**Researching the Global Environmental Politics of Food**

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Our contribution to this volume focuses on the global environmental politics of food. Scholars across a range of disciplines, including both the natural and social sciences, have drawn attention to the ecological impact of food production methods, the environmental consequences of an increasingly globalized food distribution system, and the sustainability implications of dietary choices. The complexity of food supply chains at the global level has at times obscured these issues from the public’s view, but a growing amount of research on these themes has made them more visible in recent years, contributing to greater societal pressure and political debate over how best to ensure that food systems are more sustainable. In this context, social movements and civil society actors have advocated policies that strengthen local food systems and agroecological production methods. Corporations have also taken up efforts to make their global operations and products more sustainable through new technologies and certification schemes. Governments have been slow to respond to questions of food sustainability, and international governance addressing questions of food sustainability has been patchy and uneven. The result has been tension and debate in global policy and governance arenas.

 This chapter focuses on the global political dynamics at the interface of food systems and environmental systems, especially at the international level. We first provide an overview of the key research findings on this theme, focusing on the debates and governance initiatives surrounding the ecological implications of food production, the environmental dimensions of food distribution, and the sustainability of diets. Next, we examine the key theoretical insights from the global environmental politics (GEP) literature that helps to shed light on analyses of the politics of these aspects of the food system, with a specific focus on different facets of power, the concepts of distance and complexity, and institutional and governance fragmentation. The chapter then outlines emerging issues that would benefit from further scholarly research. Here we point to the implications of the rise of high-tech digital farming, the growing demand for alternative market and financial structures that better promote sustainability, and the environmental dimensions of the obesity-hunger paradox. Finally, we point to what we consider to be the most promising theoretical and methodological frameworks for research in this area, including interdisciplinary approaches and methods that draw on a range of data sources.

**The State of Debate on the GEP of Food**

Food systems and socio-ecological systems intersect in multiple ways, with impacts felt from agricultural production, food distribution, and dietary consumption activities. As food systems have become more globalized through internationally connected supply chains over the past 50 years, these problems have taken on increasing global relevance. The GEP field has only recently turned its attention to debates over food and environment in the international political arena, but has been able to draw on and build upon work in other disciplines, such as sociology, geography, environmental studies, and ecological economics, that have mapped out the connections between food and environmental systems from production to consumption. GEP research contributes to broader debates on this theme by providing analysis and insight on key political debates and governance initiatives in three broad areas of the global food system.

 First, we have seen rising concern about the various ecological side effects of food production, especially from ‘conventional’ agriculture—that is, production systems based on modern seeds, mechanization, irrigation, and monoculture planting practices—that has dominated the landscape of the past 100 or so years in the West and in the last 50 or so years in developing countries (Foley et al. 2011). Agriculture is responsible for some 20-35 percent of greenhouse gas emissions associated with climate change (Foley et al. 2011; Vermeulen et al. 2012;), which is not surprising given the heavy reliance on fossil fuels typical of conventional production methods (Weis 2010). Large-scale livestock operations are also a major source of greenhouse gases (Weis 2013). Meanwhile, agricultural production is profoundly affected by climatic change (Elliott et al. 2013). Agricultural production also consumes up to 70 percent of the world’s freshwater resources (Pimentel et al. 2004). Heavy use of agrochemicals has been associated with water pollution from chemical run-off (Pimentel 1996). The growing use of monoculture planting systems places enormous strain on agroecosystems, threatening biodiversity as well as the broader resilience of food systems (Tilman 1999). And the spread of genetically modified seeds has raised questions about biosafety (Warwick et al. 2009).

 While in the broadest sense, there is agreement that modern agricultural systems have enormous implications for the environment, there are fierce debates over how best to address them. On one hand, advocates of modern farming methods tend to push for ‘sustainable intensification’ of agriculture, an approach that places faith in technological improvements that would enable higher yields with less need for land and resources (Garnett et al. 2013; Godfray 2015). On the other hand, critics of modern agriculture call for the adoption of agroecological farming methods that do not rely on intensive use of modern technologies yet still provide sufficient food while absorbing carbon and delivering important ecological services (Holt-Giménez and Altieri 2013; Pretty 2003). The International Assessment of Agricultural Knowledge Science, Technology for Development (IAASTD) process, initiated in 2003, was illustrative of this debate. Similar to the Intergovernmental Panel on Climate Change (IPCC), the IAASTD drew on the expertise of a panel of over 400 experts and sought to evaluate the state of agricultural science, knowledge, and technology to pave a pathway forward for policy and governance. Although the panel arrived at a final report, *Agriculture at a Crossroads* (IAASTD 2009), the process was highly politicized and fractious, with sharp divisions over key issues, including the role and impact of agricultural biotechnology in farming systems (Feldman and Biggs 2012; Scoones 2009).

More recently, there has also been debate over policies to address the agriculture-climate nexus. A number of international organizations, most prominently the World Bank and Food and Agriculture Organization, have promoted ‘climate smart agriculture’ (CSA) as a means to mitigate greenhouse gases associated with agriculture and implement climate adaptive agricultural strategies (Campbell et al. 2014; Lipper et al. 2014). While addressing the climate aspects of agriculture is essential, critics see the CSA approach promoted by international agencies as reinforcing high-tech forms of agriculture and perpetuating unequal power dynamics in the food system (Newell and Taylor 2018; Taylor 2018).

Second, GEP scholars have also focused on the environmental and social consequences of globalized food distribution and powerful transnational corporations in the food system. For instance, global trade in food items can affect the environment through increased carbon emissions from land use change and transportation across long distances (Iles 2005; Schmitz et al. 2012). Additionally, the export-oriented agricultural trade system works to reinforce the environmentally degrading industrial agricultural model (Clapp 2017a), while at the same time spreading consumption of highly processed energy intensive foods (Garnett 2013). As some scholars have highlighted, local landscapes can be degraded by certain forms of agriculture in order to serve global markets, such as the rampant deforestation associated with large-scale industrial palm oil plantations (Dauvergne and Lister 2013). Further, scholars have documented concern about the biosafety implications of the trade in genetically modified seeds and foods (Falkner and Gupta 2006; Newell 2003).

 Agrifood TNCs have also become increasingly concentrated through mergers and acquisitions in recent decades (Howard 2016). As marketers of agrochemicals and genetically modified seeds that are designed to be planted in monocultures, large agribusiness input firms that dominate the market tend to reinforce the ecological side-effects of the industrial agricultural model (Clapp 2018). Vertical and horizontal integration amongst major agrifood input corporations narrows seed diversity, limiting producers’ control over what and how they produce (Isakson 2014). The financialization of food systems also works towards sustainability by reducing resilience in the food sector and encouraging damaging production methods (Burch and Lawrence 2009; Clapp and Isakson 2018). Financial investments in farmland, for example, increased in the aftermath of the food crisis, drawing attention to a new wave of ‘land grabbing.’ With these recent investments, farmland becomes a ‘quasi financial asset’ (Fairbairn 2014), where it must be transformed into financial values in order to be traded by financial players. Investors are not prioritizing socially or ecologically sound production methods in their decision-making but are mainly looking to turn large profits over a relatively short timeframe (Sommerville and Magnan 2015).

In response to these developments, critical actors have called for local food systems and food sovereignty as way to exit from global trade and corporate dominated food systems and their ecological impacts (Burnett and Murphy 2014; Lee 2013). Yet powerful actors have promoted further trade integration as a means to capture resource efficiencies that can enhance food system sustainability (OECD 2013). Others call for more open trade strategies as an adaptation strategy to enable sufficient food supplies in the face of climate change (UNEP-WTO 2009, 62). Similarly corporate actors have argued that recent agribusiness mergers are a necessary move to foster research and development into modern integrated farming technologies that can deliver sustainable solutions. These debates have policy relevance at the international level, yet to date critical voices have had less weight in the global bodies that are promoting more mainstream solutions (Clapp 2017a).

 Third, people have become much more attuned to the need for food consumption choices to be more sustainable, not just in terms of the environmental dimensions of production methods mentioned above, but also the ecological impact of individual food choices as well as broader ecological dimensions of an increasingly globalized food system that is producing ever more processed and packaged foods (Garnett 2013). There is a growing amount of research on the environmental consequences of what we eat, leading to calls for more sustainable diets (Martin and Lang 2017). Sustainable diets emphasize not just how foods are produced, but also dietary choices, with some food products, such as meat and dairy, having higher environmental impact (Jarosz 2009; Sage 2013; Weis 2013).

 Calls for greater sustainability of diets has led to greater demand for sustainable food certification schemes that enable consumers to be more aware of the social and ecological consequences of the food they eat (Auld 2014; Fuchs and Kalfagianni 2010). GEP research on the rise of these schemes has evaluated whether they are leading to more sustainable food system outcomes. The research shows that while private certification can uphold safety and quality standards in the absence of public standards, it can also increase inequality within the food system (Dauvergne 2018; Schleifer 2016). Typically, only larger companies have the financial resources required to meet certification standards, further marginalizing smaller-scale producers in the developing world. From the consumer side, certified products tend to be accessible only to a small class of wealthy urbanites (Fuchs et al. 2009).

**Theoretical Insights**

The literature on the GEP of food has yielded important theoretical insights (for a review, see: Clapp and Scott 2018). To begin, the connections between cause and environmental effect within the food system are oftentimes obscured due to highly complex and elongated food supply chains. The concept of distance, outlined by Princen (2002), is helpful in teasing out the connections between food system practices and environmental outcomes (Clapp 2015), as it encourages us to reflect on how much and which information is transmitted along supply chains from production to consumption, and to trace those information flows for greater clarity. Increasing distance can have a negative impact on the sustainability of food systems because it is associated with a concentration of control, and consequently greater inequality. When considered from a resilience perspective, greater distance in the food supply chain loosens feedback loops, making it harder to assign accountability for environmentally destructive activities (Clapp 2017b).

 It is also not clear where exactly the intersection of food and environmental issues should be governed at the international level. There is no formal international environmental regime or agreement dedicated to food and agriculture sustainability. A number of global environmental regimes address problems related to food and agriculture, such as those for climate change, biodiversity, biosafety, and pesticide use, but these arrangements cover different aspects of that system and are not coordinated with one another. Moreover, governance in this arena is complicated by the fact that economic factors play a role in generating problems within food systems but are governed in other institutions that have more authority in global governance such as the World Trade Organization (Zelli and van Asselt 2013). The concept of fragmentation is helpful for GEP studies in that it provides a framework within which to analyze the effectiveness of existing and potential governance structures (Biermann et al., 2009). This literature enables us to tease out overlaps and gaps in governance and analyze differences in governance authority and legitimacy on issues at the intersection of food and environment (e.g., Oberthür and Pożarowska 2013).

 The GEP literature often deals with the issue of power in order to understand how and why the current food system has come to be and the scope of possibilities for future trajectories. Discourses regarding sustainability in the food system are accompanied by vastly unequal power relationships and are typically highly polarized in practice. Sustainability can be understood as a discursive tool used at times to legitimize, and at others, transform the politics of food systems (Clapp and Fuchs 2009; Koc 2010). GEP literature on power is useful in showing how influential actors can pursue and push certain visions of sustainability on others in the food system. But typically these are visions that help the bottom line of businesses and only serve to reinforce existing power dynamics (Dauvergne and Lister 2013). Those who benefit from the status quo often outright resist the fundamental changes required to significantly improve sustainability outcomes. Others, however, may offer solutions that do not challenge neoliberalism and sometimes even create new opportunities for capital accumulation (Newell 2012). In this context, sustainability characteristics can be co-opted by corporations, giving the illusion of a more profound commitment to sustainability than exists in reality (Blay-Palmer 2008).

 Discourse is but one dimension of power; other dimensions include instrumental and structural power (Fuchs 2007). These concepts have also enhanced scholarly understanding of the global environmental politics of food. Instrumental power refers to the direct influence actors have over decision-making. Real world examples of instrumental power wielded by corporations include lobbying efforts or campaign financing. In contrast, structural power is less overt in shaping the behavior options of actors (Clapp and Fuchs 2009; Falkner 2008). A commonly cited example of structural power is in agenda setting. Structural power can extend beyond agenda setting as dominant positions in material structures and organizational networks can endow corporations with rule making power (Fuchs et al. 2016). Adopting a power lens provides key insights into barriers to and potential for greater sustainability in the global food system. The literature on international food regimes also employs a power lens to explain how political and economic constellations shape and create particular forms of agricultural production and consumption in the capitalist world economy. Friedmann and McMichael (1989) draw on social movement literature to explore the role of language, or discursive power, in influencing the structures of the food regime.

**Emerging Issues and an Agenda for Future Research**

The global food landscape is experiencing constant change, including that driven by technological developments, shifting economic trends, and changes in dietary patterns. These transformations of the global food system give rise to a number of emerging issues that have the potential to alter the global environmental politics of food in important ways. Here we focus on three of the changes we see as requiring further attention from scholars: the shift toward what is called ‘digital farming’—the utilization of big data and internet-connected devices that is reshaping what constitutes farming; the barriers to the further development of alternative market systems that could better promote sustainability; and the environmental dimensions of the increasingly prevalent paradox of the coexistence of obesity and hunger around the world. These three issues are, in our view, among the most pressing today with respect to the imperative of sustainability, and among the most challenging to address in terms of politics and policy.

***The Environmental Implications of the Rise of ‘Digital Farming’***

Recent years have seen the rise of new information platforms that rely on big data to guide farming decisions (Bronson and Knezevic 2016; Wolfert et al. 2017). These platforms utilize satellite images and sophisticated software programs to analyze climate and soil conditions in individual fields, giving farmers specific prescriptions regarding the precise types and quantities of seeds, chemicals, and other inputs necessary to maximize their yields. High-tech tractors and drones are then used to apply the inputs onto fields. This shift toward information technology as a guiding feature of modern agriculture has occurred alongside the growing concentration of agribusiness firms in the sector. The companies that are developing these platforms laud them for their ability to promote agricultural sustainability because it allows for inputs to be used and applied more precisely, conserving resources and resulting in reduced chemical use (Bayer 2018). Critics are concerned that digital farming platforms will only lock farmers into industrial farming methods and are less confident that the environmental outcomes will be positive (ETC Group 2016). More research is needed to untangle the likely impact of this push for digital farming.

***Challenges and Opportunities in Building Alternative Market Relationships to Support Sustainable Food Systems***

As noted above, the current structures for trade and finance tend to work against the goals of sustainable food systems. While there has been a robust interest in local market systems, scaling these initiatives out has proven challenging due to current policy and governance structures that favor international trade relationships. Moreover, mainstream financial institutions are more likely to work with and provide capital to large-scale industrial farms, viewing smaller scale, alternative food and agriculture enterprises as being riskier investments (Vander Stichele 2015). These findings suggest that rethinking the structure of the economy and building alternative market relationships could bring about greater sustainability within food systems. However, more research is needed to tease out the challenges and opportunities presented by alternative market arrangements and how they interface with existing market and financial structures that encourage the kinds of large-scale agriculture and food systems that are unsustainable. Identifying cause and effect of economic relationships on the sustainability of food systems is challenging due to the high level of governance fragmentation on the issues of food, environmental, and financial policies. The field would benefit from in-depth studies further exploring the dynamics between food and finance and their implications on the governance of sustainable food systems.

***Obesity/Hunger Paradox and Connection to Environment***

Today, nearly 800 million people suffer from chronic hunger alongside 1.9 billion people that are considered overweight (FAO 2016). Addressing sustainability in the context of this paradox is challenging but research needs to more fully explore the connections between undernutrition, overnutrition, and the environmental consequences of this duality. For instance, the mainstream response to addressing global hunger is to push for greater food production. However, there is ample evidence that currently levels of global food production can meet the caloric needs of 1.5 times the population, revealing that food access is the culprit rather than food production (Holt-Giménez et al. 2012). The emphasis on productivism through industrial agricultural methods has environmental ramifications, but it is also perversely linked to rising rates of overnutrition and non-communicable diseases worldwide. While it cannot be denied that increased food production has led to societal gains in some contexts, food abundance has also contributed to losses through the growth of ultra-processed, packaged foods that are not only harmful from a health perspective but also damage the environment (Scott 2018). More in depth studies of the contradictions and environmental consequences of food and nutrition policies that seek to address both hunger and overnutrition are needed in the field.

**Promising Conceptual and Methodological Approaches**

Interdisciplinary/transdisciplinary studies will continue to be necessary to examine these complex issues at the intersection of food and environmental politics at the global level. Transdisciplinarity involves bridging science and policy for the betterment of society and therefore entails both knowledge co-production as well as a particular social outcome (Pohl 2008). Researchers are encouraged to move away from the study of issues in intellectual silos and, rather, to interact with the world beyond their academic departments to produce policy relevant research geared towards solving today’s pressing problems. The environmental politics of food intersects with a variety of disciplines that draw on different conceptual foundations, not all of which can be covered here in depth. Below we outline the approaches that are relatively well established in the topic area and which can provide new researchers with strong conceptual foundations.

 Much of the GEP of food literature is grounded in concepts that emerge from the disciplines of political science and international relations. This includes conceptual frameworks that feature the role and significance of power—of both markets and political actors—in shaping policy and governance that sets the rules and norms underpinning food systems in a global context. Power, as noted above, can be interpreted as structural, such as market power and the ability to shape agendas, but also includes the power to shape discourse and to exert direct influence via lobbying (Clapp and Fuchs 2009). Much of the literature on the global environmental politics of food that features the role of power also draws on other disciplines in the social sciences, including sociology and geography, which also tend to utilize the concept of ‘food regimes’ to frame food system dynamics as the product of contests of power within global capitalist relations (Friedmann and McMichael 1989). These broader analyses that incorporate power can be useful in unpacking the forces that are relevant to understanding the form and shape of policy and governance outcomes in the food system.

 The discipline of economics offers useful conceptual framing for scholars seeking to understand the functioning of food systems from the local to the global scale. Because food systems are closely entwined with market exchange, concepts used to study markets, such as oligopoly, concentration, and externalities, are extremely useful in examining the sustainability of food systems. Subfields of economics such as ecological economics, green economics, and behavioral/cognitive economics, also known as ‘heterodox economics,’ challenge the traditional, neoclassical approaches to economics by offering alternative models to understand economic aspects of food systems (Cato 2011; Gerber and Steppacher 2012). Concepts such as throughput and scale from ecological economics, for example, which help to explain the ecological implications of the driver for perpetual economic growth, help to uncover the dynamics driving unsustainable food systems. Insights from green economists, with their focus on grassroots and local responses to environmental degradation arising from growth-oriented economic policies, are also useful in analyzing the sustainability dimensions of food systems.

 The interdisciplinary field of environmental studies and sciences is also an essential component of research in the GEP of food. Political analysis of the global environmental dimensions of food systems must necessarily be grounded in scientific analyses of the ecological implications of different models of food production and distribution. Systems thinking that is foundational to environmental studies and sciences is especially useful when addressing food systems so closely tied to ecological processes (Kay and Schneider 1994). Rather than focus on the interaction of individual parts, systems thinking supports the notion that the whole can be greater than the sum of its parts (Hinrichs 2010). A systems approach considers the underlying structure and connections of a system to reveal points of leverage and operates from the understanding that change within complex systems can be unpredictable, non-linear, and occur over distant time horizons (Chase and Grobinger 2014). Resilience thinking is closely related to a systems approach and offers solutions for managing resources sustainably (Walker and Salt 2006). These concepts are especially useful in considering the dynamics of change and sustainability in food systems.

Research into the GEP of food benefits from a mix of complementary methods. Detailed case studies can serve to link ecological impacts to broader political and market trends and help to ground our understanding of political dynamics by placing them in specific contexts and unique circumstances. Detailed case studies on their own may not yield broader lessons to explain outcomes in the food system as a whole. But when taken together, a large body of detailed case studies is essential for detecting patterns and drawing lessons for policy and governance. Data-based inductive analyses are also useful to explain the global political and ecological dynamics of food systems. Both quantitative and qualitative data are useful inputs to analyses that seek to tease out dynamics that underlie the drivers of environmental trends in food systems and the political responses to those trends. Data on ecological and agricultural indicators is essential for tracking trends and outcomes, while firsthand insights of stakeholders and policy practitioners is needed to ensure practical relevance. These varied types of data help to ground research to specific localities while enabling a more robust comparison across case studies, essential for identifying broader, global trends. Process tracing, a qualitative research method for describing and evaluating causal claims, is also a fruitful tool to understand policy and governance dimensions of the issues (Collier 2011).

**Conclusion**

Research into the global environmental politics of food is necessarily an interdisciplinary exercise, drawing on a range of literatures, approaches, and theoretical concepts. Although GEP research into this thematic area is relatively new, it brings important insights to our understanding of the policy and governance implications that arise from a greater understanding of the environmental dimensions of food and agriculture systems. The study of the global environmental politics of food is somewhat diffuse, as there is no single international regime or treaty devoted to sustainable food systems. Although this feature of the issue area presents some challenges for researchers, as they must examine not just a range of fragmented governance arrangements but also an issue in which governance is lacking. A number of insights from the GEP literature are helpful for understanding these unique dynamics, including the concepts of fragmentation, complexity and distance, and power. Future research on the global environmental politics of food will benefit from the further application of the concepts, as well as additional insights from other fields of study that help to give insight into food system-environment dynamics at the global level.

**References**

Auld, Graeme. 2014. *Constructing Private Governance: The Rise and Evolution of Forest, Coffee, and Fisheries Certification*. New Haven: Yale University Press.

Bayer. 2018. Digital Farming Vision. Available online at: http://www.digitalfarming.bayer.com/our-vision.html, last accessed January 17, 2018.

Biermann, Frank. 2009. The Fragmentation of Global Governance Architectures: A Framework for Analysis. *Global Environmental Politics* 9 (4): 14-40.

Blay-Palmer, Alison. 2008. *Food Fears: From Industrial to Sustainable Food Systems*. Burlington: Ashgate.

Burch, David, and Geoffrey Lawrence. 2009. Towards a Third Food Regime: Behind the Transformation. *Agriculture and Human Values* 26 (4): 267-279.

Burnett, Kim, and Sophia Murphy. 2014. What Place for International Trade in Food Sovereignty? *The Journal of Peasant Studies* 41 (6): 1065-1084.

Bronson, Kelly, and Irena Knezevic. 2016. Big Data in Food and Agriculture. *Big Data & Society* 3 (1).

Campbell, Bruce M., Philip Thornton, Robert Zougmoré, Piet van Asten, and Leslie Lipper. 2014. Sustainable Intensification: What is its Role in Climate Smart Agriculture? *Current Opinion in Environmental Sustainability* 8: 39-43.

Cato, Molly Scott. 2011. *Environment and Economy*. New York: Routledge.

Chase, Lisa, and Vern Grobinger. 2014. *Food, Farms, and Community: Exploring Food Systems.* Durham: University of New Hampshire Press.

Clapp, Jennifer. 2015. Distant Agricultural Landscapes. *Sustainability Science* 10 (2): 305-316.

———. 2017a. The Trade-ification of the Food Sustainability Agenda. *The Journal of Peasant Studies* 44 (2): 335-353.

———. 2017b. Responsibility to the Rescue? Governing Private Financial Investment in Global Agriculture. *Agriculture and Human Values* 34 (1): 223-235.

———. 2018. Mega Mergers on the Menu: Corporate Concentration and the Politics of Sustainability in the Global Food System. *Global Environmental Politics* 18 (2).

Clapp, Jennifer, and Caitlin Scott. 2018. The Global Environmental Politics of Food*. Global Environmental Politics* 18 (2).

Clapp, Jennifer, and Doris Fuchs. 2009. *Corporate Power in Global Agrifood Governance*. Cambridge: MIT Press

Clapp, Jennifer, and S. Ryan Isakson. 2018. *Speculative Harvests: Financialization, Food, and Agriculture.* Halifax: Fernwood Press.

Collier, David. 2011. Understanding Process Tracing. *Political Science and Politics* 44 (4): 823-830.

# Dauvergne, Peter. 2018.The Global Politics of the Business of “Sustainable” Palm Oil. *Global Environmental Politics* 18 (2).

Dauvergne, Peter, and Jane Lister. 2013. *Eco-Business: A Big-Brand Takeover of Sustainability*. Cambridge: MIT Press.

Elliott, Joshua, Delphine Deryng, Christoph Muller, Katja Frieler, Markus Konzmann, Dieter Gerten, Michael Glotter, Martina Florke, Yoshihide Wada, Neil Best, Stephanie Eisner, Baláza M. Fekete, Christian Folberth, Ian Foster, Simon N. Gosling, Ingjerd Haddeland, Nikolay Khabarov, Fulco Ludwig, Yoshimitsu Masaki, Stefan Olin, Cynthia Rosenzweig, Alex C. Ruane, Yusuke Satoh, Erwin Schmid, Tobias Stacke, Qiuhong Tang, and Dominik Wisser. 2013. Constraints and Potentials of Future Irrigation Water Availability on Agricultural Production under Climate Change. *PNAS* 111 (9): 3239-3244.

ETC Group. 2016. *Merge-Santo: New Threat to Food Sovereignty*, *Briefing Note, March 23*. Available online at: http://www.etcgroup.org/content/merge-santo-new-threat-food-sovereignty, last accessed January 17, 2018.

Fairbairn, Madeleine. 2014. ‘Like Gold with Yield’: Evolving Intersections between Farmland and Finance. *Journal of Peasant Studies* 41 (5): 777-795.

Fish and Agriculture Organization (FAO). 2016. *Malnutrition in the Crosshairs*. Available online at: http://www.fao.org/news/story/en/item/455867/icode/, last accessed January 16, 2018.

Falkner, Robert. 2008. *Business Power and Conflict in International Environmental Politics*. New York: Palgrave Macmillan.

Falkner, Robert, and Aarti Gupta. 2006. The Influence of the Cartagena Protocol on Biosafety: Comparing Mexico, China and South Africa. *Global Environmental Politics* 6 (4): 23-55.

Feldman, Shelley, and Stephen Biggs. 2012. The Politics of International Assessments: The IAASTD Process, Reception and Significance. *Journal of Agrarian Change* 12 (1): 144-169.

Foley, Jonathan A., Navin Ramankutty, Kate A. Brauman, Emily S. Cassidy, James S. Gerber, Matt Johnston, Nathaniel D. Mueller, Christine O’Connell, Deepak K. Ray, Paul C. West, Christian Balzer, Elena M. Bennett, Stephen R. Carpenter, Jason Hill, Chad Monfreda, Stephen Polasky, Johan Rockström, John Sheehan, Stefan Siebert, David Tilman, and David P. M. Zaks. 2011. Solutions for a Cultivated Planet. *Nature* 478 (7369): 337-342.

Friedmann, Harriet, and Philip McMichael. 1989. Agriculture and the State System: The Rise and Decline of National Agricultures, 1870 to the Present. *Sociologia Ruralis* 29 (2): 93-117.

Fuchs, Doris. 2007. *Business Power in Global Governance*. Boulder: Lynne Rienner.

Fuchs, Doris, and Agni Kalfagianni. 2010. The Causes and Consequences of Private Food Governance. *Business and Politics* 12 (3): 1-34.

Fuchs, Doris, Agni Kalfagianni, and Maarten Arensten. 2009. Retail Power, Private Standards, and Sustainability in the Global Food System. In *Corporate Power in Global Agrifood Governance*, edited by Jennifer Clapp and Doris Fuchs, 29-60. Cambridge: MIT Press.

Fuchs, Doris, Antonietta Di Giulio, Katharina Glaab, Sylvia Lorek, Michael Maniates, Thomas Princen, and Inge Røpke. 2016. Power: The Missing Element in Sustainable Consumption and Absolute Reductions Research and Action. *Journal of Cleaner Production* 132: 298-307.

Garnett, Tara. 2013. Food Sustainability: Problems, Perspectives and Solutions. *The Proceedings of the Nutrition Society* 72 (1): 29-39.

Garnett, T., M. C. Appleby, A. Balmford, I. J. Bateman, T. G. Benton, P. Bloomer, B. Burlingame, M. Dawkins, L. Dolan, D. Fraser, M. Herrero, I. Hoffmann, P. Smith, P. K. Thornton, C. Toulmin, S. J. Vermeulen, and H. C. J. Godfray. 2013. Sustainable Intensification in Agriculture: Premises and Policies. *Science* 341 (6141): 33-34.

Gerber, Julien-François, and Rolf Steppacher. 2012. *Towards an Integrated Paradigm in Heterodox Economics*. London: Palgrave Macmillan.

Godfray, H. Charles J. 2015. The Debate over Sustainable Intensification. *Food Security* 7 (2): 199-208.

Hinrichs, Clare. 2010. Conceptualizing and Creating Sustainable Food Systems: How Interdisciplinarity Can Help. In *Imagining Sustainable Food Systems: Theory and Practice*, edited by Alison Blay-Palmer, 17-35. Surrey: Ashgate.

Holt-Giménez, Eric, and Miguel A. Altieri. 2013. Agroecology, Food Sovereignty, and the New Green Revolution. *Agroecology and Sustainable Food Systems* 37 (1): 90-102.

Holt-Giménez, Eric, Annie Shattuck, Miguel Altieri, Hans Herran, and Steven Gliessman. 2012. We Already Grow Enough Food for 10 Billion People…and Still Can’t End Hunger. *Journal of Sustainable Agriculture* 36 (6): 595-598.

Howard, Philip. 2016. *Concentration and Power in the Food System: Who Controls What We Eat?* London: Bloomsbury.

International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD). 2009. *Agriculture at a Crossroads - Executive Summary of the Synthesis Report.* Available online at: http://www.globalagriculture.org/fileadmin/files/weltagrarbericht/IAASTDBerichte/IAASTDExecutiveSummarySynthesisReport.pdf, last accessed January 16, 2018.

Iles, Alastair. 2005. Learning in Sustainable Agriculture: Food Miles and Missing Objects. *Environmental Values* 14 (2): 163-183.

Isakson, S. Ryan. 2014. Food and Finance: The Financial Transformation of Agro-Food Supply Chains. *The Journal of Peasant Studies* 41 (5): 749-775.

Jarosz, Lucy. 2009. Energy, Climate Change, Meat, and Markets: Mapping the Coordinates of the Current World Food Crisis. *Geography Compass* 3 (6): 2065-2083.

Kay, James J., and Eric Schneider. 1994. Embracing Complexity: The Challenge of the Ecosystem Approach. *Alternatives* 20 (3): 32-39.

Koc, Mustafa. 2010. Sustainability: A Tool for Food System Reform? In *Imagining Sustainable Food Systems: Theory and Practice*, edited by Alison Blay-Palmer, 37-48. Surrey: Ashgate.

Lee, Richard Philip. 2013. The Politics of International Agri-Food Policy: Discourses of Trade-Oriented Food Security and Food Sovereignty. *Environmental Politics* 22 (2): 216-234.

Lipper, Leslie, Philip Thornton, Bruce M. Campbell, Tobias Baedeker, Ademola Braimoh, Martin Bwalyah, Patric Caron, Andrea Cattaneo, Dennis Garrity, Kevin Henry, Ryan Hottle, Louise Jackson, Andrew Jarvis, Fred Kossam, Wendy Mann, Nancy McCarthy, Alexandre Meybeck, Henry Neufeldt, Tom Remington, Pham Thi Sen, Reuben Sessa, Reynolds Shula, Austin Tibu, and Emmanuel F. Torquebiau. 2014. Climate-Smart Agriculture for Food Security. *Nature and Climate Change* 4: 1068-1072.

Martin, Pamela, and Timothy Lang. 2017. *Sustainable Diets.* London: Routledge.

Newell, Peter. 2003. Globalization and the Governance of Biotechnology. *Global Environmental Politics* 3 (2): 56-71.

Newell, Peter. 2012. *Globalization and the Environment: Capitalism, Ecology and Power.* Cambridge: Polity.

Newell, Peter, and Olivia Taylor. 2018. Contested Landscapes: The Global Political Economy of Climate-Smart Agriculture. *The Journal of Peasant Studies* 45 (1): 108-129.

Oberthür, Sebastian, and Justyna Pożarowska. 2013. Managing Institutional Complexity and Fragmentation: The Nagoya Protocol and the Global Governance of Genetic Resources. *Global Environmental Politics* 13 (3): 100-118.

Organisation for Economic Co-operation and Development (OECD). 2013. The Role of Food and Agricultural Trade in Ensuring Domestic Food Availability. In *Global Food Security: Challenges for the Food and Agricultural System*. Paris: OECD.

Pimentel, David. 1996. Green Revolution Agriculture and Chemical Hazards. *The Science of the Total Environment* 188: S86-S98.

Pimentel, David, Bonnie Berger, David Filberto, Michelle Newton, Benjamin Wolfe, Elizabeth Karabanakis, Steven Clark, Elaine Poon, Elizabeth Abbet, and Sudha Nandagopal. 2004. Water Resources: Agricultural and Environmental Issues. *BioScience* 54 (10): 909-918.

Pohl, Christian. 2008. From Science to Policy Through Transdisciplinary Research. *Environmental Science and Policy* 11 (1): 46-53.

Pretty, Jules. 2003. Agroecology in Developing Countries: The Promise of a Sustainable Harvest. *Environment: Science and Policy for Sustainable Development* 45 (9): 8-20.

Princen, Thomas. 2002. Distancing: Consumption and the Severing of Feedback. In *Confronting Consumption*, edited by Ken Conca, Michael Maniates, and Thomas Princen, 103-131. Cambridge: MIT Press.

Sage, Colin. 2013. The Interconnected Challenges for Food Security from a Food Regimes Perspective: Energy, Climate and Malconsumption. *Journal of Rural Studies* 29: 71-80.

Scott, Caitlin. Sustainably-Sourced Junk Food? Big Food and the Legitimacy Challenge of Sustainable Diets. *Global Environmental Politics* 18 (2).

Schleifer, Philip. 2016. Private Governance Undermined: India and the Roundtable on Sustainable Palm Oil. *Global Environmental Politics* 16 (1): 38-58.

Schmitz, Christoph, Annie Biewald, Hermann Lotze-Campen, Alexander Popp, Jan Philipp Dietrich, Benjamin Bodirsky, Michael Krause, and Isabelle Weindl. 2012. Trading More Food: Implications for Land Use, Greenhouse Gas Emissions, and the Food System. *Global Environmental Change* 22 (1): 189-209.

Scoones, Ian. 2009. The Politics of Global Assessments: The Case of the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD). *Journal of Peasant Studies* 36 (3): 547-571.

Sommerville, Melanie, and André Magnan. 2015. ‘Pinstripes on the Prairies’: Examining the Financialization of Farming Systems in the Canadian Prairie Provinces. *The Journal of Peasant Studies* 42 (1): 119-144.

Taylor, Marcus. 2018. Climate-Smart Agriculture: What Is It Good For? *The Journal of Peasant Studies* 45 (1): 89-107.

Tilman, David. 1999. Global Environmental Impacts of Agricultural Expansion: The Need for Sustainable and Efficient Practices. *Proceedings of the National Academy of Sciences* 96 (11): 5995-6000.

United Nations Environment Programme (UNEP) and World Trade Organization (WTO). 2009. *Trade and Climate Change*. Available online at: https://www.wto.org/english/res\_e/booksp\_e/trade\_climate\_change\_e.pdf, last accessed January 16, 2018.

Vander Stichele, Myriam. 2015. How Financialization Influences the Dynamics of the Food Supply Chain. *Canadian Food Studies* 2 (2): 258-266.

Vermeulen, Sonja J., Bruce M. Campbell, and John S.I. Ingram. 2012. Climate Change and Food Systems. *Annual Review of Environment and Resources* 37 (1): 195-222.

Walker, Brian, and David Salt. 2006. *Resilience Thinking: Sustaining Ecosystems and People in a Changing World.* Washington: Island Press.

Warwick, Suzanne I., Hugh Beckie, and Linda M. Hall. 2009. Gene Flow, Invasiveness, and Ecological Impact of Genetically Modified Crops. *Annals of the New York Academy of Sciences* 1168: 72-99.

Weis, Tony. 2010. The Accelerating Biophysical Contradictions of Industrial Capitalist Agriculture. *Journal of Agrarian Change* 10 (3): 315-341.

Weis, Tony. 2013. *The Ecological Hoofprint: The Global Burden of Industrial Livestock*. London: Zed Books.

Wolfert, Sjaak, Lan Ge, Cor Verdouw, and Marc-Jeroen Bogaardt. 2017. Big Data in Smart Farming – A Review. *Agricultural Systems* 153: 69-80.

Zelli, Fariborz, and Harro van Asselt. 2013. Introduction: The Institutional Fragmentation of Global Environmental Governance: Causes, Consequences, and Responses. *Global Environmental Politics* 13 (3): 1-13.