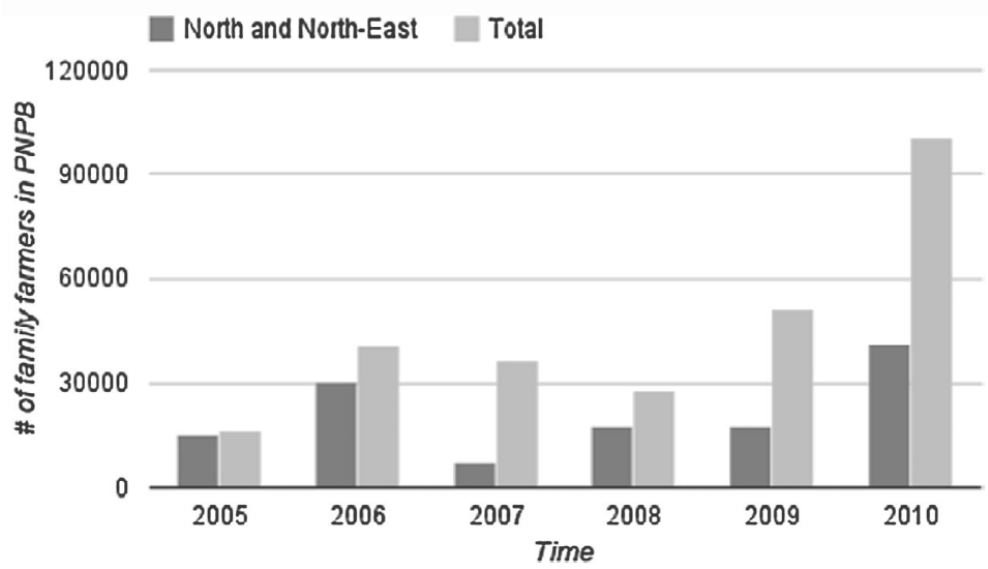


Figure 3.3 Number of family farmers that participated in the PNPB in the North/Northeast and in total, 2005–2010
Source: developed by authors. based on data from MDA (2010)

3.3.4 Research methodology

All agricultural cooperatives participating in the PNPB are registered on a continuously updated list (MDA, 2012c). This registration can be used by biodiesel companies that want to buy feedstock from these cooperatives to obtain the SFS. During our fieldwork in fall 2012, 18 cooperatives in the northeastern states were registered: Alagoas (1), Bahia (14), Piaui (1) and Sergipe (2). This research focuses on the state of Bahia because it has the largest number of participating cooperatives and is one of the largest states in Brazil with a variety of agricultural systems. Bahia has approximately 760,000 farmers who would qualify as family farmers (IBGE, 2006), with a growing number of farmers currently involved in the PNPB through the SFS. Most farmers involved in the PNPB are members of agricultural cooperatives. Bahia can be divided into three different agro-ecological zones that each produce different biodiesel crops: coastal (palm oil), central/ semi-arid (castor) and western (soy) (Figure 3.4).

In total, 8 out of 14 cooperatives in Bahia (that together represented 32,000 family farmer members in 2012; Table 3.2) were selected for our field research, based on regional differentiation across these three agro-ecological zones. Seven of them had DAP Juridica and were on the ministry's list; the eighth is in the process of receiving approval from the ministry for inclusion on the list. The regional spread, climatological differentiation and crop diversity make these cooperatives representative of the 14 Bahia agricultural cooperatives on the ministry's list. Semi-structured interviews (13) were held with the president and/or manager of these eight cooperatives who was responsible for implementing the PNPB and for technical assistance. Triangulation of this information was obtained through informal interviews and participation in meetings with family farmers

(cooperative members) (11), academics (9) and regional and national policy makers (9) and through analyzing policy documents and secondary literature. The interviews with cooperatives took place in fall 2012 but built on various previous visits to Brazil in the period 2007–2010. Cross-checking the interview information with other sources proved to be difficult. The last agricultural census was held in 2006, which means that any changes as a result of the (revision of the) PNPB are not yet available. Another challenge is that the census provides general information about family farmers but not information specific to cooperative members or PNPB participants. No reliable data exist on cooperative members or PNPB participating farmers.

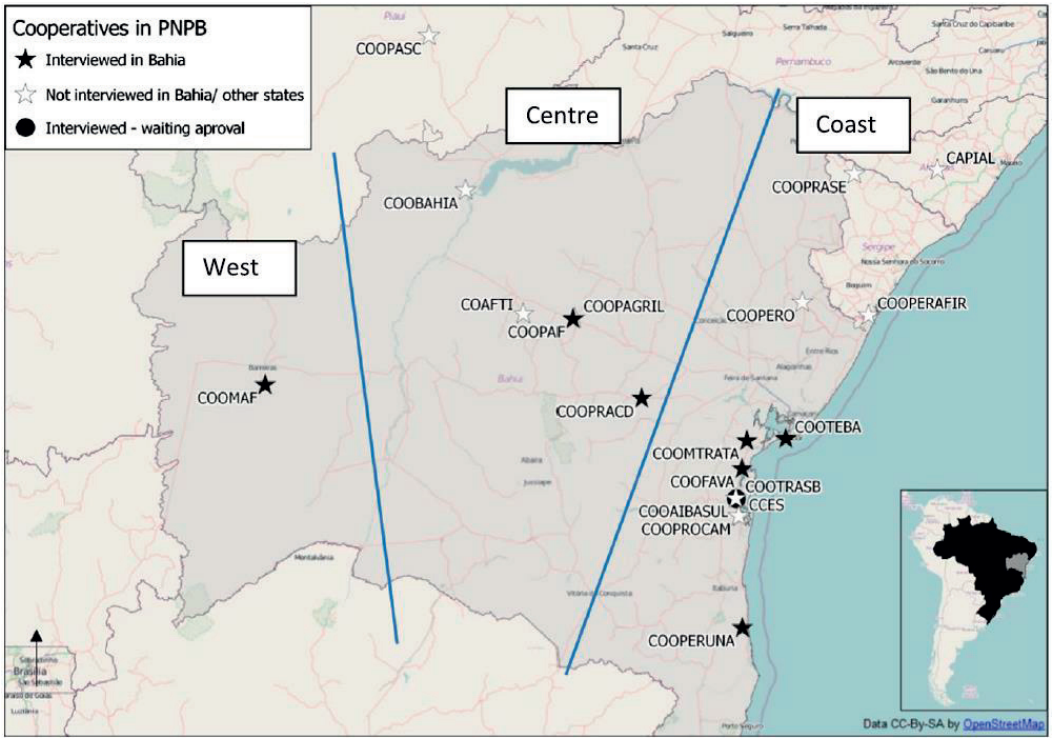


Figure 3.4 Selected cooperatives in the three agro-ecological zones of the State of Bahia
Source: Cartographer B. du Pon, based on data provided by authors.

3.4 Bahian cooperatives participating in the PNPB

This section begins by analyzing the general issues and experiences mentioned by all cooperatives,[9] followed by a discussion of specific developments per agro-ecological zone.

3.4.1 Cooperatives and the PNPB

All eight cooperatives are relatively young (<17 years). Five cooperatives were founded in the late 1990s and the remaining three were founded in the early 2000s (Table 3.2). This shows that all of these cooperatives were founded during the second phase of rural development policies (1998–2005), which also explains why many of them have a background in social movements or rural syndicates. They were often built upon or started by local labor unions or social movements that used existing organizational structures and/or received governmental support through agricultural reform (i.e., redistribution of land for landless farmers), although some were (co-)founded by farmers, banks, or NGOs (Table 3.2). Only COOTEBA was founded by a company (Brazil Ecodiesel) and a bank (Banco do Brasil) at the start of the PNPB, with the sole objective of delivering biodiesel feedstock. According to the classification system presented above, all cooperatives can be regarded as representing the ''economics of solidarity''. Two show some traits of ''elite cooperatives'' (COOTRASB and COOMAF)[10] because they have limited and more exclusive membership conditions and a strategic focus on specific niche markets for their agricultural products. Nevertheless, both presented plans to gradually open up membership to larger numbers of family farmers, which represents a strategic move to maintain the DAP Juridica certificate. All eight cooperatives have seen membership numbers increase rapidly in recent years and most are still in the process of developing their institutional structures. They started small, with 20–50 farmers (COOPAF is an exception, having started with > 500 members), but have grown rapidly, with between 50 and 500 new members/year. This also illustrates the rather recent cooperative tradition in Bahia compared with other regions in Brazil, where cooperatives can have histories of over 100 years. According to our interviews, membership increase was attributable to the cooperatives' more active approach toward family farmers, offering technical assistance and trainings, as well as their successes in obtaining higher prices for certain agricultural products in recent years. Most of the cooperatives try to keep their membership fees low to attract farmers to join. Membership is generally paid in cash or by a combination of cash and goods. To put our sample in perspective, the 32,328 members of the eight studied cooperatives in 2012 compose less than 5% of the total number of family farmers in Bahia (761,528 in 2006, IBGE, 2006). These data, however, do provide evidence of major growth in cooperative membership in Bahia from the approximately 830 members in the late 1990s.

Cooperatives and their members mentioned a number of reasons why they were not attracted to the PNPB before 2009: internal debates/conflicts over fuel versus food production, little trust of biodiesel industries, the absence of a formalized position for cooperatives within the PNPB and the

[9] All data in this section are based on interviews with cooperatives, family farmer members and other stakeholders unless indicated otherwise. Because several interviewees demanded anonymity (especially with regard to criticism of PBio and the government), clear references to particular cooperatives could not always be made.

[10] It is interesting that these same two cooperatives are currently (late 2013) having trouble obtaining and maintaining the SFS.

inaccessibility of the SFS for cooperatives. The latter made them irrelevant partners for industry. Their strong relationships with and embeddedness in social movements may explain the strong internal food-versus-fuel debates and the strong reluctance to collaborate with the biodiesel industry to produce agro-fuels. After 2009, this changed because of new market opportunities for family farmers, the benefits of additional technical assistance and seeds and the opportunity to strengthen their power (interview with COOMAF). The creation of PBio, with the federal government's clear aim to develop biodiesel programs in the northeast, further stimulated this process. This policy change also opened up the market for cooperatives with a more ''elitist'' background (e.g., COOTRASB and COOMAF) because they would not have qualified for the SFS before 2009 and therefore would not have been useful partners for the industry. Cooperatives are gradually harmonizing their strategies vis-à-vis PBio and learning from each other on the PNPB. Cooperatives show similar developments with regard to biodiesel dynamics and they are increasingly interlinked and collaborating with each other through horizontal coordination. They view the PNPB—especially since its 2009 revision—as an additional opportunity to empower their institutional structures and to provide more and better technical assistance, support and services to their family farmer members.

This change also brought the further dependence of cooperatives on the current system. The (financial) support for technical assistance embedded in the SFS and the biodiesel supply contracts are crucial for the growth and professionalization of cooperatives. Without these ''rights'', participation in the PNPB would be much less attractive for cooperatives. Hence, a main concern of cooperatives is the future stability of the program and its institutional changes, especially their dependence on PBio as the sole buyer of their raw materials. Cooperatives feel vulnerable to policy adaptations, for instance, when PBio might be released from its obligation to buy from them. This dependence of cooperatives on the current policy structure becomes evident when noticing that most cooperatives only started participating in the PNPB after the 2009 policy revisions.

Table 3.2 Case study cooperatives in the PNPB, Bahia

Cooperative name	Region	Type cooperative	Classification	Foundation (# members start) (# members 2012)	Founders	Type of farmers	Principal biodiesel crop	Involved with PNPB since	Contract PBio	DAP Juridica	Technical assistance	Other policy programs
COOFAVA	Coast	Agricultural cooperative	Economics of Solidarity	1997-2001, restart 2007 (40) (800)	Banco do Brazil, agricultural producers	Family farmers	Palm	2008	2008	Yes	Yes	-
COOMAF	West	Agricultural cooperative	Economics of Solidarity (traits of Elite Cooperatives)	2003 (40) (600)	Rural syndicates, local farmers	Family farmers	Soy	2009	2009	Yes	Yes	PNAE, PAA
COOMTRATA	Coast	Work cooperative, 2007 buying/selling cooperative	Economics of Solidarity	2000 /2007 (28) (228)	28 families	90% Family farmers, 10% small producers	Palm	2007		Yes	Yes	PNAE
COOPAF	Centre	Agricultural cooperative	Economics of Solidarity	2006 (550) (8000)	Brazil Ecodiesel, rural syndicates, MDA	Family farmers	Castor	2004	5yr contract	Yes	Yes	-
COOPERACD	Centre	Agricultural cooperative	Economics of Solidarity	1997 (50) (1200)	Movimento Sem Terra	Sentados + Family farmers	Castor	2004	2007	Yes	Yes	PNAE, PAA
COOPERUNA	Coast	Agricultural cooperative	Economics of Solidarity	1999 (50) (6000)	Rural syndicates, Bank of Northeast, NGO	70 % qualify as family farmers	Castor (experiments with sunflower)	2008	5yr contract	Yes	Yes	PNAE, PAA
COOTEBA	Centre/ Coast	Agricultural cooperative	Economics of Solidarity	1996 (50) (7000)	Movimento de Luta pela Terra (Social movement)	Family farmers	Castor	2004/5 Brazil Ecodiesel	2009	Yes	Yes	PNAE, PAA
COOTRASB (waiting for MDA approval)	Coast	Labour cooperative	Economics of Solidarity (traits of Elite Cooperatives)	1997 (21) (8500)	21 farmers	Family farmers, agricultural producers	Castor (sunflower, soy)	2009	2012	No	Yes	-

Source: based on interview data, see also Appendix I & III

3.4.2 Cooperatives by agro-ecological zone

The PNPB aims at promoting specific crops (palm, castor, and sunflower) produced by family farmers that often relate to different agro-ecological conditions in specific agricultural systems. In the western agricultural zone of Bahia, the cooperative COOMAF has soybeans as its main vegetable oil crop for biodiesel production (Figure 3.4). Because oil from soybeans is dominating biodiesel production in Brazil (more than 90%) and is mainly produced by large-scale agro-industry farmers in the center-west (ANP, 2012; MDA, 2013a), this poses challenges for COOMAF. A comparative advantage exists because COOMAF soybeans are produced only by family farmers. The cooperative considers the PNPB a welcome additional and secure source of income, mainly because of the fixed, long-term contracts with PBio. This means that farmers run less risk regarding seed investments and during the growing season. COOMAF also encourages its members to participate in other government programs such as the National School Nutrition Program and the Food Acquisition Program. Family farmers have been convinced to join because of the benefits of membership, including the agricultural and non-agricultural services provided to them such as assistance meeting irrigation challenges and assistance with crops adapted to the agro-ecological conditions of that region. For instance, a local seed bank was developed to improve productivity. These initiatives and technical assistance to members are made possible through financial support from the PNPB contracts, according to COOMAF. However, for COOMAF, it remains quite challenging to convince family farmers to join the cooperative. Family farmers live in very remote areas and do not always understand the cooperative system. Distance makes it complicated for COOMAF to provide sufficient agricultural assistance to all (potential) members.

In the center of Bahia, castor is the main biodiesel crop; castor is a crop rich in oil (up to 45%) that produces high-quality biodiesel. In this region, castor beans have always been planted by farmers. The crop is considered very suitable for family farming because production requires a large amount of (hand) labor. Castor oil once had a quite low market value, but market prices are increasing rapidly. This poses new challenges in the context of the PNPB because the oil is currently rather expensive for biodiesel production. However, from a rural development perspective, this price increase enables farmers to earn more from their produce. Cooperatives have further contributed to this phenomenon by successfully excluding local intermediaries and motivating farmers to sell their produce directly to the cooperative (see also Schaffel et al., 2012). This change has not only reduced costs, but also given cooperatives more power to negotiate better prices for their members. Although selling castor for biodiesel production is no longer the most attractive market, at this moment, contracts with PBio still give cooperatives and family farmers highly valued security in the form of a guaranteed market with pre-negotiated prices. Climatologic conditions (shortness of rain) may (and did) lead to failed harvests and lower production, making it impossible for cooperatives to meet the required quantities as agreed in their contracts with PBio and causing financial difficulties. Nevertheless, both COOPERACD and COOPAF indicated that the SFS created a buffer between their members and PBio, allowing them to (re)negotiate with PBio on behalf of their members. The sharp increase in membership in both cooperatives after 2009 shows their success in this endeavor.

Another key benefit from the PNPB is technical assistance, which PBio must deliver to the farmers and for which it uses the cooperatives. COOPERACD and COOPAF argue that many members face challenges because of their remote locations and poor infrastructure. The technical assistance

program helps cooperatives to reach these farmers and to increase their agricultural productivity (see also Schaffel et al., 2012). Both cooperatives argued that medium-sized family farmers are most successful in benefiting from their technical assistance and adapting farming practices because they have the capacity and education to adopt new knowledge and change production practices. The smallest farmers in remote areas—the original targets of social inclusion—profit less from PNPB-induced technical assistance because they are primarily subsistence farmers with less ability and/or willingness to make these types of structural changes (see also Watanabe et al., 2012). Cooperatives find it difficult to convince these farmers to join technical assistance programs through membership but also indicate that they themselves fall short in efforts to approach them. This may be owing to the fact that these farmers choose not to join the PNPB (for a variety of different reasons) or that they are not interested in cooperative membership in general. Further survey research on small family farmers is needed on this subject.

In the coastal region of Bahia, biodiesel comes from palm trees. Palm tree planting has a long tradition in the region, with different varieties and productivity levels, but has primarily been used as a local cooking oil. Local cartels kept palm oil prices quite low for a long time, but cooperatives have been able to break these cartels, resulting in a rapid increase in prices offered to farmers, according to COOTRASB. Although cooperatives do have contracts with PBio, no palm oil for biodiesel production has been delivered yet; projects are still in an initial phase. PBio has provided cooperatives and their farmers with new high-productivity palm tree varieties, but these palm trees take 4–5 years to become productive and the new trees have not yet been harvested. This is also the largest challenge for palm farmers because they have to reserve land for new trees but receive no additional income for years. COOFAVA uses technical assistance to temporarily promote inter-cropping with, e.g., bananas. Cooperatives, often with local government assistance, also improve traditional pressing methods (and increase harvests) by establishing small pressing factories to create a product with a higher value, a strategy frequently adopted by cooperatives (see also Wilkinson and Herrera, 2010: 759). International market prices for palm oil are higher than the local prices offered by PBio because it only pays prices comparable with those for soy oil, whereas palm oil has a higher value. However, COOTRASB accepts prices that are lower than international market prices because they are part of a package that includes (technical) assistance for pressing facilities, agricultural equipment and credit access. Additionally, other cooperatives prefer to continue selling (part of) the harvest to PBio because of the income security for family farmers. Participation in the PNPB helps them to improve their organizational capacities and to receive financial compensation for their agricultural extension services.

3.5 Social inclusion

3.5.1 Cooperative inclusion in the PNPB

Regardless of the diversity of family farmer cooperatives in the three regions,[11] the cooperatives as a whole appreciate the PNPB because it offers concrete support and resources for family farmers such as obligatory technical assistance, the provision of seeds, infrastructure improvements and partial income security. The PNPB is preferred over other large government family farmer support

[11] See footnote 7.

programs, such as the PNAE and the PAA, because it is the only program that offers financial resources through contracts with the biodiesel industry/PBio. To participate in both PNPB/SFS and other governmental family farmer support programs, either DAP individual (farmers) or DAP Juridica (cooperatives) is needed. Although the difficulty in obtaining DAP is sometimes mentioned as an important reason why family farmers do not want to participate in the PNPB (Kilham et al., 2010; e.g., Watanabe et al., 2012), none of the eight cooperatives and none of the interviewed family farmers recognized this as a problem. Obtaining DAP Juridica proved possible, but the need to review DAP Juridica every 1–3 years is perceived as a significant administrative burden by some cooperatives. Individual family farmers indicated that DAP individual can be easily obtained through local rural syndicate offices.

At the start of the PNPB, social movements related to agriculture—and many economics of solidarity cooperatives that originated from these movements—were quite critical of the biodiesel policy. In spite of the SFS, they considered the PNPB to be part of the agribusiness paradigm with major advantages for large-scale agriculture. In addition, they had principal objections against using arable land for fuel instead of food production (e.g., Fernandes et al., 2010). This view dominated the public debate in Bahia in the early years of the PNPB. Cooperatives proved unable and unwilling to convince and organize family farmers around biodiesel feedstock production, in part because the biodiesel policy did not specify the tasks and responsibilities of cooperatives and cooperatives could not function as legal entities in SFS contracts; they were only able to carry out extension services and coordinate the buying of seeds, fertilizers and agricultural equipment. The 2009 policy change enhanced the position and power of cooperatives in biodiesel policy implementation, resulting in greater membership and improved organizational capacity and professionalization. The PNPB also motivated cooperatives to establish better organizational and collaborative structures to develop a common negotiation strategy with Petrobras. These interactions and joint operations have also increased mutual learning among cooperatives. They are becoming more than just providers of feedstock for the biodiesel industry and providers of technical assistance and services to members. They are professionalizing their buying and selling positions in the market, building storage facilities to have better negotiation positions on the market, constructing and running small factories/presses that help them (and their members) to add value to agricultural products and expanding their services to a broader variety of farm products by including more crops or livestock. This process of growth and institutionalization is paralleled by a stronger market orientation, larger organizations with their own interests, greater financial risks and vulnerability and a growing (financial) dependence of cooperatives on government programs, to the extent that this dependence may undermine long-term stability. Hence, the character of these economics of solidarity cooperatives is beginning to change. Some cooperatives felt that they had to ensure that farmers did not perceive them as extensions of a government agency but continued to see them as organizations that represented the interests of their members.

The challenges cooperatives face in relation to the PNPB are political and financial in nature. The uncertain future of the program and the significant dependence on the SFS pose major challenges. Cooperatives indicated that the sole reason that PBio or any other biodiesel company buys raw material from cooperatives is to obtain SFS. Several cooperatives mentioned concerns that PBio only uses soy for biodiesel production and re-sells the other vegetable oils (castor and palm) with a profit to other industries (a development also noted by César and Batalha, 2013: 4033; Wilkinson

and Herrera, 2010: 759). Family farmers are then hardly relevant as raw material producers for biodiesel production but rather are only an entry ticket into the biodiesel market auctions. As soon as the political system changes this SFS/auction entrance requirement, the preferential family farmer position in biofuel feedstock provisioning could be severely undermined.

In addition, most cooperatives are facing financial woes because their low membership fees barely cover organizational costs. By the same token, they are hesitant to increase fees because that could discourage family farmers from becoming members. Although cooperatives are hesitant to impede access for family farmers, recently at least two cooperatives substantially increased their fees, and others are considering doing so. This is necessary to cover increasing financial costs to run and professionalize their cooperatives and to cope with existing internal financial problems. In addition, cooperatives function as a financial buffer between family farmers and PBio. Because the 2009 PNPB reform cooperatives sign market contracts with PBio and receive financial compensation from PBio for, e.g., extension services, in return, they guarantee a certain harvest output. When the harvest fails and cooperatives cannot satisfy contract requirements, they are placed in a difficult (financial) position, but then PBio also provides (or pays cooperatives or other institutions to provide) technical assistance because of the policy requirement to buy feedstock from (or, better, to have contracts with) family farmers. Nonetheless, cooperatives have argued that to maintain or even expand this system of family farmer social inclusion, more investments (beyond the scope of the PNPB) are needed to improve infrastructure, storage facilities, technical advice and value-adding steps. All cooperatives complained about the lack of support for these additional investments and their inability to obtain bank credit, which hampered them in becoming more professional and better in serving (and expanding) their member bases.

3.5.2 PNPB inclusion, rural development, social sustainability

The PNPB sees family farmer participation in the biodiesel chain as an indicator or even an objective for improving social inclusion and, as a result, the social sustainability of biodiesel production. This is clearly formulated as one of the main objectives of the biodiesel policy and it resulted in high expectations among academics, companies and farmer representatives in the early years of PNPB implementation. The failure to involve family farmers in the PNPB and, thus, to ''socially include'' them in rural development led to disappointment and disregard for the entire PNPB policy (see, for a discussion, César and Batalha, 2010; Wilkinson and Herrera, 2010). Did the 2009 policy change force them to conclude differently?

The 2009 change in PNPB policy did alter the participation of family farmers in PNPB, mostly through cooperatives. The further institutionalization of the cooperatives may be considered an unintended, but very relevant, side effect of the PNPB policy. Three questions remain: which family farmers participate in and hence profit from PNPB (mainly through cooperatives); does that participation result in their social inclusion and improved rural development (as was the objective of PNPB); and does PNPB participation also entail family farmer inclusion in the biofuel chain?

The increased number of family farmers who have signed contracts with PBio (as individuals or as cooperative members) has clearly increased since 2009. However, not all family farmers profit equally from this change. In interviews, cooperatives and state officials clearly indicated that few smaller, subsistence farmers are members of the expanding cooperatives and few have signed contracts with PBio. As such, this category does not seem to have profited from the PNPB policy

change. It is difficult for cooperatives to stimulate membership among these farmers, and therefore, they are also excluded from the technical assistance, services and support provided through the PNPB and related programs. These farmers are often located in remote geographic areas with limited infrastructure. They generally have low levels of education and few resources and are reluctant to change their current farming practices according to the advice of cooperative staff or government officials. This differentiation between subsistence farmers and family farmers who are better off supports the conclusions of Rathmann et al. (2012) and Kilham et al. (2010) on the degree to which PNPB has reached its targets of social inclusion: it has not done so for all farmers. The inclusion policy of PNPB has achieved better results for family farmers who were already included in some form of commercializing their produce. However, did this result in the social inclusion of these family farmers in rural development?

The PNPB offered these family farmers an additional, secure market outlet and increased access to assistance and services. Cooperatives have been instrumental in reaching out to these family farmers, channeling technical advice, seeds, infrastructure and credit facilities to member farmers. Through our interviews with cooperative leaders and staff, (a limited number of) individual family farmer members, state officials and PBio staff and from the (scarce) literature on PNPB policy in Bahia, it is clear that cooperative family farmer members indeed profit from these secure market outlets and especially from the PNPB technical and service support programs. As such, the inclusion of family farmers in the PNPB does seem to advance their social inclusion in Bahian rural (or, perhaps, economic) development. Through family farmer participation in the PNPB, incomes did increase (César and Batalha, 2013). Cooperatives all argue that this relative success can be attributed to the PNPB policy changes, which slowly moved the program from general national policies that hardly worked (2004–2009) to more locally adapted implementation measures that stimulated agricultural modernization and innovation and thus the social inclusion of family farmers in economic development. Cooperatives have been instrumental in translating general national PNPB policy objectives into local, specific implementation trajectories for family farmers. However, the changing social and economic landscape of vegetable-oil-producing family farmers in Bahia should not be only ‘‘credited’’ to the biodiesel policy. The ‘‘cooperative effect’’ of the PNPB falls under wider efforts and opportunities to strengthen cooperatives through government programs such as the PNAE and the PAA. These programs offered opportunities for cooperatives to address and gain access to a variety of new markets and hence to become more attractive to family farmers. Although the PNPB’s social inclusion policy is primarily of an economic nature (and focuses very little on other dimensions of rural development), some cooperatives argue that membership provides family farmers access to other (social) services provided through cooperatives, partly from governmental programs. We did not further investigate that claim.

Our final question relates to biofuels. With the revised PNPB, family farmers have become more involved in the biodiesel economy, but it is not particularly evident that this means that they have become part and parcel of the biodiesel production chain. The SFS obligation has resulted in an increased number of contracts between PBio and (individual or collective) family famers and has thus provided the latter with significant technical assistance and support to improve their farming practices, productivity and incomes (as reported from interviews with cooperatives, family farmers and state officials). However, their material output (vegetable oil crops) is not always directed to biodiesel production. Significant parts of family farmer vegetable oil crops are ultimately used in other products, often because of higher market value for alternative oil crop applications (see also

César and Batalha, 2013: 8-9) and because farmers have long-standing social relationships with other buyers. Our interviews provided indications that sometimes PBio rerouted family farmer produced oil to products other than biodiesel and sometimes family farmers and cooperatives preferred to sell their oil harvest to other market channels for better profits. Hence, although a significant number of family farmers in Bahia do profit from the biodiesel policy of social sustainability through social inclusion in economic development, this not does necessarily take place through inclusion in the biodiesel production chain. Hence, cooperatives have been a major institutional force in improving the inclusion of a specific (but not necessarily small) category of family farmers in rural development through biodiesel policy. The PNPB policy revision has structurally changed the landscape of vegetable-oil-producing family farmers in Bahia in terms of economic development and in terms of the position of cooperatives. Much of how this develops is, in the eyes of the cooperatives, dependent on the continuation of financial support that is currently available through the PNPB. It remains to be determined if, how and to what extent cooperatives can become less dependent on the PNPB's SFS policy and can rely more strongly on membership fees and market sources in organizing and modernizing family farming in Bahia.

3.6 Conclusion

The inclusion and operationalization of social sustainability in biodiesel policy in Brazil is unique, but it has lessons that are applicable beyond Brazil. Other countries are also looking for ways to combine sustainability concerns with biofuel policies; however, often the environmental component prevails over social concerns. Brazilian biodiesel shows the opposite with the prevailing idea that biodiesel production should not come at the expense of small family farmers and that their ''social inclusion'' could best be enhanced through their active participation in the biodiesel production chain. This PNPB social sustainability policy came with new governance instruments and arrangements in which agricultural cooperatives were given—and assumed—a central role. Thus far, this social biodiesel policy has resulted in more biodiesel company contracts with family farmers who produce vegetable oils (often through cooperatives) but not necessarily in an equal increase in channeling oil crops toward biodiesel refineries. Significant parts of family farmer vegetable oil crops are ultimately used in other products, often because of the higher market value for alternative oil crop applications and because farmers have long-standing social relationships with other buyers. This makes the claim that active participation in biodiesel production leads to increased social inclusion and thus ''social sustainability'' for biofuels problematic.

In recent years the increasing level of participation of family farmers and cooperatives in the PNPB is not driven by their desire to produce biodiesel feedstock and one can question how much additional family farmer biodiesel feedstock has entered the biodiesel value chain due to the PNPB. Rather participation is driven by the PNPB requirements for fixed contracts, SFS and agricultural assistance, which make participation in the program attractive for these groups of farmers. The social inclusion of the PNPB should therefore be viewed in the broader context of agrarian development. The increased economic—and derived social—development of family farmers was not caused by their inclusion in the biodiesel product chain but rather because family farmers became better organized in (stronger) cooperatives, and these cooperatives were able to profit from their powerful position in the SFS/auctioning arrangement in providing and/or coordinating technical assistance, services and support for their members. Hence, the PNPB—

along with other governmental programs—has improved the organizational and supportive capacities, membership and power of cooperatives in Bahia.

The rural development of farmers in Bahia, and the growth and importance of cooperatives is thus (partly) dependent on the current biodiesel policy arrangements. An assessment of this rural development model through biodiesel policy reveals several serious limitations and drawbacks, both in its current setting and in its future outlooks. First, marginal subsistence farmers have been sidelined in this rural development model because they are neither members of cooperatives nor profit from the social inclusion policies of the PNPB. In that sense, social inclusion works for only a portion of small family farmers, because social inclusion is in essence a market model, but subsistence farmers are only marginally included in the market. Second, the current preferential PNPB policies for cooperatives may hamper the development and innovation of cooperatives to become more independent from governmental support, alignment and protection. These policies may impede their development into more independent ''market-oriented'' organizations focused on interest representation, through their members and by their members. Their current, rather ''comfortable'' position may prevent cooperatives from exploiting their full potential to reach other ''markets'' and aim for a wider, more diverse strategy for the rural development of their members. Third, the cooperatives' dependence on the PNPB and related policies is quite consequential when changes occur, as concluded by Wilkinson and Herrera (2010: 759) and Garces and Vianna (2009: 650). A lowering of the required percentage of raw material that must come from family farmers (for instance, following rapidly increasing blending targets, or less preference for the north and the northeast) would decrease the power of cooperatives and family farmers vis-à-vis the biodiesel industry. A change in the approach or policy of the dominant biodiesel chain actor, PBio, could undermine the entire system, but increased competition by adding new buyers could strengthen the negotiating power of cooperatives. Most dramatically, abandoning the SFS would also endanger the current emerging role of cooperatives and the economic development of family farmers. In that sense, this rural development model is strongly dependent on PNPB policy and is not yet a ''stand-alone'' general model that can be disseminated widely throughout the rural north and northeast.

Including cooperatives in government family farmer policies has a strong tradition in the south but has been rare in the northeast of Brazil. The government has never managed to promote cooperative development and farmers never organized themselves massively into cooperatives in this region. With the social biodiesel policy, the government found an (indirect) strategy to advance cooperatives in the north and northeast by significantly enhancing the organizational and institutional capacity and power of economics of solidarity cooperatives. Instead of fighting against the capitalist agro-industrial paradigm as part of social movements, such as the MST, they have become more mainstream cooperatives that seize the opportunities of large-scale national policies to strengthen organizational capacity and membership and to advance a market-oriented rural development model. As a result, cooperatives have, to some degree, also contributed to the ''pacification'' of agricultural movements and syndicates and diminished rural biofuel protests along food-versus-fuel lines in Bahia. These ''cooperative policy outcomes'' allow for the expectation that the social policy on biodiesel will continue for some time. Cooperatives can and do play a very important role in creating and linking horizontal (between farmers) and vertical (between farmers and state/ business organizations) networks, pacifying rural conflicts and advancing rural development.

What does this all mean for social sustainability in the context of global bioenergy debates? What becomes directly evident from this study is that social sustainability of biofuels is important, but much more complicated than often thought and hence time and again poorly understood. Initiatives for sustainability certification often come with additional administrative costs and incomprehensible accounting systems that in practice create major barriers for family farmers rather than stimulating their participation. Cooperatives can become suitable intermediaries to facilitate family farmer inclusion in sustainable production, as they have done in other commodities (e.g., coffee). Yet, it remains questionable whether biofuel production is a suitable development trajectory for family farmers in the first place. The underlying question in the biofuel debate is whether participation in these global commodities that aim for large quantities at low prices is a good strategy for family farmers to begin with. For small farmers it might make more sense to focus on markets with higher added value and appreciation for their specific product(ion) (e.g., the production of specialty products for the cosmetic industry, fair trade products). The social sustainability of biodiesel in Brazil has little to do with biodiesel production and products, nor with food versus fuel, but more with the choices these farmers and cooperatives make to secure (future) income and to benefit from governmental policies. The economic incentives offered by the PNPB lead to rural development, but not through biodiesel production.

4 Negotiating Authority in Global Biofuel Governance: Brazil and the EU in the WTO[12]

Abstract

The global demand for biofuels (liquid or gas fuels deriving from biomass) has grown dramatically in recent years. European Union policies that promote biofuels as more sustainable sources of transport fuel are partly driving this development. In this article, we analyze how Brazil, as a key producer of biofuels, navigates an emerging global governance context for sustainable biofuels. We do so by examining how Brazil responds to EU biofuel sustainability imperatives, including by evoking World Trade Organization disciplines in questioning their transnational validity and reach. While Brazil emphasizes the social and developmental objectives of its biofuel policies in a domestic context, it frames itself globally as a leading producer of sustainable biofuels. In so doing, it navigates intersecting spheres of authority in a manner that promotes its own biofuel policy agenda, partly by seeking to reframe "sustainability" debates internationally to reflect its developmental agenda.

[12] This chapter has been published as: Stattman, Sarah L., and Aarti Gupta. 2015. "Negotiating Authority in Global Biofuel Governance: Brazil and the EU in the WTO." Global Environmental Politics 15 (1). The MIT Press: 41–59. doi:10.1162/GLEP_a_00271.

4.1 Introduction

Globalization is changing the nature and practices of global governance, including those relating to governance of large-scale environmental change. A complex array of actors and institutions now frames and seeks to manage environmental problems in diverse ways, resulting in intersecting spheres of public and private authority that shape governance outcomes. We interpret authority here as the capacity to define the content of rules and norms that shape social, economic, and political processes (loosely based on Knill and Lehmkuhl, 2002: 43). Our interest is in how the state, still a dominant actor in global environmental governance, navigates shifting spheres of governance authority in promoting its own policy agenda. In assessing such a role for the state, we focus here on global biofuels governance and the Brazilian state.

Biofuels are liquid or gas fuels derived from biomass sources such as starch, sugars, fat, wood, or waste. Although classifying categories of biofuels is subject to debate, so-called first-generation biofuels are associated mainly with (1) sugar or starch from food sources such as sugarcane or corn that is converted to bioethanol, and (2) vegetable oils (soy, rapeseed, palm) or animal fats that are converted to biodiesel. Second-generation biofuels are derived from ligno-cellulosic (woody) sources, while third-generation biofuels are produced from algae (Johnson et al., 2012).

This paper focuses on first-generation biofuels because they are produced on a large scale as transport fuel, and are now under intense scrutiny with regard to sustainability and potential competition with food security (Dam et al., 2010; FAO, 2009; Johnson et al., 2012). The environmentally friendly characterization applied to such biofuels in the early years of their development now faces sustained critiques because of an array of assumed negative effects arising from their production and use. These include increased deforestation and land clearing, accusations of land-grabbing, expansion of agricultural areas at the cost of nature conservation, and undermining of food security by diverting crops for fuel rather than food (FAO, 2009; Wilkinson and Herrera, 2010). The European Union (EU), one of the largest markets for biofuels, has reacted to such concerns by attempting to promote global trade in “sustainable” biofuels (Dam et al., 2010). What constitutes sustainable remains heavily contested, partly because different understandings have varying implications for access to a growing global market for biofuels.

As a leading producer and strong proponent of a global biofuels market, Brazil has to engage with the EU sustainability imperatives that now dominate global biofuel trade and governance debates (Garcez and Vianna, 2009; Goldemberg et al., 2008; Mol, 2010). Brazil is one of the few countries with long-established domestic biofuel policies and programs. While it is often seen as able to dictate biofuel developments within its borders, Brazil’s authority to continue to do so, given a rapidly evolving global biofuel trade and governance context, remains a timely question to examine.

Much scholarly attention in recent years has focused on rapidly evolving private sources of multilevel biofuel governance authority, including the proliferation of private sustainability roundtables and other voluntary standard setting initiatives (Leopold, 2010; Mol, 2010, 2007; Ponte, 2014; Schleifer, 2013). We explore, instead, how the Brazilian state interacts with two dominant sources of state-led, public authority to shape the trajectories of global biofuel trade and governance: the EU and the World Trade Organization (WTO). The EU shapes an emerging market in sustainable biofuels through

its renewable energy and fuel quality directives. The WTO is the dominant source of global rulemaking on the international commodity trade, and thus is a key arena for complex debates about trade in sustainable biofuels (and associated biomass).

We first discuss the shifting spheres of authority within which states now operate in a changing global environmental governance context. We then turn to a brief overview of domestic biofuel policies and priorities in Brazil. Next we analyze the evolution of the EU's biofuel policies over the last decade, and how Brazil and the EU use the WTO to negotiate global biofuel trade and sustainability imperatives. We argue that Brazil strategically frames its biofuel policies and practices to link sustainability imperatives to its core developmental agenda, as a way to navigate (and contest) ongoing EU efforts to "rescale" governance authority via the vehicle of sustainability.

We base our analysis on primary and secondary literature, as well as on interviews with representatives of governments, international organizations, civil society, producer organizations, and private certification initiatives in Brazil, the Netherlands, Geneva (for the WTO), and Brussels (for the EU). We also draw on one author's participant observation of expert meetings on biofuel policies in the EU and Brazil from 2007 through 2012.

4.2 Globalization, the State, and Proliferating Spheres of Authority

Globalization and its processes have resulted in diverse actors becoming involved in governing global environmental change (Andonova and Mitchell, 2010). In light of this, scholarly attention has focused on the role of the state and, particularly, an assumed decline in the authority of the state to govern global environmental change. Some, like Rosenau, allege that states are losing ground to other actors, such as networks of corporations, nongovernmental organizations, or advocacy groups, and that governance authority now resides in (potentially competing) spheres of authority rather than in hierarchically organized arrangements consisting largely of states (Rosenau, 2007). The notion of a "sphere" captures the multiple public/private and formal/ informal loci of authority that underpin current global environmental governance, signifying for some a "deterritorialization of authority" (Rosenau, 2007: 91).

While such perspectives assume that the state is losing authority to nonstate actors or becoming "disoriented" (Arts et al., 2009) others highlight its continuing importance even in contexts where global environmental politics is being rescaled, and/or question a strongly drawn divide between public and private authority in environmental governance (Andonova and Mitchell, 2010; Pattberg and Stripple, 2008; Reed and Bruyneel, 2010). Given these debates, it is pertinent to examine whether and how state authorities are still "able, capable and leading the environmental governance of biofuels" (Mol, 2010: 2).

Although the state remains important in global environmental governance, how and why remain key questions to investigate in specific issue areas. In assessing this for the contested realm of global biofuel governance, we focus on how the Brazilian state navigates distinct spheres of authority, including through selecting favorable fora and framing trade and governance imperatives in ways that resonate with its own policy priorities. Our analysis also goes beyond a focus on the omnipresent Westphalian model of the state in OECD countries, to include distinct "empirical expressions of statehood," such as emerging economies and/or areas of limited statehood

(Compagnon et al., 2012: 238). In our analysis, we consider how Brazil, as a prominent emerging economy and strong developmental state, engages with and seeks to shape global biofuel sustainability imperatives in specific multilateral fora. We turn next to a brief examination of Brazil's domestic biofuel policy choices and the rationales underpinning them.

4.3 Governing Biofuels in Brazil: Developmental Imperatives

Brazil is often characterized as an emerging environmental power, given its rich natural resources and biodiversity and its large-scale production and use of renewable energy (Dauvergne and Farias, 2012: 912; Hurrell, 2010: 44; Sotero and Armijo, 2007: 7). It is also seen as a quintessential "developmental" state, one wherein the "idea of development has long been a fundamental value with great political and policy resonance within Brazil's political [and foreign policy] discourse" (Dauvergne and Farias, 2012: 906; see also Hochstetler and Montero, 2013). President Lula da Silva (2003–2010) and his successor Dilma Rousseff (2011–) have sought to emphasize Brazil's role on the global stage as an emerging world power that advocates for fairness in international trade relations. This includes pushing for recognition of the legitimate development agenda of the global South and encouraging South-South collaboration and coalition building (Sotero and Armijo, 2007).

Brazil and the US are the main producers and exporters of ethanol, augmented now by a growing (domestic) biodiesel market (Lamers et al., 2011). While ethanol production capacity temporarily declined in 2012, Brazil remains a frontrunner in this realm (A detailed discussion of Brazil's domestic biofuels policy evolution is beyond the scope of this paper, but see Bastos Lima, 2012; Stattman et al., 2013). Brazil's focus on biofuels dates back to 1970s' concerns about energy security and dependence on fossil fuel imports, and concurrent recognition of the country's immense agricultural potential as a source of alternative fuels (Stattman et al., 2013). The first domestic bioethanol policies were set up during the period of military dictatorship (1964–1985). Ernesto Geisel introduced the national program called ProÁlcool in 1975, promoting the use of ethanol (produced from sugarcane) as an alternative to fossil fuels for the transport sector. ProÁlcool addressed two urgent crises: the adverse impacts of high international oil prices that were affecting Brazil's currency reserves, and the low (and falling) price of sugar on international markets, one of Brazil's main traded crops.

The initial successes of ProÁlcool through the 1980s ran into hurdles in the 1990s, when declining oil prices and favorable sugar prices resulted in shortages of ethanol supply, and thus reduced enthusiasm from consumers to use pure ethanol to fuel cars (Lehtonen, 2011; Stattman et al., 2013). By 2003, however, with the introduction of the flex-fuel car (which permitted a flexible mixing of ethanol and gasoline at the pump), the demand for ethanol rose again (Bastos Lima, 2012). Together with growing production capacity, such developments transformed Brazil into the second-largest producer of ethanol by 2011, although maintaining this position depends on changing dynamics of domestic demand and continuing prospects to increase production (EIA, 2012a, 2012b).

The success of ProÁlcool stimulated the government of President Lula da Silva in the early 2000s to (re)-consider alternatives for diesel fuel (for a detailed history, see Pousa et al., 2007). This resulted in the first national biodiesel policy, the National Program for Production and Use of Biodiesel (henceforth the biodiesel program), being launched in December 2004 (Brazilian law: Lei 11.097;

MDA, 2010). The biodiesel program sought to reproduce the successes of ProÁlcool with regard to fuel production capacity, along with several social, environmental, and developmental aims in addition to energy security. These included encouraging biofuel crop diversification (rather than focusing on a single crop, such as soybeans), spreading crop production regionally (rather than concentrating on one state/geographic area), and including small-scale family farmers in biofuel crop production (rather than relying exclusively on large-scale agribusiness) (Garcez and Vianna, 2009; Hall et al., 2009; Stattman and Mol, 2014). Many of these measures responded to perceived negative social and environmental consequences associated with ProÁlcool, such as large-scale (monoculture) sugarcane production, and concentrating production in specific regions (mainly the state of Sao Paulo).

To meet such multiple objectives, the government established blending targets for biodiesel in diesel, which have increased from 2 percent in 2008 to 7 percent in 2014[13]. While this sent a strong signal to the market, biodiesel companies also needed a state-administered "Social Fuel Seal" to access this market on favorable terms, which could be obtained by buying a percentage of feedstock from small-scale family farmers. The government also introduced tax exemptions favoring use of local oil crops grown by small-scale farmers (such as castor beans) over commodity crops produced by large-scale commercial farmers in monocultures (such as soybeans). President Lula da Silva threw his political weight behind the biodiesel program, given its link to his national development agenda that called for special attention to family farming and economic development of poorer regions (César and Batalha, 2010; Watanabe et al., 2012).

As these elements suggest, the national biofuel debate in Brazil has evolved from an initial focus on energy security in the 1970s to include a broader social and developmental agenda (Lehtonen, 2011), even as such objectives have proven challenging to implement in practice. Thus, most biodiesel in Brazil is still produced from commodity crops such as soybeans rather than from castor oil, and from feedstocks grown by large-scale rather than small-scale family farmers (ANP, 2012). While this is partially because of lack of infrastructure and/or farmer expertise and experience with alternative crops (Hospes and Clancy, 2011; Stattman and Mol, 2014), large-scale biofuel production methods still dominate, and there are persisting internal conflicts within the Brazilian state about the production versus social and developmental goals of the biodiesel program (César and Batalha, 2010; Garcez and Vianna, 2009; Hall et al., 2009; Stattman et al., 2013). In continuing efforts to operationalize the social inclusion elements of this program, the government has instituted financial loan systems for farmers and support for local food production, with recent efforts to involve agricultural cooperatives (Stattman and Mol, 2014; Watanabe et al., 2012).

As described above, the ethanol and biodiesel programs in Brazil have been fueled by energy security, as well as economic and social development imperatives. Environmental concerns feature less prominently in domestic discourse. For example, the ecological risks of large-scale monoculture plantations of sugarcane and soybean have been debated, as has indirect land use change resulting from biofuels and associated biomass production. Some measures to reduce the negative environmental impacts of burning sugarcane in manual harvesting have also been taken.

[13] Governo deve elevar percentual do biodiesel no diesel." Folha de Sao Paulo, May 24, 2014.

Nonetheless, there are few environmental regulations in place domestically that relate directly to biofuel production. The biodiesel program officially has an environmental pillar, yet in practice this calls for compliance with existing environmental legislation on deforestation and land use change (e.g., the Forest Conservation Code) and existing pesticide regulations, which Brazilian authorities view as sufficient but which also face implementation challenges (Nazareno, 2012). The rapid increase in biodiesel blending targets is likely to enhance reliance on the production capacity of large-scale monoculture-based agro-industry, rather than on more sustainable practices of small-scale family farmers (Garcez and Vianna, 2009; Goldemberg et al., 2008; Martinelli and Filoso, 2008).

In sum, the evolution of both ProÁlcool and the biodiesel program demonstrate the key role of the Brazilian state in establishing and expanding its domestic biofuel market. In certain instances, this has gone hand-in-hand with industry-led initiatives, such as development of the flex-fuel car. Yet, aligned with the state's developmentalist orientation, its role in establishing and enforcing blending targets and other goals has been central to creating a stable domestic (and export) market for biofuels to fulfill domestic policy priorities. A 2011 law further reinforced the state's role in this sector by changing the domestic classification of ethanol from an agricultural product to a fuel under the purview of the National Petroleum Agency. With fuel prices more directly controlled by the state, such a reclassification ensures a greater involvement by the state in the domestic (and export) market for ethanol (Brazilian law: Lei 12.490/2011.).

We turn next to the EU's attempt to create and govern an emerging global market in sustainable biofuels. These efforts have stimulated a Brazilian emphasis on the environmental sustainability of its biofuels, particularly ethanol, in a global trade context, even as it engages with and contests the transnational reach of the EU's sustainability criteria within the WTO.

4.4 Governing Biofuels in the EU: Sustainability Imperatives

EU interest in biofuels began in the late 1990s. A 2000 EU green paper titled "Towards a European Strategy for the Security of Energy Supply" first proposed an increased emphasis on biofuels in the transport sector (EC, 2000a). Expectations of a dramatic increase in oil prices fueled a search for alternatives for the "energy poor" EU. The green paper also presented biofuels as essential to meeting Europe's climate mitigation goals, framing biofuels as a "green alternative" to fossil fuels in the transport sector (Leopold, 2010: 4). In addition, ongoing reform of the EU Common Agricultural Policy (CAP), which has reduced farm subsidies, gave an impetus to identifying alternative uses for agricultural land in the EU (EC, 2000b). The green paper thus launched a debate about biofuels as a way to reduce vulnerability of the energy supply and achieve greenhouse gas emission reduction targets, while simultaneously providing support to rural farmers through an alternative land use possibility.[14]

This initial debate led to adoption of the EU Directive on the Promotion of the Use of Biofuels and Other Renewable Fuels for Transport (henceforth the biofuels directive) in 2003 (EC, 2003). The directive called on all EU member states to encourage an indicative, non-mandatory minimum blending of biofuels in transport fuel, going from 2 percent in 2005 to 5.75 percent by 2010. The aim

[14] See for example: Biofuels for transport". EurActiv, November 24, 2010

was to send a strong signal to industry and governments that the EU considered biofuels a long-term alternative to fossil fuel use in the transport sector, although this directive did not, at the time, include sustainability criteria for biofuels (see also Schleifer, 2013).

In 2007, the EU presented its Energy and Climate Change Policy containing its 20-20-20 targets: a 20-percent reduction of greenhouse gas emissions by 2020 compared to a baseline of 1990, a 20-percent share of renewables, and a 20-percent increase in energy efficiency. This document emphasized that sustainability, competitiveness, and security of supply were central to Europe's future energy policy. Together with an intensifying debate about sustainable biofuels, this led to a draft directive wherein the Commission proposed mandatory sustainability criteria for biofuels (EC, 2008, 2007; Schleifer, 2013). The result was the 2009 Renewable Energy Directive, which amended and replaced the 2003 biofuels directive (EC, 2009). With this new directive, sustainability concerns moved to the front and center of EU biofuels policy. The Renewable Energy Directive required a 20-percent share of energy from renewable sources by 2020, and a 10-percent share of renewable energy specifically in the transportation sector, most of which was envisioned to be met through biofuels. For biofuels to count towards this obligatory 10-percent target, however, their use has to constitute a minimum 35-percent reduction in greenhouse gas emissions compared to fossil fuels, a figure set to increase to 60 percent by 2018 (EC, 2009: articles 9, 65–81, 84). In a related development, the EU also amended its Fuel Quality Directive in further specifying its biofuel sustainability goals (The European Parliament and of the Council of the European Union, 2009a: articles 3, 8-10). This directive reconfirmed that greenhouse gas emissions from biofuels should be at least 35 percent lower than those from fossil fuels, and further stated that biofuels produced from raw material obtained from land with high biodiversity, including highly biodiverse grasslands or high-carbon stock, could not count towards the mandatory blending targets (The European Parliament and of the Council of the European Union, 2009a: articles 11, 38, 2009b: article 17-3, 3-5, article 7b).

With these directives, the EU aimed to stimulate the emergence of a global market in sustainable biofuels. However, its sustainability criteria remain internally and externally contested, and are continually evolving (Leopold, 2010; Oosterveer and Mol, 2010; Schleifer, 2013). In September 2013, for example, the European parliament voted to place a 6-percent cap on the use of food-based biofuels in meeting the EU's target of 10-percent biofuels in transportation, and proposed a 2.5-percent sub-target for promoting production and consumption of second- and third-generation biofuels, which the EU refers to as "advanced biofuels."[15] Although the result was two votes short of securing a majority, this represented an evolving debate within the EU on defining and agreeing on appropriate targets for sustainable biofuels.[16]

Biofuel producer countries, including Brazil and Indonesia, have raised concerns in various global fora about the consequences of the EU's sustainability requirements for trade in biofuels and associated biomass. For example, UNICA, the Brazilian Association for Sugarcane Producers, released a statement criticizing the 2013 European Parliament vote and questioning the "arbitrary cap on use of all food-based biofuels." It went on to note that "such a cap ignores important differences between

[15] EU Parliament 2013. It is important to note that in the US, the term "advanced biofuel" has a different meaning and is based on greenhouse gas emission reduction potential of a biofuel.
[16] Food price fears push EU lawmakers to put a lid on biofuels growth. EurActiv, September 12, 2013

conventional biofuels' environmental performance and is vulnerable to being de facto discriminatory and breaching World Trade Organization rules,"[17] a perspective supported by other trade analysts.[18]

For some, the EU's sustainability criteria for traded biofuels are designed to exclude certain crops or production areas from EU markets, such as palm oil from Southeast Asia, or soybeans from the Cerrado region in Brazil, which is classified as a highly biodiverse grassland.[19] The WTO compatibility of the EU's sustainability criteria thus remains a contested issue. Explicitly to avoid potential WTO conflicts, EU policy does not require that all biofuels meet its sustainability criteria, nor does it restrict imports of "unsustainable" biofuels. Instead, it merely stipulates that only biofuels that meet the criteria can count towards member state mandatory renewable energy targets (EC, 2013; European Parliament and of the Council of the European Union, 2009).

This ensures, however, that interpreting, adjusting, and elaborating the EU's sustainability criteria, as well as ascertaining and certifying which fuels meet these criteria, is rapidly becoming a key battleground in negotiating global biofuel governance authority. Various actors, including companies, multistakeholder roundtables, and/or private consultancies, are now undertaking such certification. In July 2011, the EU approved seven voluntary sustainability labeling and certification schemes as demonstrating compliance with the EU's biofuels sustainability criteria. This number had increased to nineteen by October 2014.[20] Member states or biofuel companies can choose the sustainability label they want to apply to ensure that their biofuels comply with EU legislation and thus count towards obligatory blending targets. This results in a growing juxtaposition between public and private authority in interpreting and implementing EU sustainability criteria, a topic that is beyond the scope of this present paper but that merits greater scrutiny.

A striking element of the EU's sustainability criteria has been a relative lack of emphasis on the social aspects of sustainability. Environmental concerns, including greenhouse gas emissions or loss of highly diverse grasslands and biodiversity, are driving EU sustainability discussions. Another much-debated concern has been indirect land use change linked to biofuel production, yet this is missing from the EU's sustainability criteria, because of persisting controversies over how to attribute specific land use changes to demand for biofuels, or how to measure such changes (Johnson et al., 2012; Ponte, 2014; Schleifer, 2013).

In contrast to environmental considerations, social aspects of sustainability are portrayed by the EU as important but as being adequately covered by other institutional fora, such as the International Labor Organization.[21] Although some private certification initiatives endorsed by the EU increasingly include social criteria, the EU calls only for biannual reporting relating to food security and local

[17] Brazil's UNICA Statement on European Parliament Vote Outcome on Biofuels/ILUC. September 11, 2013.
[18] Concerns EU's Renewable Energy Directive Breaks Rules of Free Trade. EurAsia Review.com, November 21, 2011
[19] Author meeting with various NGOs and a representative of the Dutch Commission on BiomassSustainability, May 25, 2010. The Hague, Netherlands.
[20] See for a continually updated list:
http://ec.europa.eu/energy/renewables/biofuels/sustainability_schemes_en.htm
[21] Author interview with representatives of Reporter Brasil, March 2010; author interview with a representative of the Roundtable of Sustainable Biofuels, June 2009; author interview with an official of the Dutch Office of Environmental Affairs, May 2009 and May 2010.

development in producer countries.[22] This omission is linked partly to concerns that explicit inclusion of such criteria will be seen as interference with national sovereignty of biofuel producing countries. Yet, for countries like Brazil, the EU's environmental sustainability criteria also remain a bone of contention, insofar as they have the potential to impinge upon domestic production practices. We turn next to how Brazil utilizes the WTO to contest the transnational reach of the EU's sustainability imperatives.

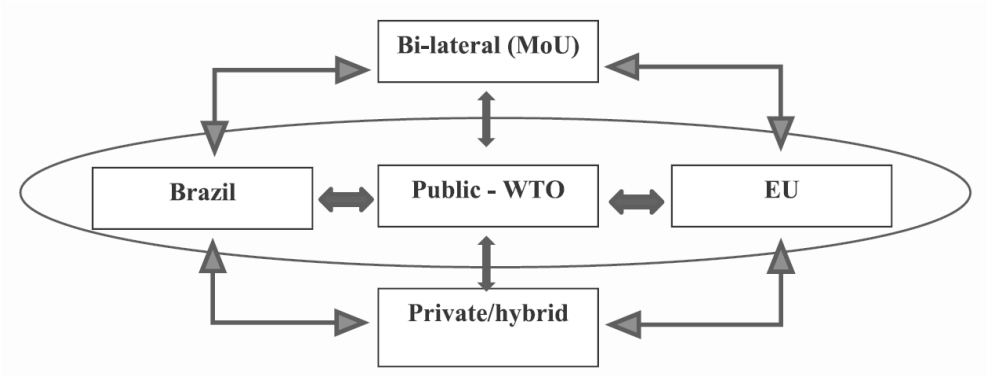


Figure 4.1 Spheres of interaction for governing sustainable biofuels: Brazil and the EU
Source: developed by authors

4.5 Negotiating Governance Authority: Evoking the WTO

In negotiating the dynamics of global biofuel trade and governance, the EU and Brazil interact in a variety of fora at multiple levels. As shown in Figure 4.1, these include not only the WTO but also other multilateral fora such as the Food and Agriculture Organization (FAO) and the Convention on Biological Diversity (CBD), as well as bilateral agreements and private sustainability initiatives. Despite these multiples sites of authority, the WTO remains a central venue for global biofuel governance and sustainability debates.

Brazil has strongly supported the WTO historically, with active engagement in global trade negotiations and processes (Dauvergne and Farias, 2012; Hurrell, 2010). It has also exercised leadership in the WTO by successfully forging coalitions with other developing countries, and by continually emphasizing the links between global trade liberalization and the legitimate development goals of developing countries (Dauvergne and Farias, 2012).

With regard to global biofuel trade, WTO debates revolve around two key issues: how biofuels are classified within WTO disciplines (for a detailed discussion of this complex issue, see Motaal, 2008), and compatibility of the EU's sustainability criteria with WTO obligations. WTO classification of

[22] Ibid.

biofuels and biofuel-linked biomass is a crucial issue. The WTO classifies traded goods as agricultural, industrial, or environmental. Such classifications have distinct WTO disciplines and obligations attached to them, particularly relating to the extent of domestic financial support or subsidies permitted.

Given their nature, biofuels can be classified as any or all of the above, with consequently differing implications for market access and domestic production processes. Currently, ethanol (derived from sugarcane or maize, among other sources) is classified as an agricultural good within the WTO. As a result, the Agreement on Agriculture (AoA) applies to trade in ethanol, with domestic subsidies pertaining to such production and trade permitted in line with this agricultural agreement. In addition, the AoA also applies to various crops traded as agricultural commodities, which constitute the biomass for first-generation biofuels (see Motaal, 2008).Biodiesel, by contrast, is classified as an industrial good in the WTO, regulated under the Agreement on Subsidies and Countervailing Measures (SCM). This agreement has stricter rules on trade-distorting domestic subsidies than does the AoA. If so, policies and measures that intend to stimulate or privilege domestic production of biodiesel at the cost of another WTO member can be challenged under the SCM.

Classification thus can have vital implications for market access to a growing global biofuel and biomass commodity market (ICTSD, 2009; IPC, 2006). The global trade in biofuels and related biomass is projected to increase in the coming years (Table 4.1), partly to fulfill EU and other mandatory governmental blending targets (Junginger et al., 2011; Lamers et al., 2011; OECD-FAO, 2013).Thus, WTO classification is a key negotiating site wherein state strategies and political conflicts around (different types of) biofuels play out. Further complicating the classification debate is the fact that trade in ethanol versus biodiesel is related to very different crop configurations, agricultural production dynamics, and sustainability issues.

The trade dynamics surrounding Brazilian ethanol exports to the EU are relatively straightforward, with ethanol being the processed commodity that enters international trade. Biodiesel trade dynamics are more complex and fluid, and more closely tied to broader markets for agricultural products and vegetable oils (Stattman et al., 2013). While Brazil does not yet export biodiesel to Europe in significant quantities, it does export large quantities of soybeans to the EU, from which biodiesel can be produced (Lamers et al., 2011). Given that soybeans are also traded globally as agricultural commodities under the AoA, where these commodities are converted to biofuels thus also is important, since applicable WTO rules and classification categories may change accordingly.

Given these implications of differing classification categories, Brazil has pushed strongly in the Doha Round of trade negotiations over the last decade for both ethanol and biodiesel to be reclassified as environmental goods within the WTO (see also Oosterveer and Mol, 2010; UNCTAD, 2011; WTO, 2005). Environmental goods are subject to lower tariffs and subsidies under WTO rules than agricultural and industrial goods. Such a reclassification would benefit Brazil, given the widely held view that it is not only the most efficient, but also the most sustainable, producer of sugarcane ethanol in the world.[23] From Brazil's perspective, classifying biofuels as environmental goods would

[23] EPA 2012; Johnson et al. 2012; sugarcane.org/sustainability/best-practices, accessed December 5, 2012.

contribute to a more competitive market by lowering or eliminating tariffs and subsidies.[24] This would mean more opportunities to increase its biofuel exports while simultaneously promoting its international agenda to ensure that trade liberalization furthers the South's developmental goals.[25] As Brazil sees it, such a reclassification of biofuels is justified to improve "market access for products that have low environmental impact and/or are derived from or incorporate cleaner technologies…[but which also contribute to] poverty alleviation through income generation and job creation for local populations."[26] From the Brazilian perspective, there is a need to redress an imbalance in the current "traditional" understanding of environmental goods in the WTO, which privilege "end of pipe technologies and products [in which] developed countries hold 90 percent of the … market.[27] The 2005 Brazilian submission called instead for the "definition of environmental goods [to] cover products such as natural fibers and colorants and other non-timber forest products, renewable energy, including ethanol and biodiesel" in which developing countries have a competitive advantage (WTO, 2005: 2).

To this end, Brazil (supported by Chile, Columbia, Singapore, and New Zealand) proposed again at a special session of the WTO Committee on Trade and Environment in November 2007 that biofuels be considered environmental goods, subject to tariff cuts or elimination in the Doha Round. The EU (supported by the US, Japan, and Australia) opposed this proposal, partly because the "environmental" credentials of certain imported biofuels might be suspect (Burrell et al., 2012: 784-785; Weiß, 2011). Its opposition also related to fears that such a reclassification would result in cheaply (and, in the case of Brazil, more efficiently) produced first-generation biofuels being "dumped" on the EU market, which could potentially harm European biofuel producers and delay the EU's ambition to encourage second- and third-generation "advanced" biofuel production and trade (author interview with Dutch representative to the WTO, Geneva, June 2008 Burrell et al., 2012).

Brazil argues, however, that if the EU were serious about sustainability, it would encourage the import of biofuels such as Brazilian ethanol, which is environmentally superior to others. In opposing such reclassification, the EU is, from the Brazilian perspective, protecting its less-efficient biofuels industry through agricultural subsidies and import tariffs. For Brazil, the EU is using "green protectionism" to protect its domestic industries, and its rural and agricultural policy priorities, under the guise of sustainability requirements. Thus, the compatibility of governmental financial support or stimulation of domestic biofuel production is closely linked to the classification debates. The heavy subsidizing of biofuels by OECD countries, combined with the potential impact of the 2009 Renewable Energy Directive's sustainability criteria on market access, has led Brazil to threaten to

[24] No specific WTO definition exists of environmental goods. Members negotiate to designate specific products as environmental goods, which are then placed on a WTO list. http://www.wto.org/english/tratop_e/envir_e/envt_rules_exceptions_e.htm. Last accessed October 27, 2014.
[25] Mol 2010, 9.
[26] WTO 2005, 2.
[27] WTO 2005, 2.

file a complaint against the EU at the WTO, although it has not yet done so (Oosterveer and Mol, 2010; Steenblik, 2007).[28]

The second WTO debate relates to compatibility of the EU's sustainability criteria with its global trade obligations, given their potential impact on biofuel trade and market access. Brazil argues in the WTO that, while countries are entitled to develop standards for environmental protection, these cannot discriminate between "like products." This implies that trade barriers against, for example, soy oil used for biodiesel production are discriminatory, if soy oil used in food production is not required to fulfill similar sustainability criteria. In the face of such differential treatment for a "like product," the EU's sustainability requirements are portrayed by Brazil as a non-tariff trade barrier that is open to challenge within the WTO (ICTSD, 2009; IPC, 2006; Motaal, 2008).

Trade disputes, both over biofuel classification and over market disruption resulting from the EU's sustainability imperatives, are increasingly likely to emerge. Argentina has filed a WTO dispute against the EU regarding its biodiesel policies, accusing the EU of violating the Agreement on Subsidies and Countervailing Measures and other WTO agreements.[29] Brazil has focused so far on diplomatic approaches, but this might change, depending on how EU biofuels legislation evolves. Brazil's central claim is that the EU need not concern itself with Brazil's domestic biofuel production processes, which the sustainability imperatives propose to target. The Brazilian Sugarcane Association, for example, has complained that EU sustainability imperatives are a "moving target" that reflect a lack understanding of local production circumstances.[30]

The foregoing discussion illustrates some of the complexities surrounding the emerging global biofuels market and attempts by the EU to exercise governance authority in this market, with the WTO serving as an important forum wherein these negotiations play out. Brazil evokes WTO rules in the attempt to strengthen its authority to shape the emerging global biofuels market, even as it seeks to protect its domestic biofuel priorities and production processes from cross-border governance attempts. It does so by projecting itself a market leader in sustainable biofuels internationally, and by emphasizing the developmental benefits of improved market access to its (environmentally) sustainable ethanol

[28] A list of all biofuels support policies can be found on: www.oecd.org/tad/agricultural-policies/support-policies-fertilisers-biofuels.htm.

[29] Argentina inicia disputa en OMC por reglas europeas para el biodiesel. Reuters America Latina, May 15, 2013; WTO 2012: Dispute DS452 and DS459; Members grapple with certifying products, and certifying the certifiers (indicating various disputes over the Biofuels directive and the Fuel Quality directive). WTO, October 29–31, 2013.

[30] Author interviews with representatives of UNICA, Brussels, March 2010 and Brazil, October 2012.

Table 4.1 Brazilian Exports (Total) and EU-27 Imports of Biofuels and Biofuels-Related

Year		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013*	2014*
Brazilian Exports, kt (for biofuels in millions of liters)	Ethanol** (Trade balance)	165.1	230.3	155.3	759.4	2434.4	2629	3454	3564.8	5174.5	3340.2	1851	530	3089	4605.1	9521.9
	Biodiesel	..	..	..	..	..	..	0	2.5	1.5	2.7	8.3	6.1	12.5	17	22.7
	Oilseeds	10710.3	15703.2	18242.5	21949.9	19935.7	23124.8	20107.5	25128.8	24152.6	25492.1	31863.1	34574.2	35754.2	33198.9	34220.5
	Vegetable oils	1156.1	1742.5	1998	2572.1	2620.8	2777.1	2490	2375.3	2371.8	1646.7	1620.8	1823.7	2102.8	2196.5	2042.5
EU-27 Import, kt (for biofuels in millions of liters)	Ethanol	..	..	22.3	143	358.2	597.5	943.9	1415.4	2196.3	1680	1506.1	1785.3	2100	1771.2	2404.6
	Biodiesel	12.5	14.8	3.3	19	23.5	96.2	452.3	1409.7	2840.5	2183.2	2345.8	2965.9	3114	2394.3	2673.6
	Oilseeds	19913.6	19694	17432	17183	15528.5	15535.7	16897.7	17317.5	17689.8	15753.5	16087.9	16125.3	16075	17294.7	16764.8
	Vegetable oils	4488.6	5570.8	5899.8	6016.8	6527.2	7890.1	8438.3	8526.2	9116.2	8716.3	8531.5	7729.3	8365.3	8103.4	8045.8
	(vegetable oils for biofuels use)***	(476.1)	(552.3)	(590.4)	(687.5)	(1326.6)	(1898.1)	(2853.1)	(4427.8)	(6515.2)	(8520.1)	(8982.1)	(8846)	9006.5)	(9208.1)	(9182)

Source: OECD-FAO (2013)

* Projected; ** Since no specific export figures are available, we use trade balance here to reveal trends; *** This sub-category shows the quantity of vegetable oils imported for biofuel production.

4.6 Conclusions

States and other actors are now negotiating the authority to govern the relatively new area of global biofuel trade and sustainability. Our analysis reveals how interactions between important biofuel producers and importers, such as Brazil and the EU, are key to shaping global biofuel trade and sustainability governance. States, our analysis confirms, are central to negotiating, contesting, and recasting norms and standards of multilevel biofuel governance.

By examining the interactions between the EU and Brazil within the WTO, we show how these actors interact to further their own strategic governance aims and trade interests in the biofuels policy realm. One such arena of negotiation is the classification of biofuels within the WTO. Brazil projects itself within multilateral fora such as the WTO as the most efficient and sustainable producer of sugarcane-based ethanol, and thus argues for enhanced market access for such ethanol. It seeks to achieve this by pushing to reclassify biofuels as environmental goods. In so doing, it attempts to link the WTO's Doha Round trade liberalization agenda to its developmental aims, but in this case by arguing that such aims can also be furthered through liberalizing trade in environmental goods.

As our discussion shows, however, such an outcome is only feasible if environmental goods are (re)conceptualized to include products in which the South has, or may have in the future, a comparative advantage, such as food-based biofuels. Such a reconceptualization hinges, however, on contested understandings of the sustainability of first-generation (food-based) biofuels, such as ethanol and biodiesel. For the EU, a key publicly stated policy aim is to use trade disciplines and sustainability criteria to promote a shift from food-based biofuels to more (environmentally) "advanced" biofuels, even as questions about the protectionist intentions underlying EU biofuel policies continue to persist. In projecting itself as a producer and exporter of "advanced biofuels" (even if food-based), Brazil seeks to contest the EU's attempts to shape global biofuel trade to fit its own regional policy imperatives.

The global debate over sustainable biofuels is thus as much a battle over governance of national territory as of global market access, insofar as it impinges upon domestic production practices. To date, Brazil has not yet (needed to) adjust its domestic biofuel policy priorities and practices because of the EU's environmental sustainability requirements. However, this could change in the future, as negotiations over the meaning and operationalization of sustainability proliferate in multiple arenas. While our focus here has been on the WTO, our findings can be usefully supplemented by analyzing how Brazil has contested global rule-making efforts in multilateral fora that are more directly concerned with the environmental and food security aspects of biofuel production and trade, such as the CBD or FAO.[31]

Going beyond Brazil, the implications of evolving biofuel sustainability imperatives are likely to vary for smaller developing countries, or those with less advanced domestic biofuel production policies, meriting further analysis. This includes analyzing interactions between hybrid public–private spheres of authority in the biofuel domain, and their impact on how (different categories of) states frame

[31] See Bastos Lima and Gupta 2013 and 2014 for discussion of how Brazil and others have opposed efforts to develop multilateral rules on biofuels in UN fora, such as FAO and CBD.

and negotiate sustainability. An increasingly important question becomes whether and how the hybridization of authority stimulates or discourages a "greening" of the developmental state in domains such as sustainable biofuels.

5 Towards Sustainable Biofuels in the European Union? Lessons from a Decade of Hybrid Biofuel Governance[32]

Abstract

The European Union (EU) stands at a crossroads regarding its biofuel policies. For more than a decade, the EU sought to create a market for and govern sustainable biofuels for the transport sector, even as debates over sustainability escalated. It did so by devising novel hybrid (public and private) governance arrangements. We took stock of the nature and outcomes of this experiment in hybrid biofuel governance. We relied on qualitative methods of analysis, whereby we reviewed and synthesized the evolution of EU biofuel governance arrangements over time, through detailed document analysis of secondary and primary literature, including EU and related policy documents and private certification scheme websites. Our analysis reveals that, instead of yielding an increasingly stringent sustainability framework, the hybrid EU governance arrangements resulted in a proliferation of relatively lax, industry-driven, sustainability standards, even as the notion of "sustainable biofuels" remained contested in public and political debate. These findings contribute to an ongoing debate about the merits of hybrid (public–private) governance arrangements, and whether a hybrid approach helps strengthen or weaken sustainability objectives. We conclude that a more stringent EU meta-standard on sustainability needs to be developed, to underpin future governance arrangements.

[32] This chapter has been published as: Stattman, Sarah L., Aarti Gupta, Lena Partzsch and Peter Oosterveer. 2018. "Toward Sustainable Biofuels in the European Union? Lessons from a Decade of Hybrid Biofuel Governance." *Sustainability* 10 (4111); doi:10.3390/su10114111

5.1 Introduction

For the last decade and a half, the European Union (EU) experimented with novel, hybrid (i.e., both public and private) governance arrangements for the production, import, and use of sustainable biofuels for its transport sector. It is now at an important juncture in its biofuel policies, with sustainability debates continuing to rage within the EU and beyond, and important changes being considered and implemented with regard to future policy choices.

In this article, we take stock of the nature and outcomes of the EU's experiment in hybrid biofuel governance, in order to draw lessons for future policy directions. This is a very timely moment to do so, given extensive political and societal debate underway about the sustainability of biofuels, and recent responses of EU institutions to such debates. A recent illustration is the decision by the European Parliament (17 January 2018) to phase out the use of palm oil as a feedstock for production of biofuels by 2021. This decision challenges a key element in EU's biofuel policy of the last decade, which laid down that inclusion of particular feedstocks would be based on whether or not they fulfilled the EU's standard for sustainable biofuels. By excluding a particular feedstock, in this case palm oil, regardless of whether it complies with the EU's sustainability requirements or not, the European Parliament seems to suggest that the standard and procedures developed in the EU's Renewable Energy Directive (RED) do not guarantee the sustainability of biofuels.

The RED directive, adopted in 2009 and covering the period of 2010–2020, was implemented after years of discussion, and is the cornerstone of the EU's hybrid biofuel governance architecture. It prescribes minimum greenhouse gas (GHG) emission reductions for biofuels, relative to the fossil fuel that biofuels are intended to replace. It also prohibits biofuel feedstock production on land with recognized high biodiversity and carbon stocks and on peatland. As proof of compliance, the European Commission (EC) asks for a sustainability certification of biomass-based fuel, independently from whether biofuels are produced within the EU or imported.

With this policy, the EU aimed to replace 10% of all transport fuel consumed within the EU from fossil to bio-fuel by 2020 (European Parliament and of the Council of the European Union, 2009; The European Parliament and of the Council of the European Union, 2009b). In responding to increasing controversy over sustainability criteria for biofuels, however, one key change was made in April 2015. In the context of a new directive on the quality of petrol and diesel fuels, and the promotion of energy from renewable sources, the EU agreed to put a cap of 7% on use of first-generation biofuels (i.e., based on agricultural crops), to limit the volume of such crops grown solely for energy consumption (The European Parliament, 2015).

The EU RED directive and associated decisions, regulations, norms, and standards lay the groundwork for a particular, novel (hybrid) governance approach to biofuels within the EU, wherein the EU sets a "meta-standard" (the basic, minimum, sustainability requirements) and leaves it to private initiatives to assess and certify compliance of a particular biofuel with this standard, through private certification schemes. The integration of private certification initiatives with RED created a hybrid biofuel governance landscape within the EU, i.e., a combination of public standards and private certification initiatives to govern access to the EU biofuel market (Ponte and Daugbjerg, 2015).

Extensive research in recent years focused on how private certification initiatives function (Partzsch, 2011; Ponte and Daugbjerg, 2015; Schleifer, 2013; Stattman and Gupta, 2015). Many studies discussed, additionally, the sustainability debates around biofuels, including the pros and cons of various measurement tools to assess the (adverse) effects that biofuels might have on changing land use, GHG emissions, and agricultural production, among others (Bailis and Baka, 2011; Bernard and Prieur, 2007; Pacini et al., 2013). Our article adds to these existing studies by examining and distilling lessons from 10 years of hybrid biofuel governance within the EU, wherein the functioning of private certification initiatives is one key (but not the only) element of the analysis. We analyze the links between these private initiatives and EU-devised meta-sustainability standards, which in turn are evolving in response to continued debate and controversy over the sustainability of biofuels as alternatives to fossil fuels. It is the interaction between public and private governance elements that we are interested in, particularly in light of the recent decision by the European Parliament that challenges the long-standing basis of the RED-centered hybrid governance arrangement. This laid down that the sustainability of a particular biofuel is assured if the EU RED sustainability criteria are fulfilled, as verified through private certification processes recognized and accredited by the EU. In this arrangement, any feedstock could be used, as long as it is certified according to EU standards. As this seems no longer to be the case, some critical questions arise. Why does the European Parliament no longer recognize this governance arrangement as a guarantee for sustainable biofuels, and what does this mean for the future of biofuel policy in the EU? We discuss these questions in this paper.

We proceed as follows: the next section conceptualizes hybrid governance, as we use the term here. Section 3 describes the evolution of hybrid biofuel governance in the EU. Section 4 evaluates how these governance arrangements worked in the last decade, and the extent to which they furthered the EU's sustainability goals. We conclude by drawing out the implications of our findings for the future of biofuel policy in the EU. We rely on qualitative methods of analysis, whereby we review, distill, and synthesize the evolution of EU biofuel governance arrangements over the last decade, through detailed document analysis of secondary and primary literature, including EU and related policy documents, and private certification scheme briefs and websites.

Our analysis reveals that, instead of yielding an increasingly stringent EU-wide framework to guarantee use of sustainable biofuels within the EU, the hybrid governance arrangements resulted in a proliferation of relatively lax, industry-driven, sustainability standards, at the cost of more ambitious multi-stakeholder initiatives, even as the notion of biofuel sustainability remains contested in public and political debate. These findings contribute to an ongoing debate in the literature about the merits of hybrid (public–private) governance arrangements, and whether a hybrid approach helps strengthen or weaken sustainability objectives. Our analysis shows that hybridity did not deliver on strengthening sustainability objectives, as envisioned by some advocates of public–private governance. We conclude that a more stringent EU meta-standard on sustainability needs to be developed, to underpin future governance arrangements.

5.2 Hybrid Environmental Governance

Hybrid governance, or the interaction between private and public sources of authority, was the subject of several studies in the global environmental realm (Falkner, 2003). Much analytical

attention was devoted to the emergence of hybrid governance and sources of their legitimacy (Chan and Pattberg, 2008; Partzsch, 2011). Related research highlighted the consequences of these developments for the (changing) authority of the state (Cashore et al., 2004; Green, 2013).

In conceptualizing hybrid biofuel governance here, we build on the interpretation by Ponte and Daugbjerg, who argue that hybridity is a form of mutual dependence between public and private actors (Ponte and Daugbjerg, 2015, p.2). They define hybridity as:

> "*polyarchic and overlapping governance arenas, where interactions between a variety of mutually dependent private and public actors give rise to hybrid regulatory features, and where collective orders and individuals engage in cross-border rulemaking, implementation, and enforcement activities*" (Ponte and Daugbjerg, 2015, p. 4).

Working with such a notion of hybridity, a key debate in the literature is how hybrid forms of governance are related to sustainability outcomes, particularly given the proliferation of such arrangements in the sustainability realm. Hybrid forms of governance are especially evident in the issue-areas of forests (Bartley, 2014), fisheries (Gulbrandsen, 2010), and commodities, such as palm oil for biofuels (Schouten and Glasbergen, 2012). Whether these arrangements further sustainability, or rather detract from it, remains debated. Some scholars argue that hybrid governance may enhance the governance capability to achieve sustainably goals, including environmental protection (for example, climate mitigation, biodiversity conservation, and indirect land-use change), social advancement (for example, improved labor conditions), and economic prosperity (for example, financial viability and macro-economic effects) (Abbott, 2012; Scarlat and Dallemand, 2011, p. 3; Schleifer, 2013, p. 3). Others consider that hybridity risks undermining sustainability objectives through leaving too much decision-making authority to private actors, and thereby also exacerbating environmental degradation, socially unjust outcomes, or economic hardship (Cashore and Stone, 2014).

At the very least, this debate in the literature reveals that the contribution of hybrid forms of governance to realizing sustainability objectives remains variable and unstable. The inclusion of private initiatives in state-led governance can, in theory, promote adoption of more stringent criteria and prioritize best practices for a "race to the top". On the other hand, if multiple options are available and competition between private schemes arises, the resultant fragmentation can also undermine sustainability in a "race to the bottom". It is timely, therefore, to examine this relationship for the case of EU biofuel policies, to which we turn below.

5.3 EU Biofuel Regime: The Emergence of Hybridity Governance

This section describes the landscape of the EU hybrid biofuel governance regime. We firstly outline the emergence of the regime and the sustainability imperatives therein. We then consider the involvement of private voluntary certification schemes in the context of EU biofuel sustainability objectives.

5.3.1 EU Biofuel Directives: Scope and Sustainability

The first EU "biofuels" directive—to promote the use of biofuels and other renewable fuels for transport—entered into force in 2003 and set a voluntary blending target of 2% in 2005, and a

binding target of 5.75% renewable energy in the transport sector by 2010 (European Parliament and The Council Of The European Union, 2003). There were no strict sustainability standards, but the EC had to report on cost-effectiveness, and economic and environmental aspects of biofuels production and trade, the effect of biofuels on climate change, indirect land-use change (ILUC), and the long-term options for energy efficiency in the transport sector.

Following the implementation of the biofuels directive, the use of biofuels for road transport increased to 2.6% in 2007 (European Commission, 2009). This was partially achieved by a growth in imported bioethanol in the period between 2005 and 2007, due to the lower production costs and higher efficiency of Brazilian sugarcane ethanol at that time (Stattman and Gupta, 2015). Also, biodiesel trade increased through cheap soybean oil from the United States, where farmers benefited from subsidies (European Commission, 2009). However, this increase in international trade complicated reporting on GHG emissions, an important sustainability indicator.

Official GHG emission savings in this period amounted to 9.7 Mt (2006) and 14.0 Mt (2007) CO_2-eq., but these figures remained debatable because the EU based them on the assumption that biofuels were produced from "abandoned" agricultural land, while indirect land-use change impacts from biofuels (ILUC) were not taken into consideration. By 2006, lobbyists, environmental organizations, and scientists began arguing that the EU's desire to make its transport energy more sustainable led to increased GHG emissions in other countries (Bailis and Baka, 2011; European Commission, 2009), thus undermining the main sustainability objective incorporated in the biofuels directive. They argued that these (in)direct adverse effects should be included as risks to be mitigated in EU biofuel policies (Bailis and Baka, 2011; Baka, 2014). The debate became most heated with the 2007–2008 food price crisis, when United Nations (UN) Special Rapporteur on the Right to Food Jean Ziegler called biofuels a "crime against humanity" (Ziegler, 2008). After years of deliberations—both in public and behind the scenes—two follow-up EU directives came into effect in 2009: the Renewable Energy Directive (RED) (The European Parliament and of the Council of the European Union, 2009b) and the revised Fuel Quality Directive (FQD) (European Parliament and of the Council of the European Union, 2009). These directives called for detailed reports from member states on land-use change and other environmental impacts from increased production of biofuels, thus making sustainability objectives officially part of EU biofuel policies by defining basic sustainability criteria.

RED requires the EU to meet at least 20% of its total energy needs from renewables by 2020, of which at least 10% must come from renewable transport fuels. Biofuels may only be counted if they meet the sustainability criteria set by the EU. These criteria are as follows: (1) biofuels must achieve GHG savings of at least 35% in comparison to fossil fuels and this requirement rose to 50% in 2017 and 60% in 2018 (but only for new production plants); (2) biofuels cannot be grown in areas converted from land with previously high carbon stock such as wetlands or forests; and (3) biofuels cannot be produced from raw materials obtained from land with high biodiversity, such as primary forests or highly biodiverse grasslands (The European Parliament and of the Council of the European Union, 2009b). These criteria were further elaborated through detailed standards and norms in order to reconcile diverse national interpretations, for example, European Standard series EN 16214 and associated technical specifications (European Committee for Standardisation (CEN)., 2018). When biofuels are compliant with these criteria, the EU accepts them as being produced in a "sustainable" manner. Companies can demonstrate compliance by using voluntary schemes recognized by the European Commission.

Despite the sustainability requirements put in place by RED and FQD, debates about the potential adverse effect of biofuels continued. In particular, there were ethical concerns with regard to food versus fuel, an issue immediately related to the land-use change driven by the increasing demand for biofuels (Afionis and Stringer, 2012; Stattman and Gupta, 2015). Political debates resulted in April 2015 in the agreement that the EU would use a cap of 7% for biofuels derived from crops grown on agricultural land, to be used as part of the renewable energy target for transportation by 2020 (Biofuelsdigest, 2014; The Council Of The European Union, 2014; The European Parliament, 2015). This agreement also included obligatory reporting on GHG emissions caused by indirect land-use change and an obligation for member states to create incentives for advanced biofuels. Here, we can see that, although the EU shifted considerable governance authority to the private sector when demanding "voluntary schemes" to certify the sustainability of biofuels, more recently, the European Parliament strengthened its baseline sustainability criteria within its mandatory regulation, given the food vs. fuel debates. This implies a slight "re-centering of the state" (Bartley, 2014) in the EU's hybrid approach to biofuel governance, through the enhancement of the sustainability meta-standard.

In November 2016, the EC published a draft proposal for REDII, i.e., a revised biofuel policy for the post-2020 phase. It announced a gradually phasing out of conventional biofuels by 2030. While the proposal includes a call to increase the proportion of renewable energy in Europe to 27% by 2030, it proposes to reduce the contribution from conventional biofuels in transport from a maximum of 7% in 2021 to 3.8% in 2030. It also puts into place an obligation to raise the share of other "low-emission fuels", such as renewable electricity and advanced biofuels in transport, to 6.8%. Furthermore, the Commission suggests that advanced biofuels are those that emit at least 70% fewer GHG emissions than fossil fuels (compared to savings of 60% in 2018 for new production plants by RED).

This appears to signal a trend that the EC will continue encouraging the development of advanced alternative fuels for transport through a blending mandate for fuel suppliers, while progressively phasing out the contribution from food-based biofuels. Such a trend is partly driven by the negative public perception on biofuels as competing directly with food. As Marie Donelly, Director for Renewables, Research, and Energy Efficiency in the Commission's Energy directorate puts it, "we have to be very sensitive to the reality of citizens' concerns, sometimes even if these concerns are emotive rather than factual based or scientific" (EuroActive, 2016). As revealed by this statement, the EU's sustainability standard-setting and associated hybrid governance continues to be a subject of contestation and multiple interpretations.

5.3.2 RED Endorsed Voluntary Certification Schemes

Parallel to the implementation of these EU directives, there was proliferation in the development of private biofuel certification schemes. This was partly because the EU developed its biofuels sustainability standard as a meta-standard (Samerwong et al., 2017), leaving compliance with it to be assessed by private actors. One of the key considerations for doing this concerns the limitations the EU encountered as a consequence of international trade regulation (Ackrill and Kay, 2011; Bartley, 2014). The regulations included in the World Trade Organization (WTO) seriously limit the possibility of states to impose regulations and product requirements on other member states (Stattman and Gupta, 2015). A hybrid governance approach that builds on a meta-standard seems to offer better

opportunities to influence non-product-related processing and production methods beyond the EU (Ponte and Daugbjerg, 2015).

This was most evident in the period between the initial adaptation of RED in 2009 and the acceptance of compliance with RED of the first seven private schemes in July 2011 (Pacini et al., 2013). During this period, the number of schemes available to certify biomass or biofuel as meeting EU criteria increased to 67 (Dam et al., 2008), including the Biomass Biofuels Sustainability Voluntary Scheme (2BSvs) and the International Sustainability and Carbon Certification (ISCC), which became the most popular schemes issuing certificates for EU RED (Moser et al., 2014, p. 45).

From the 67 available schemes, 19 were accepted by the EU as of December 2016 (European Commission., 2018). These can roughly be divided into three categories: (1) roundtable/multi-stakeholder initiatives (e.g., Roundtable on Sustainable Biofuels (RSB), Roundtable on Sustainable Palm Oil (RSPO), Roundtable on Responsible Soy (RTRS)); (2) industry schemes (e.g., 2BSvs, Bonsucro**,** and Greenergy); and (3) government-supported schemes (e.g., ISCC with initial support from the German government, NTA 8080 with support from the Dutch government) (Kemper and Partzsch, 2018; Pacini et al., 2013). Some schemes have a specific national scope whereas others are potentially applicable worldwide. Also, some cover particular crops and only parts of the biofuel production chain, whereas others cover all biofuel crops and entire production chains.

The Roundtable on Sustainable Palm Oil (RSPO) is an example of such a scheme. The RSPO was founded in Switzerland in 2004 as the result of an informal meeting initiated by the World Wide Fund for Nature (WWF) two years earlier with Aarhus United UK Ltd., Golden Hope Plantations Berhad, Migros, Malaysian Palm Oil Association, Sainsbury's, and Unilever (Partzsch, 2011). This private initiative developed a scheme to certify the sustainability of palm-oil products. For instance, most palm oil is processed into foodstuffs (68%) and cosmetics (27%), and only 5% is used for biofuels (although this share is increasing rapidly) (Kekeritz et al., 2016). Certifying palm oil for biofuels required some adaptation because, in the context of palm oil for food, sustainability was not discussed in these terms (e.g., GHG savings).

It took almost two years after RED was published before the EC approved the first voluntary schemes as certifiers of compliance with the EU meta-standard. This caused a regulatory gap between the policy-driven market demand being generated for "sustainable" biofuels, and their (certified) availability on the market (Pacini et al., 2013). As a result, in the intervening period, various stakeholders sought to fill this gap by creating their own sustainability scheme. For some, this may have been a strategic move, in the hope that the EC would adopt a given scheme as a way to make its sustainability requirements operational, giving the initiators a first mover advantage. For others, the hope was to create an effective multi-stakeholder platform that would develop a baseline of stringent criteria to promote sustainability objectives (Pacini et al., 2013).

The EU continued recognizing new schemes after 2011, but the acceptance of schemes by the EC is temporary (for a period of five years), and, as shown in, several schemes were not renewed after the expiration of the first five-year period, such as RSPO RED.

Table 5.1 European Commission's acceptance of voluntary schemes

Year of Acceptance	2011	2012	2013	2014
Voluntary scheme	2BSvs (Biomass Biofuels voluntary scheme)	Ensus *	Biograce GHG	Gafta Trade Assurance
	Abengoa–RBSA * (Abengoa's Bioenergy Sustainability Assurance Standard)	NTA 8080 * (Dutch Technical Agreement 8080)		HVO (hydrotreated vegetable oil) Renewable Diesel Scheme for Verification of Compliance with the RED sustainability criteria for biofuels
	BonSucro	Red Tractor		KRZ INIG System (System of certification of biofuels and bioliquids)
	Greenergy*	Redcert		Trade Assurance for Combinable Crops
	ISCC (International Sustainability and Carbon Certification)	SQC (Scottish Quality Farm Assured Combinable Crops)		Universal Feed Assurance
	RSB EU RED (Roundtable for Sustainable Biomaterials)	RSPO RED (Roundtable on Sustainable Palm Oil) *		
	RTRS EU RED (Round Table on Responsible Soy)			

* Expired (status December 2017)

Source: adapted from NL Agency 2011 (2011 p. 29) with added information from other sources European Commission (2018); Runge (2007); Sengers (2010); Munro (2015) and https://ec.europa.eu/energy/en/topics/renewable-energy/biofuels/voluntary-schemes (visited 24 July 2018)

To understand the process and proliferation of schemes, one has to look at the timeline of EU policies. The political discourse shifted during the 2007–2008 food price crisis when scholars demystified the "ethanol bubble" (Runge and Senauer, 2007, p. 41) and outlined potentially devastating implications for global poverty and food security (Munro, 2015; Sengers et al., 2010). As a consequence, environmental non-governmental organizations (NGOs) started fiercely opposing biofuels (Partzsch, 2011). Critical NGOs, such as Oxfam and Friends of the Earth, were involved in initial efforts to define sustainability criteria for biofuels, in particular, in the (Dutch) Cramer Commission, a multi-stakeholder initiative initiated in 2006 that resulted in the NTA 8080. However, for a while, WWF remained the only NGO to participate in later initiatives, such as the ISCC (International Sustainability and Carbon Certification) supported by the German government from 2006 till 2012 (ISCC 2016). No NGOs are members of 2BSvs, a collaboration between seven French grain producers in 2012 (2BSvs 2016). This dwindling NGO participation indicates the growing civil society opposition against the weak definition of "sustainability" in these initiatives, as well as against biofuels in general.

A comparative study by WWF (2013) found large differences between private certification standards, especially with regards to their performance on environmental and social dimensions, and with regards to the aspects of sustainability covered—whether they were social, economic, and/or environmental dimensions (Bor, 2012; NL Agency - Ministry of Economic Affairs Agriculture and Innovation, 2011; The Natural Resources Defense Council (NRDC)., 2014). Complementing this study, Kemper and Partzsch (2018) found that higher NGO presence in biofuel certification schemes correlated with stronger sustainability criteria. Roundtable/multi-stakeholder initiatives were demonstrated to be more ambitious, compared to government-supported and industry schemes. Partly, this was because, in the EU's hybrid governance system, it was also left open whether these private initiatives needed to draw on evolving EU norms and standards, such as EN 16214 (European Committee for Standardisation (CEN)., 2018), designed to operationalize its sustainability criteria, or whether they could devise their own norms and standards to comply with EU criteria. The EU's norms and standards sought to operationalize a minimum, narrow set of sustainability criteria (mainly environmental considerations). For future research, the analysis can also look at the effect of these norms and standards and include other voluntary standard-setting bodies such as the International Organization for Standardization (ISO), but this is beyond the scope of this paper.

5.4 Evaluating the Effects of the EU's Hybrid Biofuel Governance System

As we sketched above, the EU's biofuel sustainability certification approach can be characterized as a form of hybrid governance, since it relies on a combination of public–private standard-setting and implementation. We next consider below whether hybrid governance furthers or undermines the fulfillment of the EU's sustainability goals and potentially increases or decreases their stringency.

5.4.1 The EU Meta-Standard

RED formulated three minimum sustainability criteria (GHG savings, protection of land with high carbon stock, and protection of biodiverse forests and grasslands). To be accepted by the EC as certifiers of compliance with EU's sustainability requirements, voluntary certification schemes have to meet, at least, these three criteria. In addition, since 2015, the EU agreed to put a cap of 7% on conventional biofuels, to limit the quantity of potentially edible crops grown on agricultural land for energy consumption. For REDII, the European Commission now proposes to further strengthen requirements for GHG savings (70% less GHG emissions than fossil fuels compared to required savings of 60% in 2018 for new production plants) and to lower the cap on conventional biofuels to 3.8% in 2030. All other criteria included in an RED-accepted scheme remain voluntary. This implies that the current RED serves as a meta-standard or legal (minimum) baseline for private certification schemes (Figure 5.1). As a "meta-standard", it is a minimum standard that aims to have a broad reach and exclude (at least) the least sustainable practices.

The timeline of accepted sustainability schemes (see Table 5.1) reveals that the short-term initial effect of this hybrid governance strategy was a growth in the number of certification schemes. There was also an increase in the number of companies and projects participating in the various schemes. The first schemes were often the result of a broad multi-stakeholder consultation process, with a wide scope reaching well beyond the minimum RED requirements, as they were not yet fixed at the time of their development. Looking at the more recent schemes, the picture is different. These

schemes are often led by business conglomerates and offer little more than compliance with the minimum EU standard. The lack of transparency in the certification and auditing process suggests business as usual, rather than improvements with regards to sustainability objectives on the ground. While the EC is yet to provide a clear long-term vision or a foreseeable increase in the sustainability requirements in the meta-standard (other than GHG emissions and a cap on conventional biofuels), current RED's ambitions for strengthening sustainability in biofuel production is undermined through the expansion of certification schemes containing minimal sustainability standards.

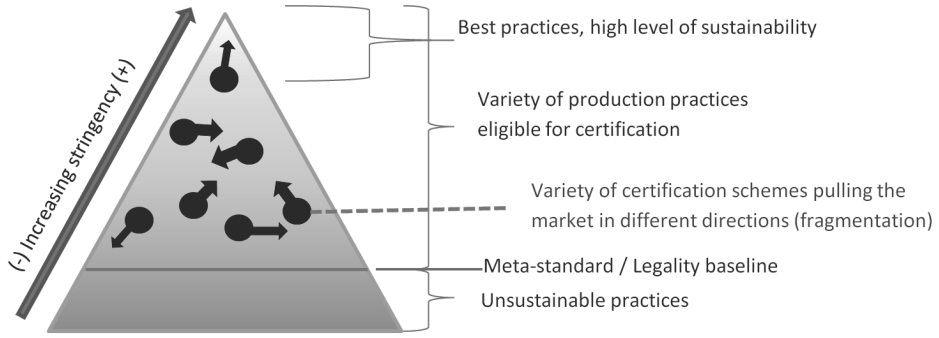


Figure 5.1 Fragmentation of certification options, according to stringency
Source: developed by authors

A potential benefit of using a meta-standard approach is the reduced costs for standard development and control, compared to a scenario where the EU would have to carry out certification by itself (Abbott, 2012). The large variability of biofuel resources, production regions, and competition with other markets would have made it very difficult to introduce a simple universally applicable certification scheme. In the present set-up, sectors and companies are able to develop a certification scheme that fits with the specific needs of their markets and industries. This helped improve the speed of diffusion, because these private standards are able to adapt their criteria faster than the EU bureaucracy could do (Schleifer, 2013). In particular, voluntary schemes allowed the EU to promote sustainable production and processing methods beyond their own territory, for example, for palm oil production in Indonesia and Malaysia, if this feedstock is processed into biofuel and exported to the EU and included in the 10% transport target (Afionis and Stringer, 2012; Ponte and Daugbjerg, 2015).

While WTO trade rules allow some regulatory scope for environmental sustainability, social sustainability rules are deemed non-compliant. Therefore, the EU refrained from introducing binding requirements on social sustainability criteria in the RED meta-standard (Ponte and Daugbjerg, 2015). By contrast, voluntary standards may include social sustainability requirements, for instance, minimum wages on biofuel farms (Stattman and Mol, 2014). However, even more ambitious schemes, such as the Roundtable for Sustainable Biomaterials (until 2013 known as the "Roundtable on Sustainable Biofuels"), which was one of the earlier and more ambitious multi-stakeholder schemes developed in 2006, only request reporting about social aspects and do not prescribe specific

standards. Among the schemes that the European Commission accepted so far, there is little incentive to demand sustainable practices that go beyond the meta-standard.

5.4.2 Proliferation, Fragmentation, and Competition: Too Many Schemes Dilute Sustainability

RED has not limited the number of private voluntary certification schemes that can apply for acceptance. This means that any scheme that meets the meta-standard sustainability requirements can be accepted. On the one hand, this keeps the market accessible for new applicants. On the other hand, however, this multiplicity and diversity between schemes results in fragmentation and a push toward including only the minimum sustainability objectives from the EU biofuel policy (Abbott, 2012; Schleifer, 2013).

As we showed earlier, after promulgation of RED in 2009, more industry-driven schemes began emerging, such as 2BSvs and Bonsucro/Better Sugarcane Initiative (Table 5.1). Generally, these schemes are less stringent and remain close to the minimal EU sustainability meta-standard, even if they are locally successful (Manos et al., 2014). Arguably then, by accepting industry schemes, the EU is undermining the likelihood of companies to be certified by the more stringent certification schemes. The increasing spread of certification schemes to choose from, and the competition between them, led to a "race to the bottom", i.e., a "pick-and-choose" system wherein companies avoid schemes that would demand changes in their current production process or that are seen as too stringent. Most companies choose to be certified by industry and government-supported schemes, and hardly any company commits itself to the stricter RSB or RSPO standard (International Sustainability and Carbon Certification (ISCC), 2016; Moser et al., 2014; RSB, 2016). The ISCC issued more than 13,000 certificates (and only five projects are on the "blacklist") (International Sustainability and Carbon Certification (ISCC), 2016). Often, companies are certified by several schemes; thus, if they lose the certification from a more stringent scheme, for example, RSPO certification, they still remain certified by the less stringent schemes, for example, ISCC (Deutscher Bundestag, 2016). As such, their products can still count toward the EU's 10% transport target. Thus, even companies losing (a specific) certification do not lose their access to the European market. While, at the outset, in an environment of policy uncertainty, hybrid governance helped set the scene by creating elaborate sustainability frameworks, after the adoption of RED in 2009 and its request for certification, this upward sustainability standard-setting process was (partly) undermined by companies demanding lower requirements. New certification schemes rather contributed to business as usual instead of promoting sustainability.

What we can observe with this approach of RED, i.e., a de facto promotion of its legally required sustainability criteria, is that companies reorient their strategies in order to be certified by only the minimum meta-standard, rather than pursuing (even if voluntarily) more stringent best practices with regards to sustainability certification (Bartley, 2014, p. 104). The ensuing variety and strategic maneuvering of those seeking to be certified also creates fragmentation (Abbott, 2012; Schleifer, 2013). Such dynamics then do not contribute to promoting more sustainable outcomes on the ground.

Another shortcoming of these dynamics in biofuel sustainability certification is that certification occurs primarily where it is easy to obtain, i.e., at production sites that already comply with the required minimal meta-standard. Most of the 19 voluntary schemes that the European Commission

accepted for RED are not applicable to developing countries, for example, the Scottish Quality Farm Assured Combinable Crops (SQC) scheme, which certifies only Scottish biomass (European Commission, 2016). Consequently, certification does not serve as a tool to expand the use of best practices, especially when the benefits of becoming certified under a more ambitious sustainability scheme are limited. Less sustainable farms have sufficient alternative export possibilities (beyond access to the EU market) that do not require certification (Mohr and Bausch, 2013, p. 10; Saikkonen et al., 2014, p. 8). See Textbox 5.1 for examples of strategies that may encourage a race to the top. The fact that private certification schemes are not embedded in laws or policies of producing countries might increase this effect even further (Gulbrandsen, 2005a; Mayer and Gereffi, 2010; Ruysschaert and Salles, 2014, p. 440). This would be an argument for a more legality-driven approach to promote sustainability outcomes across a whole sector. For example, the Indonesian Sustainable Palm Oil system (ISPO) is a mandatory national standard that is applicable to all oil palm growers in Indonesia (Indonesian Sustainable Palm Oil (IPSO), 2016); however, ISPO is yet to be accepted by the EC (European Commission, 2016).

Textbox 5.1 Top-runner program for sustainable biofuels

- Japan encourages competitiveness on energy efficiency with a unique program: the Top Runner Approach. The program sets a mandatory meta-standard, based on the most efficient ("top runner") products on the market, for a variety of appliances, equipment, and automobiles. It has been a highly effective program since its adoption in 1998 and is now considered one of the major pillars of Japanese climate policy. By 2009, the program achieved mandatory energy efficiency standards for 21 products (Kimura, 2010).
- Likewise, the European Commission could limit the number of accepted biofuel certification schemes and only accept the most stringent schemes for contributions to its 10% transport target. This would prevent earlier and more ambitious schemes to vanish from the market. Companies would be more likely to commit to schemes that are more ambitious and, hence, more likely to stay on the Commission's list.

Source: developed by authors

5.4.3 Certification and the Stimulation of Best Practices

As we argued above, voluntary certification schemes have become, in part, responsible for the execution of the sustainability requirements of RED. This is controversial due to the nature of many voluntary certification schemes, which are driven by mainly profit-seeking private actors (Partzsch, 2011; Ponte and Daugbjerg, 2015). With regards to what constitutes stringent criteria and best practices, biofuel certification schemes reveal a broad variety in governance procedures and standard-setting with regards to coverage, assurance, verification, transparency, quality, and monitoring and reporting mechanisms. Ambitious certification schemes were developed before a discussion started on a mandatory requirement for sustainability certification of biomass-based transport fuels, i.e., specifically before the 2007–2008 food price crisis. The most ambitious schemes were developed for high value-products, for example, palm oil in certified food and cosmetic products. The Rapunzel "HAND IN HAND" program, started in 1992, can definitely be considered a "best practice" (see fail to deliver on its promises. Textbox 5.2) (Rapunzel., 2016). With regards to biofuel certification, multi-stakeholder initiatives in particular, such as the Cramer Commission and

the RSB, demonstrated a broad set-up and inclusion of various sustainably criteria, including environmental and social reporting indicators (Cramer et al., 2007; RSB, 2016). The government-driven schemes in their early phase of set-up also demonstrated this broader and more stringent approach, in particular, ISCC and NTA 8080 that the Dutch normalization institute NEN developed following the Cramer Commission. However, different to Rapunzel's "HAND IN HAND" program, these schemes never aimed for *organic* biomass production when talking about *sustainable* biomass. Prohibition of genetically modified organisms (GMOs) was an issue in the Cramer Commission (Partzsch, 2011), but did not enter into any final criteria catalog. Central to the Cramer Commission, which focused on biomass-based fuels, was the GHG balance. The Commission suggested a minimum requirement of 30% GHG reduction for 2007 and 50% GHG reduction for 2011 (and 70% emission reduction in the long run), compared to fossil fuels (Cramer et al., 2007). RSB requests GHG emission reduction of 50% compared to fossil fuel (RSB, 2016). The 2009 EU RED criteria are similar: GHG savings of at least 35% in comparison to fossil fuels, 50% since 2017, and 60% since 2018 (but only for new production plants) (The European Parliament and of the Council of the European Union, 2009b).

The effectiveness of individual certification schemes was the topic of extensive research by academics and NGOs, which demonstrated that there is a large gap between intentions and set-up of many voluntary schemes, and that these schemes have limited (global) impact (Dam et al., 2008; Gulbrandsen, 2005a; Meyer and Priess, 2014; Ruysschaert and Salles, 2014; WWF-Germany., 2013). A related risk of using voluntary schemes is that certification itself is not always a guarantee that standards are actually followed or enforced or that underlying governance issues are addressed (Bush et al., 2015; Larsen et al., 2013; Mayer and Gereffi, 2010). This means that compliance with a scheme is not the same as achieving the sustainability objectives set out by the policy. The EU's dependence on, and trust in, certification as a tool for improving sustainability might, therefore, fail to deliver on its promises.

Textbox 5.2 Best Practice: Rapunzel HAND IN HAND Sustainability Criteria for Palm Oil.

- No clear-cutting of primary forests; protection of the natural habitat of endangered animals and plants
- Promotion of animal and plant diversity also inside palm plantations
- 100% organic cultivation, no combined organic-conventional operations and absolute prohibition of genetically modified organisms (GMOs)
- Integration in locally grown structures, respect of land ownership rights and rights of indigenous people
- Transparent production structures and process chains
- Regular on-site visits of Rapunzel agri-engineers
- Verifiable social standards
- External control and certification of independent agencies

The German organic food company Rapunzel started the HAND IN HAND program in 1992, which certifies palm oil from Ghana, among other raw materials, used in the company's products. The program combines the ideas of controlled organic farming and fair trade.

Source: Rapunzel (2016) (authors' translation from German)

Most private schemes deal differently with regards to other sustainability criteria, such as biodiversity. For example, the Cramer Commission (2007) proposed that plantations must not be located in or in the immediate vicinity of "gazetted protected areas". A core RSB principle is that "biofuel operations shall avoid negative impacts on biodiversity, ecosystems, and conservation values" principle 7, see Reference (International Sustainability and Carbon Certification (ISCC), 2016), including that "ecological corridors shall be protected, restored, or created to minimize fragmentation of habitats" principle 7, see Reference (International Sustainability and Carbon Certification (ISCC), 2016). Similarly, the Cramer Commission and RSB asked for environmental reporting, including on the use of agro-chemicals. The EU RED prohibits feedstock production on land with recognized high biodiversity and carbon stocks, and on peatland. There is, however, no ban or need for reporting on the use of agro-chemicals (The European Parliament and of the Council of the European Union, 2009b). So, we may argue that more than two decades after the set-up of the "best practice" Rapunzel scheme, the EU's hybrid governance approach is still lagging behind in terms of what is possible regarding sustainability. The examples described above illustrate that hybrid governance may enhance the governance capability to achieve sustainably goals, but only if states include in their meta-standard new or improved "best practices" developed by private schemes that instituted more stringent sustainability requirements (Abbott, 2012).

5.4.4 Assumptions and Characteristics of the Biofuels Market

To understand the governance and sustainability challenges related to the biofuels market, it is important to take the specific characteristics of this market into consideration, because they influence the European governance landscape. Biofuels are not sold on a consumer market like foodstuffs and cosmetics. When people buy gasoline, they have no information about how the blended percentage of biofuels contained therein is certified. There are also no alternatives available at the point of sale, from which a consumer could choose. This also poses a limitation relating to the

difficulty of quantifying the amount of certified biomass for biofuels by private initiatives, making it harder to assess their success in comparison with one another.

As outlined above, worldwide demand for biofuels is primarily policy-driven, rather than by economic considerations. An increasing number of countries developed a biofuel-for-transport strategy by using policy or tax incentives/cuts, blending targets, or production subsidies. Only in the United States of America (USA) and the EU are these blending mandates under continuous scrutiny because of sustainability concerns. In other regions, the focus is primarily limited to energy-security aspects (Renewable Energy Policy Network for the 21st Century (REN21), 2014; Stattman and Gupta, 2015). The wide availability of alternative markets for non-certified biomass/biofuels has implications for the effectiveness of EU policies, because there are no globally comprehensive biofuel laws and, hence, there is no level playing field for companies with regards to buying and trading biofuel resources. The willingness of companies to invest in this sector is, therefore, affected by uncertainty about long-term policy objectives regarding the insecurity about certification and the continuation of blending requirements (International Renewable Energy Agency (IRENA), 2014; Renewable Energy Policy Network for the 21st Century (REN21), 2014; WWF-Germany., 2013).

Another challenge in the case of biofuels is that this term covers many different resources, products, producing countries, etc. This makes a discussion about sustainable biofuels challenging; soy produced in one region might be seen as efficient and sustainable, while soy from another region may be not. This makes it hard to define “sustainable soy” in general terms (Stattman et al., 2013). The same applies to almost all biofuel crops and producing countries, all of which have their own interpretation of sustainability, with possibly more consideration for social or economic aspects than the EU meta-standard. Brazil, for instance, has its own social development program for the promotion of biofuels that is very different from the environmental sustainability-driven certification requirements of the EU. Instead of requesting GHG savings, protection of land with high carbon stock, and protection of biodiverse grasslands, the Brazilians included also social inclusion ambitions in their biodiesel policy (Stattman and Mol, 2014). In addition, Brazilian sugar traders argue that increasing domestic demand made export to the EU less important, together with the lack of price premiums for participation in the EU biofuels market, and the costs of certification. As such, the added value of certification for them is negligible, especially in light of other available markets (Pacini et al., 2013, pp. 901–902). It may, therefore, not be surprising that the Greenergy scheme was not renewed after its initial five-year approval by the EC.

The interplay between agricultural and food markets and the energy market is another important issue in considering sustainability standards for biofuels. Beyond the fact that production of biofuels may drive up food prices, it is clear that first-generation biofuels are intimately linked to agricultural and food markets through their reliance on the same resources. Biofuels are, thus, part of a highly international agricultural dynamics with constantly changing trade flows, as well as part of a highly volatile energy market. This creates new forms of competition on many different levels and markets. In addition to the challenges for certification, these characteristics of a biofuel market ensure that there is interference with other institutions that regulate international trade, in particular, the WTO. The EU is restricted in its ability to formulate expansive production process-based biofuel sustainability requirements, without creating non-tariff trade barriers or putting into place unjustified agricultural subsidies as a way to promote production of sustainable biofuels (Stattman and Gupta, 2015). The large share of biomass that is imported from regions outside the EU is seen as

an argument in favor of voluntary certification, as this is where unsustainable practices (environmental degradation, etc.) are witnessed more often. By making use of voluntary certification to monitor farms in non-EU producing countries, the EU avoids conflicts with the dominant free-trade paradigm and can influence production processes outside its own borders without breaking the WTO rules (Schleifer, 2013, p. 9).

5.5 Conclusions

The EU created an elaborate framework to stimulate the production and use of biofuels, while striving for sustainability within its production and supply chain. We have seen that EU biofuel policies evolved over time. While the EU was increasing the share of biofuels and renewable energies and the biomass imports in its transport policies, it was also becoming more cautious about the potential negative side-effects of stimulating biofuel production, in particular, relating to ILUC and food price increases in developing countries.

The EU's main biofuel policy tool, RED, applied a hybrid governance approach that allows the EU to demand sustainable biofuels by setting a meta-standard for sustainability and efficiently outsourcing monitoring and certification obligations to private actors. This approach promised to be flexible and to draw on latest insights into sustainability practices on the ground, as well as to make use of innovative private initiatives. The expectation was that private certification schemes would add their own additional sustainability goals to the mandatory EU meta-standard and, hence, facilitate a shift toward greater sustainability in biofuel production, within and beyond the EU. Our analysis suggests that the hybrid governance strategy relied upon by the EU did offer the potential to increase the impact and stringency of its biofuel sustainability objectives in the manner envisaged above. However, this did not materialize in practice because of the minimal requirements of the EU's meta-standard, which in turn led to a proliferation and fragmentation of available certification options, and a concurrent lack of incentives to search for and be certified against the best available practices with regards to sustainability.

Firstly, given that the EU's hybrid governance approach stimulated the involvement of private actors, the meta-standard turned out to be more crucial than initially assumed. Early sustainability schemes were formulated by multiple stakeholders, including NGOs such as Friends of the Earth and Oxfam, and addressed a broad range of sustainability aspects, reaching well beyond the minimum RED requirements to come. The later industry schemes, however, adhere to the "minimum" of the EU meta-standard. Against this backdrop, we conclude that the meta-standard is set too low and does not encourage a "race to the top" in sustainability standards. It took more than five years after the introduction of RED before the EU addressed the impact of biofuel stimulation policies on food prices, by introducing the 7% cap on the use of first-generation biofuels from crops grown on agricultural land. Now the European Commission proposes to further strengthen this requirement to a 3.8% cap on food-based fuel in 2030. Regarding the planned increase of the biofuels share, however, the overall volume of potential food processed to biofuel and renewable energies might still increase. Contributing more effectively to all dimensions of sustainability in biofuel production would require the EU to set its meta-standard at a higher level and to also include social criteria.

Secondly, the proliferation of private schemes led to a serious fragmentation of biofuel certification and associated sustainability governance. Companies may choose between several schemes and they may opt for the least demanding and still have access to European market for sustainable biofuels. As there is no economic incentive to commit to more ambitious sustainability standards, there currently is a race to the bottom. Contrary to other studies that show convergence between different standards at a higher level (Reinecke et al., 2012), the case of biofuels suggests that the presence of many different schemes results in a fragmentation-induced lowering of standards to a baseline minimum. Explanations for such differences in sectors might be the absence of consumer involvement in the development and use of biofuels standards in general, the absence of NGOs in the more recent standards, and the diversity of biomass materials used for the production of biofuels. Lessons for the setting of biofuel sustainability standards can be learned from the more ambitious standards developed for organic and "fair trade" palm oil processed to foodstuff and cosmetics (e.g., Rapunzel HAND IN HAND).

Thirdly, EU certification requirements lack incentives to strive for "best practices". Ideally, hybridization of market-based and governmental regulation would contribute to achieving real sustainability outcomes (Larsen et al., 2013). In the current system, however, we found that schemes are forced into competition, primarily motivated by (economic) decision criteria and financial benefit. We found no indications that a learning process is taking place with regards to the development and implementation of ever more stringent sustainability criteria for biofuels. The political and public debate shifted rather to the question of whether the EU should make use of agro-biomass-based biofuels in the first place to achieve its sustainability goals.

Fourthly, food-based biofuels continue to be a public concern. Ongoing debates about the adverse effect of biofuels indicate that neither individual voluntary certification standards nor the EU meta-standard have the governance capacity to address sustainability issues with the magnitude of, e.g., ILUC, thus challenging this hybrid governance approach to sustainability. This is clearly illustrated in the European Parliament decision to propose an end to the use of palm oil for biofuels. It shows the lack of public trust in the effectiveness of the complex hybrid arrangement to prevent the negative effects of biofuel production. The interaction between hybrid governance and sustainability objectives is, thus, revealed again to be delicate and changeable. Existing experience with hybrid forms of governance suggest that the EU RED arguably has little effect on the ground in biofuel-producing countries and might even be hindering the achievement of sustainability objectives. A crucial imperative for future EU biofuel governance is, therefore, to seek appropriate governance mechanisms and incentives that will actively stimulate the development and adoption of best practices. Effectively, this means a more active involvement of public authorities in the design and implementation of specific criteria and standards for biofuels.

In concluding, how do these findings resonate beyond the biofuel issue-area? It is important to note here the specific characteristics that make biofuels a special case of EU hybrid governance. Compared to most other commodity markets, government involvement in this case is high, as the EU sets specific targets for biofuel production and use, and contributed to creating a policy-led international market for biofuel production and trade. Unlike other areas, consumers are not in the front guard of making decisions, since they are not informed about the presence of biofuels in their transport fuel, neither do they have any choice in what to buy. In addition, biofuels can be produced from a broad range of different raw materials, most of which may also be used for other products,

complicating the development and application of stringent sustainability criteria. These unique characteristics notwithstanding, our broad conclusions are nevertheless applicable in other domains beyond biofuels as well. Based on our findings, we conclude that hybrid environmental governance requires active state and public involvement, to ensure the application of lessons learned, and effective implementation of sustainability standards on the ground in diverse contexts. Hybrid governance cannot be successful by simply shifting responsibilities for sustainable production and processing to private actors. For a future research agenda, it will be interesting to see how our findings about hybrid governance apply to sustainability of other agro-food chains. Also, in this paper, we primarily examined the EU approach. Comparing this to how biofuel governance evolved in, for example, the USA or in Latin America could shed further light on when and under what conditions hybrid (public–private) governance can further desired sustainability objectives.

6 Conclusion

This thesis analyses evolving biofuel governance arrangements in Brazil and the EU and the interactions between them, including diverse notions of sustainability contained herein. A central concern is the extent to which the EU has succeeded in exporting its own notions of sustainability beyond its borders, in seeking to create a global market for sustainable biofuels.

Through detailed analysis in four empirical chapters, the thesis answers two cross-cutting research questions:

- How have biofuels been governed in the EU and Brazil over time, and what (conflicting or converging) notions of sustainability are embodied in these evolving governance arrangements?

- How has the EU sought to export its notions of sustainability beyond its borders, with particular focus on Brazil, and (how) has it succeeded in doing so?

Section 6.1 of this concluding chapter synthesizes the key findings of the thesis from the four empirical chapters. Section 6.2 then answers the two cross-cutting research questions. Section 6.3 reflects on theoretical contributions and the methodological approach adopted in the thesis, including internal and external validity. Section 6.4 concludes by providing policy implications and a future research outlook.

6.1 Research findings

The overall research objectives and questions were addressed within the four empirical chapters, focusing, respectively, on evolving EU and Brazil biofuel governance and on how key aspects of sustainability were negotiated and developed in each of these contexts (see Figure 6.1).

Chapter 2 traced the historical evolution of bioethanol and biodiesel policies and governance arrangements in Brazil, including the role of key actors. In doing so, I explained how biofuels in Brazil have been governed over time, including evolving understandings of sustainability therein. The analysis showed that ethanol-focused governance arrangements concentrated primarily on energy security rather than sustainability concerns. In contrast, biodiesel governance initially was concerned with (social) sustainability, particularly questions of rural development and social inclusion of small farmers in biodiesel production. The analysis shows, however, that over time both types of biofuels are being governed to further agricultural and energy goals, rather than (social) sustainability objectives. This is illustrated by the growing focus on increasing blending targets for biodiesel, rather than on realizing social inclusion and rural development goals. These policy objectives (and their implementation) are also driven primarily by domestic imperatives, rather than export considerations.

Chapter 3 built on the historical tracing of biofuel governance arrangements in Brazil in the previous chapter to analyse in more depth the social inclusion component of Brazilian biodiesel policies. The chapter focused on the 2004 biodiesel policy and its two main objectives: to advance biodiesel as a transportation fuel and to foster social inclusion of family farmers through participation in the biodiesel chain. The chapter analyzes the extent to which cooperatives are involved in integrating family farmers into the biodiesel chain and what this means for the social sustainability of biodiesel, taking the northeast state of Bahia as a case study area. The findings show that through the biodiesel policy, cooperatives—until then a marginal phenomenon in northern Brazil—increased their membership, were empowered, and contributed to the economic development of a significant group of family farmers. However, these family farmers have not been substantially included in the biodiesel production chain itself. The chapter reveals the complexity of realizing social sustainability goals in biofuel governance. It shows that, although agricultural cooperatives can serve as intermediaries to facilitate family farmer inclusion in sustainable production, it is questionable whether a focus on producing specific quantities of global commodities, such as biofuels, is a suitable development trajectory for family farmers.

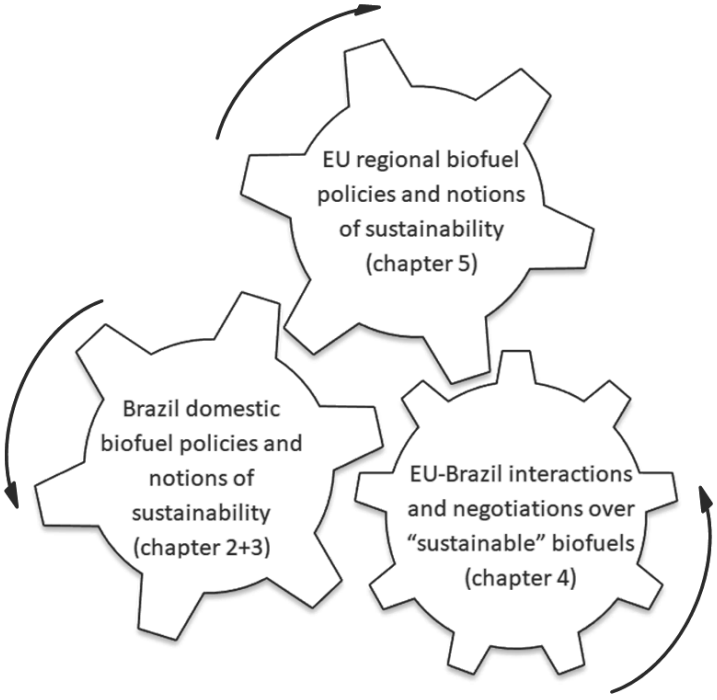


Figure 6.1 Analytical lenses: interacting spheres of governance authority
Source: developed by author

Chapter 4 moves to consider the global context for Brazilian biofuel governance and policies. It explores how global demand for biofuels has been stimulated by European Union policies that promote biofuels as a potential sustainable source of transport fuel, and how strategies are used by the EU to export its evolving notions of sustainability beyond its own borders. The chapter analyzes how Brazil has navigated an evolving global governance context for sustainable biofuels, in particular how it has responded to EU biofuel sustainability imperatives. The chapter focuses specifically on analyzing how these debates have played out in the context of World Trade Organization (WTO) disciplines governing trade in commodities such as biofuels. The chapter concludes that while Brazil emphasizes the social and developmental objectives of its biofuel policies in a domestic context, it frames itself globally as a leading producer of (environmentally) sustainable biofuels. In doing so, it navigates intersecting spheres of governance authority, such as the EU and the WTO, in a manner that promotes its own biofuel policy agenda, partly by seeking to reframe "sustainability" debates internationally to reflect its developmental agenda. The analysis shows how the global debate over sustainable biofuels is as much a battle over governance of national territory as a battle over global market access insofar as it impinges upon domestic production practices. The chapter concludes, however, that Brazil has not yet adjusted, nor felt the need to adjust, its domestic biofuel policy priorities and practices because of the EU's environmental sustainability requirements.

Chapter 5 shifts to analysing in detail how biofuel governance arrangements have evolved in the EU over time, and how understandings of sustainable biofuels have evolved within these arrangements. The chapter analyses a decade of biofuel policy making in the EU, in the context of continuous debates on sustainability issues related to the large-scale production, import and use of biofuels. In particular, the chapter focuses on the nature and functioning of the EU's novel hybrid (public-private) biofuel governance arrangements, and how notions of sustainability have been negotiated and established herein. Compared to most other commodity markets, state involvement in this case is high, as the EU sets specific targets for biofuel production and use and has contributed to creating a policy-led international market for sustainable biofuel production and trade. The EU's hybrid governance approach has been implemented since 2009, involving a meta-standard established by the EU and specific sustainability requirements developed by private and hybrid actors to comply with the meta-standard. The expectation underpinning a hybrid governance approach was that private initiatives would add their own additional sustainability objectives to the mandatory EU meta-standard, and hence lead to greater sustainability in biofuels production, both internally within and external to the EU. The chapter concludes that instead of yielding an increasingly stringent set of sustainability standards, this hybrid approach is characterized by contested notions of sustainability, with a trend towards less ambitious or lowest common denominator industry-led standards. At the same time, while the EU has continuously increased the share of biofuels and renewable energies and the biomass imports in its transport policies, it has recently become more cautious with regard to potential negative side-effects of stimulating biofuel production, in particular indirect land use change (ILUC) and food price increases in developing countries. Its biofuel policy directions are therefore yet again being adjusted and are currently at a critical juncture.

6.2 Answering Research Questions

This sub-section draws on and further syntheses of empirical findings presented above to answer the two cross-cutting research questions of this thesis.

6.1.1 Governance arrangements in Brazil and the EU

How have biofuels been governed in the EU and Brazil over time, and what (conflicting or converging) notions of sustainability are embodied in these evolving governance arrangements?

In Brazil, biofuel governance has been characterized by a strong role for the state, without much governance authority transferred to non-state actors. This has shaped the directions of, and approach to, governance, and associated sustainability goals. In realizing its specific sustainability goals, Brazil has tried to involve other actors, such as agricultural cooperatives. The thesis findings suggest that a central focus of Brazil's governance arrangements has been to set up, and institutionalize, blending targets rather than specify detailed sustainability targets. Despite concerted efforts, particularly in early years of biodiesel policy development, to broaden the scope to include social sustainability as a crucial policy goal, blending targets, i.e. percentage of biofuels blended with fossil fuels, have been a persistent and dominant focus of domestic biofuel governance in Brazil over time, for both bioethanol and biodiesel. National biofuel policies have also prioritized linking a variety of policy domains (including development, energy and agricultural policies). Biofuel governance arrangements and strategies have focused on creating schemes to subsidize and thereby increase production, including through financial incentives and price manipulation. The focus has been primarily on securing domestic supply and demand of biofuels, with more market-driven developments and export possibilities emerging as a supplementary concern in later years when the EU sought to create new markets in (sustainable) biofuels.

Through these governance arrangements, Brazil's notion of sustainability has also evolved. As chapters 2 and 3 show, there has been a shift from a concern with energy security towards one including social sustainability in biofuel governance. But in recent years, the primary concern has been to encourage large scale production rather than securing rural development. The limited environmental concerns associated with large scale biofuel production have focused on domestic issues like air pollution due to sugarcane burning during the production process, and with trying to prevent excessive reliance on one or two crops (such as sugarcane or soy) to avoid monocultures in biofuel production. This effort at crop diversification notwithstanding, the dominant crops for biofuel production in Brazil remain sugarcane and soy. Environmental concerns in Brazil's biofuel governance have hardly touched upon climate change and land use.

In the EU, governance of biofuels was initiated by an EU directive, i.e. it has been, as the case with Brazil, also state-driven. Initial governance arrangements were 'top-down' and intended to create markets in the new commodity – biofuels. However, these early governance arrangements for biofuels did not include or specify sustainability requirements. Governance arrangements instead were focused on securing alternative transport fuels, and thereby promoting large scale production and import of biofuels (bioethanol and biodiesel). The assumption underlying this was that these alternative fuels would be a greener alternative to fossil fuels, especially with regard to reductions in greenhouse gas emissions. With a growing surge in demand for biofuels as a result of these EU policies, however, sustainability came to the fore, with concerns voiced regarding conflicts between land used for biofuel versus food production, and regarding reductions of greenhouse gas emissions to the extent believed earlier. The latter was particularly voiced because of including emissions resulting from indirect land use change when converting land to biofuel production. EU biofuel

governance arrangements responded (slowly) to these concerns by developing a meta-standard that sought to reduce environmental consequences of expanded biofuel production, including adverse impacts on biodiversity. Simultaneously, a proliferation of private and hybrid governance initiatives emerged to try to address sustainability concerns. The EU responded by creating a hybrid governance scheme in order to operationalize its sustainability meta-standard. It also developed a typology of different biofuels, in order to address concerns about food-based biofuels, with diverse governance arrangements applying to different types of biofuels. More recent developments include phasing out food-based biofuels all together, in order to shift to more advanced second and third generation biofuels that raise fewer sustainability concerns.

The EU's biofuel policy directions have not, however, consistently moved towards more stringent sustainability requirements. It started out by setting ambitious goals for biofuels, to create a market in what was seen to be a more sustainable alternative to fossil fuels. However, these goals soon came in conflict with contentious debates about sustainability, including trade-offs between fuel versus food. The EU's novel hybrid governance approach has resulted in a mandatory meta-standard for sustainability, but this meta-standard is a minimum floor rather than a set of increasingly ambitious sustainability requirements. In response to a continuing controversy about sustainability, however, the EU has also recently chosen to go beyond its own meta-standard. In separate policy debates and trajectories, it recently decided to phase out palm oil for biofuel production and to place caps on biofuels produced from other food crops.

In sum, governance arrangements for the EU and Brazil are both primarily state-driven, and sustainability considerations included in these arrangements reflect different state priorities, such as environmental concerns (in the case of the EU) and social inclusion and rural development (in the case of Brazil). More than Brazil, the EU has, furthermore, relied upon private actors to operationalize its meta-standards for sustainability. In Brazil, non-state intermediaries, such as agricultural cooperatives, have been given an important role in creation and governance of a biofuel market, partly to further social sustainability goals, but these goals have been only partially realized. Furthermore, in both cases, the involvement of non-state actors has not resulted in more stringent sustainability standards being developed or realized in practice. In Brazil, the social inclusion goals have been marginalized to emphasize growing domestic production via ever increasing blending targets, while in the EU intense debates about the conflict fuel versus food has resulted in a policy shift away from first generation, food-based biofuels. This has potentially reduced the need to develop and institutionalize more stringent criteria to address environmental (and social) sustainability concerns arising from first generation biofuels.

6.1.2 EU governing beyond its borders

How has the EU sought to export its notions of sustainability beyond its borders, with particular focus on Brazil, and (how) has it succeeded in doing so?

This question is addressed here by first, identifying key evolving elements of the EU's sustainability meta-standard, and second, assessing how these were taken up or not in the Brazilian context. The section discusses how Brazil has reacted to EU sustainability imperatives over time, and whether the

EU meta-standard has impacted upon its own domestic or international biofuel policy directions and choices.

In doing so, three key elements of the EU's sustainability meta-standard and associated policy directions and debates are discussed: (a) the social sustainability-related food versus fuel debate that launched sustainability discussion within the EU, and how this was reflected (or not) in the EU sustainability meta-standard over time; (b) the environmental sustainability debate over which biofuel crops were more emission-saving and energy and climate friendly, and incorporating these elements into its sustainability meta-standard. The concern relating to indirect land use change and impact on high biodiversity areas from growing crops used for biofuels were part of this concern/debate; and finally, (c) the shift from first to second and third generation biofuel use on both social and environmental sustainability grounds.

(a) Food versus fuel: As the detailed analysis in chapters 4 and 5 has documented, the EU's initial attempts to create a market in biofuels as a sustainable transport option encountered a contentious food vs. fuel sustainability debate, which escalated into a global controversy during the food price crisis in 2007-2008. This coincided with the EU proposing obligatory blending targets for biofuels, but not yet a clear standard with regard to sustainability. Nevertheless, the food vs. fuel debate reinforced the EU's decision to add sustainability criteria to its emerging biofuel policies. However, the stringency of the EU's sustainability requirements to address this debate has been contested from the start. As the chapter shows, the EU debated its meta-standard in response to the food versus fuel debate for a while, even as more than 60 different sustainability initiatives emerged in the interim to fill the policy gap. Eventually, the EU's meta-standard does address this debate, by limiting use of food crops used for biofuels.

Has Brazil followed a similar trajectory? Brazil's response to the food versus fuel debate is, as argued in chapter 2, to engage with the debate on a global stage but largely to make the point that this is a non-issue in Brazil. The reason offered is because Brazilian sugarcane ethanol production is not pushing global or national food prices higher, because it was a long-standing existing domestic market, with a well-established calibrated balance between sugar and ethanol production (chapter 2). As for soy-based biodiesel, the argument was that there is sufficient land available to avoid a food versus fuel competition. More generally, in contrast to seeing the use of food crops for biofuels as detrimental to social sustainability and food access, the Brazilian approach and policy choices instead emphasized that biofuel (biodiesel) production helped small farmers participate in the biofuel chain, thereby increasing their sources of income and therefore their purchasing power (including for food).

In conclusion, the food versus fuel debate and its uptake in EU policies compelled Brazil to advertise its own policies and practices on a global stage as being a sustainable alternative, compared to developments in other countries where biofuel policies impacted food security (e.g. Mexico). The issue of biofuels competing with food production was considered a non-issue within Brazil itself.

(b) Environmental credentials of biofuels: As discussed in chapters 4 and 5, the 2008 EU RED directive required biofuels to reduce GHG emissions by 35% compared to fossil fuels, in order to count towards the EU's mandatory biofuel quota or to be eligible for financial support schemes. This increased to 50% in 2017. In the same directive, it was also stated that raw material from land with high biodiversity, including highly biodiverse grasslands, could not count towards the mandatory

blending targets. With these requirements, the EU attempted to stimulate the emergence of a global energy market in *sustainable* biofuels. These measures were taken after strong criticism of the earlier 2003 Biofuels directive that did not include such requirements and the strong and increasing concerns about the potential negative effects of EU biofuel policies. With these requirements, the EU attempted to create a biofuels market that was potentially more climate neutral regarding GHG emissions. To this end, the EU has created specific calculation tools that determine the extent to which certain crops count towards member state obligations relating to GHG emission saving. This also influences signals which crops are seen by the EU as preferable for biofuel production.

As a proof of compliance with its directive, the EU asked for sustainability certification of biomass used to produce biofuels. Different voluntary sustainability schemes have since been accredited by the EU to certify compliance with requirements of the EU directive. As argued in chapter 5, the EU requirements function as a meta-standard and the voluntary certification initiatives can be viewed as a form of hybrid governance that, in addition, allow the EU to pursue certain policy objectives that might otherwise run afoul of WTO obligations because of their potential negative trade impact (chapter 4). By accepting a diversity of different voluntary certification initiatives, the EU argues that trade is not limited.

The reaction in Brazil with regard to the new EU requirements regarding environmental considerations was twofold. On the one hand, Brazilian sugarcane has been labelled as one of the most efficient and environmentally friendly biofuel crops. Both EU and Brazil agreed on this, and EU policies did not change this perspective. On the other hand, the situation regarding production and use of soybeans for biodiesel is different. Already before biofuel-related sustainability concerns were initiated, worries were raised on the expansion of soybean production into the Brazilian Cerrado, i.e. the Brazilian savannah with high biodiversity. The EU is a major importer of soybeans for food and animal feed, with no special sustainability requirements. However, for soybean used for biofuels, Brazil has been compelled to exclude biodiesel derived from highly biodiverse grasslands. Non-biofuel related concerns about unsustainable, monoculture production and expansion of soybean led early on to the development of a multi-stakeholder initiative in the form of the Round Table for Responsible Soy (RTRS), which officially started in 2006 and certified the first producers in 2011.

From the start, soybeans have been the main feedstock for biodiesel production in Brazil. The global market has not played an important role because, as shown in chapter 2, in the “National Program for the Production and Use of Biodiesel” (PNPB) Brazil emphasized the national character of its policy. This is reflected in the criteria developed by the RTRS. These criteria, however, were not compliant with the EU directive. Therefore, after the implementation of the RED directive, a special EU annex was created ‘RTRS EU RED’ that made the RTRS compliant with the EU criteria, and the RTRS EU RED was reapproved in 2017. It is unclear, however, what percentage of Brazilian soy export is used for biodiesel and certified under this scheme. More importantly, it remains possible for Brazil to export soybean crops produced from areas that do have a favorable calculation for biofuels and comply with EU criteria. As it does so, it can also still produce and export from (high biodiversity or other) areas that do not meet the criteria, because the vast bulk of the international commodity market does not require certification. The EU policy therefore gave a signal and started the (local) debate, but it is very questionable whether it actually changed local practices.

In conclusion, the hybrid "tactic" of the EU, to establish its meta-standard on environmental criteria and then allow private initiatives to assess compliance, has partly worked but the overall effect has been limited, as argued in detail in chapter 5. The EU hybrid system only requires certification of biomass used for biofuels. All other usages of non-certified biomass are usable on non-biofuel markets. Nevertheless, some of the voluntary certification schemes are used by Brazilian farmers, primarily "RTRS EU RED" for soy; and "Bonsucro EU" for sugarcane. Without the EU policy, these schemes probably would not have been developed. On a critical note, however, it is questionable whether domestic production practices have changed as a result of these schemes. Case studies from chapter 3 and 4 indicate support for this conclusion, showing that exported crops that were already in compliance with EU criteria became certified for the EU market, while crops from other, not certifiable resources and lands, continue to be used within Brazil or for export to countries without these requirements. These schemes have thus not necessarily contributed to decreasing deforestation or preventing indirect land use change, as the EU policy aimed to do. The demand for biofuels has still driven up total demand for agricultural production, thus also the demand for land.

(c) Shift from first generation to advanced biofuels: The controversies about EU biofuel policies and the lack of knowledge about their sustainability has resulted, over the years, in an enormous amount of research. The research has been executed in many different fields, varying from technical innovations to social sciences. New insights have been gained not only regarding the use of biomass for biofuel production, but also regarding calculation methods, interpretations of sustainability, production systems, conversion techniques, and social and political consequences (Fehrenbach et al., 2008; Ros et al., 2010). This has broadened knowledge about ways to achieve GHG emission savings and an energy transition from fossil fuels. One result has been that the EU has moved towards ever more stringent regulation of first-generation biofuels and has sought to stimulate a move towards second and third generation biofuels, on both social and environmental sustainability grounds. The way that the EU has sought to do so is to move away from its "meta-standard" for food-based biofuels towards a policy of capping overall use of food-based biofuels.

In Brazil, an opposite development is taking place. Although here research on biofuel production and sustainability considerations has continued, it is primarily focused on improving the efficiency and conversion techniques for sugar cane and soy as primary biomass sources. In spite of ongoing debates about land expansion, the Brazilian government continues to increase biofuel-fossil fuel blending targets. The aim to include family farmers into the biofuel chain to achieve social inclusion, so prominent in the early years of biodiesel policies as shown in chapter 3, has been pushed to the background in the context of the country's increasing energy demand. The political turmoil and corruption scandals in recent years have also shifted attention away from securing Brazil's position as one of the largest biofuel exporters, an ambition held by President Lula da Silva. Brazil's financial and economic situation has also shifted focus in this and other policy programs away from social development issues.

Based on the above, it can be concluded that the EU has sought many different ways to export its notions of sustainability beyond its border, including, amongst others, to Brazil. However, its hybrid policy approach has had only a limited influence on domestic practices in Brazil, for various reasons. First of all, the EU itself has also changed its own perspective regarding biofuels. This is noticeable in the shift from "biofuel governance" to "*sustainable* biofuel governance" from 2003 until the present day. While initially, the EU prioritized setting up a meta-standard with environmental sustainability

requirements, it has in recent policy steps signaled a move away from this approach towards caps on certain food crops from particular regions. It has also chosen to emphasize a switch towards 2nd and 3rd generation biofuels that are deemed to be more sustainable.

A success has been that EU sustainability requirements have not, so far, been scrutinized by WTO trade rules. In this context, the EU has not had any conflicts with Brazil as a major exporter of soybeans. This is an entirely different case with palm oil produced in Indonesia and Malaysia, which has become under scrutiny due to the deforestation of lands with high carbon stocks. However, also in this case the meta-standard was not sufficient to block this use of palm oil. Rather in a separate trajectory, EU negotiators have agreed with palm oil producing countries to phase out the use of palm oil in transport fuels from 2030.

This example, as many others in this thesis, shows that what constitutes "sustainable biofuels" and how sustainability can be measured/guaranteed, remains contested and part of continuous, evolving debates. There is no shared notion between the EU and other biofuel production regions. Sustainability remains contested and context-based, even as the authority to define and operationalize sustainability remains largely with states (see also Figure 6.2). In addition, the EU has partly undermined the success of its own biofuel policies by only demanding sustainability for biomass used for biofuels. Crops that do not meet biofuel sustainability standards can still enter the European market for different use purposes. An alternative would have been to develop more stringent standards that also apply beyond biofuels to other use categories of the same crop. Yet the governance challenges this poses, in the context of international trade rules as well, are also significant.

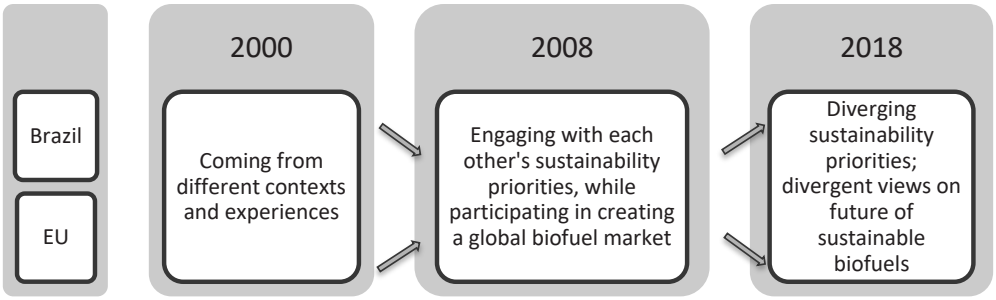


Figure 6.2 Converging and diverging EU – Brazilian notions of sustainability
Source: developed by author

6.3 Contribution to Knowledge and External Validity

This thesis contributes to existing knowledge in a variety of ways, with its findings and conclusions serving to both extend current insights on biofuel governance in the EU and Brazil, and going beyond these two countries to draw lessons for other countries engaged in biofuel production and trade. We also address lessons from the biofuel case for other areas of sustainability governance, more generally.

First, this thesis highlights the importance of a focus on governance of an emerging commodity, such as biofuels. An initial motivation to undertake this research was to place *governance* considerations central in this newly emerging sustainability debate, given a biofuels literature that at the time tended to be largely technical, with a focus on different typologies of biofuels and their technical climate mitigation potential. In emphasizing the need to examine complex governance challenges, the thesis also highlighted the need to focus on complex interactions between states and non-state actors. In doing so, it has shown that the state remains vitally important in this context, with biofuel governance trajectories being primarily state driven. While much global governance literature has focused in the last decade on the rise of private governance and the 'decline of the state' (Compagnon et al., 2012; Falkner, 2003; Mol, 2016; Pattberg and Stripple, 2008; Rosenau, 2007), this thesis reaffirms the centrality of the state, at least in this specific context (cf. Mol, 2018). While doing so, the thesis has also emphasized and further illustrated the multi-actor context of biofuel governance, wherein diverse non-state actors are also influential in shaping governance trajectories.

A particular focus has been on examining the notion of hybrid governance, wherein the state interacts with private actors in novel forms of partnership or collaboration to further its governance objectives, including those relating to the evolving and contested notion of sustainability. As this thesis reiterates, hybrid sources of authority emerge and can be potentially effective in areas not yet extensively addressed via formal, state-led governance, such as, for example, neglected and ignored or newly emerging policy domains (Cashore, 2002; Ponte and Daugbjerg, 2015). This has been reaffirmed in the literature for other policy domains, such as forestry and fisheries (Gulbrandsen, 2010, 2005a; Lars H. Gulbrandsen, 2008; Schouten and Glasbergen, 2012). As the findings of this thesis reveal, hybridity has been an important dynamic in biofuel governance as well. Furthermore, a novel finding of this thesis is that a state's embrace of hybridity can be strategic, rather than resulting from state weaknesses. As the thesis shows, the state or public authorities (in this case, the EU) make strategic use of the capabilities of other actors, particularly as a means to govern beyond their own borders. This both engages with, and departs from, dominant claims in the literature that emphasize that hybrid governance is on the rise primarily as a result of a retreat of the state, and/or in response to gaps in state-based governance or its ineffectiveness (Bush et al., 2013; Gulbrandsen, 2005b; L. H. Gulbrandsen, 2008; Mol, 2016; Schouten and Glasbergen, 2012).

The analysis suggests, rather, that the EU has strategically engaged in a hybrid governance approach as a way to operationalize and diffuse beyond its borders its own sustainability meta-standard. In Brazil, as well, the state remains central to biofuel governance trajectories, even as it has engaged in its own experiments with hybridity, in this case involving agricultural cooperatives to further its own particular sustainability goals (relating to social inclusion), with varied results. These latter insights are another novel contribution of this thesis, given that agricultural cooperatives in Brazil had been little analyzed from a sustainability perspective.

The thesis findings also reveal that hybridity *per se* does not lead to higher sustainability standards. This is in contrast to earlier claims in the literature about the promise of private and hybrid forms of environmental governance and standard-setting as a key means to 'green the state' (Eckersley, 2004). The merits of private governance and their contributions to sustainability have since been extensively debated and contested in the literature (Abbott, 2012; Bush et al., 2015; Pattberg and Stripple, 2008; Schaller, 2007).The findings of this thesis support a more critical take on hybrid approaches. Furthermore, the focus on the strategic use of hybridity to govern beyond state borders

is also novel, given extensive early debates in the governance literature about why hybrid governance is on the rise; what it might yield in terms of governance effectiveness; and whether and to what extent it was filling gaps in state-led governance. The thesis contributes to and extends these debates by examining hybridity as an explicit state strategy to govern beyond its borders, and export a *state-mandated* sustainability meta-standard.

The analysis in the thesis also shows, however, that hybridity as a strategy did not always help the EU to govern beyond borders, by successfully exporting its (contested) notion of sustainability to Brazil. The findings highlight that hybridization is thus not necessarily the best road to increasing sustainability, if the state-mandated "meta-standard" is not stringent. And even if it is, it is still a significant challenge to use it to secure a race to the top, rather than to the bottom, in hybrid sustainability standard-setting. Advantages of hybridization are particularly hard to realize in the face of fragmentation, which can arise if voluntary schemes are forced into mutual competition.

As such, our findings also engage with the extensive literature on certification as a tool of voluntary, state-led environmental governance (Bush et al., 2013; Toonen and Mol, 2016, 2013; Zhang et al., 2016). The thesis findings highlight that certification is not a substitute for mandatory state-led governance, and is rather a tool to execute a state-led meta-standard and its effectiveness depends on the stringency of the meta-standard. As such, it also contributes to long-standing debates about the interface between trade and environmental standard-setting (Maciel et al., 2015; Oosterveer and Mol, 2010), in influential international settings such as the WTO. The analysis of how Brazil and the EU engage with the notion of sustainable biofuels within the WTO reveals that debates about how to 'classify' commodities, such as biofuels, are not just about 'neutral' scientific assessments, but are very much linked to divergent sustainability framings of different states. This has implications for how other states, such as the United States or Argentina, might seek to further trade in 'sustainable' biofuels, and leverage WTO disciplines in seeking to do so.

The thesis findings are thus also very relevant to understanding biofuel governance challenges in contexts other than the EU and Brazil. The findings of Chapter 4, for example, suggest that the global debate over sustainable biofuels is as much a battle over governance of national territory as of global market access, insofar as it impinges upon domestic production practices. While Brazil has not yet adjusted its domestic biofuel policy priorities and practices because of the EU's environmental sustainability requirements, this may vary for smaller developing countries, or those with less advanced domestic biofuel production policies.

Related to this, an increasingly important question becomes whether and how the hybridization of authority stimulates or discourages a "greening" of the developmental state in domains such as sustainable biofuels. Specific findings in the empirical chapters 2 and 3 suggest that, for countries in Africa or Southeast Asia, for example, that might be interested in producing biofuels and creating a domestic market, realizing social sustainability goals requires government commitment. It is also clear that certification by itself is not a guarantee for sustainable use of natural resources, because if biofuels create demand for extra agricultural production, this has implications for a country's total land use. The findings also imply that, since different food crops are suitable for biofuel production, so countries have to consider what is most suitable for their farmers and on what scale biomass-producing crops should be produced.

With the above, the findings of the thesis confirm, more generally, the widely noted finding in the literature that sustainability remains a contested and context-specific concept (Ackrill and Kay, 2011; Ponte and Daugbjerg, 2015; Searchinger, 2009).

6.4 Future Research Outlook

This thesis focused on the governance of first-generation biofuels derived predominantly from a few globally traded commodity crops, such as sugarcane (bioethanol) and soy (diesel), with a focus on Brazil and the EU. Key findings about the potential for hybrid governance, certification and state-led meta-standard-setting processes to further sustainability in Brazil and the EU, but also in other countries beyond these two, have been outlined above.

One key area of future research relates to continued use of first-generation biofuels in other parts of the world, despite persisting sustainability concerns. Thus, examining governance dynamics and sustainability definitions in contexts other than the EU and Brazil, and for crops other than soy and sugarcanes, remains relevant and timely, for example, in the US, Argentina, as well as countries in South-East Asia and Africa.

Equally important, and increasingly the subject of emerging analyses, is the shift from first to second and third-generation biofuels, such as wood pallets, biogas, algae and other sources (Bluemling et al., 2013; Mol, 2014; Pristupa and Mol, 2015). For future research, it is important to investigate whether there are similar or different dynamics, for example, around state-led and hybrid governance approaches in these new generations of biofuels. Although sustainability concerns for these second and third generation biofuels do not appear to be as critical or prominent, this might change in the future when the scale of production increases. A crucial question meriting further research therefore is: what trade-offs might this present, and how do the lessons from first-generation biofuels apply here, if at all?

In conclusion, the thesis highlights the continually evolving nature of new sustainability challenges and solutions, such as state-created (global) markets in sustainable biofuels. The role of the state remains a centrally important dynamic to further investigate. The recent elections in Brazil point to a potential shift in power away from the political party that has – until now– promoted biofuels domestically and internationally. Preliminary signs point towards a more domestic, inward-looking agenda, which is less oriented towards positioning the country on the global stage, whether for biofuels or other prominent issues. These developments might influence the role of Brazil as a major exporter and international player in the biofuel and more broadly, in sustainable energy debates. Following and understanding these developments within Brazil will be important with regard to the evolution of the biofuel policy domain, but also for issues such as deforestation in the Amazon and climate policy more generally.

As for the EU, as noted in this thesis, it stands at a crucial cross-road in its climate and energy policies, particularly with regard to the role for biofuels herein. EU countries are now debating how to implement collectively the 2015 Paris climate Agreement, including through revisiting the implementation of the Renewable Energy Directive (RED) between 2020-2030. Consequently, future biofuel development and governance trajectories remain in flux and fundamentally uncertain in

Brazil, the EU and beyond, and will be shaped in the context of broader political developments around energy and climate policy.

References

Abbott, K.W., 2012. Engaging the public and the private in global sustainability governance. Int. Aff. 88, 543–564. doi:10.1111/j.1468-2346.2012.01088.x

Abramovay, R., Magalhães, R., Schröder, M., 2008. Social Movements Beyond the Iron Cage: Weak Ties in Territorial Development. World Dev. 36, 2906–2920. doi:10.1016/j.worlddev.2007.11.020

Ackrill, R., Kay, A., 2011. EU Biofuels Sustainability Standards and Certification Systems - How to Seek WTO-Compatibility. J. Agric. Econ. 62, 551–564. doi:doi.wiley.com/10.1111/j.1477-9552.2011.00311.x

Afionis, S., Stringer, L.C., 2012. European Union leadership in biofuels regulation: Europe as a normative power? J. Clean. Prod. 32, 114–123. doi:10.1016/j.jclepro.2012.03.034

Altieri, M.A., Toledo, V.M., 2011. The agroecological revolution in Latin America: rescuing nature, ensuring food sovereignty and empowering peasants. J. Peasant Stud. 38, 587–612. doi:10.1080/03066150.2011.582947

Andonova, L.B., 2010. Public-Private Partnerships for the Earth: Politics and Patterns of Hybrid Authority in the Multilateral System. Glob. Environ. Polit. 10, 25–53. doi:10.1162/glep.2010.10.2.25

Andonova, L.B., Mitchell, R.B., 2010. The Rescaling of Global Environmental Politics. Annu. Rev. Environ. Resour. 35, 255–282. doi:10.1146/annurev-environ-100809-125346

ANP, 2012. Anuário Estatístico Brasileiro do Petróleo, Gás Natural e Biocombustíveis 2012 [WWW Document]. URL http://www.anp.gov.br/?pg=60983 (accessed 5.14.15).

Arts, B., Lagendijk, A., Houtum, H. van, 2009. The Disoriented State: Shifts in Governmentality, Territoriality and Governance, Environment & Policy. Springer Netherlands, Dordrecht. doi:10.1007/978-1-4020-9480-4

Auld, G., Gulbrandsen, L., 2009. To Inform or Empower? Transparency in non-state certification of forestry and fisheries. Amsterdam Conf. Hum. Dimens. … 2–4.

Bailis, R., Baka, J., 2011. Constructing Sustainable Biofuels: Governance of the Emerging Biofuel Economy. Ann. Assoc. Am. Geogr. 101, 827–838. doi:10.1080/00045608.2011.568867

Baka, J., 2014. What wastelands? A critique of biofuel policy discourse in South India. Geoforum 54, 315–323. doi:10.1016/j.geoforum.2013.08.007

Bartley, T., 2014. Transnational governance and the re-centered state: Sustainability or legality? Regul. Gov. 8, 93–109. doi:10.1111/rego.12051

Bastos Lima, M.G., 2012. The Brazilian Biofuel Industry: Achievements and Geopolitical Challenges, in: Parvizi Amineh, M., Yang, G. (Eds.), Secure Oil and Alternative Energy: The Geopolitics of Energy Paths of China and the European Union. BRILL publishing, Leiden, pp. 343–369.

Bastos Lima, M.G., 2011. An Institutional Analysis of Biofuel Policies and their Social Implications in

Developing countries: Lessons from Brazil, India, and Indonesia, 10-11 October. UNRISD conference, Geneva.

Berkum, S. van, Roza, P., Pronk, B., 2006. Soja handel- en ketenrelaties. Sojaketens in Brazilië, Argentinië en Nederland - Wageningen UR. Den Haag.

Bernard, F., Prieur, A., 2007. Biofuel market and carbon modeling to analyse French biofuel policy. Energy Policy 35, 5991–6002. doi:10.1016/j.enpol.2007.08.005

Bialoskorski Neto, S., 2001. Virtual Cooperatives in Brazil and the Globalization Process. J. Rural Coop. 29.

Bialoskorski, S.N., 2003. Corporate Governance and The Role of The Managers in Brazilian Cooperatives.

Bindraban, P.S., Zuurbier, P.J.P., 2007. Sustainability of feedstock for bio-diesel, in: VI International PENSA Conference Sustainable Agri-Food Bioenergy Chains, Networks Economic & Management. Ribeirão Preto, São Paulo State, Brazil.

Biofuelsdigest, 2014. Proposal on indirect land-use change: EU Council reaches agreement [WWW Document]. URL http://www.biofuelsdigest.com/bdigest/2014/06/13/proposal-on-indirect-land-use-change-eu-council-reaches-agreement/ (accessed 3.15.15).

Bluemling, B., Mol, A.P.J., Tu, Q., 2013. The social organization of agricultural biogas production and use. Energy Policy 63, 10–17. doi:10.1016/J.ENPOL.2013.08.035

Bonus, H., 1986. The cooperative association as a business enterprise: A study in the economics of transactions. J. Institutional Theor. Econ. 142, 310–339.

Bor, R.M. van den, 2012. RED's Biofuel Certification Schemes: comparing stringency and costs. Institute for Environmental Studies VU University, Amsterdam, the Netherlands.

Burrell, A., Hubertus Gay, S., Kavallari, A., 2012. The Compatibility of EU Biofuel Policies with Global Sustainability and the WTO. World Econ. 35, 784–798. doi:10.1111/j.1467-9701.2011.01430.x

Burstein, P., 1991. Policy Domains: Organization, Culture, and Policy Outcomes. Annu. Rev. Sociol. 17, 327–350. doi:10.1146/annurev.so.17.080191.001551

Bush, S.R., Belton, B., Hall, D., Vandergeest, P., Murray, F.J., Ponte, S., Oosterveer, P., Islam, M.S., Mol, A.P.J., Hatanka, M., Kruijssen, F., Ha, T.T. |T., Little, D.C., Kusumawati, R., 2013. Certify Sustainable Aquaculture? Science 341, 1067–1068. doi:10.1126/science.1237314

Bush, S.R., Oosterveer, P., Bailey, M., Mol, A.P.J., 2015. Sustainability governance of chains and networks: a review and future outlook. J. Clean. Prod. 107, 8–19. doi:10.1016/j.jclepro.2014.10.019

Cashore, B., 2002. Legitimacy and the Privatization of Environmental Governance: How Non-State Market-Driven (NSMD) Governance Systems Gain Rule-Making Authority. Governance 15, 503–529. doi:10.1111/1468-0491.00199

Cashore, B., Auld, G., Newsom, D., 2004. Governing through markets: Forest certification and the emergence of non-state authority, Library. Yale University Press, New Haven, CT, USA. doi:10.1017/CBO9781107415324.004

Cashore, B., Egan, E., Auld, G., Newsom, D., 2007. Revising Theories of Nonstate Market-Driven (NSMD) Governance: Lessons from the Finnish Forest Certification Experience. Glob. Environ.

Polit. 7, 1–44. doi:10.1162/glep.2007.7.1.1

Cashore, B., Stone, M.W., 2014. Does California need Delaware? Explaining Indonesian, Chinese, and United States support for legality compliance of internationally traded products. Regul. Gov. 8, 49–73. doi:10.1111/rego.12053

César, A. da S., Batalha, M.O., 2013. Brazilian biodiesel: The case of the palm's social projects. Energy Policy 56, 165–174. doi:10.1016/j.enpol.2012.12.014

César, A. da S., Batalha, M.O., 2010. Biodiesel production from castor oil in Brazil: A difficult reality. Energy Policy 38, 4031–4039. doi:10.1016/j.enpol.2010.03.027

Chaddad, F., 2012. Advancing the Theory of the Cooperative Organization: The Cooperative as a True Hybrid. Ann. Public Coop. Econ. 83, 445–461. doi:10.1111/j.1467-8292.2012.00472.x

Chan, S., Pattberg, P., 2008. Private Rule-Making and the Politics of Accountability: Analyzing Global Forest Governance. Glob. Environ. Polit. 8, 103–121. doi:10.1162/glep.2008.8.3.103

Chase, J., 2003. Regional prestige: Cooperatives and agroindustrial identity in southwest Goiás, Brazil. Agric. Human Values 20, 37–51. doi:10.1023/A:1022485224726

Compagnon, D., Chan, S., Mert, A., 2012. The Changing Role of the State, in: Biermann, F., Pattberg, P. (Eds.), Global Environmental Governance Reconsidered. MIT Press, Cambridge, pp. 237–263.

Cramer, J., Wissema, E., de Bruijne, M., Lammers, E., Dijk, D., Jager, H., van Bennekom, S., Breunesse, E., Horster, R., van Leenders, C., Wonink, S., Wolters, W., Kip, H., Stam, H., Faaij, A., Kwant, K., 2007. Testing framework for sustainable biomass: Final report from the project group "Sustainable production of biomass." Commissioned by the Energy Transition's Interdepartmental Programme Management (IPM); The Hague.

Cutler, C.A., Haufler, V., Porter, T., 1999. Private Authority and International Affairs. New York Press.

Dall'Agnol, A., Moscardi, F., Hoffmann-Campo, C.B., Saraiva, O.F., Galerani, P.R., Krzyzanowski, F.C., Carrão-Panizzi, M.C., 2004. Current status of soybean production and utilization in Brazil, in: Proceedings VII World Soybean Research Conference, IV International Soybean Processing and Utilization Conference, III Congresso Brasileiro de Soja (Brazilian Soybean Congress), Foz Do Iguassu, PR, Brazil, 29 February-5 March, 2004. Brazilian Agricultural Research Corporation, National Soybean Research Center, pp. 10–18.

Dam, J. van, Junginger, M., Faaij, a. P.C., 2010. From the global efforts on certification of bioenergy towards an integrated approach based on sustainable land use planning. Renew. Sustain. Energy Rev. 14, 2445–2472. doi:10.1016/j.rser.2010.07.010

Dam, J. van, Junginger, M., Faaij, A., Jürgens, I., Best, G., Fritsche, U., 2008. Overview of recent developments in sustainable biomass certification. Biomass and Bioenergy 32, 749–780. doi:10.1016/j.biombioe.2008.01.018

Daugbjerg, C., Swinbank, A., 2014. Globalization and new policy concerns: the WTO and the EU's sustainability criteria for biofuels. J. Eur. Public Policy 22, 429–446. doi:10.1080/13501763.2014.927520

Dauvergne, P., Farias, D., 2012. The Rise of Brazil as a Global Development Power. Third World Q. 33, 903–917. doi:10.1080/01436597.2012.674704

Deutscher Bundestag, 2016. Umsetzung verbindlicher Umwelt- und Sozialstandards in der

internationalen Palmölproduktion. Antwort der Bundesregierung. Deutscher Bundestag. doi:Drucksache 18/8987

EC, 2013. European Commission, Climate Action Policies, Transport, and Fuel Quality [WWW Document]. URL http://ec.europa.eu/clima/policies/transport/fuel/index_en.htm

EC, 2009. On the Promotion of the Use of Energy from Renewable Sources and Amending and Subsequently Repealing Directives 2001/77/EC and 2003/30/EC. The European Parliament and the Council, Brussels.

EC, 2008. Proposal for a Directive of the European Parliament and of the Council: on the Promotion of theUse of Energy fromRenewable Sources. Commission of the European Communities, Brussels.

EC, 2007. An Energy Policy for Europe. Commission of the European Communities, Brussels.

EC, 2003. On the Promotion of the Use of Biofuels or other Renewable Fuels for Transport. Published by The European Parliament and the Council.

EC, 2000a. Towards a European Strategy for the Security of Energy Supply. Commission of the European Communities, Brussels.

EC, 2000b. Directorate-General for Agriculture and Rural Development. CAP Reform: Rural development. Commission of the European Communities, Brussels.

Eckersley, R., 2004. The Green State: Rethinking Democracy and Sovereignty |. Cambridge: MIT Press.

EIA, 2012a. U.S. Energy Information Administration. Country Analysis Briefs: Brazil [WWW Document]. URL www.eia.gov/cabs/Brazil/Full.html

EIA, 2012b. U.S. Energy Information Administration. Biofuels Issues and Trends [WWW Document]. URL http://www.eia.gov/biofuels/issuestrends/pdf/bit.pdf

EurActiv, 2013. Food Price Fears Push EU Lawmakers to Put a Lid on Biofuels Growth.

EuroActive, 2016. Commission under fire over post-2020 biofuels targets [WWW Document]. URL https://www.euractiv.com/section/energy/news/commission-under-fire-over-post-2020-biofuels-targets (accessed 12.2.16).

European Commission., 2018. List of approved voluntary schemes [WWW Document]. URL https://ec.europa.eu/energy/en/topics/renewable-energy/biofuels/voluntary-schemes (accessed 10.2.18).

European Commission, 2016. Proposal for a Directive of the European Parilament and of the Council amending Directive 2012/27/EU on energy efficiency. European Commission, Brussels.

European Commission, 2009. The Renewable Energy Progress Report: Commission Report in accordance with Article 3 of Directive 2001/77/EC, Article 4(2) of Directive 2003/30/EC and on the implementation of the EU Biomass Action Plan, COM(2005)628. Brussels.

European Committee for Standardisation (CEN)., 2018. CEN/TC 383 - Sustainably produced biomass for energy applications [WWW Document]. Eur. Comm. Stand. URL https://standards.cen.eu/dyn/www/f?p=204:32:0::::FSP_ORG_ID,FSP_LANG_ID:648007,25&cs=12A33D937B5D72BE2C6A56EC998F853BF (accessed 10.29.18).

European Parliament and of the Council of the European Union, 2009. Directive 2009/30/EC of 23 April 2009 amending Directive 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions and amending Council Directive 1999/32/EC as regards th. The European Parliament and Council, Brussels.

European Parliament, The Council Of The European Union, 2003. Directive 2003/30/EC of the European Parliament and of the Council of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport, Official Journal L 123 , 17/05/2003 P. 0042 - 0046. The European Parliament and the Council of the European Union, Brussels.

Falkner, R., 2003. Private Environmental Governance and International Relations: Exploring the Links. Glob. Environ. Polit. 3, 72–87. doi:10.1162/152638003322068227

FAO, 2009. Case Studies on Bioenergy Policy and Law: Options for Sustainability - legislative study number 102. Rome.

FAO, 2008. The State of Food and Agriculture. Biofuels: prospects, risks and opportunities. Rome.

Fehrenbach, H., Giegrich, J., Reinhardt, G., Schmitz, J., Sayer, U., Gretz, M., Seizinger, E., Lanje, K., Reinhardt, D.G., Sayer, D.U., 2008. Criteria for a sustainable use of bioenergy on a global scale. Texte Res. Rep. 130 + 110 ann. doi:206 41 112

Fernandes, B.M., Welch, C.A., Gonçalves, E.C., 2010. Agrofuel policies in Brazil: paradigmatic and territorial disputes. J. Peasant Stud. 37, 793–819. doi:10.1080/03066150.2010.512459

Fischetti, S.O., 2008. Ethanol revolution; green and yellow. Bizz Editor.

Garcez, C.A.G., Vianna, J.N. de S., 2009. Brazilian Biodiesel Policy: Social and environmental considerations of sustainability. Energy 34, 645–654. doi:10.1016/j.energy.2008.11.005

Goldemberg, J., Coelho, S.T., Guardabassi, P., 2008. The sustainability of ethanol production from sugarcane. Energy Policy 36, 2086–2097. doi:10.1016/j.enpol.2008.02.028

Goldemberg, J., Coelho, S.T., Lucon, O., 2004. How adequate policies can push renewables. Energy Policy 32, 1141–1146. doi:10.1016/S0301-4215(03)00077-6

Green, J., 2013. Rethinking private authority: Agents and entrepreneurs in global environmental governance. Princeton University Press, New York.

Gulbrandsen, L.H., 2010. Transnational environmental governance : the emergence and effects of the certification of forests and fisheries. Edward Elgar, Cheltenham.

Gulbrandsen, L.H., 2008. The Role of Science in Environmental Governance: Competing Knowledge Producers in Swedish and Norwegian Forestry. Glob. Environ. Polit. 8, 99–122. doi:10.1162/glep.2008.8.2.99

Gulbrandsen, L.H., 2008. Accountability Arrangements in Non-State Standards Organizations: Instrumental Design and Imitation. Organization 15, 563–583. doi:10.1177/1350508408091007

Gulbrandsen, L.H., 2005a. The effectiveness of non-state governance schemes: A comparative study of forest certification in Norway and Sweden. Int. Environ. Agreements Polit. Law Econ. 5, 125–149. doi:10.1007/s10784-004-1010-9

Gulbrandsen, L.H., 2005b. Explaining different approaches to voluntary standards: A study of forest certification choices in Norway and Sweden. J. Environ. Policy Plan. 7, 43–59. doi:10.1080/15239080500251874

Hall, J., Matos, S., Severino, L., Beltrão, N., 2009. Brazilian biofuels and social exclusion: established and concentrated ethanol versus emerging and dispersed biodiesel. J. Clean. Prod. 17, S77–S85. doi:10.1016/j.jclepro.2009.01.003

Hira, A., de Oliveira, L.G., 2009. No substitute for oil? How Brazil developed its ethanol industry. Energy Policy 37, 2450–2456. doi:10.1016/j.enpol.2009.02.037

Hochstetler, K., Montero, A.P., 2013. The Renewed Developmental State: The National Development Bank and the Brazil Model. J. Dev. Stud.

Hospes, O., Clancy, J., 2011. Unpacking the discourse on social inclusion in value chains, Value chains, social inclusion and economic development. Routledge Studies in Development Economics.

Hospes, O., Stattman, S.L., Pooter, S. de, 2009. Groen en geel zien: private partnerschappen voor duurzame productie van soja en palmolie, in: Breeman, G., Goverde, G., Termeer, K. (Eds.), Governance in de groen-blauwe ruimte. Handelingsperspectieven voor landbouw, landschap en water. Van Gorcum, Assen, pp. 244–258.

Hurrell, A., 2010. Brazil and the New Global Order. Curr. Hist. 109, 60–68.

IBGE, 2006. Censo Agropecuario 2006 [WWW Document]. Inst. Bras. Geogr. e Estatística. URL http://ibge.gov.br/espanhol/estatistica/economia/agropecuaria/censoagro/default.shtm (accessed 9.28.13).

ICTSD, 2009. Biofuels Certification and the Law of the World Trade Organization. Washington D.C.

IEA, 2017. Renewables 2017.

Indonesian Sustainable Palm Oil (IPSO), 2016. Homepage [WWW Document]. URL http://ispo-org.or.id/index.php?lang=en (accessed 12.2.16).

Ingalsbe, G., Groves, F.W., 1989. Historical development. Coop. Agric. 106–120.

International Renewable Energy Agency (IRENA), 2014. REmap 2030: A Renewable Energy Roadmap, Summary of Findings. Abu Dhabi.

International Sustainability and Carbon Certification (ISCC), 2016. ISCC System [WWW Document]. URL https://www.iscc-system.org/ (accessed 8.10.16).

IPC, 2006. WTO Disciplines and Biofuels: Opportunities and Constraints in the Creation of a Global Marketplace. Washington D.C.

Izquierdo, N.L., 2012. The enlarged biofuels family | GRID-Arendal [WWW Document]. Grid Arendal - UNEP. URL http://www.grida.no/resources/6222 (accessed 12.15.18).

Jagger, A., 2013. The fluctuating fortunes of Brazilian ethanol. Biofuels, Bioprod. Biorefining 7, 103–105. doi:10.1002/bbb.1400

Johnson, F.X., Pacini, H., Smeets, E., 2012. Transformations in EU biofuels markets under the Renewable Energy Directive and the implications for land use, trade and forests. Center for International Forestry Research (CIFOR). doi:10.17528/cifor/003775

Junginger, M., van Dam, J., Zarrilli, S., Ali Mohamed, F., Marchal, D., Faaij, A., 2011. Opportunities and barriers for international bioenergy trade. Energy Policy 39, 2028–2042. doi:10.1016/j.enpol.2011.01.040

Kekeritz, U., Lemke, S., Meiwald, P., Ebner, H., Maisch, N., Beck, M., Brantner, F., Brugger, A., Koenigs, T., Lindner, T., Nouripour, O., Özdemir, C., Roth, C., Sarrazin, M., Schmidt, F., Trittin, J., Wagner, D., Amtsberg, L., Andreae, K., Deligöz, E., Gastel, M., Hajduk, A., Künast, R., Rüffer, C., Schick, G., 2016. Verbindliche Umwelt- und Sozialstandards in der internationalen Palmölproduktion verankern. Deutscher Bundestag.

Kemper, L., Partzsch, L., 2018. A water sustainability framework for assessing biofuel certification schemes: Does European hybrid governance ensure sustainability of palm oil from Indonesia? J. Clean. Prod. 192, 835–843. doi:10.1016/J.JCLEPRO.2018.05.053

Kersbergen, K. Van, Waarden, F. Van, 2004. "Governance" as a bridge between disciplines: Cross-disciplinary inspiration regarding shifts in governance and problems of governability, accountability and legitimacy. Eur. J. Polit. Res. 43, 143–171. doi:10.1111/j.1475-6765.2004.00149.x

Kilham, S., Camargo, C., Willetts, J., 2010. Biodiesel: Farmer's Perspectives from Bahia Brazil. Sydney.

Kimura, O., 2010. Japanese Top Runner Approach for Energy Efficiency Standards. SERC Discussion Paper: SERC09035.

Knill, C., Lehmkuhl, D., 2002. Private Actors and the State: Internationalization and Changing Patterns of Governance. Governance 15, 41–63. doi:10.1111/1468-0491.00179

Lamers, P., Hamelinck, C., Junginger, M., Faaij, A., 2011. International bioenergy trade—A review of past developments in the liquid biofuel market. Renew. Sustain. Energy Rev. 15, 2655–2676. doi:10.1016/j.rser.2011.01.022

Larsen, R.K., Jiwan, N., Rompas, A., Jenito, J., Osbeck, M., Tarigan, A., 2013. Towards 'hybrid accountability' in EU biofuels policy? Community grievances and competing water claims in the Central Kalimantan oil palm sector. Geoforum 54, 295–305. doi:10.1016/j.geoforum.2013.09.010

Leeuwen, J. van, 2010. Who greens the waves? Changing authority in the environmental governance of shipping and offshore oil and gas production. Wageningen Academic Publishers, Wageningen.

Lehtonen, M., 2011. Social sustainability of the Brazilian bioethanol: Power relations in a centre-periphery perspective. Biomass and Bioenergy 35, 2425–2434. doi:10.1016/j.biombioe.2009.05.027

Leite, J.G.D.B., Bijman, J., Giller, K., Slingerland, M., 2013. Biodiesel policy for family farms in Brazil: One-size-fits-all? Environ. Sci. Policy 27, 195–205. doi:10.1016/j.envsci.2013.01.004

Leopold, A., 2010. (De) Constructing a "Sustainable" "Biofuel" - Synthesis paper. Stockholm, Sweden.

Levidow, L., 2013. EU criteria for sustainable biofuels: Accounting for carbon, depoliticising plunder. Geoforum 44, 211–223. doi:10.1016/j.geoforum.2012.09.005

Maciel, C.T., 2015. Public morals in private hands? A study into the evolving path of farm animal welfare governance. Wageningen Univercity.

Maciel, C.T., Mol, A.P.J., Bock, B.B., 2015. Paving the way for farm animal welfare in international relations: an EU–Brazil case study. Contemp. Polit. 21, 435–450. doi:10.1080/13569775.2015.1013291

Magalhães, C., Drouvot, H., 2009. O impulso do Biodiesel na Região Nordeste do Brasil: uma oportunidade por um desenvolvimento cooperativo? 5ème colloque de l'IFBAE, Grenoble.

Magalhães, J.P. de A., Kuperman, N., Machado, R.C., 1991. Proálcool: uma avaliação global.

Makadok, R., Coff, R., 2009. Both Market and Hierarchy: An Incentive-System Theory of Hybrid Governance Forms. Acad. Manag. Rev. 34, 297–319. doi:10.5465/AMR.2009.36982628

Manos, B., Bartocci, P., Partalidou, M., Fantozzi, F., Arampatzis, S., 2014. Review of public–private partnerships in agro-energy districts in Southern Europe: The cases of Greece and Italy. Renew. Sustain. Energy Rev. 39, 667–678.

MAPA, 2013. Statistical Yearbook of Agrienergy 2012. Brasília D.F.

MAPA, 2006. Brazilian Agro energy Plan 2006-2011. Embrapa Publishing House, Brasília D.F.

Martinelli, L.A., Filoso, S., 2008. Expansion of Sugarcane Ethanol Production in Brazil: Environmental and Social Challenges. Ecol. Appl. 18, 885–898. doi:10.1890/07-1813.1

Mayer, F., Gereffi, G., 2010. Regulation and Economic Globalization: Prospects and Limits of Private Governance. Bus. Polit. 12. doi:10.2202/1469-3569.1325

MDA, 2013a. O que é o Programa Nacional de Produção e Uso do Biodiesel (PNPB)? [WWW Document]. Ministério do Desenvolv. Agrário. URL http://www.mda.gov.br/portal/saf/programas/biodiesel/2286217 (accessed 3.23.13).

MDA, 2013b. Secretaria Agricultura Familiar – sobre o programa (PNPB) [WWW Document]. Ministério do Desenvolv. Agrário.

MDA, 2013c. Ministério do Desenvolvimento Agrário [WWW Document]. URL http://www.mda.gov.br/ (accessed 9.26.13).

MDA, 2012a. Chamento Público de projectos. Tema: 'Fortalecimento da Participação de Cooperativas da Agricultura Familiar no Program Nacional de Produção e Uso de Biodiesel – PNPB, das Regiões Centro-Oeste, Nordeste e Semi-árido.'

MDA, 2012b. Secretaria Agricultural Familiar, Programas, Biodiesel. [WWW Document]. Ministério do Desenvolv. Agrário. URL http://www.mda.gov.br/portal/saf/programas/biodiesel/2290882 (accessed 5.7.13).

MDA, 2012c. Cooperativas habilitadas biodiesel [WWW Document]. Ministério do Desenvolv. Agrário2. URL http://www.mda.gov.br/portal/saf/institucional/cooperativashabilitadasbiodiesel (accessed 9.1.12).

MDA, 2010. Programa Nacional de Producao e Uso de Biodiesel: inclusao social e desenvolvimento territorial [WWW Document]. Ministério do Desenvolv. Agrário. URL www.mda.gov.br/portal/saf/arquivos/view/biodisel/arquivos-2011/Biodiesel_Book_final_Low_Completo.pdf (accessed 5.8.13).

Ménard, C., 2004. The Economics of Hybrid Organizations. J. Institutional Theor. Econ. JITE 160, 345–376. doi:10.1628/0932456041960605

Meyer, M. a., Priess, J. a., 2014. Indicators of bioenergy-related certification schemes - An analysis of the quality and comprehensiveness for assessing local/regional environmental impacts. Biomass and Bioenergy 65, 151–169. doi:10.1016/j.biombioe.2014.03.041

Mitchell, D., 2008. A Note on Rising Food Prices.

Mohr, A., Bausch, L., 2013. Social sustainability in certification schemes for biofuel production: an explorative analysis against the background of land use constraints in Brazil. Energy. Sustain. Soc. 3, 6. doi:10.1186/2192-0567-3-6

Mol, A.P.J., 2018. The environmental state and environmental governance, in: Boström, M., Davidson, D. (Eds.), Environment and Society: Concepts and Challenges. Palgrave, pp. 119–142.

Mol, A.P.J., 2016. The environmental nation state in decline. Env. Polit. 25, 48–68. doi:10.1080/09644016.2015.1074385

Mol, A.P.J., 2014. Bounded Biofuels? Sustainability of Global Biogas Developments. Sociol. Ruralis 54, 1–20. doi:10.1111/soru.12026

Mol, A.P.J., 2010. Environmental authorities and biofuel controversies. Env. Polit. 19, 61–79. doi:10.1080/09644010903396085

Mol, A.P.J., 2007. Boundless biofuels? Between environmental sustainability and vulnerability. Sociol. Ruralis 47, 297–315. doi:10.1111/j.1467-9523.2007.00446.x

Moore, S.F., 1973. Law and Social Change: The Semi-Autonomous Social Field as an Appropriate Subject of Study. Law Soc. Rev. 7, 719–746. doi:10.2307/3052967

Moser, C., Hildebrandt, T., Bailis, R., 2014. International Sustainability Standards and Certification, in: Solomon, B.D., Bailis, R. (Eds. . (Eds.), Sustainable Development of Biofuels in Latin America and the Caribbean. Springer New York, New York, NY, pp. 27–69. doi:10.1007/978-1-4614-9275-7_2

Motaal, D.A., 2008. The Biofuels Landscape; Is There a Role for the WTO? J. World Trade 42, 61–86.

Munro, B., 2015. PhD thesis: The lost innocence of ethanol: power, knowledge, discourse, and U.S. biofuel policy. Kansas State University.

MVO, 2009. Market analysis: Oils and Fats for Fuel. Rijswijk.

Nazareno, A.G., 2012. Brazil: Combat the effects of Forest Code changes. Nature 486, 191. doi:10.1038/486191d

NL Agency - Ministry of Economic Affairs Agriculture and Innovation, 2011. How to select a biomass certification scheme? Utrecht, the Netherlands.

OECD-FAO, 2013. Dataset OECD-FAO Agricultural Outlook 2013–2022 [WWW Document]. URL www.oecd.org/site/oecd-faoagriculturaloutlook

OECD-FAO, 2008. OECD-FAO Agricultural Outlook 2008-2017.

OECD, 2008. Economic assessment of biofuel support policies. Dir. Trade Agric. Econ. 1–119.

Oosterveer, P., Mol, A.P.J., 2010. Biofuels, trade and sustainability: a review of perspectives for developing countries. Biofuels, Bioprod. Biorefining 4, 66–76. doi:10.1002/bbb.194

Pacini, H., Assunção, L., 2011. Sustainable biofuels in the EU: the costs of certification and impacts on new producers. Biofuels 2, 595–598. doi:10.4155/bfs.11.138

Pacini, H., Assunção, L., Van Dam, J., Toneto, R., 2013. The price for biofuels sustainability. Energy Policy 59, 898–903. doi:10.1016/j.enpol.2013.03.042

Padula, A.D., Santos, M.S., Ferreira, L., Borenstein, D., 2012. The emergence of the biodiesel industry in Brazil: Current figures and future prospects. Energy Policy 44, 395–405. doi:10.1016/j.enpol.2012.02.003

Partzsch, L., 2011. The legitimacy of biofuel certification. Agric. Human Values 28, 413–425. doi:10.1007/s10460-009-9235-4

Pattberg, P., Stripple, J., 2008. Beyond the public and private divide: Remapping transnational climate governance in the 21st century. Int. Environ. Agreements Polit. Law Econ. 8, 367–388. doi:10.1007/s10784-008-9085-3

Petrobras, 2013. Our history [WWW Document]. URL http://www.petrobras.com.br/en/about-us/our-history/ (accessed 5.16.13).

Ponte, S., 2014. "Roundtabling" sustainability: Lessons from the biofuel industry. Geoforum 54, 261–271. doi:10.1016/j.geoforum.2013.07.008

Ponte, S., Daugbjerg, C., 2015. Biofuel sustainability and the formation of transnational hybrid governance. Env. Polit. 24, 96–114. doi:10.1080/09644016.2014.954776

Pousa, G.P.A.G., Santos, A.L.F., Suarez, P.A.Z., 2007. History and policy of biodiesel in Brazil. Energy Policy 35, 5393–5398. doi:10.1016/j.enpol.2007.05.010

Pristupa, A.O., Mol, A.P.J., 2015. Renewable energy in Russia: The take off in solid bioenergy? Renew. Sustain. Energy Rev. 50, 315–324. doi:10.1016/J.RSER.2015.04.183

PRONAF, 2013. Declaração de Aptidão ao Pronaf [WWW Document]. URL http://comunidades.mda.gov.br/ (accessed 1.1.13).

Quiñónez, J., Oyuela Sandino, D., Hernández Martinez, E., Al., E., 2012. Biofuel Partnerships: from Battleground to Common Ground? The Effects of Biofuel Programs on Smallholders' use of Land and Rights to Land in Four Countries. The Hague.

Rapunzel., 2016. Homepage Hand in Hand [WWW Document]. URL http://www.rapunzel.de/uk/palmoel-bio-serendipalm.html (accessed 8.10.16).

Rathmann, R., Szklo, A., Schaeffer, R., 2012. Targets and results of the Brazilian Biodiesel Incentive Program – Has it reached the Promised Land? Appl. Energy 97, 91–100. doi:10.1016/j.apenergy.2011.11.021

Reed, M.G., Bruyneel, S., 2010. Rescaling environmental governance, rethinking the state: A three-dimensional review. Prog. Hum. Geogr. 34, 646–653. doi:10.1177/0309132509354836

Reinecke, J., Manning, S., von Hagen, O., 2012. The Emergence of a Standards Market: Multiplicity of Sustainability Standards in the Global Coffee Industry. Organ. Stud. 33, 791–814. doi:10.1177/0170840612443629

REN21, 2018. Renewables 2018 Global Status Report.

REN21, 2017. Renewables 2017 Global Status Report.

REN21, 2015. Renewables 2015: Global Status Report.

Renewable Energy Policy Network for the 21st Century (REN21), 2014. Renewables 2014: Global Status Report. Paris, France.

Repórter Brasil, 2010. No Title [WWW Document]. URL http://www.reporterbrasil.org.br/listasuja/index.php (accessed 1.20.10).

Rice, T., 2010. Meals per gallon: The impact of industrial biofuels on people and global hunger 48.

Ros, J.P.M., Overmars, K., Stehfest, E., Prins, a G., Notenboom, J., Oorschot Van, M., 2010. Identifying the indirect effects of bio-energy production. PBL Bilthoven.

Rosenau, J.N., 2007. Governing the ungovernable: The challenge of a global disaggregation of authority. Regul. Gov. 1, 88–97. doi:10.1111/j.1748-5991.2007.00001.x

Rosillo-Calle, F., Cortez, L.A.B., 1998. Towards ProAlcool II—a review of the Brazilian bioethanol programme. Biomass and Bioenergy 14, 115–124. doi:10.1016/S0961-9534(97)10020-4

Rothkopf, G., 2007. A Blueprint for Green Energy in the Americas: Strategic Analysis of Opportunities for Brazil and the Hemisphere. Featuring: The Global Biofuels Outlook 2007. Inter-American Development Bank.

Rovere, E.L. la, Pereira, A.S., Simões, A.F., 2011. Biofuels and Sustainable Energy Development in Brazil. World Dev. 39, 1026–1036. doi:10.1016/j.worlddev.2010.01.004

RSB, 2016. Roundtable On Sustainable Biomaterials – Trusted Solutions for a New World [WWW Document]. URL http://rsb.org/ (accessed 8.10.16).

Runge, C.F., Senauer, B., 2007. How Biofuels Could Starve the Poor. Foreign Aff. 86, 41–53.

Ruysschaert, D., Salles, D., 2014. Towards global voluntary standards: Questioning the effectiveness in attaining conservation goals. Ecol. Econ. 107, 438–446. doi:10.1016/j.ecolecon.2014.09.016

Saikkonen, L., Ollikainen, M., Lankoski, J., 2014. Imported palm oil for biofuels in the EU: Profitability, greenhouse gas emissions and social welfare effects. Biomass and Bioenergy 68, 7–23. doi:10.1016/j.biombioe.2014.05.029

Samerwong, P., Bush, S.R., Oosterveer, P., 2017. Metagoverning Aquaculture Standards: A Comparison of the GSSI, the ASEAN GAP, and the ISEAL. J. Environ. Dev. doi:10.1177/1070496517736872

Sassen, S., 2006. Territory, Authority, Rights: From Medieval to Global Assemblages. Princeton University Press.

Scarlat, N., Dallemand, J.F., 2011. Recent developments of biofuels/bioenergy sustainability certification: A global overview. Energy Policy 39, 1630–1646. doi:10.1016/j.enpol.2010.12.039

Schaffel, S., Herrera, S., Obermaier, M., Lebre La Rovere, E., 2012. Can family farmers benefit from biofuel sustainability standards? Evidence from the Brazilian social fuel certificate. Biofuels 3, 725–736.

Schaller, S., 2007. The Democratic Legitimacy of Private Governance: An Analysis of the Ethical Trading Initiative. INEF Rep. 91/2007 55 S.

Schleifer, P., 2013. Orchestrating sustainability: The case of European Union biofuel governance. Regul. Gov. 7, 533–546. doi:10.1111/rego.12037

Schneider, S., Shigeo, S., Belik, W., 2010. Rural development in Brazil: overcoming inequalities and building new markets. Riv. di Econ. Agrar. LXV, 225–259.

Schouten, G., Glasbergen, P., 2012. Private multi-stakeholder governance in the agricultural market place: An analysis of legitimization processes of the roundtables on sustainable palm oil and responsible soy. Int. Food Agribus. Manag. Rev. 15, 63–88.

Searchinger, T., 2009. Government policies & drivers of world biofuels, sustainability criteria, certification proposals & their limitations. Biofuels Environ. consequences Interact. with Chang. L. use 37–52.

Sengers, F., Raven, R.P.J.M., Van Venrooij, A., 2010. From riches to rags: Biofuels, media discourses, and resistance to sustainable energy technologies. Energy Policy 38, 5013–5027. doi:10.1016/j.enpol.2010.04.030

Smeets, E., Junginger, M., Faaij, A., Walter, A., Dolzan, P., Turkenburg, W., 2008a. The sustainability of Brazilian ethanol—An assessment of the possibilities of certified production. Biomass and Bioenergy 32, 781–813. doi:10.1016/j.biombioe.2008.01.005

Smeets, E., Junginger, M., Faaij, A., Walter, A., Dolzan, P., Turkenburg, W., 2008b. The sustainability of Brazilian ethanol-An assessment of the possibilities of certified production. Biomass and Bioenergy 32, 781–813. doi:10.1016/j.biombioe.2008.01.005

Sorda, G., Banse, M., Kemfert, C., 2010. An overview of biofuel policies across the world. Energy Policy 38, 6977–6988. doi:10.1016/j.enpol.2010.06.066

Sotero, P., Armijo, L.E., 2007. Brazil: to be or not to be a BRIC? Asian Perspect. 31, 43–70.

Souza, M.A. de, 2011. O desafio da participação na dinâmica dos empreendimentos cooperativos na Bahia o caso das associações envolvidas no Programa Nacional de Produção de Biocombustível. Universidade Federal da Bahia.

Souza, J.D.F., Paulillo, L.F., 2010. O Biodiesel Brasileiro: materias-primas, agroindustrias e a agricultura familiar, in: 48e Congresso SOBER, 28–28 July. Sociedade Brasileira de Economia, Administração e Sociologia Rural, Campo Grande - Brazil.

Spaargaren, G., Mol, A., 2008. Greening global consumption: Redefining politics and authority. Glob. Environ. Chang. 18, 350–359. doi:10.1016/j.gloenvcha.2008.04.010

Stattman, S.L., Bindraban, P.S., Hospes, O., 2008. Exploring Biodiesel Production in Brazil : a study on configurational patterns in an evolving policy domain, Plant Research International. Wageningen.

Stattman, S.L., Bindraban, P.S., Hospes, O., 2008. Exploring Biodiesel Production in Brazil, Plant Research International.

Stattman, S.L., Gupta, A., 2015. Negotiating Authority in Global Biofuel Governance: Brazil and the EU in the WTO. Glob. Environ. Polit. 15, 41–59. doi:10.1162/GLEP_a_00271

Stattman, S.L., Hospes, O., Mol, A.P.J., 2013. Governing biofuels in Brazil: A comparison of ethanol and biodiesel policies. Energy Policy 61, 22–30. doi:10.1016/j.enpol.2013.06.005

Stattman, S.L., Mol, A.P.J., 2014. Social sustainability of Brazilian biodiesel: The role of agricultural cooperatives. Geoforum 54, 282–294. doi:10.1016/j.geoforum.2014.04.001

Steenblik, R., 2007. Government Support for Ethanol and Biodiesel in Selected OECD Countries. A Synthesis of Reports addressing Subsidies for Biofuels in Australia, Canada, the European Union, Switzerland and the United States. Geneva.

The Council Of The European Union, 2014. Proposal on indirect land-use change: Council reaches agreement. The Council Of The European Union, Luxembourg.

The European Parliament, 2015. European Parliament Legislative Resolution of 28 April 2015 on the Council Position at First Reading with a View to the Adoption of a Directive of the European Parliament and of the Council Amending Directive 98/70/EC Relating to the Quality of Petrol and. The European Parliament.

The European Parliament and of the Council of the European Union, 2009a. Directive 2009/30/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions and amend. The European Parliament and Council, Brussels.

The European Parliament and of the Council of the European Union, 2009b. Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC, Official Journal of the European Union. The European Parliament and the Council of the European Union, Brussels. doi:10.3000/17252555.L_2009.140.eng

The Natural Resources Defense Council (NRDC)., 2014. Biofuel Sustainability Performance Guidelines. Natural Resources Defence Council.

Toonen, H.M., Mol, A.P.J., 2016. Environmental governance through information at sea: fisheries, shipping and tourism, in: MacDonald, B.H., Santo, E.M. De, Soomai, S.S., Wells, P.G. (Eds.), Oceans of Information: Elucidating Information Use at the Science-Policy Interface in Coastal and Ocean Management. Taylor & Francis, pp. 125–151.

Toonen, H.M., Mol, A.P.J., 2013. Putting sustainable fisheries on the map? Establishing no-take zones for North Sea plaice fisheries through MSC certification. Mar. Policy 37, 294–304. doi:10.1016/j.marpol.2012.05.012

Torgerson, R.E., Reynolds, B.J., Gray, T.W., 1998. Evolution of Cooperative Thought, Theory, and Purpose. J. Coop. 13.

Treib, O., Bähr, H., Falkner, G., 2007. Modes of governance: towards a conceptual clarification. J. Eur. Public Policy 14, 1–20. doi:10.1080/135017606061071406

UN-Energy, 2007. Sustainable Bioenergy: A Framework for Decision Makers.

UNCTAD, 2011. WTO Negotiations on Environmental Goods: Selected Technical Issues [WWW Document]. URL http://unctad.org/en/Docs/ditcted2011d1_en.pdf

van Leeuwen, J., van Tatenhove, J., 2010. The triangle of marine governance in the environmental governance of Dutch offshore platforms. Mar. Policy 34, 590–597. doi:10.1016/j.marpol.2009.11.006

Veja, 2008. Etanol não influenciou nos preços dos alimentos. Veja Rev. 28.

Veja, 1980. Historia: A explosão do álcool. Veja Rev.

Walter, A., Dolzan, P., Quilodrán, O., de Oliveira, J.G., da Silva, C., Piacente, F., Segerstedt, A., 2011. Sustainability assessment of bio-ethanol production in Brazil considering land use change, GHG emissions and socio-economic aspects. Energy Policy 39, 5703–5716. doi:10.1016/j.enpol.2010.07.043

Watanabe, K., Bijman, J., Slingerland, M., 2012. Institutional arrangements in the emerging biodiesel industry: Case studies from Minas Gerais—Brazil. Energy Policy 40, 381–389. doi:10.1016/j.enpol.2011.10.023

Weiß, W., 2011. Biofuels and WTO Law, in: Herrmann, C., Terhechte, J.P. (Eds.), European Yearbook of International Economic Law 2011. Springer Berlin Heidelberg, Berlin, Heidelberg, pp. 169–203. doi:10.1007/978-3-642-14432-5

Wilkinson, J., Herrera, S., 2010. Biofuels in Brazil: debates and impacts. J. Peasant Stud. 37, 749–768. doi:10.1080/03066150.2010.512457

WOLA, 2013. Brazil's Lessons in Rural Development: Family Agriculture, Access to Water, and Civic Engagement.

World Bank, 2013. Brazil Country Overview [WWW Document]. URL http://www.worldbank.org/en/country/brazil/overview (accessed 9.28.13).

WTO, 2005. Environmental Goods for Development: Submission by Brazil. Committee on Trade and Environment Special Session. Geneva.

WWF-Germany., 2013. Searching for sustainability. Comparative Analysis of Certification Schemes for Biomass used for the Production of Biofuels. WWF Deutschland, Düsseldorf.

Zhang, L., Xu, Y., Oosterveer, P., Mol, A.P.J., 2016. Consumer trust in different food provisioning schemes: evidence from Beijing, China. J. Clean. Prod. 134, 269–279. doi:10.1016/J.JCLEPRO.2015.09.078

Ziegler, J., 2008. Report of the Special Rapporteur on the right to food. United Nations, General Assembly, Human Rights Council. doi:GE.08-10098 (E) 180108

Zuurbier, P., van de Vooren, J., 2008. Sugarcane ethanol. doi:10.3920/978-90-8686-652-6

Appendices

Appendix I List of interviewees

Date	Name	Affiliation	Country	Additional information
21-02-2008	Director Sustainable Sourcing Development	Unilever	Rotterdam, The Netherlands	Co-interview
06-10-2008	Researcher	University of Campinas (UNICAMP), scientist	Campinas, Brazil	
27-11-2008	Committee secretary	WTO's Committee on Trade and Environment (CTE),	Geneva, Switzerland	Interviewed by student
26-11-2008	Chief of the Trade, Gender and Development	United Nations Conference on Trade and Development (UNCTAD)	Geneva, Switzerland	Interviewed by student
05-12-2008	Business Unit Manager	Dutch standardization institute (NEN)	Delft, The Netherlands	
09-12-2008	Policy advisor	Oxfam Novib	The Hague, The Netherlands	Interviewed by student
10-12-2008	Deputy Head of Unit Dispute Settlement and Legal Aspects of Trade Policy	Directorate-General for Trade European Commission	Brussel	Interviewed by student
15-12-2008	Policy advisor	Senter Novem	The Hague, The Netherlands	Interviewed by student
15-12-2008	Policy advisor	Ministry of Foreign Affairs	The Hague, The Netherlands	Interviewed by student
17-12-2008	Policy advisor	Ministry of Housing, Spatial Planning and the Environment	The Hague, The Netherlands	Interviewed by student
Div. meetings 2008-2010	Director Latin America and the Caribbean	Wageningen University and Research	Wageningen, The Netherlands; Sao Paulo, Brazil	
Div. meetings 2008-2011	Professor and founder of the Brazilian Center for Biofuels	University of Sao Paulo	Piracicaba, Brazil	
Div. meetings 2008-2011	Teamleader Natural Resources	Wageningen University and Research	Wageningen, The Netherlands	
12-01-2009	Manager Energy Transitions	Shell	The Hague, The Netherlands	Interviewed by student

16-01-2009	Chairmen of the Board	Netherlands Biodiesel Industry Association (VNBI)	Rotterdam, The Netherlands	Interviewed by student
20-01-2009	Policy officer	Directorate-General for Mobility and Transport of the European Commission (DG TREN)	Brussels, Belgium	Interviewed by student
15-04-2009	Senior policy advisor	Ministry of Economic Affairs	The Hague, The Netherlands	Co-interview
11-05-2009	Department Head global affairs	Ministry of Housing, Spatial Planning and the Environment	The Hague, The Netherlands	Co-interview
25-06-2009	Counsellor (Agriculture)	Permanent Representation of The Netherlands at the UN and other International Organizations (e.g. WTO)	Geneva, Switzerland	
26-06-2009	Manager Environmental Affairs	Roundtable on Sustainable Biofuels (RSB)	Lausanne, Switzerland	
23-06-2009	Implementation manager and chair of technical working group on social issues	Roundtable on Sustainable Biofuels (RSB) & Better Sugarcane Initiative (BSI)	Lausanne, Switzerland	
24-03-2010	Professor	Federal University of Rio de Janeiro	Rio de Janeiro, Brazil	
30-03-2010	Scientist	University of Campinas (UNICAMP)	Campinas, Brazil	
30-03-2010	Professor economics and international relations	University of São Paulo (USP)	São Paulo, Brazil	
31-03-2010	Head of International Affairs	Brazilian Sugarcane Industry Association (UNICA)	São Paulo, Brazil	
31-03-2010	Sustainability manager	Brazilian Sugarcane Industry Association (UNICA)	São Paulo, Brazil	
01-04-2010	Scientist	Confederaçao Brasileira de Tiro Esportivo (CBTE)	Campinas, Brazil	
06-04-2010	Consultant	Consultant Associação Nacional dos Fabricantes de Veículos Automotores (ANAFAVEA)	São Paulo, Brazil	
19-03-2011	Associate Director	Tecnologico de Monterrey, Mexico City Campus	Montreal, Canada	
26-09-2012	Academic	Universiteit van São Paulo (USP)	São Paulo, Brazil	
27-09-2012	Postdoc researcher	Wageningen University	São Paulo, Brazil	

		and Research	
27-09-2012	Researcher	Universiteit van São Paulo (USP)	São Paulo, Brazil
02-10-2012	Researchers	Federal University of Bahia (UFBA), PhD student	Salvador, Brazil
02-10-2012	Professor	Federal University of Bahia (UFBA)	Salvador, Brazil
02-10-2012	Director	COOTEBA	Salvador, Brazil
02-10-2012	Technical assistent	COOTEBA	Salvador, Brazil
08-10-2012	CEO	COOPAF	Salvador, Brazil
10-10-2012	Project Coordinator	COOPERUNA	Salvador, Brazil
11-10-2012	Technical coordinator	COOPERACD	Salvador, Brazil
15-10-2012	CEO	COOPAF	Salvador, Brazil
18-10-2012	Coordinator for Family Agriculture	COOMAF	Barreiras, Brazil
23-10-2012	Director	COOTRASB	Itubera, Brazil
23-10-2012	CEO	COOTRASB	Itubera, Brazil
24-10-2012	2nd hand of the president	COOFAVA	Valença, Brazil
25-10-2012	CEO	COOMTRATA	Nazaré, Brazil
25-10-2012	Two families (2 men, 6 women), names unknown	COOMTRATA, cooperative members	Nazaré, Brazil

Appendix II Attended meetings and conferences

Date	Conference/meeting title	Organized by	Country	Role
06-10-2008	Biofuels and sustainability: Brazilian perspectives	Shell	The Netherlands	Observer
03-07-2009	Biofuel workshop	Research School for Resource Studies for Development (CERES)	The Netherlands	Participant
24-02-2010 - 26-02-2010	Energy transitions in an interdependent world: what and where are the future social science research agendas?	Sussex Energy Group, Science and Technology Policy Research	United Kingdom	Presenter
25-05-2010	NGO meeting - biofuels	Biomass Sustainability Committee (Dorette Corbey)	The Netherlands	Observer
10-11-2010 - 12-11-2010	Towards a New Knowledge for Scale Sensitive Governance of Complex Systems	Scaling and Governance network, Wageningen University	The Netherlands	Presenter
29-11-2010 - 30-11-2010	Sustainable Biomass for European Energy Conference	Flemish Institute for Technological Research (VITO)	Belgium	Participant
16-02-2011	Good Governance of Land and Natural Resources – Balancing Global and Local Interests	Centre for Development Innovation (CDI)	The Netherlands	Presenter
16-03-2011 - 19-03-2011	Global Governance: Political Authority in Transition	International Studies Association (ISA)	Canada	Presenter
22-03-2012 - 24-03-2012	Energy and Society Workshop	Institute of Social Sciences University of Lisbon	Portugal	Presenter
05-06-2012	European Strategic Energy Technology Plan	European Industrial Bioenergy Initiative (EIBI)	Belgium	Observer
27-09-2012	Ethanol Commercial Diplomacy	Brazilian Center of Latin American Studies (CBEAL)	Brazil	Participant
10-10-2012	Technical Assistance meeting - biofuels	Cooperatives in Salvador	Brazil	Observer

Appendix III Interview guidelines and questionnaires

Example of semi-structured guide for chapter 2

This is an example of a semi-structured questionnaire used during a field visit to Brazil between March 15, 2010 – April 9, 2010. The respondents varied from: policy makers, ethanol and biodiesel producers, sugarcane and vegetable oil farmers, fuel consumers and car industry representatives. N.B. a selection of questions was made for each interviewee, dependent on background and expertise. The insights of these exploratory interviews were used as background information for chapter 2 of this thesis.

1. Ethanol

a. Contemporary situation

- How would you define the contemporary bio ethanol sector in Brazil?
- What do you expect for the future?

b. Key historical events

- Can you describe important positive events in the development of the ethanol sector in Brazil? How did these moments/events impact the sector?
- Can you describe important negative events in the development of the ethanol sector in Brazil? How did these moments/events impact the sector?

c. Policy, Polity and Politics

- Which steering tools are and have been used to stimulate ethanol production?
- What are the key objectives of ethanol policies?
- Do the political steering instruments fit the objectives of ethanol policies?

- Who are the most important actors/stakeholders/players in the ethanol industry?
- Who were, in your opinion, the key instigators of bio-ethanol policies?
- Who benefits most from these policies? In what way? Has this changed over time?

- Which organisations/institutions are involved?
- Has this changed in the different stages of the ethanol policies?
- What is the impact of the contemporary global interest for the organisation of the market?

d. Transmission or transition

- Within the ethanol program
- From ethanol to biodiesel

2. Biodiesel

a. Contemporary situation

- How would you define the contemporary biodiesel sector in Brazil?
- What do you expect for the future?

b. Key historical events

- Can you describe important positive events in the development of the biodiesel sector in Brazil? How did these moments/events impact the sector?
- Can you describe important negative events in the development of the biodiesel sector in Brazil? How did these moments/events impact the sector?

c. Policy, Polity and Politics

- Which steering tools are and have been used to stimulate biodiesel production?
- What are the key objectives of biodiesel policies?
- Do the political steering instruments fit the objectives of biodiesel policies?

- Who are the most important actors/stakeholders/players in the biodiesel industry?
- Who were, in your opinion, the key instigators of biodiesel policies?
- Who benefits most from these policies? In what way? Has this changed over time?

- Which organisations/institutions are involved?
- Has this changed in the different stages of the biodiesel policies?
- What is the impact of the contemporary global interest for the organisation of the market?

d. Transmission or transition

- Within the biodiesel program
- From ethanol to biodiesel

Example of semi-structured guide for chapter 3

This is an example of a semi-structured questionnaire used during a field visit to Brazil between September 25, 2012 –November, 8 2012. Goal of this visit was to increase the understanding of cooperatives involved in the biodiesel projects in Bahia. The collected information has been used for chapter 3 of this thesis.

Interviews with COOPERATIVES

COOP: _____
Name: _____
Position: _____
E-mail: _____
Phone: _____
Adress: _____
Website: _____/ N
Anonymous Y / N

General information (COOPs)

Members _____ Represent size in Ha _____

classified FF _____ Represent size in Ha _____

COOP founded in _____

Who started the COOP (bit of history):_____

_____

Tell a bit more about type of COOP, just agricultural or also other objectives/sectors:

_____

(ask for available document of start of COOP Y / N)

Who are in the direction of COOP?

_____

Is the direction rotated? Y / N How often:_____

How can FF become a member of the COOP?

_____

_____

Is there a membership fee? Y / N How much:

_____

Are there membership obligations? Explain:

_____

Is there a difference between FF and other members? Explain: _____

_____

Can you give a typology of the FF that participate in the PNPB? _____

_____

_____(land size, family, education, crop varieation, involvement in COOP, etc.)

PNPB & Family Farming

COOP particpates in PNPB Y / N since: _____

How, by whom, when are decisoins made about participation in PNPB_____

_____

Does COOP have SFS Y / N since: _____ how long is it valid:

_____

Do you think the SFS helps to improve the with the social inclusion of FF? Explain: _____

_____

Do you actively try to increase the amount of FF in PNPB? Explain:_____

_____

To get SFS, the COOP needs FF with DAP. Who gives DAP in your region:

_____

Are there any problems with DAP? Explain: _____

_____

Are there problems with DAP and FF with regard to landtitles? Explain: _____

_____

Are Government organisations are involved with regard to PNPB/SFS? Which? How?

_____

_____

Do you collaborate with other organisations/COOPS in PNPB, which and how: _____

_____

Family farming & Technical assistence

With which crops does your COOPerative participates in the PNPB?

Castor Y / N

Sunflower Y / N

Palm oil Y / N

Others: _____

Harvest	Crops	% that comes of FF	#ha	Main buyer

2007/8				
2008/9				
2009/10				
2010/11				
2011/12				
2012/13				

Can you explain any changes in the table above? _____

_____

What happens with the raw material? Describe process from harvest to reception of money: _____

_____

_____

Are there problems with biodiesel production? Explain: _____

_____

How do FF receive their money from the PNPB? _____

Do FF need loans? For what? From whom? _____

_____

Does COOP have own crushing machine? Y / N Why?

_____

Does COOP have storage facilities? Y / N Why?

_____

Who pays for cost of seeds

_____

Who pays for cost of fertilizers

_____

Who pays for cost of transport of raw material?

_____

Do FF receive technical assistence as part of PNPB Y / N

Does the COOP provide TA? Y / N

Do other organisations also provide TA? Y / N Which:

_____

What kind of technical assistence do you provide? _____

_____

Who are the people that give technical support for biodiesel crops? _____

_____

How often TA of COOP visits FF _____week / month / year

Who pays for cost of TA _____

Does the TA assistence result in new farming pracitces? Example? _____

_____

Is the productivity of these crops improving? What are contraints or helping factors? _____

_____

_____(land / labour / availability of seeds / others)

Is TA satisfactory in your opinion? Why? _____

_____

Petrobras (Pbio) / other buyers

Do you work with Petrobras/Pbio Y / N since: _____

If NO, why not:

_____

If YES: What do you sell to Pbio: raw material / vegetable oil / other; _____

Who negotiates the contract: _____

What is the duration of the contract: _____

Who determines prices paid for in contract with Pbio:

_____

Is quantity predefined? Y/ N

What happens if the production is to low? _____

_____

Who finances investments?

_____

Is Petrobras responsible for funding your COOPerative? Y/ N

Which part of your income is dependent on Petrobras? _____

What will happen if support by Petrobras will stop?

_____

Do you trust the strategy Petrobras or would you prefer to sell to others too?

_____

What are in your eyes the advantages/disadvantages of Pbio?

_____

What do you think will happen in the future with the involvement of Petrobras in the PNPB?

_____

Other contracts

Besides Pbio, do you sell the oil crops to other buyers? Y / N

To whom do you prefer to sell? Why? _____

_____

What kind of contracts?

_____

Who negotiates the contract:

_____

Who determines prices paid for:

_____

For how many years:

_____

Is quantity predefined? Y/ N

Who finances investments?

_____

Does SFS stamp help with the making of contracts with industry? Y / N

Who gives better price: Petrobras / local market / international market / others: _____

Expectations

Are FF benefitting from the PN/PB? Explain: _____

_____

Do you thinkt that as a result of PNPB, FF have a better income? Explain: _____

_____

Is the decision-making process of COOPS different now FF can participate in PNPB? Explain:

_____

How do you define social inclusion? Explain: _____

_____

Do you think PNPB and SFS are useful tools to stimulate social inclusion? Explain: _____

_____

How do you see the future of FF? Explain: _____

How do you see the future of the PNPB? Explain: _____

What are main problems/constraints for COOPS in PNPB? Explain: _____

Do you think that the biodiesel market development will increase / decrease in the future? Explain:

_____

What could be improved?

_____

Other information

Do you have background documents or other info available? Y / N

What kind: _____

Do you have contact information about:

_____

_____

Summary

This thesis examines the global governance of sustainable biofuels, with a specific focus on Brazil and the European Union (EU) as major players in the production, trade and use of first-generation liquid biofuels. Biofuels are solid, liquid or gas fuels derived from biomass sources such as starch, sugars, fat, wood, or waste. So-called first generation liquid biofuels are those derived either from sugar or starch from food crops such as sugarcane or corn, which are converted to bioethanol; or from vegetable oils (soy, rapeseed, palm) or animal fats, which are converted to biodiesel. This thesis focuses on first-generation liquid biofuels because they are produced on a large scale for transport fuel and are under intense scrutiny with regard to sustainability and potential competition with food security.

The EU, one of the largest markets for biofuels, is leading in the attempt to promote global trade in "sustainable" biofuels. Brazil, as a leading producer and strong proponent of a global biofuels market and a key exporter to the EU, has to engage with the EU sustainability imperatives that now dominate global biofuel trade and governance debates. While Brazil is often believed to be able to dictate biofuel developments within its borders, its authority to continue to do so, given a rapidly evolving global biofuel trade and governance context, is becoming less evident and needs to be examined.

Biofuels have been on the national governance agenda of some countries since the 1970s, but emerged on the global governance agenda in the late 1990s, in response to the twin challenges of the search for energy security and addressing climate change. Biofuel policies are being implemented by countries across the globe with the ambition to (partly) replace fossil fuels for transport with renewable alternatives. A vast conglomerate of state and non-state initiatives are involved in the multilevel governance of biofuels over the past few years. Governing biofuels is thus a complex multifaceted (global) governance challenge, with multiple sectors, multiple actors, and multiples sites of governance now emerging and interacting, and divergent notions of sustainability deployed herein. In this context, it is important to understand how governance of biofuels has been approached, and how existing approaches to sustainability have fared, and whose notion of sustainability is shaping global biofuel trade and markets.

This thesis thus analyses evolving biofuel governance arrangements in Brazil and the EU and the interactions between them, including diverse notions of sustainability contained herein. A central concern is whether, and to what extent, the EU has succeeded in exporting its own notions of sustainability beyond its borders, in seeking to create a global market for sustainable biofuels.

Through detailed analysis in four empirical chapters (all published), the thesis answers two cross-cutting research questions:

- How have biofuels been governed in the EU and Brazil over time, and what (conflicting or converging) notions of sustainability are embodied in these evolving governance arrangements?

- How has the EU sought to export its notions of sustainability beyond its borders, with particular focus on Brazil, and (how) has it succeeded in doing so?

Chapter 2 traces the historical evolution of bioethanol and biodiesel policies and governance arrangements in Brazil, including the role of key actors. In doing so, it explains how biofuels in Brazil have been governed over time, including evolving understandings of sustainability therein. The chapter finds that ethanol-focused governance arrangements focused primarily on energy security rather than sustainability concerns. In contrast, biodiesel governance initially was also concerned with (social) sustainability, particularly questions of rural development and social inclusion of small farmers in biodiesel production. Over time, however, the analysis shows that both types of biofuels are being governed to further agricultural and energy goals, rather than social sustainability objectives. This is illustrated by the growing focus on increasing blending targets for biodiesel, rather than on realizing social inclusion and rural development goals. These policy objectives (and their implementation) are also driven primarily by domestic imperatives, rather than export considerations.

Chapter 3 builds on the historical tracing of biofuel governance arrangements in Brazil to analyse the social inclusion component of Brazilian biodiesel policies. The chapter focuses on the 2004 biodiesel policy and its two main objectives: to advance biodiesel as a transportation fuel and to foster social inclusion of family farmers through participation in the biodiesel chain. The chapter analyzes the extent to which cooperatives are involved in integrating family farmers into the biodiesel chain and what this means for the social sustainability of biodiesel, taking the northeast state of Bahia as a case study area. The findings show that through the biodiesel policy, cooperatives—until then a marginal phenomenon in northern Brazil—increased their membership, were empowered, and contributed to the economic development of a significant group of family farmers. However, these family farmers have not been substantially included in the biodiesel production chain itself. The chapter reveals the complexity of realizing social sustainability goals in biofuel governance. It shows that, although agricultural cooperatives can serve as intermediaries to facilitate family farmer inclusion in sustainable production, it is questionable whether a focus on producing specific quantities of global commodities, such as biofuels, is a suitable development trajectory for family farmers.

Chapter 4 moves to consider the global context for Brazilian biofuel governance and policies. It explores how global demand for biofuels has been stimulated by European Union policies that promote biofuels as a potential sustainable source of transport fuel, and strategies used by the EU to export its evolving notions of sustainability beyond its own borders. The chapter analyzes how Brazil has navigated an evolving global governance context for sustainable biofuels, in particular how it has responded to EU biofuel sustainability imperatives. It focuses specifically on analyzing how these debates have played out in the context of World Trade Organization (WTO) disciplines governing trade in commodities such as biofuels. The chapter finds that while Brazil emphasizes the social and developmental objectives of its biofuel policies in a domestic context, it frames itself globally as a leading producer of (environmentally) sustainable biofuels. In so doing, it navigates intersecting spheres of governance authority, such as the EU and the WTO, in a manner that promotes its own biofuel policy agenda, partly by seeking to reframe “sustainability” debates internationally to reflect its developmental agenda.

Chapter 5 shifts to analysing in detail how biofuel governance arrangements have evolved in the EU over time, and how understandings of sustainable biofuels have evolved within these arrangements. The chapter analyses a decade of biofuel policy making in the EU, with a focus on the nature and functioning of the EU's novel hybrid (public-private) biofuel governance arrangements, and how notions of sustainability have been negotiated and established herein. The EU's hybrid governance approach has been implemented since 2009, involving a meta-standard established by the EU and specific sustainability requirements developed by private and hybrid actors to comply with the meta-standard. The expectation underpinning a hybrid governance approach was that private initiatives would add their own additional sustainability objectives to the mandatory EU meta-standard, and hence lead to greater sustainability in biofuels production, both internally within and external to the EU. The chapter finds that instead of yielding an increasingly stringent set of sustainability standards, this hybrid approach is characterized by contested notions of sustainability, with a trend towards less ambitious or lowest common denominator industry-led standards. At the same time, while the EU has continuously increased the share of biofuels and renewable energies and the biomass imports in its transport policies, it has recently become more cautious with regard to potential negative side-effects of stimulating biofuel production, in particular, indirect land use change (ILUC) and food price increases in developing countries. Its biofuel policy directions are therefore yet again being adjusted and are currently at a critical juncture.

In concluding, Chapter 6 combines the insights of the four empirical chapters in order to answer the main research questions. It sums up how biofuels have been governed in the EU and Brazil over time, and what notions of sustainability are embodied in these evolving governance arrangements. It also addresses how the EU has sought to export its notions of sustainability beyond its borders and whether it has succeeded in doing so.

The thesis finds that governance arrangements for the EU and Brazil are both primarily state-driven, and sustainability considerations included in these arrangements reflect state priorities, such as environmental concerns (in the case of the EU) and social inclusion and rural development (in the case of Brazil). In Brazil, biofuel governance has been characterized by a strong role for the state, without much governance authority transferred to non-state actors. The EU has relied more upon private actors to operationalize its meta-standards for sustainability. EU's novel public-private hybrid governance approach has resulted in a mandatory meta-standard for sustainability, but this meta-standard is a minimum floor rather than a set of increasingly ambitious sustainability requirements.

In Brazil, while non-state intermediaries, such as agricultural cooperatives, have been given an important role in creation and governance of a biofuel market, partly to further social sustainability goals, these have been only partially realized. Furthermore, in both cases, the involvement of non-state actors has not resulted in more stringent sustainability standards being developed or realized in practice.

The thesis findings show, furthermore, that the EU has sought many different ways to export its notions of sustainability beyond its borders, including, amongst others, to Brazil. However, its hybrid policy approach has had only a limited influence on domestic practices within Brazil. In concluding, the thesis highlights how persisting controversies over sustainability have resulted in the EU moving towards ever more stringent regulation of first-generation biofuels, even as the opposite dynamic

can be observed in Brazil. The analysis reveals, more broadly, that what constitutes “sustainable biofuels” and how sustainability can be furthered remains subject to continuous debate. Sustainability is contested and context-based, even as the authority to define and operationalize it continues to lie largely with states.

About the author

Sarah Stattman (1981, the Netherlands) spent most of her childhood in Amsterdam, where she completed her gymnasium degree at the Montessori Lyceum Amsterdam. She continued her education at Wageningen University, where she completed a BSc program in International Development Studies (major: communication, technology, and policy; minor 1: international affairs; minor 2: law) in 2005. During her BSc studies, she was involved with various extracurricular activities, such as the study association and the educational board. Together with study companions, she participated in and eventually won the "Health battle 2004", organised by the National Committee for International Cooperation and Sustainability. Her team was awarded with a study trip to Cambodia. She continued her studies in Wageningen with the MSc program of International Development (major: law and governance) from which she graduated cum laude in 2008. Part of her MSc program was an internship as an assistant to a Member of the European Parliament in Brussels. In addition, she went back to Cambodia for research about the development of healthcare in the region.

Her master's thesis led to an interest in the growing (international) demand for biofuels and the role of Brazil hereby. She was able to continue researching this topic after graduation by working as a PhD student at the Environmental Policy Group (ENP) at Wageningen University. Her thesis research allowed her to travel to Brazil for multiple field visits, which she really enjoyed. Besides doing the PhD, she also worked in 2013-2014 as a personal assistant for a business developer in order to gain more commercial experience. In 2015, she started working as a strategic and tactical policy advisor on commercial transportation for the Municipality of Amsterdam. Her job involved advising on the key challenge of keeping the city accessible, while also moving to more environmentally friendly and safe modes of transportation. In February 2019, she switched jobs and moved from the municipal to the national-level. She works now as a policy advisor for the Ministry of Agriculture, Nature and Food Quality in the Netherlands, where she advises on themes relating to horticulture chain management and biotechnology.

List of publications by the author

Peer-reviewed publications

- **Stattman, S.L.**; Gupta, A.; Partzsch, L.; Oosterveer, P.J.M. (2018). Toward Sustainable Biofuels in the European Union? Lessons from a Decade of Hybrid Biofuel Governance. *Sustainability 10 (11).* (Chapter 5 in this thesis).
- **Stattman, S.L.**; Gupta, A. (2015). Negotiating Authority in Global Biofuel Governance: Brazil and the EU in the WTO. *Global Environmental Politics 15 (1): p. 41 - 59.* (Chapter 4 in this thesis).
- **Stattman, S.L.**; Mol, A.P.J. (2014). Social sustainability of Brazilian biodiesel: The role of agricultural cooperatives. *Geoforum 54: p. 282 - 294.* (Chapter 3 in this thesis).
- **Stattman, S.L.;** Hospes, O. ; Mol, A.P.J. (2013). Governing biofuels in Brazil: A comparison of ethanol and biodiesel policies. *Energy Policy 61: p. 22 - 30.* (Chapter 2 in this thesis).
- Hospes, O.; **Stattman, S.L.**; Pooter, S. de (2009). Groen en geel zien: private partnerschappen voor duurzame productie van soja en palmolie. *In: Governance in de groen-blauwe ruimte. Handelingsperspectieven voor landbouw, landschap en water / Breeman, G., Goverde, G., Termeer, K., Assen : Van Gorcum, p. 244 - 258.*

Other publications

- Greco, F.M.; Bindraban, P.S.; **Stattman, S.L.** (2009). Analysis of the Soybean debate : a case study on the debate about labor conditions in Brazil. *Wageningen: Plant Research International, Report/Plant Research International 292, 46.*
- Hospes, O.; Bolman, B.; **Stattman, S.L.** (2008). An external evaluation of the Pure Oil Program. *Wageningen : Wageningen University, 83 p.*
- **Stattman, S.L**.; Bindraban, P.S. ; Hospes, O. (2008). Exploring Biodiesel Production in Brazil : a study on configurational patterns in an evolving policy domain. *Wageningen : Plant Research International BV, Report / Plant Research International 199, 114*
- **Stattman, S.L.**; Bindraban, P.S. ; Hospes, O. (2008). The national biodiesel programme of Brasil - who might benefit? *Wageningen : Wageningen International.*

Netherlands Research School for the
Socio-Economic and Natural Sciences of the Environment

D I P L O M A

For specialised PhD training

The Netherlands Research School for the
Socio-Economic and Natural Sciences of the Environment
(SENSE) declares that

Sarah Lillian Stattman

born on 22 August 1981 in Zeist, The Netherlands

has successfully fulfilled all requirements of the
Educational Programme of SENSE.

Wageningen, 15 April 2019

The Chairman of the SENSE board

Prof. dr. Martin Wassen

the SENSE Director of Education

Dr. Ad van Dommelen

The SENSE Research School has been accredited by the Royal Netherlands Academy of Arts and Sciences (KNAW)

KONINKLIJKE NEDERLANDSE
AKADEMIE VAN WETENSCHAPPEN

The SENSE Research School declares that **Sarah Lillian Stattman** has successfully fulfilled all requirements of the Educational PhD Programme of SENSE with a work load of 59.6 EC, including the following activities:

SENSE PhD Courses

- Environmental research in context (2008)
- Earth System Governance (2008)
- Integrated Assessment of Global Environmental Change: Causes and responses (2008)
- Research in context activity: 'Co-organizing discussion and exchange group for PhD candidates on the subject of biofuel development and assessment' (2008-2011)
- Social Theory and the Environment. Introduction into Ecological Modernisation Theory (2009)

Other PhD and Advanced MSc Courses

- Qualitative data analysis: procedures and strategies, Wageningen University (2008)
- Advanced social theory, Wageningen University (2008)
- PhD scientific writing, Wageningen University (2008)
- Techniques for writing and presenting scientific papers, Wageningen University (2009)

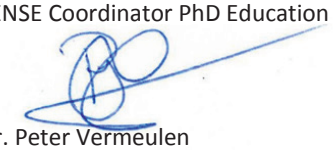
Management and Didactic Skills Training

- Supervising several MSc student with thesis entitled (2008-2013
- Teaching in the MSc course 'Climate Governance' (2011-2013)
- Teaching in the MSc course 'Environmental Policy: Analysis and Evaluation' (2008-2010)
- Coordination of MSc colloquia of the Environmental Policy chair group (2009-2011)

Selection of Oral Presentations

- *The National biodiesel program of Brazil: transition or transmission?* Energy Transition Conference, 24-26 February 2010, Sussex, United Kingdom
- *Multi-scale biofuel governance; an expanding universe for sustainability initiatives*. Scaling and Governance conference, 10-12 November 2010, Wageningen, The Netherlands
- *Multi-sphere biofuel governance and changing state authority: the case of Brazil*. ISA Conference, 16-19 March 2011, Montreal, Canada
- *Social dimensions of Brazilian biodiesel policy: a farmers perspective*. Energy and Society workshop, 22-24 March 2012, Lisbon, Portugal

SENSE Coordinator PhD Education



Dr. Peter Vermeulen

Cover design by: Sarah Stattman & Dennis Hendriks (ProefschriftMaken)

Printed by: ProefschriftMaken / Digiforce (on FSC-certified paper)