ABSTRACT

Title of Document: SEEDS OF CONTESTATION: GENETICALLY MODIFIED CROPS AND THE POLITICS OF AGRICULTURAL MODERNIZATION IN GHANA

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What actors, expertise, and models of development are advanced by the 'new Green Revolution in Africa'? This dissertation addresses this question through a blend of discourse analysis and ethnographic fieldwork during a period of agricultural transition in Northern Ghana. What struggles over authority, knowledge, identity, and property define this contemporary political economy of agricultural modernization in Ghana? I argue that legal, techno-scientific expertise and agribusiness work together to advance a model of agricultural development based on new forms of capital, governance structures, and technology. This model of agricultural development is mobilized and legitimated through discourses of emergency, salvation, entrepreneurship, and humanitarianism. In this new Green Revolution in Africa, regions like Northern Ghana are seen by development planners as 'backwards,' with growing 'yield gaps' that undermine food security. What is needed, from this perspective, is capital investment, entrepreneurship, and access to yield-enhancing technologies, such as 'pro-poor biotechnology.' Deficiency frames, the combined use of hype and science, and donations become critical mechanisms to facilitate—or resist—the entry of contested agricultural technologies and models of agricultural development. At the center of these discursive strategies is the figure of the farmer, who is seen as an agent and object of salvation by proponents and opponents alike. I complement discourse analysis with ethnography to show that these grand plans to transform farming from a way of life to a business are constantly challenged by the existing complexity of Africans' multiple, coexisting roles, risk reduction practices, and notions of entrepreneurship.

SEEDS OF CONTESTATION: GENETICALLY MODIFIED CROPS AND THE POLITICS OF AGRICULTURAL MODERNIZATION IN GHANA

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List of Abbreviations

3ADI African Accelerated Agribusiness and Agro-Industries Development Initiative
AATF African Agricultural Technology Foundation
ABNE African Biosafety Network of Expertise
ABS Africa Biofortified Sorghum
ABSP Agricultural Biotechnology Support Project
ACDI/VOCA Agricultural Cooperative Development International/Volunteers in Overseas Cooperative Assistance
ADB Agricultural Development Bank of Ghana
ADVANCE Agricultural Development and Value Chain Enhancement
AfDB African Development Bank
AFSTA African Seed Traders Association
AGOA African Growth and Opportunity Act
AGRA Alliance for a Green Revolution in Africa
ARC Institute for Agricultural Research (South Africa)
ASTI Agricultural Science and Technology Indicators
AU African Union
BMGF Bill and Melinda Gates Foundation
BNARI Biotechnology and Nuclear Agriculture Research Institute
Bt *Bacillus thuringiensis*
BUSAC Business Sector Advocacy Challenge Fund
CAADP Comprehensive Africa Agriculture Development Programme
CARGS Competitive agricultural grant system
CEDO Community Enterprise Development Organization
CEO Chief Executive Officer
CFT Confined field trial
CGIAR Consultative Group on International Agricultural Research
CIAT International Center for Tropical Agriculture
CIMMYT International Maize and Wheat Improvement Center
CIP International Potato Center
COFAM Coalition for Farmers' Rights and Advocacy Against GMOs
CORAF West and Central African Council for Agricultural Research and Development
CRI Crops Research Institute (Ghana)
CSIR Council for Scientific and Industrial Research (Ghana)
CSIRO Commonwealth Scientific and Industrial Research Organisation (Australia)
DFID Department for International Development (UK)
DONATA Dissemination of New Agricultural Technologies in Africa
EDAIF Export Development and Agricultural Investment Fund
FARA Forum for Agricultural Research in Africa
FAO United Nations Food and Agriculture Organization
FAS Foreign Agricultural Service (US)
FDI Foreign Direct Investment
FSG Food Sovereignty Ghana
G8 Group of Eight

GAIN Global Agricultural Information Network
GAPs Good agricultural practices
GCAP Ghana Commercial Agriculture Project
GE Genetically engineered
GIIN Global Impact Investing Network
GM Genetically modified
GMO Genetically modified organism
HYVs High yield varieties
IAASTD International Assessment of Agricultural Knowledge, Science and Technology for Development
IAR Institute for Agricultural Research (Nigeria)
IARCs International Agricultural Research Centres
ICRISAT International Crops Research Institute for Semi-Arid Tropics
IFAD International Fund for Agricultural Development
IFDC International Fertilizer Development Center
IFPRI International Food Policy Research Institute
IITA International Institute for Tropical Agriculture
IMF International Monetary Fund
INERA Institute of Environment and Agricultural Research (Burkina Faso)
IP Intellectual property
IPRs Intellectual property rights
IRRI International Rice Research Institute
ISAAA International Service for the Acquisition of Agri-biotech Applications
KARI Kenya Agricultural Research Institute
KNUST Kwame Nkrumah University of Science and Technology
MDGs United Nations Millennium Development Goals
MoFA Ministry of Food and Agriculture (Ghana)
MVP Millennium Villages Project
NARI National Agricultural Research Institute
NARO National Agricultural Research Organization (Uganda)
NCOS National Centre of Specialization
NEPAD New Partnership for Africa's Development
NEWEST Nitrogen-use efficiency, water-use efficiency, and salt tolerance rice project
NGO Nongovernmental organization
NRCRI National Root Crops Research Institute (Nigeria)
OFAB Open Forum for Agricultural Biotechnology in Africa
PABRA Pan-African Bean Research Alliance
PASS Program for Africa's Seed Systems
PBS Program for Biosafety Systems
PBR Pod-borer Resistant
PIPRA Public Intellectual Property Resource for Africa
PPP Public-private partnership
PRI Program-related investment
RAINS Regional Advisory Information and Network Systems (Ghana)

SABIMA Strengthening Capacity for Safe Biotechnology Management in sub-Saharan Africa
SADA Savannah Accelerated Development Authority
SADC Southern Africa Development Community
SAP Structural Adjustment Program
SARI Savannah Agricultural Research Institute (Ghana)
TRIPS Trade-Related Aspects of Intellectual Property Rights
UNDP United Nations Development Programme
UNIDO United Nations Industrial Development Organization
USAID United States Agency for International Development
USDA United States Department of Agriculture
WAAPP West Africa Agricultural Productivity Program
WACCI West African Center for Crop Improvement
WARDA Africa Rice Center/West Africa Rice Development Association
WB World Bank
WEF World Economic Forum
WEMA Water-Efficient Maize for Africa
WTO World Trade Organization

CHAPTER ONE:
Politicizing Agricultural Development:
Contesting Discourses of Authority, Expertise, and Identity in Ghana

I. Overview

In 2011, without much public fanfare, Ghana passed Biosafety Act 831, which allows for the cultivation of genetically modified (GM) crops.[1] More than three years later, activists from Food Sovereignty Ghana sued the Ghana National Biosafety Committee and the Ministry of Food and Agriculture in order to ban the commercialization of genetically modified organisms (GMOs). The Ghana National Association of Farmers and Fishermen joined the case in defense of the introduction of GM crops. The political party of Kwame Nkrumah, the Convention Peoples' Party, joined the plaintiffs in order to reject the "imposition" of GMOs; GMOs represented the "neocolonization" that Kwame Nkrumah had warned about in his writings.[2] The current court case is generating a growing public debate about GMOs in Ghana, as well as attracting a larger audience. As one member of Food Sovereignty Ghana told me in the context of the court case, "the world is watching Ghana."[3]

Ghana's agricultural future is at a critical juncture. Ghana's developmental success in West Africa suggests that if Ghana chooses to adopt genetically modified (GM) seeds, others will likely follow suit. The genetic manipulation of seeds has been both a source of global contention, and heralded as a technology with great potential

[1] Author interview with anti-GMO activist and organizer Bern Guri of CIKOD, Accra, February 14, 2014. Other informants involved in mobilizing against GMOs confirmed this account that there was little public awareness when Ghana passed the National Biosafety Act 831 in 2011.

[2] Author interview with Yaw Gyan, the spokesman of the Convention Peoples' Party, Accra, May 4, 2015.

[3] This group was quite elusive to get in touch with. Once I did finally meet with three of the core members of the organization and mentioned that I had called and sent multiple emails, they explained that they received dozens of emails from foreigners interested in the case. Conversation with members of Food Sovereignty Ghana, Accra, May 5, 2015.

to improve livelihoods. Proponents of GM seed like the Bill and Melinda Gates Foundation and USAID endorse biotechnology as a means to improve crop yields and mitigate the effects of drought. Opponents like La Via Campesina and the African Biodiversity Network cast this new technology as threatening to cultural and biological diversity and small farmers' self-sufficiency. The debate is further intensified by aid agencies, foundations, and the media that portray Africa as a 'deficient' continent in need of intervention. Increased population pressures, the effects of climate change, and the impact of the food price crisis of 2007-8 have placed African agriculture on the international agenda. The introduction of GM seed as part of the "new Green Revolution" of agricultural transformation has been cast, on the one hand, as the technological savior to address Africa's food insecurity, and, on the other hand, as the Trojan horse of corporate neocolonialism.[4]

My dissertation examines a set of interrelated questions about this debate: ***What actors, expertise, and models of development are advanced by the 'new Green Revolution in Africa'? What struggles over authority, knowledge, identity, and property define the contemporary political economy of agricultural modernization in Ghana?***

I argue that legal, techno-scientific expertise and agribusiness work together to advance a model of agricultural development based on new forms of capital, governance structures, and technologies. This model of agricultural development is

[4] For an example of the framing of the introduction of genetically modified seed as a technological savior, see Robert Paarlberg's book *Starved for Science.* Robert Paarlberg, *Starved for Science: How Biotechnology Is Being Kept Out of Africa* (Cambridge: Harvard University Press, 2008). For an example of the framing of GM seed as a Trojan Horse see the work of African Centre for Biosafety, such as Elenita C. Daño, *Unmasking the New Green Revolution in Africa: Motives, Players and Dynamics* (Penang, Malaysia; Bonn, Germany; and Richmond, South Africa: joint publication by Third World Network, Church Development Service, and the African Centre for Biosafety, 2007).

legitimated through discourses of emergency, salvation, entrepreneurship, and humanitarianism. I view the debates over GM seed and agricultural modernization as contestations between multiple stakeholders over competing imaginaries of development—what it should look like, who should guide it, and whether success means integration into the global market economy. I contend that the polarized nature of debates over genetically modified seed that frames African agriculture as a system in crisis makes way for exclusionary forms of agricultural development dominated by both experts and entrepreneurs. Opponents view GM seed as a technology that poses unique risks thereby requiring moratoriums, extensive study, and regulation of genetically modified seed; proponents view biotechnology[5] outreach, training, philanthropy, and stewardship over GM seed as necessary in order to realize the benefits of this essential technology. This emergency framing makes piecemeal approaches, compromises, and deliberation appear irresponsible in the face of such urgency.

II. Theoretical Contributions and Foundations

In order to understand this contested period of agricultural transformation, I utilize both discursive and materialist explanations, drawing upon scholarship within global environmental politics, critical international political economy, post-development studies, and food politics. My study intends to make three main contributions to political science. First, I build upon the literature on political

[5] The U.S. Office of Technology Assessment considers biotechnology to include any technique that uses living organisms to improve plants, to make or modify products, or to develop microorganisms for particular uses. See U.S. Congress, Office of Technology Assessment, *New Developments in Biotechnology: U.S. Investment in Biotechnology-Special Report, OTA-BA-360.* (Washington, DC: U.S. Government Printing Office, July 1988), 3.

authority by examining how public-private partnerships, experts, and activists each make bids to exercise authority that can be in tension with that of the state and each other. Second, I contribute to political economy and studies of the global commons by enlisting the concept of enclosure to analyze processes of commodification of seed and land, a defining feature of the new Green Revolution in Africa. Third, I fill a gap in the literature on the GMO debate through my analysis of the shared strategies between proponents and opponents of genetically modified crops. I discuss each of these contributions and their theoretical foundations through an exploration of four key themes: authority, knowledge and expertise, enclosure, and resistance.

Authority

In her seminal work, *The Retreat of the State: The Diffusion of Power in the World Economy* (1996), Strange asserts that it is imperative to look at the power exercised by authorities other than states. She argues that there has been a growing diffusion of authority as "now it is markets which, on many crucial issues, are the masters over the governments of states."[6] The paradox is that whereas there has been an overall decline in the authority of states, there has been an increase in government intervention.[7] That is to say that there has been not a retreat in the *quantity* of authority exercised by states, but the *quality* of that authority.[8] Applying Strange's ideas about shifting authority[9] from states to markets helps us to understand the changing role of the state from the first Green Revolution to the new Green

[6] Susan Strange, *The Retreat of the State: The Diffusion of Power in the World Economy.* (Cambridge: Cambridge University Press, 1996), 4.
[7] Ibid.
[8] Strange, *Retreat of the State*, xii.
[9] I define authority as the marriage of power with legitimacy.

Revolution. Strange states that the expansion of the private authority of transnational corporations happened in large part due to state policies and also for "'reasons of state.'"[10] Yet privatization went too far, as even the World Bank acknowledged in their mea culpa, *Reforming Infrastructure*.[11] This is where we see the emergence of a new institutional arrangement—and development buzzword—public-private partnerships (PPPs).

Schäferhoff, Campe and Kaan (2003) characterize transnational public-private partnerships as a hybrid type of governance "in which nonstate actors co-govern along with state actors for the provision of collective goods, and adopt governance functions that have formerly been the sole authority of sovereign nation-states."[12] Reynaers and De Graaf (2014) state that public-private partnerships are "in line with the suggestion that the public sector should no longer provide services but should rather supervise private firms taking over this responsibility."[13] These governance

[10] Strange, *Retreat of the State*, 45. This is what Harvey refers to as the "neoliberal state." David Harvey, *A Brief History of Neoliberalism* (New York: Oxford University Press, 2005). Other authors that speak about private authority include those within the edited volumes by Deborah A. Avant, Martha Finnemore, and Susan K. Sell, *Who Governs the Globe?,* Miles Kahler and David Lake, *Governance in a Global Economy: Political Authority in Transition,* and A. Claire Cutler, Tony Porter, and Virginia Haufler, *Private Authority and International Affairs*. Deborah A. Avant, Martha Finnemore, and Susan K. Sell, eds. *Who Governs the Globe?* (Cambridge: Cambridge University Press, 2010). Miles Kahler and David Lake, eds. *Governance in a Global Economy: Political Authority in Transition*. (Princeton: Princeton University Press, 2003). A. Claire Cutler, Tony Porter, and Virginia Haufler, eds. *Private Authority and International Affairs* (Albany: SUNY Press, 1999).

[11] The 2004 report *Reforming Infrastructure* can be understood as the World Bank's mea culpa for overselling the merits of privatization. As stated in the report, "As with all economic elixirs, privatization has been oversimplified, oversold, and ultimately disappointing—delivering less than promised." (Kessides, Ioannis N. *Reforming Infrastructure: Privatization, Regulation, and Competition.* Washington, D.C.: World Bank and Oxford University Press, 2004), 24.

[12] Marco Schäferhoff, Sabine Campe and Christopher Kaan, "Transnational Public-Private Partnerships in International Relations: Making Sense of Concepts, Research Frameworks, and Results," *International Studies Review* 11, no.3 (2003): 451-52.

[13] The authors cite Osborne and Gaebler's 1992 influential bestseller *Reinventing Government: How the Entrepreneurial Spirit is Transforming the Public Sector.* Bill Clinton has a blurb running along the top of the cover of *Reinventing Government*: "Should be read by every elected official in America. This book gives the blueprint." The *Washington Post* writes "A landmark in the debate on the future of public policy." The lead author, David Osborne, was an advisor to Vice President Al Gore. See David

structures transfer the responsibility for the design and delivery of public service to the private sector through long-term contracting. Akintoye, Beck, and Hardcastle (2003) explain that public-private partnerships involve "…private companies in the design, financing, construction, ownership and/or operation of a public sector utility or service… Arguably, the joint approach allows the public sector client and the private sector supplier to blend their special skills and to achieve an outcome, which neither party could achieve alone."[14]

However, in the African context, it is not just the private sector that has encroached upon some of the functions of the nation-state. Rather, nongovernmental organizations and external development agencies have provided many of the services associated with the public sector—what Harvey (2005) refers to as "privatization by NGO."[15] James Ferguson (2006) makes the point that in the shift in donor policies away from funding to African bureaucracies and towards NGOs as more "'grassroots' channels of implementation," many functions of the state "have been effectively 'outsourced' to NGOs" with the consequence of the deterioration in state capacity.[16] This outsourcing of the provision of public services to NGOs that is common within African states warrants attention to the role in which NGOs may play as part of public-private partnerships. Taking this into account, I define public-private

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Osborne and Ted Gaebler, *Reinventing Government: How the Entrepreneurial Spirit is Transforming the Public Sector* (Reading, MA: Adison Wesley, 1993). Referenced in Anne-Marie Reynaers and Gjalt De Graaf, "Public Values in Public-Private Partnerships," *International Journal of Public Administration* 37, no.2 (2014): 120-28.

[14] Akintola Akintoye, Matthias Beck, and Cliff Hardcastle, *Public-private partnerships: Managing risks and opportunities* (Oxford: Blackwell Science, 2003), xix.

[15] Harvey, *A Brief History of Neoliberalism,* 177.

[16] One key explanation for the deterioration in state capacity as a result of the increased prominence of NGOs in the provision of public services can be attributed to the departure of qualified staff from poorly paid government positions to much higher paid positions within nongovernmental organizations. James Ferguson, *Global Shadows: Africa in the Neoliberal World Order* (Durham: Duke University Press, 2006), 38.

partnerships as the public sector provision of an enabling policy environment for the involvement of private companies, NGOs, foundations, and foreign aid agencies in the financing, design, construction, operation, and ownership of a public sector utility or service. Whereas the literature on PPPs is attentive to the growing authority of the private sector, I highlight the role of philanthropy in legitimating such forms of authority.

Public-private partnerships have become a widely accepted institutional alternative to the public sector's provision of services and facilities and to complete privatization.[17] The idea of PPPs fits within a neoliberal discourse that promotes smaller government and a growing role for the private sector, but also emerges in the wake of realizations that privatization has been "oversold."[18] The state provides the "enabling environment" for private sector investment through neoliberal legislative changes and good governance. These partnerships diffuse responsibility among agents, socializing risks taken by the private sector. Through such partnerships with the public sector, global agribusiness corporations gain greater access to African policymakers and legislative tools. This is what Jennifer Clapp and Doris Fuchs (2009) refer to as "corporate agrifood governance" where corporations play a key role in influencing the rules to regulate their own behavior.[19] Furthermore, these partnerships have a dual legitimating function: the public component of these partnerships can mitigate negative perceptions about corporate activity; the private

[17] Harvey, *A Brief History of Neoliberalism,* 177.
[18] Kessides, *Reforming Infrastructure*, 24.
[19] Jennifer Clapp and Doris Fuchs, eds. *Corporate Power in Global Agrifood Governance* (Cambridge, MA: MIT Press, 2009), 1. For more literature on food governance see Nora McKeon, *Food Security Governance: Empowering Communities, Regulating Corporations* (New York: Routledge, 2015); Robert Faulkner, ed. *The International Politics of Genetically Modified Food: Diplomacy, Trade and Law* (New York: Palgrave Macmillan, 2006); Andrée, *Genetically Modified Diplomacy: The Global Politics of Agricultural Biotechnology and the Environment.*

component can lend greater legitimacy to governments criticized as being inefficient or corrupt. The combination of the financial power of corporations and foundations with state legitimacy is linked to another form of political authority in the African Green Revolution: the "rule of experts."[20]

Knowledge and Expertise

Experts have emerged as key actors within public-private partnerships in African agricultural development, though the political authority of experts in Africa dates back to colonial rule. In Helen Tilly's (2011) historical monograph *Africa as a Living Laboratory: Empire, Development, and the Problem of Scientific Knowledge, 1870-1950* (2011) one essential element to the effective governance of the British Empire on the continent is the production and dissemination of knowledge.[21] Scientific knowledge was both developed and applied in colonial Africa; Africans became active agents in the appropriation, production, and application of scientific knowledge.[22] Scientific knowledge dominated over vernacular knowledge in development decisions made by technical experts supported with funds from the Empire, as knowledge and expertise became an expression of colonial rule.[23] The work of experts that could claim to know Africa and would support 'development' on the continent became a crucial element in the rationalization of a continuation of

[20] See Timothy Mitchell, *Rule of Experts: Egypt, Techno-Politics, Modernity* (Berkeley: University of California Press, 2002).
[21] Helen Tilly, *Africa as a Living Laboratory: Empire, Development, and the Problem of Scientific Knowledge, 1870-1950* (Chicago: University of Chicago Press, 2011), 70.
[22] Tilly, *Africa as a Living Laboratory*, 14.
[23] Tilly, *Africa as a Living Laboratory,* referencing Frederick Cooper, and D.A. Low and John Lonsdale, 71. Frederick Cooper, *Africa Since 1940: The Past of the Present* (Cambridge: Cambridge University Press, 2002). D. Anthony Low and John Lonsdale, "Introduction: Towards the New Order, 1945-1963," in *History of East Africa, Volume III*, eds. D.A. Low and Alison Smith (Oxford: Claredon Press, 1976), 1-63.

Empire in the post-World War II period.[24] This knowledge of Africa developed through years of research and social engineering enabled the British colonial officials to acquire an authority grounded in expertise on African affairs.

Timothy Mitchell (2002) describes the politics of such technical expertise and the ways in which development planners have sought to disengage themselves from the political realities that they have helped shape. In his study of 20th-century techno-politics in Egypt, Mitchell looks at the ways in which problems in the developing world have been presented as problems of mismanagement or nature rather than political issues. Such a framing of the problem as one that is technical or managerial gives experts political authority to determine the solutions.[25] James Scott (1998) concurs with Mitchell and explains how this problem definition grants authority and power to experts: "If the environment can be simplified down to the point where the rules do explain a great deal, those who formulate the rules and techniques have also greatly expanded their power. They have, correspondingly, diminished the power of those who do not."[26] This "rule of experts" can have important exclusionary effects. Knowledge, rather than being neutral, is a way by which power operates; scientific knowledge, for example, can suppress local forms of knowledge due to its privileged position within modern institutions. As my research indicates, the power of scientific knowledge is reflected in the ways in which farmers' experimentation is labeled "trial and error" whereas the plant biotechnology is presented by industry as offering precise means of achieving agricultural advancement. In reality, both farmers'

[24] Cooper, *Africa Since 1940.*
[25] Mitchell, *Rule of Experts.*
[26] James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven: Yale University Press, 1998), 303.

experimentation and plant biotechnology research and development involve trial and error.[27]

Crisis frames encourage and legitimate the entry of experts to address the problem. Roe (1995) makes the following provocative claim about the role of crisis narratives enabling a 'rule of experts':

> …crisis narratives are the primary means whereby development experts and the institutions for which they work claim rights to stewardship over land and resources they do not own. By generating and appealing to crisis narratives, technical experts and managers assert rights as 'stakeholders' in the land and resources they say are under crisis.[28]

While experts can play critical roles in providing much needed assistance during a crisis, crisis itself can accelerate processes of enclosure, which I turn to next.

Enclosure

The global food crisis of 2007-8 became a catalyst for discussions about how to improve food security. One angle of interpretation for the crisis that gained ground within the G8 New Alliance for Food Security and Nutrition, the World Bank, and the Alliance for a Green Revolution in Africa (AGRA) was the idea that what was standing in the way of food security was insecure property rights.[29] Securing land

[27] This became apparent after multiple conversations at SARI regarding Bt cowpea—it was unclear which cowpea gene would accept the transgene and such results were found after trial and error. The difference, of course, is that biotechnology can speed up certain processes through the identification of marker genes.

[28] Emery M. Roe, "Except Africa: postscript to a special section on development narratives," *World Development* 23, no.9 (1995): 1066.

[29] The G8 New Alliance for Food Security and Nutrition Cooperation Framework identifies the Ghanaian government's commitment to "taking actions to facilitate inclusive access to and productive use of land" as a means to achieve food security in Ghana. G8 New Alliance for Food Security and Nutrition, *G8 Cooperation Framework to Support the "New Alliance for Food Security and Nutrition" in Ghana*, accessed July 1, 2015, http://www.state.gov/documents/organization/190626.pdf , 3. The World Bank's 2014 progress report, *Enabling the Business of Agriculture*, identified registering land as a core objective and links this objective to improved economic and food security of women: "With

rights through formal land titles, the argument goes, would improve food security, particularly for women. Better intellectual property right protection for plant breeders would bring greater investment to the seed sector, improving crop productivity. Access to proprietary resources would enable the development of 'pro-poor' biotechnology[30] that could address both crop loss as well as malnutrition. Each of these strategies to address food insecurity in Africa can be understood as a form of enclosure, and has been resisted by food sovereignty activists. Before I discuss this resistance, I describe what I mean by "enclosure."

The term has its historical roots in the enclosing of common pastureland that began in 16th century-England. Historian J.M. Neeson (1993) identifies enclosure as the "extinction of common right," which led to the decline of small farms and the creation of a class of landless laborers.[31] The legal process of enclosure allowed landholders to acquire other parcels of land, which created large farms and enabled landholders to claim private ownership. By the 18th century, the law itself becomes a mechanism of the expropriation of common land from the peasantry.[32]

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insecure property rights, the female farmers tend to produce less than their asset base could otherwise support because they fear that if they are more productive, men in the community would probably take control of their land." World Bank Group, *Enabling the Business of Agriculture: 2015 Progress Report* (Washington, D.C.: The World Bank Group, 2014), 15. See also The World Bank, *World Development Report 2008: Agriculture for Development* (Washington, D.C.: The World Bank, 2007). The Alliance for a Green Revolution in particular highlights the importance of land security for women's food security in their report *AGRA in 2012: Moving from Strength to Strength.* Alliance for a Green Revolution in Africa, *AGRA in 2012: Moving from Strength to Strength* (Nairobi, Kenya: Alliance for a Green Revolution in Africa (AGRA), 2013), 12.

[30] 'Pro-poor' biotechnology refers to the development of transgenic crops to suit the needs of the smallholder farmer as well as the diets of the local people. That is, the technology is intended to be well suited for the local context and may offer benefits such as drought-tolerance or micronutrient enhancement. For more on the history of framing GM crops as a 'pro-poor' technology, see Dominic Glover, "The corporate shaping of GM crops as a technology for the poor," *The Journal of Peasant Studies* 37, no.1 (2010): 67-90.

[31] J.M. Neeson, *Commoners: Common Rights, Enclosure and Social Change in England, 1700-1820* (Cambridge: Cambridge University Press, 1993), 15.

[32] Karl Marx, *Capital, Volume 1*, translated by Ben Fowkes (New York: Penguin Classics, 1976), 885.

This concept of enclosure can be used to describe the politics of contemporary acquisition of fundamental bases for life processes—land and seed—through dispossession.[33] On the African continent, there has been growing concern[34] about the practice of "land grabbing" defined by Matondi, Havnevik, and Beyene (2011) as the "exploration, negotiations, acquisitions or leasing, settlement and exploitation of the land resource, specifically to attain energy and food security through export to investors' countries and other markets."[35] Within the domain of seed there are parallel enclosures. The development of proprietary seed, which is seed that is protected by a patent, has raised alarms regarding the ways in which farmers' experimentation and knowledge can be used to develop seed that later cannot be freely saved or shared. This form of enclosure has been deemed 'biopiracy,' that is, "the unauthorized commercial use of biological resources and/or associated traditional knowledge, or the patenting of spurious inventions based on such knowledge, without compensation."[36] These new enclosures of seed and land are what David Harvey calls 'accumulation by dispossession,' a term he substitutes for Marx's concept of

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[33] See for example White, Ben, Saturnino M. Borras Jr., Ruth Hall, Ian Scoones, and Wendy Wolford. "The New Enclosures: Critical Perspectives on Corporate Land Deals," *Journal of Peasant Studies* 39, nos. 3-4 (2012): 619-47.

[34] This concern was institutionalized in 2010 through the Principles for Responsible Agricultural Investment (PRAI) sponsored by the World Bank, the Food and Agriculture Organization (FAO) and the United Nations Conference on Trade and Development (UNCTAD). Jennifer Clapp, "Responsibility to the Rescue? Governing Private Investment in Global Agriculture" (paper presented at the International Studies Association, Toronto, Canada, March 26, 2014).

[35] Prosper B. Matondi, Kjell Havnevik and Atakilte Beyene, "Introduction: biofuels, food security and land grabbing in Africa," *Biofuels, food security and land grabbing in Africa*, edited by Prosper B. Matondi, Kjell Havnevik and Atakilte Beyene (London: Zed Books, 2011), 1. For more on the land grab see Philip McMichael, "The land grab and corporate food regime restructuring," *Journal of Peasant Studies* 39, no.4 (2012): 681-701; and the work of the transnational activist network La Via Campesina that characterizes the 'land grab' as an "Old phenomenon, new appearance." La Via Campesina, "International Conference of Peasants and Farmers: Stop land grabbing!" Report and Conclusions of the International Conference of Peasants and Farmers, Mali, November 17-19, 2011, (2012) accessed July 2nd, 2015, http://viacampesina.org/downloads/pdf/en/mali-report-2012-en1.pdf .

[36] Ikechi Mbeoji, *Global Biopiracy: Patents, Plants, and Indigenous Knowledge* (Ithaca: Cornell University Press, 2006), 13.

primitive accumulation in order to highlight the ongoing process of accumulation.[37] Such accumulation originates from the moment in which agricultural producers are severed from their means of subsistence, the land, and now more recently, the seed.[38]

The enclosure of seed occurs through legal regimes such as the 1994 WTO's TRIPS agreement that allows the patenting of seeds. This legal maneuver is used to protect genetically modified seed, now understood by law as an information technology.[39] Patents on seeds are significant for four reasons: first, it is now possible to assert private ownership over life in the form of a seed; second, a consequence of this private ownership is the disruption of the traditional practice of seed-saving; third, this proprietary regime disregards the local and traditional knowledge of the use of plants that serve as a foundation for plant biotechnology and other research developments; and fourth, there is no compensation for prior development of the seeds. In his examination of the historical origins of the political economy of plant biotechnology, Kloppenburg (2004) details how germplasm derived from the Third World was appropriated for crop improvement in the "gene-poor" industrialized world at little cost and required no compensation to these "gene-rich" sources. This transfer of genetic material institutionalized by the Consultative Group on

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[37] See Harvey, *A Brief History of Neoliberalism*; David Harvey, "The 'New Imperialism: Accumulation by Dispossession," *Socialist Register*, 40 (2004): 63-87.

[38] On land see Marx, *Capital, Vol.1*, Chapter 26 "The Secret of Primitive Accumulation." On seed see Vandana Shiva, *Tomorrow's Biodiversity* (New York: Thames & Hudson, 2000). The dissertation's primary focus is on the enclosures on seeds, though I will continue to identify parallels in the domain of land.

[39] For references to plant biotechnology as information technology see *Plant Biotechnology Research and Development in Africa: Challenges and Opportunities, Hearing Before the Subcommittee on Research Committee on Science House of Representatives,* 108th Cong., p.65 (June 12, 2003) (statement by Dr. Robert B. Horsch of Monsanto Corporation); Simon Walker, "The TRIPS Agreement, Sustainable Development and the Public Interest," *IUCN Environmental Policy and Law* 41 (2001): vii-60.

International Agricultural Research (CGIAR) used indigenous landraces[40] as raw materials for the subsequent breeding of hybrid high-yield varieties used during the first Green Revolution.[41] The patenting of transgenic seeds based off of generations of farmers' experimentation raises important questions about the valorization of knowledge—that is, whose knowledge is privileged, why, and how. In Chapter Three, I discuss how this enclosure has led to the emergence of new forms of capital: "biocapital" and "philanthrocapital."[42]

Enclosure is characteristic of what McMichael terms the "corporate food regime."[43] That is to say, corporations, by working closely with the public sector, have increased influence in shaping the rules governing trade, intellectual property, and food production, particularly within the World Trade Organization.[44] Food sovereignty and anti-globalization activists have responded to this enclosure of land and seed in the form of global protests, sustained online campaigns, and the development of alternative forums, such as the World Social Forum, to mobilize around these issues. These mobilizations against the corporate food regime represent

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[40] A locally adapted, domesticated variety.

[41] Jack Ralph Kloppenburg Jr., *First the Seed: the Political Economy of Plant Biotechnology*. 2nd ed. (Madison, WI: University of Wisconsin Press, 2004), 161. Hybrids are one of the first means to commodify seed as they have reduced fertility when replanted. This loss of hybrid vigor made it so that farmers would need to return to the market to buy seeds with greater frequency.

[42] I build off of Rajan (2006) to develop the concept of biocapital: Rajan, Kashik Sunder, *Biocapital: The Constitution of Postgenomic Life* (Durham: Duke University Press, 2006). The idea of philanthrocapital is both used popularly within philanthropic circles (Bishop and Green 2009) and the subject of scholarly inquiry (Thompson 2014). See Matthew Bishop and Michael Green, *Philanthrocapitalism: How Giving Can Save the World* (New York: Bloomsbury Press, originally published in 2008 with a new foreword by Bill Clinton in 2009); Carol B. Thompson, "Philanthrocapitalism: Appropriation of Africa's Genetic Wealth," *Review of African Political Economy* 41, no. 141 (2014): 389-405.

[43] Philip McMichael, "Global Development and the Corporate Food Regime," *New Directions in the Sociology of Global Development* 11 (2005): 269-303. Harriett Friedmann coined the term "food regime," defining it as an emergent in the post-war period "the rule-governed structure of production and consumption of food on a world scale." Friedmann, Harriett. "The Political Economy of Food: A Global Crisis," *New Left Review* 197, no.1 (1993): 30-31.

[44] Korten, David C., *When Corporations Rule the World,* 2nd ed. (Bloomfield, CT: Kumarian Press, 2001).

a classic case of what Polanyi terms "double movement."[45] That is, the expansion and domination of the market sparks a countermovement from within society—calls for government intervention and regulation—in order for society to protect itself from the perils inherent in the self-regulating market system.[46] Polanyi (1944) argues that this countermovement is a pragmatic response to the dislocation that attacks the fabric of society when the market is disembedded from nature and society.[47] Rather than the economic order embedded within the social order as it had been prior to the 18th century, society was made subordinate to the market economy.[48] At the turn of the 21st century, the designation of a seed as a proprietary commodity, rather than a foundational element of life, reflects this disembeddedness of the market from nature and society.[49] The mobilization of the activist organization, Food Sovereignty Ghana, in response to the Plant Breeders' Bill currently before Ghanaian Parliament, is an illustration of this double movement. Food Sovereignty Ghana perceived this expansion of plant breeders' rights as an infringement on farmers' right to save seeds and has used protests, information dissemination, and a lawsuit to respond to this new enclosure. As I show in Chapter Three, agribusiness and philanthropy respond to such activists' pressures by advancing ideas of donation and giving through the

[45] Nora McKeon and Philip McMichael, "Land grabbing, investments in agriculture, and questions of governance," (paper presented at the International Studies Association, Toronto, Canada, March 27, 2014).
[46] Karl Polanyi. *The Great Transformation: The Political and Economic Origins of Our Time*, 2nd ed. (Boston: Beacon Press, 2001), 80.
[47] Polanyi, *Great Transformation,* 136, 60.
[48] Polanyi, *Great Transformation,* 74. Polanyi on the market economy: "Ultimately, that is why the control of the economic system by the market is of overwhelming consequence to the whole organization of society: it means no less than the running of society as an adjunct to the market. Instead of economy being embedded in social relations, social relations are embedded in the economic system... For once the economic system is organized in separate institutions, based on specific motives and conferring a special status, society must be shaped in such a manner as to allow that system to function according to its own laws. This is the meaning of the familiar assertion that a market economy can function only in a market society." Polanyi, *Great Transformation,* 60.
[49] See Polanyi on "fictitious commodities," *Great Transformation*, 75-6.

development of 'pro-poor' biotechnology. Such practices serve to both normalize the perception of seed as property and present capitalism as a beneficiary of the poor.

One way to facilitate enclosure is through divorcing the target of enclosure (seed, land) from its larger ecological and social context. James Scott speaks of the deployment of tunnel vision to simplify complex reality[50]; Timothy Mitchell describes the rendering of Egypt into an object of development through the distancing view from above.[51] Both techniques—the constriction of vision and the cartographer's view—radically simplify the object of focus, making it easier for the state or capital to act upon it. Scott describes this as "legibility": the simplification, standardization, and formalization of nature and space in order to support state- and economy-making. The normalization of industrial agriculture can be understood as part of the modern state project of legibility.[52] Industrial agricultural systems—due to mechanization, standardization, production of monocultures, and formulaic use of inputs (pesticides, herbicides, fertilizers)—are highly legible systems designed for high agricultural productivity. Yet, in the narrowed focus on agricultural productivity, these systems have also had to face chemical-resistant 'superweeds,' soil nutrient depletion, and reduced biodiversity—consequences that emerge from outside of this constricted field of vision. This shift towards industrial agriculture on the African continent entails both the formalization of land rights and seed law harmonization. Through legislative changes, the complex plurality of land tenure systems and

[50] Scott, *Seeing like a State,* 11.
[51] Mitchell analyzes how USAID in particular rendered Egyptian agriculture as an object of study to be managed by its experts. The cartographer's view is a metaphor for the way in which USAID removed its influence on Egyptian development, framing Egyptian agricultural challenges as problems of nature or demography, rather than a problem of politics that they helped shape. Mitchell, *Rule of Experts*, 209.
[52] Scott, *Seeing like a State*.

traditional practices of seed saving and sharing are rendered legible, facilitating land transactions enticing investment in the agricultural sector.[53]

I find that this tunneling of vision entails a corollary narrowing down of the range of identities farmers can take in this new Green Revolution.[54] In Chapter Four, I describe such shifts as the move from farming as a way of life to farming as a business. As the modern state exercises the power of regularization, a sub-set, a "random" element, the outliers of the state's population, can be sacrificed.[55] In the case of agriculture, those populations outside of the food system, the undesired plants and animals deemed "weeds" and "pests" get assigned as "deviant" and targeted for technological intervention in order to achieve more regular, mechanized crop cultivation.[56] Biological diversity is dramatically reduced through the application of pesticides and the production of monocultures. Cultural diversity as manifest through traditional agricultural practices is also sacrificed through the power of regularization. Certain populations of farmers are encouraged to "exit" agriculture in order to enhance overall agricultural productivity.[57] This is akin to what Escobar (2010) terms "'produce (for the market) or perish.'"[58]

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[53] See Sara Berry, "Debating the Land Question in Africa," *Comparative Studies in Society and History* 44, no.4 (2002): 638-68.
[54] Escobar (2010) describes this as the reduction of people's lives to a single trait, such as 'small farmer', by development professionals that renders a person a case to be reformed or treated. Arturo Escobar, "Planning," in *The Development Dictionary: A Guide to Knowledge as Power*, 2nd ed., edited by Wolfgang Sachs (London: Zed Books, 2010), 154.
[55] This is what is meant by Foucault's idea that the modern state exercises a right to make live and let die. See for example, *The History of Sexuality, Vol.1*: "One might say that the ancient right to *take* life or *let* live was replaced by a power to *foster* life or *disallow* it to the point of death." Michel Foucault, *The History of Sexuality, Vol. 1: An Introduction,* translated by Robert Hurley (New York: Vintage Books, 1990), 138. Original italics.
[56] See Scott, *Seeing like a State*.
[57] I discuss this idea of exit encouraged by actors like the World Bank and IFPRI in Chapter Four.
[58] Escobar, "Planning," 155.

The cultivation of genetically modified crops is an agricultural practice that is not for all farmers: it is both capital- and knowledge-intensive requiring costly investment and training by experts in the use of this new agricultural technology. Drawing upon literature on environmental learning and agricultural knowledge, I describe the avenues of technology and information diffusion designed or anticipated by experts involved in agricultural research and biosafety.[59] Training, demonstration farms, elite farmers, and biotechnology outreach are used to encourage the emulation of successful farmers and thereby the widespread adoption of genetically modified crops. Yet, as studies have shown, the profitability of transgenic crops is not guaranteed; large-scale farmers and other more risk-tolerant farmers have been some of the main beneficiaries of this new technology.[60]

Resistance

The political analysis on the GMO debate—both popular and scholarly—tends to reflect the polarity of the debate itself in its examination of either biotechnology proponents or anti-GMO activists (Herring 2010; Shiva 2000; Paarlberg 2008; Andrée 2007).[61] The scholarly literature on the politics of GMOs has

[59] Glenn Davis Stone, "Agricultural Deskilling and the Spread of Genetically Modified Cotton in Warangal," *Current Anthropology* 48, no.1 (2007): 67-103; Paul Richards, "Cultivation: Knowledge or Performance?" In *An Anthropological Critique of Development: The Growth of Ignorance*, ed. Mark Hoban, 61-78. (London: Routledge, 1993); Ian Scoones and John Thompson, eds. *Beyond Farmer First: Rural People's Knowledge, Agricultural Research, and Extension Practice.* (London: Intermediate Technology Publications, 1994); Ann M. Vandeman, "Management in a Bottle: Pesticides and the Deskilling of Agriculture," *Review of Radical Political Economics* 27, no.3 (1995): 49-55; Everett M. Rogers, *Diffusion of Innovation*, 5th ed. (New York: The Free Press, 2003).
[60] Stone, "Agricultural Deskilling"; William G. Moseley and Leslie C. Gray, *Hanging by a Thread: Cotton, Globalization and Poverty in Africa* (Athens: Ohio University Press, 2008).
[61] Ronald Herring, "Framing the GMO: Epistemic Brokers, Authoritative Knowledge, and Diffusion of Opposition to Biotechnology," in *The Diffusion of Social Movements: Actors, Mechanisms, and Political Effects,* eds. Rebecca Givan, Kenneth Roberts, and Sarah Soule. (Cambridge: Cambridge University Press, 2010); Vandana Shiva, *Tomorrow's Biodiversity*; Robert Paarlberg, *Starved for*

highlighted the ways in which claims about the risks posed by GMOs diffuse through transnational advocacy networks with implications for biosafety regulation (Herring 2010; Paarlberg 2008), the emergence of a discourse of precaution and the development of the Cartagena Protocol on Biosafety (Andrée 2007), the divergence of US and EU biosafety regulatory policies (Jasanoff 2005; Lynch and Vogel 2001), attitudes towards GMOs (e.g. Jasanoff 2005; Stone 2010), the impact of framing on social mobilization (Heller 2013; Bonnuiel, Joly and Marris 2008), the potential benefits and costs of GM crops in the developing world (Pinstrup-Andersen and Schiøler 2001; Wu and Butz 2004; Fitting 2011; Moseley and Gray 2008; Stone 2007), and the conditions of production of plant biotechnology (Bingen 2008; Zerbe 2005; Kinchy 2012; Shiva 1999, 2000).[62]

Though there are differences in terms of access to material and institutional resources, I find that both proponents and opponents of the introduction of GM crops

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Science: How Biotechnology Is Being Kept Out of Africa (Cambridge: Harvard University Press, 2008); Peter Andrée, *Genetically Modified Diplomacy: The Global Politics of Agricultural Biotechnology and the Environment* (Vancouver: UBC Press, 2007).

[62] See Herring, "Framing the GMO,"; Paarlberg, *Starved for Science*; Andrée, *Genetically Modified Diplomacy;* Sheila Jasanoff, *Designs on Nature* (Princeton: Princeton University Press, 2005); Diahanna Lynch and David Vogel, *The Regulation of GMOs in Europe and the United States* (New York: Council on Foreign Relations, 2001); Glenn Davis Stone, "The Anthropology of GM Crops," *Annual Review of Anthropology*, 39 (2010): 381-400; Heller, Chaia. *Food, Farms, and Solidarity*. Durham: Duke University Press, 2013; Christophe Bonneuil, Pierre-Benoit Joly, and Claire Marris, "Disentrenching Experiment: The Construction of GM-Crop Field Trials As a Social Problem," *Science, Technology, and Values* 33, no. 2 (2008): 201-29; Per Pinstrup-Andersen and Ebbe Schiøler, *Seeds of Contention: World Hunger and the Global Controversy over GM Crops* (Baltimore: The Johns Hopkins University Press, 2001); Felicia Wu and William Butz, *The Future of Genetically Modified Crops: Lessons from the Green Revolution* (Santa Monica: Rand Publishing, 2004); Elizabeth Fitting, *The Struggle for Maize: Campesinos, Workers, and Transgenic Corn in the Mexican Countryside* (Durham: Duke University Press, 2011); Moseley and Gray, *Hanging by a Thread*; Glenn Davis Stone, "Agricultural Deskilling and the Spread of Genetically Modified Cotton in Warangal," *Current Anthropology* 48, no.1 (2007): 67-103; Jim Bingen, "Genetically Engineered Cotton: Politics, Science, and Power in West Africa," in *Hanging by a thread: Cotton, globalization, and poverty in Africa*, William G. Moseley and Leslie C. Gray, eds. (Uppsala: Ohio University Press, 2008); Noah Zerbe, *Agricultural Biotechnology Reconsidered: Western Narratives and African Alternatives* (Trenton, NJ: Africa World Press, 2005); Abby Kinchy, *Seeds, Science, and Struggle: The Global Politics of Transgenic Crops.* (Cambridge: MIT Press, 2012); Vandana Shiva, *Biopiracy: The Plunder of Nature and Knowledge* (London: South End Press, 1999); Shiva, *Tomorrow's Biodiversity.*

use a combination of *hype* and *science* to attract attention and to establish authoritative claims.[63] I define hype as the deployment of simplistic, exaggerated claims to stimulate activity such as consumption, investment, philanthropy, or to mobilize activism. In this respect, this study contributes to the existing research in contentious politics by critically examining the commonalities between industry and social movement organizations in this heated debate. In particular, framing the debate as a matter of urgency and offering clear solutions—either adopting GM seed or banning it completely—helps to mobilize resources.[64] Furthermore, both GM proponents and opponents use law to advance or impede the introduction of genetically modified crops.[65] Stone's (2002) article "Both Sides Now: Fallacies in the Genetic-Modification Wars, Implications for Developing Countries, and Anthropological Perspectives,"[66] acknowledges the use of hype on both sides of the debate—labeling the terrain of the debate the "Golden Age of Misinformation"—but does not provide a thorough account of the strategic commonalities between GMO adversaries. The production, dissemination, and uptake of information in this

[63] On the importance of science to environmental activists I look to Epstein's study of the anti-whaling movement where she identifies science as "a key weapon in the arsenal of environmental activism." Charlotte Epstein, "Knowledge and Power in Global Environmental Activism," *International Journal of Peace Studies* 10, no.1 (2005): 47. See also Ken Conca, *Governing Water: Contentious Transnational Politics and Global Institution Building* (Cambridge, MA: MIT Press, 2006). The concept of hype builds upon Rajan's work in *Biocapital*, which I discuss in Chapter Two.

[64] See Tarrow (2006) and Keck and Sikkink (1998) on framing: Sidney Tarrow, *The New Transnational Activism* (Cambridge: Cambridge University Press, 2006), 61-64; Margaret Keck and Kathryn Sikkink, *Activists Beyond Borders: Advocacy Networks in International Politics* (Ithaca: Cornell University Press, 1998).

[65] Sheila Jasanoff's edited volume, *Reframing Rights: Bioconstitutionalism in the Genetic Age* calls to attention the way in which law has been used to redefine life alongside technological developments in the life sciences. The authors are less attentive, however, to the use of law by activists to challenge these new conceptions of biological life. Jasanoff, Sheila, ed, *Reframing Rights: Bioconstitutionalism in the Genetic Age* (Cambridge, MA: MIT Press, 2011).

[66] Glenn Davis Stone, "Both Sides Now: Fallacies in the Genetic-Modification Wars, Implications for Developing Countries, and Anthropological Perspectives," *Current Anthropology* 43, no.4 (2002): 611-630.

debate—whether in the form of hype or of scientific knowledge—is critical for both sides of the debate to achieve their aims.

III. Methods

My methodological approach is situated within interpretive social science which views knowledge, including scientific knowledge, as historically-situated in power relations. Interpretivism is best suited for studying meaning-making processes and how social and political identities crystallize or change over time.[67] The project uses a blend of discourse[68] analysis, participant observation, and interviews in order to analyze debates about food security and the cultivation of genetically modified crops in Ghana. I complement the rich locally specific observations gained by both participant observation of farming communities and extensive interviews with a wide-range of knowledge-holders in Ghana with that of discourse analysis. This combination of methods is well suited for analysis of the power struggles that influence the trajectory of this agricultural transition. I follow an emerging tradition of scholars who use discourse analysis to analyze environmental and food politics.[69] Epstein argues that the study of discursive power, the power to make meaning, has been neglected in international relations. Escobar (2008) articulates why this power to

[67] For more on the interpretive turn in political science see Dvora Yanow and Peregrine Schwartz-Shea, eds., *Interpretation and method: Empirical research methods and the interpretive turn* (New York: ME Sharpe, 2006); Wedeen, Lisa. "Reflections on Ethnographic Work in Political Science." *Annual Review of Political Science* 13 (2010): 255-72.

[68] Escobar (1995) defines discourse as "the process through which social reality comes into being…the articulation of knowledge and power, of the visible and the expressible." Arturo Escobar, *Encountering Development* (Princeton: Princeton University Press, 1995), 39.

[69] See for example Karen T. Litfin, *Ozone Discourses: Science and Politics in Global Environmental Cooperation* (New York: Columbia University Press, 1994); Charlotte Epstein, *The Power of Words in International Relations: Birth of an Anti-Whaling Discourse* (Cambridge: MIT Press, 2008); Andrée, *Genetically Modified Diplomacy*.

make meaning is significant: "Power inhabits meaning, and meanings are a main source of social power; struggles over meaning are thus central to the structuring of the social and physical world itself."[70] Lukes' idea of the third of dimension of power—that is, the power to shape perceptions, cognitions, and preferences—also speaks to the power of discourse. This ability can prevent people from forming grievances and can allow for greater acceptance of the status quo. This power to shape perceptions can prevent individuals from becoming aware of their true interests due to repression, mystification, or the unavailability of alternative ideological frames.[71] A Foucauldian approach to discourse analysis recognizes that discourse itself exhibits agency: discourse makes certain things easier to imagine, and other things harder to question.[72] This becomes acutely evident in cases such as processes of development and modernization.

In order to analyze the struggles over knowledge, authority, identity, and property within the new Green Revolution in Africa, I employ a Foucauldian discourse analysis that is influenced by the post-development literature (Escobar 1995, 2008; Sachs 2010; Rahnema and Bawtree 2008).[73] This literature works to denaturalize notions of progress and development, and conceives of modernity as a culturally particular construction that reflects Western values and assumptions. This critique of modernity includes an approach to science and technology that treats them

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[70] Arturo Escobar, *Territories of Difference: Place, Movements, Life, Redes* (Durham: Duke University Press, 2008), 14.
[71] Steven Lukes referencing Charles Tilly. Steven Lukes, *Power: A Radical View*, 2nd ed. (New York: Palgrave Macmillan, 2004), 10.
[72] According to Foucault, discourse should not be treated as "groups of signs...but as practices that systematically form the objects of which they speak." Michel Foucault, *The Archaeology of Knowledge and the Discourse on Language,* translated by A.M. Sheridan Smith (New York: Pantheon Books, 1972), 49.
[73] For an exemplar edited volume that illustrates this approach see Sachs, Wolfgang, ed., *The Development Dictionary: A Guide to Knowledge as Power,* 2nd ed. (London: Zed Books, 2010).

as historical and cultural productions.[74] Post-development scholars consider development as a particular worldview and ask how we have come to accept Western notions of development as the universal ideal. I build on post-development scholarship to both reveal how the debate over GMOs constitutes a debate about development and to provide insights into the discursive maneuvers that assist the diffusion of this controversial technology. Discourse analysis allows me to explore key concepts that make up the conceptual repertoire of modernization and development, namely shifting notions of authority, knowledge, property, identity, and resistance.[75] The idea is to expose some of the underlying assumptions that set boundaries on the thinking about change in Africa.

Discourse analysis is concerned with the study of sets of articulated practices that unite around a common set of meanings, values, and perspectives. Discourse analysis is useful for studying assumptions regarding cause and effect, what actors are considered legitimate stakeholders, what kinds of knowledge and values are privileged, and how key contested terms like 'sustainability' are framed. Discourse analysis of the GM debate allows me to situate my research in Ghana within global dynamics that identify certain populations and places as deficient[76] and in need of intervention. Discourse analysis also reveals how both proponents and opponents of GM alike place *life at the center* of the debate—albeit vastly different conceptions of life. Discourses prescribe certain practices that work to shape social reality. For

[74] See for example Rajan, *Biocapital*; Foucault, *The History of Sexuality.*
[75] Sachs, Wolfgang, ed. "Preface," *The Development Dictionary: A Guide to Knowledge as Power,* 2nd ed., edited by Wolfgang Sachs (London: Zed Books, 2010), xii.
[76] This idea of "deficiency" within development discourse refers to a lack of income, technology, market access, or education. Deficiency is conceived of a problem of the poor catching up with the rich; deficiency is in this sense a relative concept. See Sachs, "Preface."

example, the discourse of progress places great value on science-based solutions, and articulates a vision of the future in terms of consistent improvement. When genetic modification is framed as part of 'progress' and 'modernity', the adoption of such technology produces corollary subjects that are 'modern.' Likewise, the rejection of such technologies can render those that are averse to these technologies as 'backwards.'

This approach allows me to study how identities such as the entrepreneur are shaped through language and produced and re-produced through agricultural practices. Because the expansion of plant biotechnology is conditional on information flows, information regarding GM crops must be disseminated in order to both ameliorate anxieties of the public regarding this new technology and to train farmers and researchers on how to use it.[77] The way in which this information is distributed, framed, and positioned in the Ghanaian context is critical to my analysis. I pay attention to how issues are linked, how means and ends are defined, and what identities are being promoted (e.g. agrarian entrepreneur v. self-sufficient farmer). This analysis of the debate over the cultivation of genetically modified crops allows me to understand how language affects both development practice and how risk is conceived. The framing of food production in African countries as a system in crisis has made technologies like GM seed that promise higher yields increasingly attractive and more likely to be adopted. Yet activists' counter-frames of GM seed as threatening motivate calls for outright bans of this new technology.

Some of the texts analyzed on this study include annual reports of foundations and agribusiness corporations, the policy plans of bilateral aid agencies,

[77] For a discussion of biotechnology as information technology see Rajan, *Biocapital,* 41-47.

intergovernmental organizations or NGOs, congressional hearings on plant biotechnology in Africa, interview transcripts, public statements, and websites featuring advertisement and political campaigns by seed corporations and activist organizations. I examine key texts that have been enlisted by major actors in the GMO debate[78] or in development planning that are anticipated to reach a wide audience (such as World Bank reports, protest statements by social movement organizations, or annual reports of foundations). More specifically, the data for the analysis of the debate over the cultivation of GM crops in Africa has been collected by: tapping into online advocacy networks via social media such as Greenpeace, La Via Campesina, African Centre for Biosafety, Slow Food International; tracking new developments in the agricultural biotech industry via the listservs of the International Service for the Acquisition of Agri-biotech Applications (ISAAA), Monsanto, World Poultry, All About Feed; establishing a Google Alert of "GMO", "biotech outreach", and the "African food crisis"; LexisNexis searches on food security and biotechnology; monitoring the Convention on Biological Diversity Biosafety Clearinghouse; following Ghanaian news sources such as Ghana News Agency, Daily Graphic, All Ghana News, and My Joy Online; and analyzing the reports of major actors in agricultural development such as the World Bank, USAID, USDA GRAIN reports, the annual reports of the Bill and Melinda Gates and Rockefeller foundations, Feed the Future reports, and the G8 New Alliance for Food Security and Nutrition progress reports.

[78] I have been following the GMO debate since 2004 while in my master's program at San Francisco State University, which has given me a strong background in the major players involved in the debate.

In order to prepare my analysis, I sift through the material to identify certain patterns of framing, content, and tone (the latter is why I prefer the painstaking task of reading and studying the visual presentation rather than automating this process via content analysis). I pay attention to not only to the language that is stressed (bolded, enlarged or highlighted text, use of buzzwords), but also to the images that are used as an accompaniment. For example, the use of images of women and children juxtaposed against text is commonplace in documents produced by international and bilateral aid agencies and foundations. The use of hungry children conveys a certain meaning (need for assistance), as does the use of a single woman smiling on her thriving farm (the suggestion that these interventions are successful). I approach the analysis of these texts as a two-step process: each text is read once to read for tone, refine theoretical categories[79] or generate new ones; and second, the text is re-read to identify patterns and linkages between concepts. I consider the author and audience that will receive the text, where detail is placed, and who is the actor and who is being acted upon. For example, I would consider what role is identified for development planners, for governments, for NGOs, for individual farmers, for communities. Is the receiving population given agency? How are they described? Regarding the level of detail, if a document provides general information about Ghana but a lot of specific detail about the budget and financial trends, this can reveal that the receiving audience is more concerned with finances than locale. Hank Johnston (2002) notes the strengths and limitations of this technique: "because textual data come

[79] Categories include hype (exaggerations, overstatements, misinformation), emergency (urgency, crisis, "do or die" framing), salvation (sweeping solutions, recognition of past sins), science (to make a political point, to advance a policy, as part of a "science fight"), entrepreneurship (the self-made man or woman, innovation), expertise (particularly where it is identified as lacking, actors to address deficiency).

contextually embedded and are often gathered in ways that offer insights into their interpretation that are lost in survey techniques, qualitative analysis offers higher validity of the findings but less reliability."[80] Working with and analyzing the texts directly, rather than imputing them into content analysis, allows me to achieve a kind of "'discursive embeddedness'" that can enable me to better identify conceptual linkages and thematic patterns across texts and statements. This discursive embeddedness also enables me to more readily identify shifts in the ways in which concepts and themes are linked. Shifts in conceptual linkages may alternately strengthen or challenge my argument.

My fieldwork consists of eleven months of extensive, on-the-ground Fulbright-funded field research in Northern Ghana conducted during three trips January 2012, July 2012-March 2013 (supported by a Fulbright fellowship), and May 2015 (supported by a Program for Society and the Environment grant). While in the field, I participated in farming and post-harvest activities in rural communities in the Upper East and Northern regions of Ghana. I spoke to a range of actors across Northern Ghana and in Accra (farmers, farmer organizations, traditional leaders, policymakers, actors working for aid agencies and NGOs, scientists, academics, bureaucrats, and actors within agribusiness) about how they perceive agricultural challenges in Ghana, and what roles the state, private actors, new technologies, and local communities can play in addressing them. I conducted repeated interviews of agricultural research scientists involved in the development of transgenic crops over a period of three years. I interviewed both advocates and opponents of biotechnology,

[80] Hank Johnston, "Verification and Proof in Frame and Discourse Analysis," in *Methods of Social Movement Research,* eds. Beth Klandermans and Suzanne Staggenborg (Minneapolis: University of Minnesota, 2002), 69.

discussed their informational strategies, and obtained samples of the materials they circulate to advance their positions. I interviewed the main actors involved in the recent court case brought by Food Sovereignty Ghana against the Ghanaian government to halt the commercialization of genetically modified crops.

I use an ethnographic approach[81] because of the unique ability of ethnography to contextualize and complicate discourse. In policy documents and reports people in places such as Northern Ghana are turned into abstract elements of statistical measurements and are rarely given voice. Ethnography allows me to gain insight into farmers' perceptions of such interventions and transitional moments that are ordinarily invisible within these policy spaces. This approach renders visible "subjugated knowledges" excluded when scientific expertise dominates.[82] Ethnography allows me to expose some of the hype: both the exaggerated promise of biotechnology and the activists' accounts of the total erosion and takeover of traditional practices. My ethnographic research reveals the multiple, coexistent roles, differing notions of entrepreneurship, feeding family first, and other local risk-reduction strategies that coexist with agricultural modernization programs, as they have during previous iterations. It also shows the long, complex, and uncertain—

[81] As Bayard de Volo and Schatz state, ethnographic methods typically include some combination of the following: "living in the community being examined; learning a local language or dialect; participating in the daily life of the community through ordinary conversation and interaction; observing events (meetings, ceremonies, rituals, elections, protests); examining gossip, jokes, and other informal speech-acts for their underlying assumptions; recording data in field notes that attempt to produce daily accounts of social and political life; in other ways letting trust and emotional engagement be of benefit to the research project." Lorraine Bayard de Volo and Edward Schatz, "From the Inside Out: Ethnographic Methods in Political Research," *Political Science and Politics* 37, no.2 (2004): 267.

[82] Michel Foucault, *Society Must Be Defended: Lectures at the Collège de France, 1975-1976,* translated by David Macey (New York: Picador, 2003).

rather than sweeping and transformative—path of plant biotechnology development. Discourse analysis lends these ethnographic insights an explanatory efficacy.

I approached ethnography as a method of immersing in everyday life: I immersed myself in the field through learning basic phrases and key words related to my research in local languages (Dagbani and Gurene), participating in festivals and other local activities, eating and learning to cook local food, living with a Ghanaian family in the peri-urban part of Tamale[83], and engaging in informal conversation while using local methods of travel. I recorded daily field notes and maintained contact with my informants in between research trips. As Bayard de Volo and Schatz (2004) highlight, ethnographic research means "letting trust and emotional engagement be of benefit to the research project."[84] Through repeated travel to Ghana, I was able to gain greater access to a wide-range of stakeholders (including elites that would be otherwise difficult to reach) and get richer, and likely more honest, accounts of the politics of agricultural development in Ghana.

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[83] One manner by which I was able to engage in participant observation was the choice of residences I made during the 10-months of research. On the first three months of my research in Ghana trip, I resided at the Tamale Institute of Cross-Cultural Studies (known as TICCS). In this place, simultaneously a place of tourist encounter, development projects (both led by the NGOs and faith-based organizations), and knowledge exchange (the Institute ran the only courses on the language, culture, and development of Northern Ghana and the library had rare books on the region), I had many conversations with those that passed through the guesthouse and café regarding the perceptions they had and the possibilities they saw with development in Ghana. During most of the remaining eight months when I was conducting research in the Northern Region, I lived with a family at the interface of the rural-urban divide, once a village and now absorbed by the ever-expanding Tamale metropolitan area. While I was living in a "modern" home with electricity and Westernized building construction, my neighbors across the dirt road lived in a traditional complex of the grid with earthen walls and a thatch roof, cows led by Fulani herdsman traversed the neighborhood, and chickens, goats, sheep, and guinea fowl populated the ditches and served as a source of food, "landscaping,", and soil fertility. Small plots of maize and vegetable gardens are interspersed among the homes. Small shops provided staple non-perishable items and families sold the surplus of the tomatoes, groundnut, pepe, and okra on stands alongside the roads that fed into the center of town. While in Accra, I stayed with U.S. foreign service officers adjacent to the U.S. Embassy that gave me insider perspectives on U.S. involvement and development assistance in Ghana.

[84] Bayard de Volo Edward Schatz, "From the Inside Out," 267.

By combining field observations with discourse analysis, I situate my analysis simultaneously at the local and the global levels. Such an approach can be characterized as an "ethnography of global connection."[85] It should be stressed that I am studying an active period of agricultural transition as actors within Ghana begin, resist, and/or consider the adoption of genetically modified crops. At this stage, my primary concern is the kinds of discourses that animate, enable, or justify agricultural change in Ghana. By studying a transition, the dissertation benefits from the relevance and ability to study closely the micro practices of development change.[86] The drawback to studying a transition is that information is inherently incomplete and the motivations of development may be obscured. However, I am less interested in the truth of the information that I analyze, and more interested in the posturing, the framing, and the blocking out of alternative truths that is a part of this information production.[87] Truthful or not, such narrowing of vision produces potent political effects and shapes peoples' livelihoods and local ecologies. By combining ethnographic and interpretive methods, I render visible competing modes of knowledge, authority, and legitimacy within debates over food security and sustainable development.

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[85] Anna Lowenhaupt Tsing, *Friction: An Ethnography of Global Connection* (Princeton: Princeton University Press, 2005).

[86] In *Encountering Development,* Escobar explains the importance of micro practices of development change: "The overall goal was dictated by development economics: to promote growth through certain types of investment projects…This goal required the rationalization of the productive apparatus, according to the methods developed in the industrialized nations…This could be done only through new practices concerning the everyday actions of an ever larger number of development technicians and institutions. The importance of these micro practices—replicated by hundreds of technicians at all levels—cannot be overemphasized, because it is through them that development is constituted and advanced. The new practices concerned many activities and domains, including, among others, technical assessments; institutional arrangements; forms of advice; the generation, transmission, and diffusion of knowledge; the training of personnel; the routine preparation of reports; and the structuring of bureaucracies." Escobar, *Encountering Development*, 88-89.

[87] Tsing, *Friction.*

IV. Case Selection

Most studies on the politics of GMOs focus on Europe, the Americas, and South Asia, with considerably less attention to the African continent. I have followed the global GMO debate since 2004 and have been interested in the competing accounts of genetically modified seeds as a technology in support of, or detrimental to, the livelihoods of the poor. I also have a longstanding interest in environmental and social justice and, in particular, the ways in which calls for justice are articulated in the developing world—what Joan Martinez-Alier calls an "environmentalism of the poor."[88] Southern African states such as Zambia rejected American GM food aid out of concerns regarding public health. South Africa is by far Africa's largest producer of genetically modified crops and is hailed as a model for African states, yet it is also home to the African Centre for Biodiversity, a very dynamic activist organization that disseminates information about the negative effects of transgenic crops.[89] I became interested in whether Ghana, as an exemplar state for West Africa, would exhibit some of the same patterns in the commercialization of and contestation over genetically modified seed. Ghana was chosen for my research both because it is a country that has attracted agricultural investment and development assistance as part of the new Green Revolution in Africa, and because it is in many ways a typical case of uneven agricultural development in sub-Saharan Africa. It is also a country that reflects contention over genetically modified crops and agricultural modernization: at the time that I chose Ghana as a site for research, the Ghanaian Parliament had ended a seven-year deliberation over the biosafety bill.

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[88] Joan Martinez-Alier, *The Environmentalism of the Poor: A Study of Ecological Conflicts and Valuation* (Northampton, MA: Edward Elgar Publishing, 2002).
[89] Previously African Centre for Biosafety.

Currently, farming on much of the African continent can be characterized as labor-intensive, small-scale, rainfed agriculture with minimal use of inputs and mechanization. Saving seeds as well as the use of manure to fertilize the fields by farmers wealthy enough to own livestock continue to be thriving traditional agricultural practices. African farmers use the least amount of fertilizer worldwide and hybrid seeds are still a novelty in places like Northern Ghana.[90] Ghana, like many other sub-Saharan countries, faces warming temperatures and erratic rains as well as increasing population density. The average age of farmers is increasing as senior high school students move from rural areas to study in cities, and think less about returning to work on the family farms. Urbanization and the expansion of cities compete with farming land. These conditions have prompted calls for a new Green Revolution in Africa, the topic of Chapter Three.

The inequality between the North, primarily a rural and peri-urban space, and the South, where industry is concentrated, has deepened. Northern Ghana is framed by Southerners and foreigners alike as 'backwards,' 'deficient' and in need of intervention.[91] The three regions that make up Northern Ghana (Northern Region, Upper East Region, and Upper West Region) account for approximately 13.4% of the

[90] Morris et.al., *Fertilizer Use in African Agriculture: Lessons Learned and Good Practice Guidelines* (Washington, D.C.: The World Bank, 2007); author interviews at the Ministry of Food and Agriculture Upper East Regional Office March 4, 2013 and with Dr. Kojo Amanor at the University of Ghana, Legon, March 26, 2013.

[91] The common perception by Southerners was that the North was backwards, hot, and had nothing going on. This sentiment was widely shared among people that had never been there. Part of this denigration of the North likely has ties to the history of North-South relations whereby Northerners made up the pool of slaves for the centralized Southern kingdoms and the trans-Atlantic slave trade. For a discussion of internal colonization in Ghana see Akosua Adoma Perbi, *A History of Indigenous Slavery in Ghana* (Accra: Sub-Saharan Publishers, 2004).

total population and 44.9% of the landmass of the country.[92] In comparison with the rest of the country, it has low levels of literacy and formal education[93], low levels of productivity as measured by crop yields, high levels of micronutrient deficiency among women and children, and low rates of agricultural technology adoption (such as fertilizers, 'improved seed,'[94] pesticides, tractors, and irrigation). Northern Ghana is a part of the savannah agro-ecological zone with distinct short rainy (4-6 months) and long dry seasons (6-8 months).

Ghana has had a history of attracting development assistance with a longstanding goal of developing commercial agriculture.[95] Recent support from entities such as USAID, the World Bank, and the Alliance for a Green Revolution in Africa (AGRA) has focused on increasing agricultural productivity in Northern Ghana, especially in the seed sector. Current president John Mahama, of the National Democratic Congress (NDC) political party, won support through a series of promises to devote greater attention to economic growth in the North via the commercialization of Northern agriculture. This plan to modernize agriculture has been initiated through a public-private partnership termed the Savannah Accelerated Development Authority (SADA) and the Ghana Commercial Agriculture Program (GCAP), which I discuss in

[92] The Northern Region is the largest of the three regions that make up Northern Ghana, accounting for 29.5% of the total landmass with a population size of 1,820,806. The Upper East is one of the most densely populated areas of the country with a population size of 964,500 but only 2.7% of the country's total landmass. The Upper West has a population size of 576,583 and 12.7% of the country's landmass. See "About Ghana: Regions," Government of Ghana, accessed July 2nd, 2015, http://www.ghana.gov.gh.

[93] In many conversations during my fieldwork in Northern Ghana I was told that during the British indirect rule of the Northern Territories the British educational policy in Ghana was intended to maintain Northerners as an uneducated labor force.

[94] Improved seed refers to seed that is certified by agronomists and produced through foundation seed.

[95] This is reflected in the themes of Ghana's Farmers' Day, a day to celebrate farmers' achievements, typically recognizing large- to medium-scale farmers or those that adopt modern agricultural technologies. For a review of recent Farmers' Day themes see "Farmers' Day FAQs," Ministry of Food and Agriculture, Republic of Ghana, accessed July 2nd, 2015, http://mofa.gov.gh/site/?page_id=6843.

Chapter Four. The passage of the Biosafety Act 831 in December 2011, has allowed a series of transgenic confined field trials to commence, two of which (Bt cotton and Bt cowpea) are based in the Savannah Agricultural Research Institute in Northern Ghana. Chapter Three takes a closer look at the public-private partnership that supports the research and development of transgenic cowpea undergoing a confined field trial at SARI.

My field sites were divided among participant observation in farming communities in Northern Ghana and more formal interviews with actors involved in initiatives to modernize agriculture in Accra, Tamale, and Bolgatanga. I conducted research in the regional capitals of Tamale (Northern Region) and Bolgatanga (Upper East), the villages of Kukuo Yapalsi and Bongo that have direct access to state resources,[96] and the villages of Kpegu Bugurugu and Vea that lack such access. These villages were selected following my pilot research trip in January 2012. In order to gain community access, I used snowball sampling, linking up initially with an opinion leader, who then was able to introduce me to elders and traditional leaders. I asked how farmers perceive the agricultural challenges they face, what forms of knowledge and expertise do farmers rely on to respond to these challenges, and what they conceive are the roles of technology, local and scientific expertise in responding to these challenged in Northern Ghana.

In the cities of Tamale, Bolgatanga, and Accra I interviewed a wide-range of actors that work to shape understandings of how food should be produced and distributed in Ghana. I conducted repeated interviews with agricultural research

[96] Kukuo Yapalsi has an assemblyman who was a National Farmer that resides in the village. The resident chief of Bongo is a Paramount Chief.

scientists at SARI, bureaucrats in the regional and national offices of the Ministry of Food and Agriculture, actors (particularly those employed by USAID) involved with the implementation of the Obama Administration's Feed the Future initiative, U.S. foreign service officers, actors involved and impacted by the SADA initiative, faculty at the Integrated Community Development program at the University of Development Studies (UDS), actors involved with biotechnology outreach programs (particularly those that are a part of the Program for Biosafety Systems), farmers associations, and activists in opposition to genetically modified crops. I also asked these actors to characterize the agricultural challenges that farmers face and how these challenges should be addressed, but was more direct in asking whether they see a role for genetically modified crops in responding to these challenges.[97]

I approach my dissertation research as part of a larger study of a period of transition in Ghana's agricultural development trajectory. Ghana currently has a number of public-private partnerships that have been mobilized to modernize Ghana's agricultural system. At the time that I commenced fieldwork in January 2012 and July 2012-March 2013, the four core public-private partnership initiatives[98] that I had identified to study—the Savannah Accelerated Development Authority's work on land rights and commercial agriculture, the Alliance for a Green Revolution in Africa's work on seeds and policy advocacy, the Ghana Commercial Agriculture Program's development of nucleus-outgrower schemes and land facilitation mechanisms to expand commercial agriculture, and the introduction of genetically

[97] At the time I conducting most of my fieldwork (2012-13), there was little widespread knowledge of genetically modified crops. Awareness about the debate was concentrated among elites, and not among farmers.
[98] The fourth public-private partnership is the Ghana Commercial Agriculture Program (GCAP).

modified seeds—were in various stages of their implementation. During this time, a private auditor for SADA was still conducting baseline surveys on agriculture, though the afforestation project began in a hurry before the run-up to the December 2012 general elections. AGRA had been active in Ghana for a longer period of time and was involved in an expansive array of projects related to agriculture. In 2007, AGRA supported the development of the West African Center for Crop Improvement that trains students from across West Africa in biotechnology and plant breeding at the University of Ghana, Legon. (It now has two cohorts of PhD alumni). AGRA's Policy and Advocacy Program for the seed sector worked with the Ministry of Food and Agriculture and has influenced seed and fertilizer legislation in Ghana such as the Plant and Fertilizer Act, 2010 (Act 803) that laid the foundations for the highly contested Plant Breeders' Bill currently before Parliament.

Confined field trials of three genetically modified crops (an early step on the road to commercial release) began in 2013: GM rice was planted at the Council for Scientific and Industrial Research (CSIR) Kumasi in March 2013, Bt cotton was planted at the Savannah Agricultural Research Institute (SARI) Nyankpala in June 2013, and Bt cowpea was planted at the SARI Nyankpala in September 2013. In May 2015, I conducted follow-up interviews with a number of contacts at SARI, as well as actors affiliated with GCAP and SADA. As of May 2015, there are two different applications for additional transgenic crop field trials before the National Biosafety Authority.[99] In spring 2015, the Ghana Commercial Agriculture Program completed

[99] The Savannah Agricultural Research Institute (SARI) has applied for approval of multi-locational field trials of Bt cowpea, but this approval may be delayed as a result of the lawsuit against the National Biosafety Committee. Author interview with Dr. I.D.K. Atokple, SARI, Nyankpala, May 7, 2015. Monsanto has applied for approval of a field trial of Bt cotton with a stacked trait, herbicide-

the concept development for the land facilitation mechanism, but as of May 2015 has not yet developed a database to catalogue available land. GCAP has begun to select nucleus farmers to develop commercial agriculture in Northern Ghana.[100] During this third trip, I was also able to interview some of the key actors involved in the ongoing lawsuit against the National Biosafety Committee and the Ministry of Food and Agriculture brought by Food Sovereignty Ghana in order to halt the commercialization of genetically modified foods. In particular, I spoke to members of Food Sovereignty Ghana and a spokesperson of the Convention Peoples' Party, a senior advisor and the Country Coordinator of the Program for Biosafety Systems, a high-ranking official of the Ministry of Food and Agriculture, and the acting CEO of the National Biosafety Authority.

V. Key Findings

The effort to promote a new Green Revolution in Africa triggers and renews struggles over authority, knowledge, identity, and property. For instance, there is a widespread recognition within both popular discourse and scholarly literature of the highly polarized nature of the debate over GM seeds. However, this focus on the polarity of the debate obscures from view the similar sets of strategies utilized to both advance and impede biotechnology-based Green Revolution programs. First, I find that both proponents and opponents of GM seeds use a blend of two discursive strategies—hype and expertise—to facilitate the entry, or to resist, the cultivation of

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tolerance. Author interview with the acting CEO of the National Biosafety Authority, Accra, May 20, 2015.

[100] Author interview with a bureaucrat working on the land facilitation mechanism from the National Lands Commission, Accra, May 20, 2015. I discuss "nucleus-outgrower" farming arrangements in Chapter Four.

genetically modified crops. I define hype as the deployment of simplistic, exaggerated claims to stimulate activity such as consumption, investment, philanthropy, or to mobilize activism. The use of hype garners attention and support, whereas the use of scientific knowledge is used to legitimate their respective positions. The emergency framing collectively constructed through the discursive strategy of hype makes incremental approaches, compromises, and deliberation appear careless in the face of such urgency.

Adversaries have also taken the fight over this controversial technology to the legal domain: both proponents and opponents alike have employed legal expertise to advance, or impede, the introduction of GM crops. An international assemblage of biotechnology proponents have lobbied and offered legal and biosafety expertise to shape biosafety legislation in African countries such as Ghana. A result of these efforts is the passage of Ghana's Biosafety Act in 2011 that provides the framework for the management of biotechnology in the country. The recent lawsuit by Food Sovereignty Ghana against the Government of Ghana to ban the commercialization of GMOs bases its case upon this biosafety legislation, thereby legitimating the law that allowed GMOs into Ghana in the first place. Second, another key finding of the project is that this blend of hype and expertise works in tandem with the law to generate a 'rule of experts.'[101] This political shift gives scientists, biosafety experts, and lawyers greater power in shaping food and agriculture policy. Hype about GMOs as 'Frankenfoods' and 'terminator seeds' creates a perception of genetic modification as a uniquely "risky" technology that needs to be managed by biosafety expertise and legislation. In the speculative economy of the life sciences industry, hype about the

[101] Mitchell, *Rule of Experts*.

promise of biotechnology to deliver both economic and humanitarian benefits also solicits the authority of legal experts and intellectual property protection to safeguard investments and handle liability issues. In the courtroom and in Parliament, professional advocates navigate and shape legislation to advance their case. This proliferation and elevation of expertise can marginalize the majority of Africans who lack such expertise, and may ultimately lead to less democratic decision-making on food and agriculture policy.

Third, in the face of this contestation, I find that the promotion of 'pro-poor' biotechnology in Africa is being used to reframe biotechnology as a humanitarian enterprise. Using the concept of "philanthrocapitalism"[102]—that is, the merging of philanthropy with the logic of venture capital—I demonstrate how the "donation" of 'pro-poor' biotechnology serves to advance new markets in Africa under the pretext of providing a philanthropic response to the perceived food security needs of smallholder farmers and local communities. This "donation" mechanism produces an additional effect: the "gift" of a proprietary gene by an agribusiness corporation for the development of 'pro-poor' biotechnology reflects a conception of genes and seed as something that can be privately owned first, and then given away. This normalizes the seed as a commodity—rendering it "biocapital," that is, a new phase of capital whereby biological life becomes a key source of market and informational value.[103] It

[102] Carol B. Thompson, "Philanthrocapitalism: Appropriation of Africa's Genetic Wealth," *Review of African Political Economy* 41, no. 141 (2014): 389-405.
[103] Rajan, *Biocapital.*

advances a "genecentric" view of biological life that locates biodiversity in the stock of genetic material that divorces the seed from its social and ecological context.[104]

Fourth, at the center of these discursive strategies is the figure of the farmer, who is seen as an agent and object of salvation by GM proponents and opponents alike. The farmer entrepreneur, in the view of the World Bank and the Alliance for a Green Revolution in Africa, can save Africans from poverty and is even capable of 'feeding the world,' if only s/he were to access scientific knowledge and modern agricultural technologies. By contrast, food sovereignty activists see the farmer's rejection of GM seed as the means to save livelihoods endangered by the threat of GMOs and corporate domination. My ethnographic findings in Northern Ghana—a space that has been identified by both sides of this debate as deficient and in need of assistance—indicate that farmers are unlikely to buy into much of this hype. Rather, I find that farmers in Northern Ghana are "mixers": they pragmatically use a range of traditional and modern agricultural technologies and do not see traditional, organic farming and the use of modern inputs as mutually exclusive. Furthermore, ethnography allows me to show that these grand plans to transform farming from a way of life to a business are constantly challenged by existing complexity: multiple, coexisting roles, risk reduction practices, and local notions of entrepreneurship. This suggests that efforts to construct new farmer identities as part of the new Green Revolution in Africa will be frustrated, and likely incomplete.

[104] Arturo Escobar, *Territories of Difference: Place, Movements, Life, Redes* (Durham: Duke University Press, 2008).

VI. Chapter Outline

In Chapter Two, "Technological Savior or Terminator Gene? Hype, Science, and Law in the GMO Debate," I argue that the food crisis frame is used to advance—or impede—the adoption of this controversial technology, genetically modified crops. I contend that scholarly focus on the polarity of the debate obscures the common strategies deployed by adversaries. I provide examples of how both proponents and opponents use *hype*, as a bid for attention, and *science*, as a bid for authority, to attract supporters to their cause. The debate has also moved into the legal domain as both sides use law to regulate or ban GMOs. In bringing GMOs to the courtroom, activists have sometimes invoked and reinforced the same legal regime that enabled the introduction of GMOs in the first place.

The crisis frame that has been used by GM proponents to introduce genetically modified crops has also been employed to assert the need for a new Green Revolution in Africa. In Chapter Three, "What is New About the 'New Green Revolution'? Philanthrocapital, Biocapital, and Public-Private Partnerships," I critically analyze the "newness" of the Green Revolution in Africa. I examine whether and in what ways the introduction of genetically modified crops, as part of this program of agricultural transformation, constitute a radically new departure from the first Green Revolution. I offer three defining features that distinguish this new Green Revolution in Africa from previous agricultural modernization efforts. First, I look at the changing role of the nation-state in agricultural research and development from a state that "enables" rather than leads. These changes become evident in the proliferation of public-private partnerships. I focus my attention on the public-private

partnership that has supported the research and development of genetically modified cowpea in Ghana. Second, I look at the peculiar interface between legal and techno-scientific expertise, philanthropy, and new forms of capital that distinguish this new Green Revolution. I introduce the concept of philanthrocapitalism as a mechanism that facilitates the commodification of seed. Third, I consider the role of philanthrocapitalism and legislative changes that facilitate the normalization of a new form of capital, biocapital.

Whereas Chapter Three emphasizes what is new about this Green Revolution in Africa, Chapter Four, "Experts and Entrepreneurs: From Farming as a Way of Life to Farming as a Business," highlights the extent to which these initiatives focus on the farmer, a continuity between these two periods of agricultural transformation. I turn to my ethnographic observations in Northern Ghana to examine development strategies that attempt to transform farming through the promotion of entrepreneurship. I look at the ways in which discourses of entrepreneurship are promoted through education, training, and emulation. The use of new technologies, as well as agricultural education and training, challenge traditional roles as techno-scientific knowledge and business skills become privileged over experiential knowledge. In the final section of the chapter, I bring to light existing complexity on the ground that will likely frustrate these attempts to transform farming from a way of life to a business.

In the Conclusion, "Seed Politics and the Question of Democracy," I discuss further the significance of my work and future directions for research. A particularly promising avenue for further analysis are the issues of democracy and accountability

that have been raised by a wide range of actors in the GMO debate in Ghana. I consider the way in which actors ranging from activists within the food sovereignty movement to members of the Ministry of Food and Agriculture Board of Directors are using this debate over GMOs as an opportunity to call for the democratization of food policy. In this sense, the debate about GMOs can be understood as a proxy for much larger debates not only about development, but also democracy itself.

CHAPTER TWO:
Technological Savior or Terminator Gene?
Hype, Science, and Law in the GMO Debate

I. Introduction

The challenge of feeding a growing population during an age of declining arable land and natural resources has generated an intense debate over the adoption of new agricultural technologies, particularly genetically modified (GM) seeds. Genetically modified (GM) crops are framed alternately as a means to improve the lives of a growing population in the face of climate change and as undermining the capacity for life—in the form of a seed—to reproduce itself. As such, this genetic manipulation has been both heralded as a technology with great potential, and condemned as a source of worldwide contention: the "golden rice" that will save children from blindness and early death, or the "terminator seed" that will lead to the poisoning of our food supply and the collapse of biodiversity.

Despite the controversial nature of this technology, GM crop cultivation on the whole is rising: between 1996 and 2013 the land devoted to GM crops has increased 100-fold, making it among the fastest adopted crop technologies in the history of modern agriculture. However, GM crop cultivation is also geographically concentrated, as 76% of this cultivation takes place within the U.S., Brazil, and Argentina.[1] In order to understand the uptake of this technology, it is important to recognize not only the dualistic nature of these framings, but also the commonalities between adversaries. This chapter explores how both proponents and opponents of the

[1] International Service for the Acquisition of Agri-biotech Applications (ISAAA), "Executive Summary: Global Status of Commercialized Biotech/GM Crops: 2013," *ISAAA Brief 46-2013: Executive Summary*, 2013, accessed March 4, 2014, http://www.isaaa.org/resources/publications/briefs/46/executivesummary/default.asp.

genetic modification of seeds deploy discourses of *emergency* and *salvation* to usher in, or to resist, biotechnology's reach in the developing world. Fervent proponents of GM seed make inflated claims about the promise of biotechnology to address the plight of the starving to both encourage investment in new agricultural technologies as well as to mitigate fears. Ardent opponents of GM seed, though motivated by genuine concerns about the socio-ecological implications of this technology, make a parallel move: they frame GM seed as a catastrophe-in-waiting and use this sense of urgency to catalyze support. Thus, both poles of this debate collectively construct emergency.

What is at stake in the framing of genetically modified crops as responding to, or creating the conditions for, emergency is the narrowing of the range of options considered for future food production. More specifically, I argue that this construction of emergency may foreclose deliberation over the full range of options on how to address global food insecurity, thereby favoring ready-made, "off-the-shelf" technical solutions controlled by experts. Both poles of the GM debate, in dramatizing future food scenarios, construct conditions whereby small steps, compromises, or piecemeal approaches appear deficient and inappropriate in the face of such urgency. Because emergencies are conceived of as large in scale, responses are expected to match this scale; as such, global networks of trade and aid seem well suited for a task of this magnitude. This suggests that preoccupations with 'feeding the world' can have the unintended consequence of disregarding incremental and inclusive approaches to food security that may be less resource-intensive and environmentally damaging.

In this chapter I outline how the dynamics of the GM crop debate construct dualities that generate emergencies of scale. The adoption of GM crops gets posed as an "all or nothing" economic game: the uptake of this technology opens a door to either economic prosperity or indebtedness. This is seen in the expansion of farmer input-support programs, total packages that provide all necessary technological inputs[2] to transform the smallholder farmer into the 'serious' businessmen that feeds the world, or, by contrast, accounts of Bt cotton farmers' suicides in India as a result of deepening indebtedness from the high costs of genetically modified seed.[3]

The literature on the GM debate emphasizes its polarized character, but ignores the extent to which both the biotechnology industry and anti-GM activists employ similar tactics to shape public opinion and policy regarding genetically modified organisms (GMOs).[4] Despite the divergent framings of how to address

[2] Inputs refer to fertilizers, agrochemicals, irrigation systems, and tractors that are characteristic of capital-intensive agriculture.

[3] Glenn Davis Stone, "The anthropology of GM crops," *Annual Review of Anthropology* 39 (2010): 381-400.

[4] The political analysis on the GMO debate—both popular and scholarly—tends to reflect the polarity of the debate itself in its examination of either biotechnology proponents or anti-GMO activists (see for example Ronald Herring, "Framing the GMO: Epistemic Brokers, Authoritative Knowledge, and Diffusion of Opposition to Biotechnology," in *The Diffusion of Social Movements: Actors, Mechanisms, and Political Effects,* eds. Rebecca Givan, Kenneth Roberts, and Sarah Soule. (Cambridge: Cambridge University Press, 2010); Vandana Shiva, *Tomorrow's Biodiversity* (New York: Thames & Hudson, 2000); Robert Paarlberg, *Starved for Science: How Biotechnology Is Being Kept Out of Africa* (Cambridge: Harvard University Press, 2008); Peter Andrée, *Genetically Modified Diplomacy: The Global Politics of Agricultural Biotechnology and the Environment* (Vancouver: UBC Press, 2007). The scholarly literature on GMOs has highlighted the ways in which claims about the risks posed by GMOs diffuse through transnational advocacy networks with implications for biosafety regulation (Herring 2010; Paarlberg 2008), the emergence of a discourse of precaution and the development of the Cartagena Protocol on Biosafety (Andrée 2007), the divergence of US and EU biosafety regulatory policies (Jasanoff 2005; Lynch and Vogel 2001), attitudes towards GMOs (e.g. Jasanoff 2005; Stone 2010), the impact of framing on social mobilization (Heller 2013; Bonnuiel, Joly and Marris 2008), the potential benefits and costs of GM crops in the developing world (Pinstrup-Andersen and Schiøler 2001; Wu and Butz 2004; Fitting 2011; Moseley and Gray 2008; Stone 2007), and the conditions of production of plant biotechnology (Bingen 2008; Zerbe 2005; Kinchy 2012; Shiva 1999, 2000). See Herring, "Framing the GMO,"; Paarlberg, *Starved for Science*; Andrée, *Genetically Modified Diplomacy;* Sheila Jasanoff, *Designs on Nature* (Princeton: Princeton University Press, 2005); Diahanna Lynch and David Vogel, *The Regulation of GMOs in Europe and the United States* (New York: Council on Foreign Relations, 2001); Glenn Davis Stone, "The Anthropology of

current and future agricultural challenges, both proponents and opponents of transgenic seeds[5] employ a combination of *hype*, *science,* and *law* in order to facilitate or impede the adoption of genetically modified crops. I define hype as the deployment of simplistic, exaggerated claims to stimulate activity such as consumption, investment, philanthropy, or to mobilize activism. Hype in this context is a bid for attention that overstates and simplifies the benefits or detriments of GM seeds. An unanticipated consequence of this framing of GM seeds as "risky" is the subsequent demand for an industry of experts to monitor biosafety.[6] An additional outcome of anti-GMO campaigns is the greater frequency of biotechnology outreach events, those efforts to educate, train and mitigate against negative perceptions of biotechnology and GMOs that are organized by industry-influenced public-private

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GM Crops," *Annual Review of Anthropology*, 39 (2010): 381-400; Heller, Chaia. *Food, Farms, and Solidarity*. Durham: Duke University Press, 2013; Christophe Bonneuil, Pierre-Benoit Joly, and Claire Marris, "Disentrenching Experiment: The Construction of GM-Crop Field Trials As a Social Problem," *Science, Technology, and Values* 33, no. 2 (2008): 201-29; Per Pinstrup-Andersen and Ebbe Schiøler, *Seeds of Contention: World Hunger and the Global Controversy over GM Crops* (Baltimore: The Johns Hopkins University Press, 2001); Felicia Wu and William Butz, *The Future of Genetically Modified Crops: Lessons from the Green Revolution* (Santa Monica: Rand Publishing, 2004); Elizabeth Fitting, *The Struggle for Maize: Campesinos, Workers, and Transgenic Corn in the Mexican Countryside* (Durham: Duke University Press, 2011); Moseley and Gray, *Hanging by a Thread*; Glenn Davis Stone, "Agricultural Deskilling and the Spread of Genetically Modified Cotton in Warangal," *Current Anthropology* 48, no.1 (2007): 67-103; Jim Bingen, "Genetically Engineered Cotton: Politics, Science, and Power in West Africa," in *Hanging by a thread: Cotton, globalization, and poverty in Africa*, William G. Moseley and Leslie C. Gray, eds. (Uppsala: Ohio University Press, 2008); Noah Zerbe, *Agricultural Biotechnology Reconsidered: Western Narratives and African Alternatives* (Trenton, NJ: Africa World Press, 2005); Abby Kinchy, *Seeds, Science, and Struggle: The Global Politics of Transgenic Crops.* (Cambridge: MIT Press, 2012); Vandana Shiva, *Biopiracy: The Plunder of Nature and Knowledge* (London: South End Press, 1999); Shiva, *Tomorrow's Biodiversity.*

[5] "Genetically modified," "genetically engineered," and "transgenic" seeds are fairly synonymous terms and will be used interchangeably throughout the paper. Activists tend to use the term "genetically modified" seed more frequently, and scientists and industry tend to prefer "genetically engineered" or "transgenic" seeds. Biotechnology, on the other hand, is a larger category that includes genetic modification/engineering. Genetic modification occurs through the transferring of a gene from one organism to another. One of the most common genetic modifications in plant biotechnology is the introduction of a gene from a bacterium into a plant genome in order to confer insect resistance.

[6] Andrée (2005) points out that the perception of genetically modified organisms as posing unique risks means that "those without technical expertise have limited power in both policy fora and the wider public sphere, even though they may have strong opinions on the matter and strong interests in the outcome of deliberation." Peter Andrée, "The Cartagena Protocol on Biosafety and Shifts in the Discourse of Precaution," *Global Environmental Politics* 5, no.4 (2005): 28. pp.25-46.

partnerships. This debate has increasingly been drawn into the legal arena as biotech advocates work to shape biosafety law (thereby allowing the introduction of GMOs) and opponents take them to courts to call for labeling or bans of GMOs.

In the following section, I discuss the way in which discourses of emergency and salvation circulate in conversations about global food security and delimit responses to food and agricultural challenges. Framing threats to future food production (like climate change, land pressures, and biodiversity loss) as an emergency necessitates an immediate response. Biotech proponents, that include industry, government officials and other development planners, offer technological salvation from this state of emergency through the transgenic seed. GM seed is presented as holding the potential to be adaptive to climatic change, allow for sustainable intensification[7] of farming, and tackle nutritional deficiencies. Environmental anti-GMO activists push for bans and moratoria of GMOs in order to save the planet from the perceived threats to human and ecological health. Yet not all opponents of GMOs would be satisfied with merely a ban on this technology. For instance, some of the recent opposition to GMOs in Ghana belongs to the global food sovereignty movement. This movement differs from many mainstream environmental movements as food sovereignty constitutes a form of radical mobilization that appeals to larger aspirations of independence, democracy, and solidarity. Hype is revealed as a technique that may enable campaign mobilization and affect policy changes like a moratorium on GM crops, but that is unlikely to support farther-reaching goals of public participation and influence in agriculture and food policy design.

In the third section, I examine how science is used alongside hype in the debate over the cultivation of GM crops. Biotechnology outreach has emerged as a

[7] This refers to growing more intensively on existing arable land.

strategy by industry and related public-private partnerships to combat 'GM myths' and improve the public's perception of biotechnology. However, it is not only the proponents of GM seeds that use science-based informational campaigns to influence public opinion and policy. Anti-GMO activists critique the science of genetic modification as reductionist and imprecise, and wage a parallel campaign that draws upon experts in toxicology, biology, and ecology to support their claims. Both opponents and proponents make use of hype as a bid for attention and utilize science as a bid for authority. This simultaneous generation of hype and science creates static: it becomes difficult to tease out credible scientific and experiential information from an oversupply of hype-filled, web-based content on GMOs. Furthermore, the use of science as a means to legitimate critique of GMOs has exclusionary effects, creating barriers to public participation in this debate over how food should be produced and consumed.

In the final section, I turn towards the deployment of law in this heated debate. Because of the identification of genetically modified crops as uniquely risky, the development of new legislation to manage these risks precedes the introduction of genetically modified crops.[8] The international legal regime that guides the development of biosafety law is specified under the 2000 Cartagena Protocol on Biosafety, the Convention on Biological Diversity's international agreement on biosafety.[9] The Protocol takes a precautionary approach to biotechnology.[10] Fulfilling

[8] The Cartagena Protocol on Biosafety, of which Ghana is a signatory, requires biosafety legislation in order to manage the risks and allow for the safe introduction of genetically modified organisms.
[9] Currently there are 170 parties to the Protocol, the U.S. is not one. "The Cartagena Protocol on Biosafety," Convention on Biological Diversity, accessed July 3, 2015, https://bch.cbd.int/protocol.
[10] Principle 15 of 1992 Rio Declaration on Environment and Development articulates the meaning of the precautionary principle: "In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or

the biosafety requirements of the Protocol entails training, advising, and outreach to policymakers, scientists, the media, farmers, students, and the public at large about genetically modified crops by a new set of experts, many of which are trained in Western countries. Drawing upon my fieldwork in Ghana, I examine the use of law in two ways: first, I look at the actions taken to develop legislation to accompany the introduction of this new technology; and second, I analyze the use of law by a food sovereignty activist organization to halt the commercialization of GMOs. In particular, I examine a current court case brought against the Ghanaian government by Food Sovereignty Ghana that seeks to ban the commercial introduction of GMOs. I consider how the legalization of this debate has generated two contradictory effects: it attracts more attention to the activists' cause and potentially expands the number of interested parties in court, yet, at the same time, it also serves to legitimate biosafety law and the exclusionary domains of juridical and techno-scientific expertise.

II. Emergency and Salvation: GM Seeds and the Political Economy of Hype

GM foods are safe, healthy, and essential if we ever want to achieve decent living standards for the world's growing population. Misplaced moralizing about them is costing millions of lives in poor countries… GM crops should now be growing in areas where no crops can grow, and plant-based oral vaccines should now be saving millions of deaths. –U.S. Department of Agriculture Foreign Agricultural Service[11]

Monsanto's GM seeds create a suicide economy by transforming seed from a renewable resource to a non-renewable input which must be bought every year at high prices… The suicide economy of industrialized, globalised agriculture is suicidal

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irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." Principle 15 is reaffirmed in the Cartagena Protocol on Biosafety. United Nations General Assembly, *Rio Declaration on Environment and Development*, Rio de Janiero, Brazil, June 3-14, 1992.

[11] "Agricultural news for Italy EU and World July 2012," USDA Global Agricultural Information Network (GAIN), 2002, accessed July 3, 2015, http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Agricultural%20News%20for%20Italy%20EU%20and%20World%20January%202012_Rome_Italy_2-13-2012.pdf.

at 3 levels - it is suicidal for farmers, it is suicidal for the poor who are deprived food, and it is suicidal at the level of the human species as we destroy the natural capital of seed, biodiversity, soil and water on which our biological survival depends. –Vandana Shiva, leading anti-GMO activist[12]

Emergency

After the world's population reached 7 billion people in 2011, a wave of reports and commentary framed the global food production and distribution system as one in crisis.[13] Widespread food riots as a result of dramatic surges in the price for staple foods in 2007-8 and another famine in the Horn of Africa were highlighted to convey the urgency and necessity of dealing with issues of chronic food insecurity.[14] Companies like Monsanto and Syngenta, industry leaders in the production of genetically modified and hybrid seeds, seized and exploited this sense of emergency. According to Monsanto's website, in order to "to keep up with population growth more food will have to be produced in the next 50 years as the past 10,000 years combined."[15] Syngenta also calls upon this discourse of emergency: "To feed this growing population, farmers will need to achieve at least a 70 percent increase in food production by 2050. Achieving food security won't be easy considering the

[12] Vandana Shiva, "From Seeds of Suicide to Seeds of Hope: Why Are Indian Farmers Committing Suicide and How Can We Stop This Strategy?" *Huffington Post*, April 28, 2009, accessed July 3, 2015, http://www.huffingtonpost.com/vandana-shiva/from-seeds-of-suicide-to_b_192419.html.
[13] For an example of the kind of the Malthusian-style reporting that emerged as the population approached 7 billion see "Special Series: 7 Billion," *National Geographic*, accessed July 3, 2015, http://ngm.nationalgeographic.com/2011/01/seven-billion/kunzig-text.
[14] For example, a LexisNexis search of "food" and "crisis" between 2007-2011 yielded over 1,000 relevant hits, most of which identified the role of the 2007-8 food price crisis in creating food insecurity.
[15] "Meet America's Farmers," Monsanto Company, accessed July 3, 2015, http://www.americasfarmers.com/?gclid=COzc6eSRuq4CFYmK4AodNjtYNQ.

megatrends of growing population, greater affluence, and increasing urbanization."[16] Implicit in these statements is uncertainty: how will we be able to produce this food?

This discourse of emergency is also reproduced by GM opponents through framing the diffusion of GM seeds as leading to the poisoning and corporate takeover of the world's food supply.[17] Dying bees, lab rats with huge cancerous tumors, and cross-species mutant fruits become the symbols of the food emergency to which activists respond. I identify the key characteristics of this discourse of emergency: 1) temporal compression, 2) scale, and 3) perceived threat. Identifying a situation as an emergency impacts the way in which the problem is processed: emergency connotes a large-scale threat that necessitates immediate action.[18] One of the consequences of conceptualizing food insecurity and hunger as an emergency is that solutions are 'rendered technical', skirting complex and deeply rooted socio-political issues.[19] In discussing famine, Edkins (2000) argues that famine

> …has been removed from the realm of the ethical and the political and brought under the sway of experts and technologists of nutrition, food distribution, and development. Its position there, as an appropriate subject for expert knowledge, remains a political position, but one can lay claim to a political neutrality because of the specific way that science is construed as 'truth' in modernity.[20]

The significance of the categorization of food crises as emergencies is that this classification constrains alternative agricultural imaginaries by changing the speed of

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[16] "Grow more from less," Syngenta, accessed July 3, 2015, http://www.syngenta.com/global/corporate/en/grow-more-from-less/Pages/grow-more-from-less.aspx.
[17] Visual media has been influential in drawing attention, and generating fear, around GMOs. A few examples include: *Genetic Roulette; Poison on the Platter; Seeds of Death; Transgenic Wars; Seeds of Freedom*. For more examples see "Movies to Watch—GMO and More," GMO Awareness, accessed July 3, 2015, http://gmo-awareness.com/resources/movies-to-watch-gmo-and-more/.
[18] See Michael Lipsky and Steven Rathgeb Smith, "When Social Problems Are Treated as Emergencies," *Social Science Review* 63, no.1 (1989): 5-25.
[19] Tania Murray Li, *The Will to Improve: Governmentality, Development, and the Practice of Politics* (Durham: Duke University Press Books, 2007), 7-10.
[20] Jenny Edkins, *Whose Hunger? Concepts of Famine, Practices of Aid* (Minneapolis: University of Minnesota Press, 2000), 1.

the response. As Calhoun (2004) observes, "emergency is thus a category that shapes the way we understand and respond to specific events, and the limits to what we think are possible actions and implications."[21] If immediate action is a mandated response to emergency, than this eliminates the possibility of taking slow, incremental steps to addressing the identified threat.

This "evental" character obscures the visibility of the structural processes of capital accumulation that might contribute to exacerbating the likelihood of future 'emergencies.' Unlike addressing patterns and processes that may require political action and social change, an isolated event is likely to be more responsive to technological interventions. Furthermore, global funding structures of development projects incentivize this framing of emergency; routine upkeep and project maintenance are rarely attractive needs to support.[22] The prioritization and designation of emergencies within these funding structures can be considered ways of minimizing institutional commitments to address underlying structural issues.[23] Within this logic of emergency, rich nations can afford to be very risk-averse, "but the vast majority of humankind does not have such a luxury, and certainly not the hungry victims of wars, natural disasters, and economic crises."[24] In this way, the discourse of emergency forecloses meaningful debate regarding how food should be

[21] Craig Calhoun, "A World of Emergencies: Fear, Intervention, and the Limits of a Cosmopolitan Order," *Canadian Review of Sociology and Anthropology* 41, no. 4 (2004): 376.
[22] According to the film *The Price of Aid*, 80% of the UN World Food Program's resources are dedicated to "emergencies"—"emergencies" that must be identified four months *in advance.* That is to say that countries like the United States (which provides up to 80% of the total resources for the UN WFP) identify critical regions many months in advance and ship them in-kind to the countries identified as in need. Often times this means that countries that receive such aid may not, in fact, be facing an acute food shortage, which has very negative effects on the local prices that farmers can obtain for foodstuffs like maize. Jihan el-Tahiri, *The Price of Aid* (55 minutes, released in 2004).
[23] Lipsky and Smith, "When Social Problems Are Treated as Emergencies."
[24] Norman Borlaug and Jimmy Carter, "Foreword," in *Starved for Science: How Biotechnology Is Being Kept Out of Africa*, by Robert Paarlberg (Cambridge: Harvard University Press, 2008), ix.

produced and distributed and may render additional scientific testing of GM seed "unnecessary," thereby reducing the time that activists have to respond.

Salvation

The invocation of a food emergency discourse prompts a demand for solutions. How can we feed the world with climate change threatening to wreak havoc and population continuing to grow exponentially? How may humankind be protected from the threat of toxic GMOs and corporate domination? In this constructed condition of emergency, a discourse of salvation is likely to have greater resonance. This discourse works in tandem with the emergency discourse to facilitate or impede openings for the entry of GM seed. Biotechnology is presented as a means to 'save' 'poor Africans' from hunger.[25] The discourse of salvation has three key characteristics: it is transformative, faith-based, and it is dependent on the identification of a population 'in need.' Salvationary discourse is transformative because it promises alleviation from the current condition of crisis and emergency. Claims about the 'miracles of modern science' reflect this aspect of the discourse. The discourse of salvation deployed by proponents of GM seed reveals great faith in the *promise* and *potential* of science to solve problems of food production. This faith in science is not contingent on proof. Salvation also requires a population in need of being 'saved.' Hunger and malnutrition are linked to accounts of the world's poor as

[25] For more on the history of framing GM crops as a 'pro-poor' technology, see Dominic Glover, "The corporate shaping of GM crops as a technology for the poor," *The Journal of Peasant Studies* 37, no.1 (2010): 67-90.

"starved for science."[26] Diverse livelihoods become converted into the "misery"[27] of the underdeveloped, a monolithic population that needs to be 'saved' through technological interventions.

I borrow this notion of salvationary discourse from Kaushik Sunder Rajan's book *Biocapital: The Constitution of Postgenomic Life.* Rajan finds that in the domain of genomic research the "therapeutic molecule" can be used to invoke the future possibility of life-saving treatment "which of course need never actually be realized, but…whose existence as a future goal is vital to the dynamics of the present."[28] Rajan argues that supporting the promises of the life sciences industry is an underlying belief structure of salvation.[29] The narrative of drug development is one of a "miraculous enterprise" whereby the drugs themselves are the instruments of salvation.[30] The belief in the promise and potential of science to offer life-improving technologies, both in the domains of human genomic research and agricultural biotechnology, is the driving force of this discourse of salvation. In a parallel fashion, high-yield varieties of seeds during the Green Revolution have been portrayed as the miraculous means by which India avoided famine.[31] Proponents of GM seed have drawn upon this narrative to promote a "new Green Revolution for Africa," most notably through the creation of the influential Alliance for a Green Revolution in

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[26] Reference to Robert Paarlberg's text, *Starved for Science.*
[27] I am referencing here a statement made by President Kennedy: "'The world is very different now. For man [*sic*] holds in his mortal hands the power to abolish all forms of human poverty and all forms of human life… To those people in the huts and villages of half the globe struggling to break the bonds of mass misery… we offer a special pledge—to convert our good words in good deeds—in a new alliance for progress—to assist free men and free governments in casting off the chains of poverty.'" Quoted by Arturo Escobar, "Planning," in *The Development Dictionary: A Guide to Knowledge as Power*, 2nd ed., ed. Wolfgang Sachs (London: Zed Books, 2010), 136.
[28] Kashik Sunder Rajan, *Biocapital: The Constitution of Postgenomic Life* (Durham: Duke University Press, 2006), 48.
[29] Rajan, *Biocapital,* 35.
[30] Rajan, *Biocapital,* 186-7.
[31] Paarlberg, *Starved for Science*, 8.

Africa (AGRA), funded by the Bill and Melinda Gates Foundation and the Rockefeller Foundation. GM seeds and the technologies that support them (pesticides, fertilizers, irrigation, tractors) are seen as the way by which 'the poor' can be 'saved from poverty.'

Rajan also argues that the expansion of the life sciences industry is driven by speculative capital. "Speculation and innovation both involve the articulation of *vision.* But it is articulation that takes a certain form, that of *hype.* Vision and hype are both types of discourse that look toward the future."[32] Hype is common in the information age; constant access to nearly boundless quantities of information encourages overstatements and inflationary claims to gain the attention of a busy and distracted audience. In order to generate support to fund anti-GMO campaigns, opponents may make hyperbolic claims about the impact of this new technology. Rather than presenting this technology as part of a trajectory of environmentally damaging technologies, GM seed is presented as radically "new" in order to solicit donations and other forms of support. Hype, therefore, is not only a bid for attention but also a funding mechanism.

Both opponents and proponents of GM seed rely on hype to raise capital and generate concern regarding this new technology. This political economy of hype operates at two levels. First, hype is deployed as an attention-seeking mechanism to attract an audience, maintain relevance, or to counter adversaries' claims; second, hype is used both as a way to generate excitement and solicit funds for future research and development as well as for advocacy campaigns. This use of hype to attract

[32] Rajan, *Biocapital,* 111. Original emphasis.

financial support is akin to what Anna Tsing (2005) describes as the "economy of appearances":

> *Performance* here is simultaneously economic performance and dramatic performance. The 'economy of appearances' I describe depends on the relevance of this pun; the self-conscious making of a spectacle is a necessary aid to gathering investment funds. The dependence on spectacle…is a regular feature of the search for financial capital.[33]

Pioneering industries and campaigns are more inclined to use hype, or in Tsing's terms *spectacle*, during critical times when support is most needed. Biotech proponents use hype at the research and development stage of new products, or when products are criticized. Activists use hype during critical political economic shifts like impending legislative changes on GMOs or prior to the introduction of new transgenic products into commercial markets. Hype can be an important tool in garnering the support necessary to successfully ban GMOs, or, by contrast, in generating the capital for new expansions in biotechnology research.

An example of this is a 2009 Monsanto press release that states: "Monsanto Is on the Verge of a Technology Explosion." In an animated address to investors, Monsanto's CEO and president Hugh Grant promised that on the horizon are value-added products with improved yield for growers. Yet at the end of the press release is the following:

> Cautionary Statements Regarding Forward-Looking Information: Certain statements contained in this release are 'forward-looking statements,' such as statements concerning the company's anticipated financial results, current and future product performance, regulatory approvals, business and financial plans and other non-historical facts. These statements are based on current expectations and currently available information. However, since these statements are based on factors that involve risks and uncertainties, *the*

[33] Anna Lowenhaupt Tsing, *Friction: An Ethnography of Global Connection* (Princeton: Princeton University Press, 2005), 57. Original italics.

> *company's actual performance and results may differ materially from those described or implied by such forward-looking statements*.[34]

It should be noted that such a disclosure is required by law and is common to all Monsanto correspondence to investors. Yet what is interesting about this is that investors know this, and perpetuate this economy of hype. Speculative investment offers the possibility of huge returns when investors get in early on products that may later become successes. Expanded investment in agricultural technologies such as this can create a false understanding that these technologies are 'tried and true' and constitute appropriate responses to food emergencies. For other examples of salvation and the political economy of hype, I turn to the two of the most publicized 'success' stories, GM sweet potatoes and Golden Rice.

'Pro-poor' Biotechnology: The Technological Savior

Sometimes the ones responsible for the perpetuation of hype are scientists themselves. Jennifer Thomson, the former chair of the African Agricultural Technology Foundation and the current chair of the South African National Biosafety Advisory Committee, argues that the media has been biased in its accounts of biotechnology. This bias has led to the neglect of the ways in which GM crops have 'saved' people from hunger and malnutrition. According to Thomson, the media focuses their attention exclusively on biosafety fears: "We don't, however, often read headlines such as 'GM rice saves million of Asian children from blindness' or 'GM

[34] "Monsanto Is on the Verge of a Technology Explosion, Executives Tell Investors at Annual Field Event," *PR newswire*, August 13, 2009, accessed February 12, 2012, http://news.prnewswire.com/ViewContent.aspx?ACCT=109&STORY=/www/story/08-13-2009/0005076914. My emphasis.

sweet potatoes save African crop from virus plague'…"[35] What is interesting about these statements concerning GM rice and GM sweet potato is that Thomson is invoking the "therapeutic seed" *despite the fact the therapy has yet to be realized*.[36] Neither GM rice nor GM sweet potato is commercially cultivated and therefore is not available for consumption. Furthermore, after three years of field trials at the Kenya Agricultural Research Institute, results demonstrated that GM virus-resistant sweet potatoes were no less vulnerable than ordinary varieties, and sometimes their yield was lower.[37]

Another illustration of the interplay between the discourses of emergency and salvation is the use of "Golden Rice" to demonstrate the saving force and benevolence of biotechnology. In 2000, TIME magazine declared, "This rice could save a million kids a year" because of the transgenic crop's promise to address vitamin A deficiency.[38] Over a decade later, this transgenic vitamin-A enriched "Golden Rice" is still not commercially cultivated, in part due to the destruction of field trials and the slow development of a regulatory infrastructure in the wake of the

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[35] Jennifer A. Thomson, *Genes for Africa: Genetically Modified Crops in the Developing World* (Landsdowne, South Africa: University of Cape Town Press, 2002), 3.

[36] International Service for the Acquisition of Agri-biotech Applications (ISAAA), "Press Release: Global Status of Commercialized Biotech/GM Crops: 2010," *ISAAA Brief 42-2010*, 2/22/11, 2010, accessed July 3, 2015, http://www.isaaa.org/resources/publications/briefs/42/pressrelease/default.asp. The "therapeutic seed" is a reference to Rajan's "therapeutic molecule," in *Biocapital.*

[37] New Scientist, "Monsanto failure," *New Scientist* 181, no. 2433 (2004): 7. See also Gatonye Gathura, "GM technology fails local potatoes," *The Daily Nation, Kenya*. January 29, 2004. Despite the Kenya Agricultural Research Institute's centrality in the development of transgenic crops on the African continent, the Kenyan government banned GMOs out of concern regarding food safety in November 2012. This ban has received criticism for hindering research on genetically modified crops that could address some of the country's agricultural challenges. On Kenya's ban on GMOs see AgroNews, "Kenya Banned Importation of All GMO Foods," *AgroNews*, November 22, 2012, accessed July 3, 2015, http://news.agropages.com/News/NewsDetail---8425.htm; Hillary Hueler, "In Kenya, Calls Grow to Lift Controversial GMO Ban," *Voice of America*, November 20, 2014, accessed July 3, 2015, http://www.voanews.com/content/in-kenya-calls-grow-to-lift-controversial-gmo-ban/2527833.html.

[38] TIME magazine, "This Rice Could Save a Million Kids a Year," *TIME magazine*. July 31, 2000. Front cover of magazine.

controversy surrounding GM crops.[39] Despite the fact that Golden Rice is still years away from being accessible to markets, the myth that this product is on the market and saving children has been perpetuated. Activists that impede the development of micronutrient-enhanced GM foods are framed as selfishly imposing their food choices onto people who have unfulfilled dietary needs, or in the extreme as having "the blood of…millions of children on their hands."[40] A February 2012 report by the USDA Foreign Agriculture Service agonizes that "misplaced moralizing about [GM foods] is costing millions of lives in poor countries;"[41] a U.S. Congressional Representative at a Congressional hearing on plant biotechnology in Africa likened the barring of genetically modified crops as "border[ing] on genocide".[42] Such claims reveal important slippages: the *potential* of a technology to address micronutrient deficiency is equated with *the cure* for blindness and early death.[43]

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[39] In August 2013, 400 protestors destroyed a Golden Rice experimental site in the Bicol region of the Philippines that had nearly run its field trial completion. Matt McGrath, "'Golden rice' GM trial vandalized in the Philippines," *BBC News,* August 9, 2013, accessed July 3, 2015, http://www.bbc.co.uk/news/science-environment-23632042.

[40] Patrick Moore, "Has Greenpeace Lost Its Moral Compass?" Allow Golden Rice Now!, accessed March 2, 2014, http://www.allowgoldenricenow.org/moral-compass. Dr. Patrick Moore was a co-founder of Greenpeace.

[41] "Agricultural news," USDA GAIN report 2012.

[42] The statement by Speaker J. Dennis Hastert, Representative of the 14th District of Illinois, at a congressional hearing: "Today, when we see starvation, especially in some of our African countries, we see people who are artificially putting barriers or threats to us being able to move good healthy food products into those countries. In my view, that borders on genocide. It is wrong, it shouldn't happen, and we need to use our science, we need to use our technology, and we need to fight these folks who are trying to stop this good, healthy, nourishing food from going to countries that need it." *Plant Biotechnology Research and Development in Africa: Challenges and Opportunities, Hearing Before the Subcommittee on Research Committee on Science House of Representatives,* 108th Cong., p.11 (June 12, 2003) (statement by Speaker J. Dennis Hastert, Representative of the 14th District of Illinois).

[43] A recent *New York Times* article on June 8, 2015 by well-known health columnist Jane E. Brody, "Fears, Not Facts, Support G.M.O. Labeling," makes similar assertions regarding the health effects of Golden Rice: "Thus, Golden Rice, genetically enhanced to be rich in beta-carotene, the precursor of vitamin A, may help counter vitamin A deficiency, which can cause blindness, in rice-dependent populations." This claim, as well as another regarding the stringency of testing of GMOs by government agencies, was corrected on June 11th in the online version: "An earlier version of this article referred incorrectly to the effects eating Golden Rice, which is genetically enhanced to be rich in beta-carotene, can have. While the rice is being developed with the aim of providing a new source of

The discursive effect produced is that agricultural biotech companies can position themselves as doing therapeutic, humanitarian work that de-emphasizes the profit-generating elements of their enterprise. Biotech proponents level charges against Greenpeace as having committed "crimes against humanity" for their campaign against Golden Rice, and, in doing so, place the development of Golden Rice and other transgenic crops as significant technological contributions to humanity. This belief in the ability of biotechnology to improve the human experience may be genuine, and in the early years of plant biotechnology many scientists shared the hope that such developments could address some of the agricultural and dietary needs of the developing world.[44] Yet besides the promise of 'salvation' that Golden Rice holds for small-scale farmers in the future, virtually all GM crops currently cultivated are those developed for industrial farming and dominated by a few transnational agribusiness corporations. The crops that are planted in the developing world are by and large insect-resistant Bt cotton and maize and herbicide-tolerant soy, none of which are grown for direct human consumption.[45]

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vitamin A to people who depend on rice for much of their nutrition, it has not yet been shown to counter blindness in those populations." Jane A. Brody, "Fears, Not Facts, Support G.M.O. Labeling," *The New York Times,* June 8, 2015. The online corrected version, accessed July 3, 2015, http://well.blogs.nytimes.com/2015/06/08/fears-not-facts-support-gmo-free-food/?alg=&_r=1#3be9d5072ccb3327e6eab5a2182fdac&CAMPAIGN_CODE=4LXWL .

[44] Glover, "The corporate shaping of GM crops as a technology for the poor."

[45] See Christine M. Du Bois and Ivan Sergio Freire de Sousa, "Genetically engineered soy," in *The World of Soy*, ed. Christine M. DuBois, Chee-Beng Tan, and Sidney Mintz, (Urbana: University of Illinois Press, 2008), 74-96; Smale et al., "Measuring the economic impacts of transgenic crops in developing agriculture during the first decade: approaches, findings, and future directions," *IFPRI Food Policy Review No. 10* (Washington, DC: International Food Policy Research Institute (IFPRI), 2009). Bt refers to *Bacillus thuringiensis*, the introduction of a bacterium into the plant genome to confer an insect-resistance trait.

Biotechnology as 'FrankenFoods'

Whereas proponents of GM seed invoke the promise and potential of science to save poor Africans from hunger, opponents use hype of a different kind. Anti-GM activists label GM foods 'FrankenFoods' and compare the unwilling introduction of GMOs into the food system as like being a "human lab rat."[46] Activists that include Vandana Shiva attributed genetically modified seeds to farmers' suicides even before the seeds had been adopted in India. Hence the label "suicide seeds," though it is likely that these seeds may have exacerbated existing problems once they were adopted.[47] Anti-GM activists have perpetuated the idea of an infertile transgenic 'terminator gene,' although this technology has not been developed for commercial markets. [48] The film, *Genetic Roulette*, claims that the introduction of GMOs is "…the most dangerous thing facing human beings in our generation."[49] Activists used a recent groundbreaking study on the effects of Roundup-Ready Resistant maize feed on rats to claim that this was unequivocal proof that GM foods are hazardous to human health. Images of the laboratory rats with grotesque tumors went "viral" online and were used as a visual representation of the dangers of GMOs, despite the fact that the most robust findings were that of the negative health effects of the herbicide, rather than the genetic modifications of the plants themselves.[50]

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[46] Jason Burke, "India to rule on future of aubergine as country's first genetically modified food," *The Guardian*, February 8, 2010.
[47] Stone, "The Anthropology of GM Crops," 340.
[48] Commercial varieties of GM crops pose quite a different problem—biopollution from when fertile transgenic varieties of crops cross-pollinate with native varieties of the same crop. The mechanism that prevents the saving of GM seeds is through patents and "technology use agreements," contracts that forbid farmers who purchase their seeds to save them for future use.
[49] Film by Jeffrey M. Smith, *Genetic Roulette: The Gamble of Our Lives,* 2012, movie trailer accessed February 1, 2013, http://www.examiner.com/video/video-genetic-roulette-movie-trailer.
[50] This study has been discredited and subsequently retracted, although arguably to serve political purposes. See the next section for a discussion of the politicization of research. Séralini, et.al. "Long-

What is visible is that both sides of this debate use hype, but for different purposes. Industry encourages investment in technologies like new transgenic seeds through hype and projections that are, by their nature, uncertain. Advocacy organizations like Greenpeace that oppose genetically modified crops utilize hype that invokes dystopian futures to catalyze support and attract donations. Ironically, this suggests that activists begin to act according to the rules of the speculative marketplace—both sides need to dramatize danger in order to attract funds, capital, and resources to operate. Through the dynamics of this political economy of hype, life itself is placed at the center of these contestations and increasingly reframed in economic terms.

The Global Food Sovereignty Movement: Saving Endangered Livelihoods

Environmental organizations such as Greenpeace and Friends of the Earth have led successful campaigns to ban GMOs in countries like France, Poland, Kenya, and Bulgaria.[51] Visual hype in the form of images of dead bees,[52] GMO-fed rats with tumors[53], threatening stalks of corn, and gravestones, has been used to promote the idea of GM crops as hazardous to human and ecological health. Food and Water

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term toxicity of a Roundup herbicide and a Roundup-tolerant genetically modified maize," *Food and Chemical Toxicology* 50, no.11 (2012): 4221-31. For examples of how anti-GM activists used the report see "South Africans call for immediate ban on GM maize after shocking cancer study," African Centre for Biosafety, 2012, accessed July 3, 2015, http://www.acbio.org.za/index.php/media/64-media-releases/401--south-africans-call-for-immediate-ban-on-gm-maize-after-shocking-cancer-study.

[51] "Greenpeace Media Briefing: EU Parliament to Adopt New GM Crop National Opt-Out Law," Greenpeace, January 12, 2015, accessed July 3, 2015, http://www.greenpeace.org/eu-unit/Global/eu-unit/reports-briefings/2015/GMOs%20briefing%2012012015%20%20FINAL.pdf; AgroNews. "Kenya Banned Importation of All GMO Foods."

[52] Dead bees are a reference to the problem of colony collapse disorder, of which many anti-GM activists have suggested that genetically modified crops are responsible. There is little consensus on the cause of widespread bee deaths.

[53] This is a reference to the Seralini et.al. 2012 study ""Long-Term Toxicity of a Roundup Herbicide and a Roundup-Tolerant Genetically Modified Maize" that has since been retracted by the journal *Food and Chemical Toxicology*.

Watch, LabelGMOs.org, and the NON GMO Project have led campaigns to push for GMO labeling. A ban of GMOs may be a shared goal of food sovereignty and environmental movements, but food sovereignty activists draw greater attention to the political context that allow for dramatic shifts in modes of food production. The global food sovereignty movement addresses larger questions of agency and power through a strategy that seeks to affirm and assert the right to food sovereignty, that is, the right of people to control what and how food is produced and distributed. The leading food sovereignty organizational networks, La Via Campesina and Alliance for Food Sovereignty in Africa (AFSA), are heterogeneous, decentralized and with a large base of support in the Third World.[54]

Activists from the food sovereignty movement have more radical and expansive goals, viewing the GM seed as a symbol of a larger structure of existing global inequalities. In particular, criticisms emerging out of the food sovereignty movement highlight the disproportionate influence of transnational corporations (TNCs) in shaping free trade agreements, national agricultural research, and regulation in the developing world. Corporate influence is attributed to the importation of cheap subsidized imports, the sale of large tracts of land to private investors (referred to by activists as 'land grabs'), and legislative changes to seed laws, property rights, and biosafety. GM seed represents a form of domination, corporate control, which endangers livelihoods. Such a frame is politically powerful because genetically modified seed is both developed by large agribusiness

[54] "What is La Via Campesina?" La Via Campesina, accessed July 3, 2015, http://viacampesina.org/en/index.php/organisation-mainmenu-44/what-is-la-via-campesina-mainmenu-45; "What is AFSA?" Alliance for Food Sovereignty in Africa, accessed July 3, 2015, http://afsafrica.org/what-is-afsa/.

corporations that have dominated seed markets, and cultivated as industrial-scale monocroppings that may displace small farms and biodiversity.[55]

Food sovereignty activists in Ghana led a campaign against GMOs that has culminated in protests in Accra in January 2014 and May 2015, as well as a delay in the passage of a contested Plant Breeders' Bill. Although the Biosafety Act that allowed the introduction of genetically modified organisms and the cultivation of GM crops passed quietly in 2011,[56] a Plant Breeders' Bill that would strengthen the intellectual property rights of foreign plant breeders has been the focus of protest. Hundreds of petitions were received and thousands demonstrated in the streets of the capital city of Accra. Members of Parliament decided to postpone deliberations on the legislation after criticism circulated on the airwaves that the Bill would impoverish Ghanaian farmers and the decision-making process did not involve public participation or consultation. The mobilization was organized by the Coalition for Farmers Rights and Advocacy Against GMOs (COFAM), with a significant vocal presence by Food Sovereignty Ghana. Whereas placards used the kind of visual hype common to anti-GMO demonstrations—images of apples with teeth and tongues—they also played on framing the seed companies as being malevolent manipulators of nature. "No to Man-Satan!" and "AWAY Sin-Genta!" were among some of the popular signs. The rhetoric of the organizers emphasized values of democracy, independence, and equity, suggesting that the entry of GMOs and the passing of the Plant Breeders Bill would allow foreign interests to dominate the agricultural sector,

[55] The dominance of biotech seeds across the Americas is a powerful suggestion that the globalization of this new agricultural technology can lead to the homogenization of food production practices.
[56] Author interview with anti-GMO activist and organizer Bern Guri of CIKOD, Accra, February 14, 2014.

at the expense of smallholder farmers in Ghana. In the words of one organizer, if the Bill passed, "We are doomed if this bill is passed…we will be under colonialism if the bill is passed."[57]

This corporate control constitutes the emergency to which food sovereignty activists respond: the salvation of diverse livelihoods can only be achieved through the 'global struggle' to protect cultural and biological diversity. The salvation discourse deployed by the global food sovereignty movement stands in contrast to the depoliticized technological fix offered by biotech proponents. It also differs in terms of agency—within food sovereignty discourse the political empowerment of peasants is the route to salvation, whereas biotech proponents identify salvation with the seed as a product of a marriage of techno-science and agribusiness. It can be argued that perhaps the potential here for corporations to endanger the livelihoods of peasant farmers is not overstated, and therefore not an example of hype. India has experienced a significant wave of farmers who have committed suicide following the liberalization of agriculture and the commercial cultivation of GM crops.[58] Yet such a portrayal also ignores the choices that farmers *do* have—farmers are not forced to adopt GM seeds, nor are there any practical means by which farmers could be prevented from saving their own native seeds. In short, while corporations acting alongside neoliberal economic policy reform (supported by institutions like the WTO)

[57] MyJoyOnline, "Angry farmers hit the streets over GMO," *MyJoyOnline* (Ghana), January 28, 2014, accessed July 3, 2015, http://www.myjoyonline.com/news/2014/January-28th/angry-farmers-hit-the-streets-over-gmo.php.
[58] See Stone, "The Anthropology of GM Crops."

may be able to powerfully influence the agendas and policies of developing countries, this falls short of an exertion of total control over peasant livelihoods.[59]

III. Science Fights: Myth-making, Science, and Biotechnology Outreach

…the fear that surrounds GMOs all over the world including Ghana calls for a forum such as this with the aim of educating the relevant stakeholders and the public…not forgetting the heavily funded anti-GMO groups which are misleading the public with very little evidence and in ignorance.[60] –Director General of CSIR Ghana at a sensitizing seminar of the Bt cowpea project

…if you give the impression that a genetically modified sweet potato can work because it is the poor person's crop, there will be more willingness to accept GMOs. So it is not philanthropy. It's a form of investment, a corporatized agenda for resource extraction from Africa.[61] –Mariam Mayet, director of the African Centre for Biosafety

In the global debate over the role of transgenic crops, the field experiment itself has become a political object: GM field trials have become the target of destruction in global protests in countries like France, the Philippines, India, Australia, Germany, and Spain.[62] Signaling major distrust both in state regulation to protect human and environmental health and in the intentions of multinational agribusiness corporations, global vandalism of these field trials has been frequently performed as a rejection of a 'lab rat' status. In August 2013, 400 Filipino protestors destroyed field trials of Golden Rice near completion—a symbolic action that

[59] A major caveat here is in the case whereby land reform leads to the displacement of peasants off of their land. In such cases, this does amount to an exertion of total control.
[60] Director General of the Council for Scientific and Industrial Research (CSIR) Ghana keynote address at the one day "sensitization seminar of agricultural biotechnology and the Bt cowpea project," September 18, 2013, at the Savannah Agricultural Research Institute, Nyankpala, Ghana. Transcript provided by an agricultural research scientist at SARI.
[61] Pambazuka News, "AGRA, bio-piracy and food as social justice," *Pambazuka News,* October 4, 2008, accessed July 3, 2015, http://pambazuka.org/en/category/comment/47258.
[62] Germany actually abandoned field trials in 2013 owing to persistent vandalism. "Restrictions on Genetically Modified Organisms: Germany," The Library of Congress, accessed July 3, 2015, http://www.loc.gov/law/help/restrictions-on-gmos/germany.php.

proponents viewed as tragic because of the potential of the vitamin A-enriched rice to combat blindness.[63] Protestors, on the other hand, perceived the transgenic crop plantings as an unnecessary experiment with ominous consequences. Mark Lynas, a former Greenpeace activist who had publicly apologized for his past leadership of anti-GMO campaigns in Europe, asserted in his report "The True Story About Who Destroyed a Genetically Modified Rice Crop," that such individuals were from the city and *not* farmers. He condemned the destruction of this vital research and questioned the legitimacy of the action.[64] *New York Times* reporter Amy Harmon countered that the Philippine government and Golden Rice developers—whom Mark Lynas had relied upon in his report—had incentives to discredit these protestors.[65]

These divergent accounts of responsibility for the vandalism of the Golden Rice field trial are reflective of the kind of competing claims to legitimacy found throughout the debate over GMOs. Biotech proponents such as Mark Lynas frequently frame social movements in opposition to GM crops as 'anti-science.' In order to be taken seriously within these heightened global debates over food security, many anti-GM activists engage in "science fights," utilizing scientific knowledge to undergird their critique of GMOs. They employ scientific arguments that critique the

[63] McGrath, "'Golden rice' GM trial vandalized in the Philippines."
[64] The legitimacy of the action seems to hinge in part on whether or not these were city kids, rather than farmers. Mark Lynas, "The True Story About Who Destroyed a Genetically Modified Rice Crop," *Slate,* August 26, 2013, accessed July 3, 2015, http://www.slate.com/blogs/future_tense/2013/08/26/golden_rice_attack_in_philippines_anti_gmo_activists_lie_about_protest_and.html.
[65] *New York Times* reporter Amy Harmon also covered the Golden Rice vandalism story and cited an interview with a farmer leader who organized the protest by a local paper. In response to Mark Lynas' allegations that those protestors were not farmers on Twitter, she stated that the Philippine government and Golden Rice developers have an incentive to discredit protestors. Amy Harmon, "Golden Rice: Lifesaver?" *The New York Times*, August 24, 2013.

reductionist nature of the science used to develop it[66] as well as claims of farmers' deepening indebtedness as a result of reliance on costly seeds and inputs.[67] The prompt dissemination of scientific research via transnational advocacy networks that demonstrates the harmful effects of transgenic crops has had policy ramifications and sparked greater industry scrutiny. It has led to, for example, France's regulatory decision to ban a variety of Monsanto's Bt maize, as well as to the US EPA's decision to require seed companies to submit data to the EPA about the toxicity of Bt maize pollen in butterflies or else lose the right to sell the product in the US.[68]

Incidences like these can be used to explain an emerging pattern of rapid, aggressive critique of papers unfavorable to biotech crops within the scientific community. As Emily Waltz reports in *Nature*,

> Those who develop [GM] crops face the wrath of anti-biotech activists who vandalize field trials and send hate mail. But those who…suggest that biotech crops might have harmful environmental effects are learning to expect attacks of a different kind. These strikes are launched from within the scientific community and can sometimes be emotional and personal; heated rhetoric that

[66] Shiva, *Tomorrow's Biodiversity*.
[67] Stone, "The Anthropology of GM Crops."
[68] A paper by Rosi-Marshall et.al. published in 2007 in the *Proceedings of the National Academy of Sciences* was cited as evidence in France's regulatory decision to ban MON810, a variety of Monsanto's Bt maize. See Rosi-Marshall et.al. "Toxins in Transgenic Crop Byproducts May Affect Headwater Stream Ecosystems," *Proceedings of the National Academy of Sciences* 104, no.41 (2007): 16204-08. In another example, a study conducted by John Losey and his colleagues on the effects of Bt maize pollen on monarch butterflies found that nearly half of the butterflies fed on the Bt maize pollen died within four days. The media and activists groups seized on this information: the *San Francisco Chronicle* headlined "Gene Spliced Corn Imperils Butterflies"; Greenpeace activists, dressed as monarch butterflies, protested the 'killer' GM maize in front of the US capitol. The US EPA responded by telling seed companies to submit data about the toxicity of Bt maize pollen in butterflies or lose the right to sell the product. Following the EPA's action, scientists used industry and government funding to produce reports on the toxicity of Bt maize pollen. The six papers produced in 2001 in the *Proceedings of the National Academy of Sciences* (PNAS) on the topic concluded that the most widely cultivated types of Bt maize pollen are not toxic to monarch larvae at concentrations the insects would encounter in the fields. (Losey's experimental design had used higher concentrations). The chain of events that unfolded in response to Losey's preliminary research unsettled scientists who recognized the power a single scientific paper could have in the hands of anti-GMO activists. See Emily Waltz, "Battlefield," *Nature* 461, No. 3 (2009): 27-32.

dismisses papers and can even…accuse scientists of misconduct.[69]

When a problematic paper comes out, pro-biotech scientists react quickly, criticize the work in public forums, write rebuttal letters, and send them to journal editors, policymakers, and funding agencies. Waltz does not find that the scientists' financial or professional ties to the biotech industry are the source of motivation for this forceful response.[70] Rather, she states that many of them do feel that GM crops are safe and have great potential to deliver important societal benefits. Waltz mentions that many of the scientists that have been active in responding to these problematic studies have been researching transgenic crops since the late 1980s and some have been closely involved with the regulatory approval of the first GM crops. However, in the midst of these scientific controversies, industry and industry-supported scientists have become vocal participants in discussions scrutinizing scientific studies critical of GM crops.[71]

This is not the only way that scientists have experienced difficulty conducting research on GM crops. The ability of agribusiness corporations to patent seed, as well

[69] Waltz, "Battlefield," 27.
[70] Waltz, "Battlefield," 30.
[71] Emma Rosi-Marshall, a stream ecologist, and her colleagues conducted a study at the University of Notre Dame on the effects of Bt maize on caddis flies. They found that the flies fed only Bt maize detritus grew at half the rate of flies fed conventional non-Bt maize detritus. Those flies fed high concentrations of Bt maize pollen had fatality rates twice that of the caddis flies fed non-Bt pollen. While they were criticized for their experimental design (including not conducting a dose-response and not choosing the correct maize as a control), the biggest point of contention of their critics was the conclusion that the transgenic crops has unexpected ecosystem-scale effects. Following Rosi-Marshall et.al.'s publication in *PNAS*, Monsanto sent the EPA a six-page critical response to the publication and posted the letter online. On the "Viewpoints" section of Monsanto's website, Monsanto has attacked recent publications that claim that GM foods are unsafe. Rosi-Marshall, who received harsh criticism of her study on the effects of Bt maize on caddis flies, stated in an interview that attacks such as those made against her study appear to be orchestrated. Accounts of researchers like Bruce Tabashnik reveal the plausibility of this claim. Tabashnik was warned by an etymologist, William Moar (who later took a position at Monsanto), that his yet-to-be-published paper—showing evidence of insect resistance to Bt cotton—would have "'devastating'" consequences and was warned not to publish it. Tabashnik published the paper, which was subsequently criticized by Moar at conferences and within the journal in which it was published. See Waltz, "Battlefield," 27-30.

as the desire of companies to protect intellectual property in a competitive marketplace, has created significant barriers for academic research on GM crops. Technology use agreements, company-required contracts that establish the permitted use of patented seed, forbid saving seed as well as conducting research on it. Scientists have complained that research on GM seed was ultimately up to company approval, as they would have to seek approval to both access the seed for research (negotiated on an onerous case-by-case basis) and to publish the findings.[72] As of 2009, Monsanto began issuing Academic Research Licenses that supersede the restrictions on research specified through Technology Use Agreements. This allows research on certain aspects of commercialized genetically engineered products, such as agronomic and yield comparisons, oil seed content, interactions of introduced traits with the environment, the effects of GM feed, and research on pest management and resistance. What is excluded from these agreements is research on breeding with plants produced from the transgenic seed, development of commercial and non-commercial methods for detecting the presence or absence of patent-protected traits in seed, research on modifications or improvements to the patent-protected traits, and research on new products prior to their commercialization.[73] So whereas this signals a step towards greater transparency and the potential for improved research on certain aspects of GM crops, academic researchers will continue to struggle to understand the extent of cross-pollination of GM seeds with other crop varieties, the vigor of plants

[72] Bruce Stutz, "Companies put restrictions on research into GM crops," *Yale Environment 360*, May 13, 2010, accessed July 3, 2015, http://e360.yale.edu/feature/companies_put_restrictions_on_research_into_gm_crops/2273/.
[73] "Academic Research Agreements," Monsanto Corporation, accessed July 3, 2015, http://www.monsanto.com/newsviews/pages/public-research-agreements.aspx.

produced with GM seed, and the potential for non-target genetic alterations resulting from plant biotechnology.

The dynamics of these "science fights" reveal processes of exclusion at work at two levels: first, the need to use science in order for the critique to be considered legitimate, thereby creating barriers to entry on the basis of knowledge; and second, as a byproduct of patent protections that makes the free study, assessment, and regulation of GMOs difficult. Herring (2008) highlights these processes in his analysis of the precautionary approach of the Cartagena Protocol on Biosafety that guides many countries' approach to biosafety:

> Cartagena logic created niches for salaried employees and consultants in global regulation, education, and testing activities. These are material consequences of framing; beneficiaries are sharply differentiated by class and cultural capital from average citizens.[74]

These dynamics of exclusion create realms of inclusion for the proliferation of experts: expertise is not only needed to develop the products (agricultural research scientists and plant biotechnologists), determine their nutritional benefits (nutritionists), monitor their safety (biosafety experts), create the legal regimes to protect the intellectual property (legislators and administrators), set up programs to maximize economic benefits (development planners and economists), and demonstrate their effectiveness (expert farmers in demonstration fields), *but also* to create a guild of professional advocates that can use science speak in order to resist it.

[74] Herring, "Framing the GMO," 85.

Countering the 'Myths': Information and Persuasion in the GM Debate

Activists on both sides of the GM debate use formalized rebuttals in the form of fact sheets, letters published in public online forums, and other publications to undermine the legitimacy of opponents' claims. Activist organizations such as Greenpeace, Friends of the Earth and the African Centre for Biodiversity produce fact sheets and videos that aim to counter GM 'myths.' Food Sovereignty Ghana, in drawing attention to the Plant Breeders Bill as an entry-point for the increased presence of GMOs in Ghana, organized a 'capacity-building' workshop to explain how this impending legislation may negatively affect "the interests of millions of smallholder farmers in Ghana."[75] The African Centre for Biodiversity, a South African-based advocacy NGO, circulates documents and presentations that critique the science of genetic engineering using Powerpoint presentations with detailed technical information about the processes of genetic modification. This is done so in order to attempt to block the approval of new transgenic varieties. The Pan-African organization African Biodiversity Network supports advocacy workshops of local organizations that provide the public with extensive information not only about the socio-ethical issues, but criticize the imprecision of genetic modification on scientific grounds. Studies of the impact of GM crops and feed on rats, butterflies, and other insects have also been used for anti-GM and labeling advocacy. Scientists believed to be pro-biotech have been identified as 'myth makers' online as activists challenge the reputation and legitimacy of work of these scientists.[76]

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[75] "Communiqué: FSG Workshop on GMOs, Seed Laws, and Biosafety," Food Sovereignty Ghana, accessed July 3, 2015, http://foodsovereigntyghana.org/page/6/.

[76] The use of the term "myth" to disparage the work of the opposition is used by both proponents and opponents. GM Watch lists "myth makers"—those individual scientists and consultants as well as

A common narrative of biotech proponents in Ghana was that the "anti" groups—often referencing groups such as Greenpeace or Friends of the Earth—had been very influential in promoting myths and fear about GMOs. This had made drafting a biosafety bill a drawn-out process. There was a need to counter the "spread of the gospel of anti," and one mechanism to do so was through biotechnology outreach.[77] One of the most prominent entities on the African continent that conducts biotechnology outreach, the Open Forum on Agricultural Biotechnology in Africa (OFAB), is intended to facilitate the "the flow of information from the scientific community to policy makers and the general public."[78] Biotechnology outreach campaigns such as OFAB have identified GM crop 'awareness creation' for farmers and the public at large as critical to the widespread adoption of this technology and

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organizations—that promote the "myth" that GM foods are safe and desirable. In contrast, Monsanto also has a dedicated page on its website "Myths about Monsanto" where it addresses and "corrects" these "myths." One scientist that has been a target in recent anti-GMO protests in Ghana has been Dr. Walter Alhassan of the Forum for Agricultural Research in Africa (FARA) who has been challenged by Food Sovereignty Ghana on their Facebook page. His image and name has been circulated along with the caption "THIS MAN is not a Scientist, is a consultant of US GMO industries." See https://www.facebook.com/FoodSovereigntyGhana?fref=ts. Original emphasis.

[77] Author interview with agricultural research scientist at the Savannah Agricultural Research Institute, Nyankpala, February 13, 2013. Another agricultural research scientist at SARI made a very similar comment: "The idea is that we want the media to understand what are the *facts* [stress on this word] because we know, we recognize the fact that the 'anti-groups' are out there and most of them have contact with those groups." Author interview with agricultural research scientist Dr. I.D.K. Atokple at SARI, Nyankpala, February 13, 2013.

[78] The purpose of the OFAB is described as the following: "Most African countries have been reluctant to adopt biotechnology-derived products as policy makers are confronted with contradictory sources of information. *Scientific facts are often mixed with social, ethical and political considerations.* In the face of a rapidly growing population, declining agricultural productivity and reduced resources available for agricultural research, policy makers are pressed to make the right decisions and are looking for guidance…AATF helped to establish a platform that aims at facilitating the flow of information from the scientific community to policy makers and the general public. The platform, known as the Open Forum on Agricultural Biotechnology in Africa (OFAB), was launched in Nairobi in September 2006. It brings together stakeholders in agriculture and enables interactions between scientists, journalists, the civil society, industrialists, lawmakers and policy makers." The OFAB is managed by scientists and policymakers from Kenya's Ministry of Agriculture, KARI, CIMMYT, ICRISAT, Kenyatta University, and the AATF and is chaired by the ISAAA. See "Open Forum on Agricultural Biotechnology in Africa (OFAB)," African Agricultural Technology Foundation, accessed July 5, 2015, http://www.aatf-africa.org/projects-programmes/programmes/open-forum-agricultural-biotechnology-africa-ofab. My emphasis.

have sought to correct the 'myths' about GMOs. Biotechnology outreach entails the advocacy regarding the benefits of biotechnology among African legislators, media, academics, farmers, traditional leaders, and even high school students.[79] There is recognition that in order for GM crops to be widely cultivated, farmers and the public at large have to be willing to participate in the cultivation and purchase of such crops.

The keynote address of the Director General of the Council for Scientific and Industrial Research (CSIR) Ghana at the "sensitization seminar" for Bt cowpea and agricultural biotechnology iterates the key role of biotechnology outreach as a necessary response to the purported misinformation of powerful oppositional groups.[80] "Sensitization seminar" is a term used by actors within institutions that include Ghanaian bureaucracies and the World Bank to describe seminars designed to make local communities "sensitive" to upcoming changes that may impact them. Sensitization seminars have been developed around such issues as land registration and sale, gender, and transgenic seeds. These seminars are led by experts in plant biotechnology and biosafety and are designed for a public audience with the purpose of both informing local communities about an issue and creating a space for the public to ask questions.

The Bt cowpea sensitization seminar in Ghana is an example of both biotechnology outreach and the discursive positioning of GM crops as a 'pro-poor' technology.[81] Confined field trials of the transgenic crop Bt cowpea, a staple food in West Africa, commenced in September 2013. As a requirement under the Biosafety Act 831, 2011, communities and relevant stakeholders adjacent to the project have been

[79] Author interview with Dr. I.D.K. Atokple at SARI, Nyankpala, February 13, 2013; phone interview with Dr. Walter Alhassan of Forum for Agricultural Research in Africa, March 6, 2013.
[80] Herring, "Framing the GMO."
[81] Glover, "The corporate shaping of GM crops as a technology for the poor."

invited to attend an informational seminar on the Bt cowpea that rationalizes why this new technology is necessary and beneficial for the local farming community. The Savannah Agricultural Research Institute (SARI), where some of the confined field trials have commenced, hosted this seminar that involved over 200 participants, including the regional director of the Ministry of Food and Agriculture, the district assembly, the local chief, farmers, scientists, a representative of the National Biosafety Committee, and a representative of the African Agricultural Technology Foundation (AATF).[82] The AATF has been successful at negotiating with seed corporations like Monsanto to get proprietary release of patented genetic material for African countries. In Chapter Three I examine the AATF's effort to acquire Monsanto's Bt gene for the development of transgenic cowpea.[83]

In addition to awareness creation and advocacy, these biotechnology outreach programs[84] also train scientists and bureaucrats in biotechnology stewardship. The language of 'biotechnology stewardship' is a favorite of industry, implying that problematic outcomes of the technology are due to a lack of care, rather than inherent problems of the technology itself. Biotechnology outreach programs and biosafety advising by experts has served to promote the adoption of GM crops in the developing world, as has the shared experiences of farmers at international and domestic field visits. Industry has shown enthusiasm for donating transgenes to

[82] Phone interview with agricultural research scientist of the Savannah Agricultural Research Institute, September 30, 2013.
[83] Author interview with an agricultural research scientist at SARI, Nyankpala, February 13, 2013.
[84] Other biotechnology outreach programs include the Program for Biosafety Systems, funded by USAID and managed by the International Food Policy Research Institute (IFPRI). In the realm of biotech cotton, the U.S. has played a role in the diffusion of this technology through the West African Cotton Improvement Program. The Syngenta-supported SABIMA (Strengthening Capacity for Safe Biotechnology Management in sub-Saharan Africa) project, launched by the Forum for Agricultural Research in Africa (FARA) under its African Biotechnology Biosafety Policy Platform (ABBPP), is designed to strengthen capacity in biotechnology and biosafety in Africa.

facilitate the development of 'pro-poor' technology in the developing world, given commitments to 'product stewardship.'[85] Biotechnology outreach not only mitigates fears through 'awareness creation' of the benefits of GM seeds, but it also improves the reputation of maligned companies like Monsanto. Ultimately, the greater exposure to these new technologies and improved public relations efforts enables multinational agribusiness companies to expand their market reach in the developing world.

IV. Law and the GMO debate

Besides hype and science, the law has also been used as an instrument to both advance and resist GMOs. Well-funded and networked biotech proponents have helped to shape the legislation that currently governs the entry of GMOs into Ghana. On June 21, 2011, after a seven-year-long deliberation the Ghanaian Parliament unanimously passed Ghana's Biosafety Bill. In December 2011, President Atta Mills passed the bill into law. This unanimous decision to pass the bill was in part the result of the work of a coalition of organizations involved in biotechnology outreach led by the USAID-funded Program for Biosafety Systems (PBS). Outreach educational events to "create awareness" about the status of biotech crops and the need to have a biosafety bill contributed to parliamentarians' shift of opinion in favor of passage of the legislation.[86] The PBS program in Ghana had established a Country Advisory Group in 2005, distributed information on biotechnology and biosafety issues to

[85] My research indicate that the industry, specifically Pioneer, Syngenta and Monsanto, has been "very willing to license technology" though it is concerned with "product stewardship," as they "don't want to see the technology stop working" and "mismanaged." Quotes from author interview with biotechnology advisor at USAID, Washington, D.C., May 4, 2012.

[86] Author interview with Dr. I.D.K. Atokple at SARI, Nyankpala, February 13, 2013; phone interview with Dr. Walter Alhassan of Forum for Agricultural Research in Africa, March 6, 2013; author interview with biotechnology advisor at USAID, Washington, D.C., May 4, 2012.

policymakers, and helped draft[87] a national biotechnology and biosafety policy (not unlike the recently passed Ghana Biosafety Bill). The IFPRI-managed and USAID-funded PBS programs have a global reach—they operate not only in Ghana, but also in Indonesia, the Philippines, India, Kenya, Uganda, Tanzania, Nigeria, Mali, South Africa and Malawi.[88] These programs involve a collection of international, national and local participants and seek to create conditions for the implementation of plant biotechnology by reaching out to policymakers at the national and supranational level, as well as through targeted efforts to shape public perceptions of GM crops at the local level. These biotech outreach efforts have had success not only in Ghana: a growing number of African countries have passed biosafety legislation (the first step towards the commercial cultivation of GM crops), and Ghana, Uganda, Kenya, Mozambique, Tanzania, and Nigeria have already begun field trials.[89]

Ghana's Biosafety Act reflects the influence of both the lobbying of the PBS as well as the dominant approach to precaution enshrined in the Cartagena Protocol on Biosafety, to which Ghana is a party.[90] Ghana's Biosafety Act has not adopted the holistic approach to risk assessment initially advocated by the African Group that calls for a consideration of the socio-economic impacts of genetically modified crops.[91] Ghana's Biosafety Act 831, 2011 specifies two objectives of the Act:

> (a) to ensure an adequate level of protection in the field of safe development transfer, handling and use of genetically modified organisms resulting from biotechnology that may have an adverse effect on health and the environment,

[87] The PBS program was active with biosafety legislation and early drafting up until 2008-9. Author interview with biotechnology advisor at USAID, Washington, D.C., May 4, 2012.
[88] "Program for Biosafety Systems (PBS)- Partners," International Food Policy Research Institute, accessed August 21, 2011, http://programs.ifpri.org/pbs/pbspart.asp.
[89] Author interviews at the Savannah Agricultural Research Institute, 2/13/13 and 2/22/13. Olivia Kumwenda, "GM on the rise in Africa," *Reuters*, March 31, 2011.
[90] "Cartagena Protocol on Biosafety," https://bch.cbd.int/protocol.
[91] Andrée, "Cartagena Protocol," 37.

> and (b) to establish a transparent and predictable process to review and make decisions on genetically modified organisms specified in paragraph (a) and related activities.[92]

After specifying the establishment, constitution, conduct and powers of the National Biosafety Authority (Articles 3-10), the Biosafety Act discusses the handling of request for approval including the application for export, import, transit, and introduction of GMOs into the environment, (Articles 11- 15). Article 16 allows for certain information provided to the National Biosafety Authority (NBA) by the applicant to be designated as confidential, following approval by the NBA. Article 18 identifies the Gazette as the publication that will provide public notice regarding an application for release of a GMO into the environment.

It is not until Article 19 of the Biosafety Act that risk assessment and risk management are mentioned. Risk assessment takes place following the screening and successful completion of the application and "shall be carried out taking into account available information concerning a potential exposure to the genetically modified organism."[93] Although Article 19.3 states that the Board may request additional risk assessment, it does not state if or how the socio-economic risks of the technology will be considered. This is an important oversight as many of the concerns raised by food sovereignty organizations like Food Sovereignty Ghana concern the possibility of severe indebtedness, and even subsequent suicides, by farmers whose costs of production for GM crops well exceed their profits.

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[92] Ghana Biosafety Act 831, 2011, Article 2.

[93] Full text on risk assessment and risk management in Biosafety Act 831, 2011 Article 19: "19. (1) Where an application is screened and found to be complete, the Board shall act in accordance with the advice of the technical advisory committee is respect of the risk assessment conducted as set out in the Fourth Schedule (2) Risk assessment shall be carried out taking into account available information concerning a potential exposure to the genetically modified organism."

The establishment of a National Biosafety Authority necessitates the creation of expert positions to monitor the applications for genetically modified crops. The development of expertise to monitor biosafety entails the training not only by the Program for Biosafety Systems, but also support for bureaucrats to study the biosafety regulatory systems of countries such as the U.S., Italy, and Australia.[94] The potential adverse effects on health and the environment posed by genetically modified organisms are the focus of biosafety. The question of the socio-economic effects of genetically modified crops in Ghana is seen as residing outside the parameter of biosafety.[95] This narrowing of scope is a manifestation of what Escobar (2008) terms "genecentrism," a concept I discuss in Chapter Three.

More than three years after the passage of the Biosafety Act, activists from Food Sovereignty Ghana sued the Ghana National Biosafety Committee and the Ministry of Food and Agriculture in order to ban the commercial introduction of genetically modified organisms (GMOs). On February 8, 2015 Food Sovereignty Ghana filed a writ of summons against the National Biosafety Committee (NBC) and the Ministry of Food and Agriculture (MoFA) with an application for an interim

[94] This is Eric Okoree's, acting CEO of the National Biosafety Authority, account of how he developed the expertise to monitor biosafety applications. Author interview with the acting CEO of the National Biosafety Authority, Accra, May 20, 2015.

[95] When interviewing Eric Okoree, the acting CEO of the National Biosafety Authority, about the socio-economic effects of GMOs he said that this would be considered if the application was completed. He stated that he is "not a socio-economic analyst" and suggested that raising such issues was the responsibility of civil society organizations. Author interview with the acting CEO of the National Biosafety Authority, Accra, May 20, 2015. This is additionally seen in the way the OFAB describes its work—to distill scientific fact from the impurities of social and ethical considerations: "Most African countries have been reluctant to adopt biotechnology-derived products as policy makers are confronted with contradictory sources of information. *Scientific facts are often mixed with social, ethical and political considerations.* In the face of a rapidly growing population, declining agricultural productivity and reduced resources available for agricultural research, policy makers are pressed to make the right decisions and are looking for guidance…" "OFAB," http://www.aatf-africa.org/projects-programmes/programmes/open-forum-agricultural-biotechnology-africa-ofab. My emphasis.

injunction to stop the release and commercialization of genetically modified cowpeas and rice on the grounds that the provisions of the Biosafety Act 831 have not been followed. They cite 13.1 of the Biosafety Act 2011, 831 "A person shall not, without the prior written approval of the Authority, import or place on the market a genetically modified organism." However, the confined field trials are scientific trials and are many years, and stages of approval, from commercial release. Food Sovereignty Ghana pointed out that the National Biosafety Authority had not yet been created. On February 17th, the same day when the National Biosafety Authority was inaugurated, the court case began.[96]

The catalyst for this court case appears to be the contentious Plant Breeders' Bill, which was recently tabled by Parliament to allow more time for consideration.[97] The ongoing court case has succeeded in attracting the attention of Ghanaians to the issue of GMOs, of which three years ago most Ghanaians had limited knowledge.[98] The Ghana National Association of Farmers and Fishermen joined the case in defense of the introduction of GM crops, whereas the Convention People's Party (CPP) joined on the side of Food Sovereignty Ghana. The Program for Biosafety Systems and the African Agricultural Technology Foundation have attended the hearings in support of

[96] From my interview with PBS, the NBA gets inaugurated the same day as the court case, which for some reasons provided in the interview is "sheer coincidence" because the court case was originally scheduled for an earlier date. Author interview with the Country Coordinator for the Program for Biosafety Systems, Accra, May 5, 2015.
[97] This can be implied through reviewing Food Sovereignty Ghana's web presence. I am still waiting to hear more from Food Sovereignty Ghana on why they chose to file the court case when they did.
[98] Based off of my fieldwork observations during the first two research trips in January 2012 and from July 2012-March 2013, most Ghanaians, particularly in Northern Ghana, I spoke to were unfamiliar with GMOs. Familiarity with the debate was generally limited to academics, activists involved in environmental issues, Ghanaians with extensive connections abroad, and ex-pats.

the defendants, whereas members of local and international environmental organizations[99] have attended in support of Food Sovereignty Ghana.

Food Sovereignty Ghana's choice of strategy to ban the commercialization of GMOs raises the unanticipated prospect of legitimating, rather than undermining, this regime of biosafety. That is, by calling upon specific provisions of the Biosafety Act 831 they imply that it is a matter of the implementation of the law, rather than the law itself, that poses the problem. Although activists within COFAM have framed the Plant Breeders' Bill as the "GMO bill," it is rather the Biosafety Act that allowed GMOs to enter Ghana. The consequences of this legitimation of the Biosafety Act are that many of the socio-economic risks that food sovereignty activists are so concerned with are slighted in this regime of biosafety. In this case, the use of juridical expertise, which I define as expertise of or relating to juridical proceedings and the administration of the law, may undermine some of the key objectives of the food sovereignty movement.[100]

V. Conclusion

I argue that despite the polarized nature of the debate, both proponents and opponents of GM crops rely on a combination of hype, science, and law in order to advance their positions. Both lay claims that either utilizing or banning GM seeds will contribute to environmental sustainability and improve livelihoods. These advocacy

[99] Author interview with the Country Coordinator for the Program for Biosafety Systems, Accra, May 5, 2015.
I am waiting to hear from Food Sovereignty Ghana to get more details on who attended in support of their case.

[100] David Harvey argues that such a turn toward the courts to address rights violations: "…accepts the neoliberal preference for appeal to judicial and executive rather than parliamentary powers." David Harvey, *A Brief History of Neoliberalism* (New York: Oxford University Press, 2005), 176.

efforts to persuade publics of the detriments or benefits of GM seeds could not be continued without steady sources of funding. How then is this funding secured over the long term? One way to attract support is to frame the issue as one that has significant and long-standing implications, a "matter of life and death." Whereas anti-GM movements frame transgenic seeds as threatening the livelihoods of farmers and the fundamental building blocks of life through 'biopollution,'[101] biotech proponents see tragedy in the resistance to technologies that could fight hunger and save children from blindness. Supporters of advocacy efforts on both sides of this debate can feel that their financial support—whether in the form of donations to anti-GM organizations or investment in biotech companies producing drought-resistant seed—is critical in order to 'save' vulnerable populations. The use of scientific research to substantiate certain claims or debunk 'myths' is exercised to bolster the legitimacy of certain prescriptions or prohibitions disseminated by these advocacy groups. Yet these prescriptions and prohibitions intended to improve the lives of target populations are closely tied to donor funding priorities and fiscal cycles, and can often be at odds with the needs of those whose lives they intend to improve.

The benefit that proponents and opponents gain from the construction of emergency incentivizes the use of hype. This, in turn, produces important effects on the character and quality of discussions on global food security. The discursive strategy of hype has affected debates over the future of food production in two primary ways. First, the rendering of GM seed technology as a special technology with a unique set of risks has created a demand for a particular set of experts to

[101] Biopollution refers to gene flow of transgenic species of plants to native varieties of plants through cross-pollination. This is often framed as a form of contamination and a serious threat to biodiversity.

manage these risks, a theme I further develop in the following chapters. The consequent shift in authority to the domain of experts is likely counter to the objectives of food sovereignty and anti-GMO movements that aspire for greater democratic control over decisions related to food. In a similar vein, the use of biosafety law to halt the commercialization of GMOs further legitimates this biosafety regime, and can lead to outcomes at odds with the aims of food sovereignty. Second, under conditions of emergency, simplistic, total solutions that follow a prescribed formula may be preferred over incremental, experimental, and procedural responses. In this sense, bans of GM seeds achieved through court injunctions can be an outcome of this emergency framing, and this may be a desirable end for some anti-GMO opponents. Yet for those opponents who view GM seed as a larger symbol for deeply rooted problems of inequality, power, and injustice, the emergency framing, through its consequent shifts in authority and its narrowing of focus, may hinder efforts to address these social problems. In this way, the emergency discourse and its corresponding relief plans may do violence to contingency and small steps, and render the actions of individual farmers and communities insufficient in the face of such urgency.[102]

[102] To critique the emergency framing that is deployed by GM proponents and opponents alike is not to understate the *severity* of the challenge of producing sufficient, healthy, and sustainable food now and in the future. Rather, I would argue that the problems that farmers face in this warming world are critical—drought-related water shortages or excessive flooding can certainly damage entire plots—but that the appropriate means to address these challenges cannot be found through viewing problems through this emergency lens. An alternative to hype would be to focus more attention on individual farmers' stories and grapple with the root of farmer indebtedness (which is not as simple as purchasing expensive seed).

CHAPTER THREE:
What is New About the 'New Green Revolution'? Philanthrocapital, Biocapital, and Public-Private Partnerships

I. Introduction

The negative effects of climate change and anticipated population growth have prompted calls within development circles for African countries to embrace a "new Green Revolution" in order to promote food security. This new Green Revolution is advanced by an international assemblage of actors that includes governments, agribusiness, international aid agencies, foundations, and international and national agricultural research centers. The work advocated and executed by this assemblage is intended to address perceived flaws in African farming systems and promote high agricultural productivity. A part of these initiatives to modernize African agriculture, discussed in the previous chapter, includes the adoption of genetically modified (GM) seeds. Scholars such as Scoones and Thompson (2011) identify access to markets, credit, and technology as a central feature of this African Green Revolution. [1] The idea of the "new Green Revolution" is to bring to Africa the high crop yields that countries in Asia and Latin America experienced in the mid-20th century through the introduction of scientific seeds, agrochemicals, irrigation, and linkage to markets. The work of international organizations and agribusiness to establish and strengthen "farmers' linkages to markets" as well as other links along

[1] Ian Scoones and John Thompson, "The Politics of Seed in Africa's Green Revolution: Alternative Narratives and Competing Pathways," *IDS Bulletin* 42, no.4 (2011): 1-23.

"value chains" reflects this key aspect.[2] This new face of agricultural transformation is also expected to address some of the uneven social effects of the first Green Revolution through the provision of better access to credit, the empowerment of female farmers and producers, the use of integrated soil management strategies, and the scientific research to develop locally appropriate crops for Africa.[3]

How new is this Green Revolution in Africa? On the one hand, the agricultural transformation that is being promoted in countries such as Ghana can be seen as a repackaging of modernization discourse that emerged in the 1950s. The prescriptions share a number of continuities with the agricultural changes initiated after the 1966 coup that ousted Nkrumah, as well as neoliberal structural adjustment policies initiated in the 1980s.[4] These blueprints of agricultural change, presented often as a "new Green Revolution in Africa," follow certain formulas that have been attempted before and others that appear more novel. Demonstration farms and the promotion of the 'progressive farmer' with an emphasis on the integration of small farmers into the market economy has been a feature of agricultural modernization

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[2] I discuss these linkages of farmers to global markets in the following chapter. These terms came up repeatedly in conversations with my contacts.

[3] See, for example, the work of the Alliance for a Green Revolution in Africa, a leading organization in the promotion of new Green Revolution programs. "AGRA: Growing Africa's Agriculture," Alliance for a Green Revolution in Africa, accessed July 3, 2015, http://agra-alliance.org/. Criticisms of the first Green Revolution began to emerge in the 1970s, but have re-emerged with greater force in response to the new Green Revolution agenda. On first Green Revolution criticisms see Edmund K. Oasa, "The Political Economy of International Agricultural Research: A Review of the CGIAR's Response to Criticisms of the 'Green Revolution,'" in *The Green Revolution Revisited: Critique and Alternatives*, ed. Bernhard Glaeser (London: Unwin Hyman, 1987), 13-55.

[4] Amanor (2013) writes that the 1966 coup that ousted President Kwame Nkrumah "brought pro-Commonwealth and pro-US interests to the fore in Ghana. The agricultural sector was re-organised to support the development of private capitalist estate agriculture and the creation of a new extension service in tune with the US model based on the Land Grant system." Kojo Sebastian Amanor, "Chinese and Brazilian Cooperation with African Agriculture: The Case of Ghana," *Future Agricultures Working Paper* 052, 2013, accessed July 3, 2015, http://www.future-agricultures.org/publications/search-publications/political-economy-conference-2013/conference-papers-political-economy-2013/brazilian-and-chinese-engagement/1667-chinese-and-brazilian-cooperation-with-african-agriculture-the-case-of-ghana-1?highlight=WyJhbWFub3IiXQ==, 15.

programs since the 1960s.[5] Though some of the language has changed, the promotion of entrepreneurship and market integration is an integral part of both Green Revolution programs. New (albeit different) agricultural technologies have been introduced, and actors like the CGIAR, CIMMYT, ICRISAT, the Rockefeller Foundation and the national agricultural research institutions (NARIs) have been involved in their dissemination.[6] In both Green Revolutions, agricultural transformation is conceived as a means to address poverty, development, and security concerns.

On the other hand, the particular configuration of partnerships between the public and private sector, alongside a growing role of "philanthrocapitalist" funding and demand for juridical expertise, has led to a deepening engagement of the corporate private sector within African domestic policy development. In the new Green Revolution we see a shift towards an expanded role of the private sector in plant breeding as public spending on plant breeding has declined. Legal regimes of intellectual property, biosafety, and formal land registry support and shape this program of agricultural transformation. Even though many of these legislative changes can be traced back to free trade agreements and structural adjustment loan conditionality, today they have been reframed as ways to 'Grow Africa' and meet its potential.[7]

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[5] Kojo Sebastian Amanor, "From Farmer Participation to Pro-poor Seed Markets: The Political Economy of Commercial Seed Networks in Ghana," *IDS Bulletin* 42, no.4 (2011): 50.
[6] Though for most of these actors their manner of participation has changed.
[7] Grow Africa is a public-private partnership platform "that seeks to accelerate investments and transformative change in African agriculture based on national agricultural priorities and in support of the Comprehensive African Agricultural Development Programme (CAADP), a Programme of the New Partnership for Africa's Development (NEPAD), established by the African Union in 2003." It facilitates the work of the G8 New Alliance for Food Security and Nutrition programs. See "About Grow Africa," Grow Africa, accessed July 3, 2015, http://growafrica.com/about; G8 New Alliance for

As we saw in the previous chapter, proponents of the new Green Revolution with its attendant controversial technology—genetically modified seed—face the challenge of promoting agricultural change in the context of suspicion over the safety, motivations, and outcomes of their agenda. This chapter shows that this contestation extends to broader concerns over the enclosure of seed, land, and knowledge: the patenting of seed and the prevention of seed-saving; 'land grabs' of traditional communal lands; and the exclusion of traditional or local knowledge from food and agriculture policy, respectively. I argue that these processes of enclosure reveal three key distinctions between the first and the new Green Revolution in Africa: 1) a shift in the role of the state to a state that relinquishes its leadership in service provision and instead "enables" rather than leads; 2) a new composition of legal and techno-scientific expertise that informs the new Green Revolution strategy; 3) and the proliferation of new forms of capital that integrate biotechnology with philanthropy to create new market value. These shifts are engendered by new laws that entail changed relationships to seed, whereby seed becomes patentable material, with specific regimes of access and use. These legal changes support the expansion of the private sector in Ghana by securing an 'enabling environment'[8] that purportedly makes investment in agriculture more profitable and beneficial. Philanthropy and the use of community seminars to discuss issues such as the establishment of formalized land

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Food Security and Nutrition. *G8 Cooperation Framework to Support the "New Alliance for Food Security and Nutrition" in Ghana*. Accessed July 1, 2015, http://www.state.gov/documents/organization/190626.pdf.

[8] The language of 'enabling environment' is used widely in policy documents, from Ghana's CAADP compact to World Bank reports. It is connected to the concept of good governance and the promotion of clear and transparent legal regimes to encourage economic growth and investment.

titles and transgenic seeds alter conceptions of seed and land, and lay the foundation for their commodification.

What actors, expertise, and models of development are advanced by the 'new Green Revolution in Africa'? The chapter tackles this central research question through an examination of the roles of the public and private sector in agricultural research and development, the promotion of biotechnology and its related body of expertise, and the emergence of new forms of capital that characterize the African Green Revolution. The chapter is organized as follows. First, I describe the continuities between the first and the new Green Revolution in Africa. These continuities are further analyzed in the following chapter that examines efforts to transform farming from a way of life to a business. Second, I discuss the changing role of the state in agricultural research and development over time, noting both shifts in funding and in the roles of the public and private sectors, as well as the implications of these shifts. Third, I explore the role of public-private partnerships in the introduction of genetically modified crops by turning to the example of the Bt cowpea project in Ghana. This project reveals some of the novelty of this Green Revolution in Africa: the role of 'pro-poor' biotechnology as a mechanism to minimize contestation over GMOs; the prevalence of new sets of expertise that have emerged alongside the introduction of genetically modified crops; and the ways in which the commodification of seed can be furthered through the concept of "donation." Fourth, I examine how legislative changes in the seed sector promote novel forms of capital accumulation. In the final section, I consider the relationship

between two new forms of capital—biocapital and philanthrocapital—that have emerged as key sources of market value in the new Green Revolution in Africa.

II. Continuities Between the First and the New Green Revolution in Africa

The first Green Revolution is characterized by a technological breakthrough in the development of high-yielding hybrid varieties of cereal grains, increased mechanization and irrigation, the growth of international and national agricultural research institutes (NARIs),[9] and the geopolitical context of the Cold War.[10] Supported by the Rockefeller Foundation and the U.S. government as a means to stop the spread of communism, Green Revolution programs initiated in Mexico in 1941 and India in 1956 were designed to promote high-yielding agricultural practices.[11] Faced with the plant disease wheat rust that led to a significant decline in yields and widespread hunger, Mexico was targeted as the first site for the Rockefeller Foundation's agricultural assistance.[12] The Green Revolution programs introduced high yield dwarf varieties of wheat and rice, as well as pesticides, fertilizers and improved irrigation technologies. This capital-intensive agriculture is attributed with averting famine in India and helping Mexico become an export-oriented agricultural economy. High-yield varieties of rice and maize were developed in Asia and Latin

[9] Oasa, "The Political Economy of International Agricultural Research," 40.
[10] Perkins argues that U.S. commitments to promote Green Revolution wheat breeding in Mexico and India were part of Cold War efforts to contain the former Soviet Union. John H. Perkins, *Geopolitics and the Green Revolution* (Oxford: Oxford University Press, 1997).
[11] Natural Sciences Director of the Rockefeller Foundation, Warren Weaver, articulated this rationale in an address to the President of the Rockefeller Foundation in 1951: "In this struggle for the minds of men the side that best helps satisfy man's primary needs for food, clothing, and shelter is likely to win." Rockefeller Foundation, "The world food problem, agriculture, and the Rockefeller Foundation," *100 Years: The Rockefeller Foundation*, accessed June 16, 2015, http://rockefeller100.org/items/show/3780. See also Perkins, *Geopolitics and the Green Revolution.*
[12] Mexico was also chosen because the Roosevelt administration "wanted neither a socialist nor a fascist state on its southern border." Perkins, *Geopolitics and the Green Revolution*, 9.

America suited to their respective local agro-ecological context; by contrast, Asian varieties of rice were brought to African countries without similar adaptations and with disappointing results.

The term 'Green Revolution' was coined by William Gaud, former director of USAID, to contrast it with a 'red revolution' of the spread of communism or a 'white revolution' of land redistribution in Iran.[13] The Green Revolution would promote 'plant improvement' and crop productivity, but it also suggests a benign, if not positive, effect on the environment.[14] Research in crop improvement was supported by international agricultural research centers like the International Rice Research Institute (IRRI), the International Maize and Wheat Improvement Center (CIMMYT), and the International Institute for Tropical Agriculture (IITA), bilateral aid agencies, the Rockefeller, Ford, and Kellogg Foundations, agribusiness corporations, and national agricultural research institutions. This agricultural transformation can be considered a revolution in process as it enabled a new method of producing particular crop commodities.[15] In order to realize the benefits of these high-yielding varieties, a new process of the use of supportive agricultural technologies—fertilizers, pesticides and irrigation—changed agricultural systems and the landscape upon which they were grown. The Green Revolution worked to standardize agricultural practices and generate agricultural surplus through the adoption of more limited number of cereal

[13] Raj Patel, Eric Holt-Gimenez, and Annie Shattuck. "Ending Africa's Hunger," *The Nation*, September 21, 2009.
[14] This dual meaning of "green" came into play when I gave a guest lecture on behalf of the U.S. Embassy in Accra. I was to give a lecture on the new Green Revolution at the University of Ghana. This was publicized by flyers with stick figures holding hands around the earth. A tree seedling sprouted from the top, reflecting a different understanding of a "green revolution."
[15] Keith Griffin, *The Political Economy of Agrarian Change: An Essay on the Green Revolution* (London: Macmillan Press, 1974), 48.

varietals and a more formulaic application of inputs. This standardization in process rendered legible agricultural systems for global markets.[16]

Who were the beneficiaries of the Green Revolution? One of the overriding concerns of the Green Revolution was the overall increase in agricultural productivity measured in aggregate terms, and this was achieved in certain staple food grains. In India, whose agricultural programs during this period were frequently given as a Green Revolution success story, yields for rice increased from 902 kg/hectare in 1953-54 to 2,240 kg/ha in 2010-11, whereas wheat increased from 750 kg/ha in 1953-54 to 2,938 kg/ha in 2010-11.[17] Such productivity was generated through the 'productive power' of industrial inputs that substituted (and undervalued) the 'reproductive power' of nature.[18] The components of farming reliant on the reproductive power of nature—seed saving, rainfall, composting, intercropping, the use of manure and animal labor—were substituted by the purchase of scientific seed, the establishment of irrigation systems, and the application of fertilizers and herbicides.

The introduction of Green Revolution technologies marks a shift from a labor-intensive agriculture dependent upon reproductive power to a capital-intensive system dependent upon industrial inputs. In this sense, Green Revolution technologies were landowner-biased, offering differential results to peasant farmers that did not have access to capital. Griffin (1974) argues that "unequal access to land and capital

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[16] For more on legibility see the introduction and James Scott, *Seeing Like a State* (New Haven: Yale University Press, 1998).
[17] Pratyusha Basu and Bruce A. Sholten, "Technological and Social Dimensions of the Green Revolution: Connecting Pasts and Futures," *International Journal of Agricultural Sustainability* 10, no.2 (2012): 111.
[18] Yapa, Lakshman. "Improved seeds and constructed scarcity," in *Liberation Ecologies,* eds. Richard Peet and Michael Watts (London: Routledge, 1996), 82.

frequently is accentuated by unequal access to water and technical knowledge."[19] In other words, landed wealth frequently goes hand-in-hand with political influence, and with that, privileged access to scarce means of production (i.e. tractors, subsidized fertilizer).[20] These existing patterns of inequality were deepened by technological change and government policies that privileged improvements in wealthier farming regions like rich river valleys, rather than improving the conditions of peasant farmers reliant on rainfed agriculture. Large farmers were given subsidies to mechanize production, whereas peasant farmers, especially women, struggled to gain access to small amounts of credit to improve their farming.[21]

Part of the idea of a new Green Revolution in Africa is to bring to Africa the appropriate technologies that "missed" the continent during the earlier Green Revolution. In the 1960s and early 1970s, the idea of a "Green Revolution" was largely unknown across the continent; only in the late 1970s did African countries begin to integrate Green Revolution measures into their agricultural policies.[22] For most African countries, the 1970s signaled a shift towards programs of national food self-sufficiency in order to address a growing population.[23] African governments established state farms, large-scale irrigation programs, marketing boards, input subsidy programs, and minimum price guarantees. In African countries such as Ghana much of the focus of these agricultural programs was placed on large estate agriculture that targeted large 'progressive farmers' who received subsidized fertilizer

[19] Griffin, *The Political Economy of Agrarian Change,* 30.
[20] Griffin, *The Political Economy of Agrarian Change,* 18.
[21] Griffin, *The Political Economy of Agrarian Change,* 53.
[22] Hans Holmén, "The State and Agricultural Intensification in Sub-Saharan Africa," in *The African Food Crisis: Lessons from the Asian Green Revolution,* eds. G. Djurfeldt, H. Holmén, M. Jirstrøm, and R. Larsson (Cambridge: CAB International, 2005), 88.
[23] Ibid.

and other inputs, low-interest loans, and tractors.[24]A number of countries were self-sufficient in food crop production during this time and production of maize and rice increased, but often as a result of the expansion of cultivated areas rather than yield increases. State farms and large-scale irrigation that focused on export crops proved uneconomic and were not continued. The 1980s economic crisis and the deterioration in African terms of trade for export crops contributed to the state's inability to continue such food production policies.[25] As Djurfeldt, Holmén, Jirström, and Larsson (2005) point out, a look at agricultural policies in Africa in the 1960s and 70s shows that Green Revolution programs didn't "miss" Africa, rather, they were just not sustained.[26]

Development planners advocating for a new Green Revolution intend to bring a program of agricultural modernization to transform African agricultural systems. A leading force in the promotion of the new Green Revolution in Africa is the Alliance for a Green Revolution in Africa (AGRA). Formed in 2006, the Alliance for a Green Revolution in Africa was "born of a strategic partnership between the Bill & Melinda Gates Foundation and the Rockefeller Foundation to dramatically improve African agriculture, and to do so as rapidly as possible."[27] Its agenda, in the words of the first Board Chair, Kofi Annan, is the following:

> AGRA is working with its partners to bring about a uniquely African Green Revolution that will unleash the continent's agricultural potential. Towards that end, we are evolving a strategy designed to deliver both near-term and longer-term results. This strategy…rests on the idea that AGRA's resources

[24] Amanor, "From Farmer Participation to Pro-poor Seed Markets," 50.
[25] Holmen, "The State and Agricultural Intensification in Sub-Saharan Africa," 89.
[26] Göran Djurfeldt, Hans Holmen, Magnus Jirstrøm, and Rolf Larsson, eds., *The African Food Crisis: Lessons from the Asian Green Revolution* (Cambridge: CAB International, 2005).
[27] The Bill and Melinda Gates and the Rockefeller foundations are the major funders of AGRA. "Who We Are: History of AGRA," Alliance for a Green Revolution in Africa, accessed July 3, 2015, http://www.agra.org/who-we-are/our-history/.

> and its efforts with partners should initially focus on where they will have the highest payoff—in Africa's high-potential 'breadbasket' areas.[28]

As with the introduction of hybrids during the first Green Revolution, modernization of agricultural technologies remains a key focal point. In particular, the introduction of 'pro-poor' biotechnology is seen as a critical component of addressing food insecurity and the impact of climate change.[29] The concept of 'pro-poor' biotechnology is appealing in three ways: first, as a technology that appears to be appropriate for resource-poor farmers and is thereby inclusive; second, as a technology to be developed and assessed by African national agricultural research institutions[30]; and third, as suggestive of a technological development motivated by humanitarian concerns rather than profit. In this way, the introduction of this new technology acknowledges concerns regarding the exclusionary effects of the first wave of green revolution technologies. Whether those crops identified as 'pro-poor'

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[28] Speech by Kofi Annan at the inauguration of AGRA, available at "Who We Are: History of AGRA," Alliance for a Green Revolution in Africa, accessed July 3, 2015, http://www.agra.org/who-we-are/our-history/.

[29] Beta carotene-enhanced cassava and water-efficient maize are two examples of 'pro-poor' biotechnology. BioCassava Plus aims to address micronutrient malnutrition in Nigeria and Kenya and "ensur[e] the cassava varieties meet the needs of farmers." "BioCassava Plus," Donald Danforth Plant Science Center, accessed July 5, 2015, https://www.danforthcenter.org/scientists-research/research-institutes/institute-for-international-crop-improvement/crop-improvement-projects/biocassava-plus. The Water Efficient Maize for Africa "was created with a goal to enhance food security in Sub-Saharan Africa through developing and deploying water-efficient maize royalty-free to the smallholder farmers. Insect-protection is complementary to the efforts of developing more drought-tolerant maize varieties and will also be available royalty-free. This increased yield stability has the potential to help reduce hunger and improve the livelihood of millions of Africans." See "Water Efficient Maize for Africa (WEMA)," Monsanto Company, accessed July 5, 2015, http://www.monsanto.com/improvingagriculture/pages/water-efficient-maize-for-africa.aspx. For more examples of 'pro-poor' biotechnology development, see Appendix 1: Philanthrocapitalism and Agbiotech Public-Private Partnerships in Africa.

[30] This is emphasized by organizations like the AATF that this biotechnology is developed by and for Africans in their indigenous research institutions. However, much of the product development occurs upstream in research institutions like CSIRO Australia or by companies like Monsanto. See Appendix 1. Author interview with Country Coordinator for Program for Biosafety Systems, Accra, May 5, 2015.

will benefit this targeted demographic remains to be seen—most of these transgenic crops have not yet moved beyond the confined-field trial stage of development.

Although frequently treated as a distinct 'revolution' in agricultural technologies, the introduction of genetically modified seed, sometimes referred to as the 'Gene Revolution,' could not have occurred without the prior collection of germplasm[31] from biodiverse regions achieved through the work of CGIAR during the first Green Revolution. The Green Revolution's Mexico program was not only about the introduction of dwarf hybrid wheat, it also enabled the collection of maize germplasm from Mexico, which advanced the development of hybrid maize in the United States.[32] Kloppenburg identifies that although there is extensive scholarship on the introduction of 'improved' varieties to countries like Mexico and India, there is little attention on the transfer of genetic material from Mexico to the U.S. This exchange of maize germplasm as a free good represents a common pattern whereby plant genetic resources from the developing world are conceived of as part of the "common heritage" that can be collected widely and freely and do not need to be remunerated for. This genetic transfer through global germplasm collection, sometimes referred to as "plant hunting" programs,[33] has value in the billions of dollars for its role in the development of agricultural commodities produced in advanced capitalist countries. The work of CGIAR-supported research in Africa also collects the local germplasm of centers of biodiversity for cowpea, millet, and

[31] The reproductive material of a plant, in the form of seed or plant tissue, collected for research, breeding, and conservation.
[32] Kloppenburg 152-90.
[33] The USDA had an extensive "plant hunting" program: between 1900 and 1930 the agency sponsored over fifty plant hunting expeditions, earning the name the "Golden Age of Plant Hunters." Kloppenburg 157.

sorghum. Not unlike the first Green Revolution, international agricultural research centers utilize local germplasm for agricultural research and development of drought-tolerant grains. Depending on how the products derived from this genetic material are handled, this could be accessed as a free good (as with the FAO "International Undertaking on Plant Genetic Resources"[34]), or as a commodity and intellectual property.

Another commonality between these periods of agricultural transformation is the efforts to integrate farmers into the market economy through the introduction of hybrid or genetically modified seed. The adoption of improved seed draws farmers into the market economy in two ways. First, both hybrid and GM crops create dependencies and vulnerabilities, as both have mechanisms to prevent the saving of seeds and require intensive application of inputs to support them. The reduced fertility of hybrid seeds in subsequent replanting provides a strong incentivize for farmers to purchase hybrid seed each season. Genetically modified seed is patent protected, which makes seed saving a violation of contract and prohibited by law. Therefore, farmers that rely on either hybrid or GM seed will need to purchase their seed each season from agro-dealers (along with supporting inputs), rather than relying on seed saving.[35] Second, these new technologies are designed to generate surplus that will be sold on the market, rather than meeting local food needs. Farmers' market

[34] As Kloppenburg shows "delegates from Third World and industrialized socialist countries called for the application of the principles of common heritage and free exchange to *all* categories of germplasm." Kloppenburg 172, original emphasis. See United Nations Food and Agriculture Organization. *Resolution 8/83: International Undertaking on Plant Genetic Resources*. 1983.

[35] There are two mechanisms by which this happens. With hybrid seed—the defining technology of the first Green Revolution—farmers will experience marked reductions in yields if they replant hybrid seed due to a loss of hybrid vigor in the subsequent season. With patent-protected genetically modified crops, farmers will be in violation of intellectual property law if they save seed.

integration has also been supported by a focus on elite (or 'progressive,' 'serious'[36]) farmers that could demonstrate the successful use of these new technologies that then could be emulated by others. In this way, the dissemination of these two technologies for agricultural transformation focus on the farmer as a key driver of agricultural change.

In both Green Revolutions, development planners present agricultural transformation as an engine for economic growth that can alleviate poverty and promote security. In the first Green Revolution, US geopolitical interests were concerned with expanding the reach of new agricultural technologies into countries with large peasant farmer populations as a means to diminish the possibilities of peasant revolts connected to famine.[37] Food insecurity was seen as holding the potential to increase the appeals of communism. Thus, agricultural technology diffusion was perceived as a means to stop the spread of communism and a matter of US national security. Likewise, in the African Green Revolution, the US State Department now promotes biotechnology.[38] The acceptance of biotechnology in African countries is considered a matter of US national interest because of the benefits of increased market access for American businesses.[39] Biotechnology is also seen as key to reducing food insecurity both through the potential to increase household incomes by greater crop productivity (through the reduction of pest or

[36] I discuss this in the following chapter.
[37] Perkins, *Geopolitics and the Green Revolution.*
[38] Author interview with Country Coordinator for Program for Biosafety Systems, Accra, May 5, 2015.
[39] See *Plant Biotechnology Research and Development in Africa: Challenges and Opportunities, Hearing Before the Subcommittee on Research Committee on Science House of Representatives,* 108th Cong., (June 12, 2003).

drought-related crop loss) and through micronutrient enrichment of biotech crops to help address malnutrition.

III. Public-Private Partnerships and the Changing Role of the State

In the first Green Revolution, the state played a more central role in plant breeding and crop improvement research through large amounts of funding for national agricultural research institutions (NARIs). Between the 1960s to the 1980s, the Ghanaian government implemented policies of self-sufficiency in food production through subsidizing inputs like fertilizers, providing support for marketing, a system of guaranteed prices for crops such as rice, and access to credit.[40] The Ghanaian government also experimented with state farms and large-scale irrigation projects. In 1972, the military dictatorship of Colonel I.K. Acheampong instituted an ambitious national self-reliance plan entitled Operation Feed Yourself. The emphasis on large enterprises, at the neglect of small farmers, failed to produce expected results. Furthermore, loans to farmers required land documentation, but the majority of land in Ghana is held under customary arrangements, making it "difficult to use as collateral for a mortgage."[41] Girdner et.al. argue that the critical factor in the failure of this policy has been the preferential position given to export crop production, which did not address domestic demands.

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[40] These policies had varying degrees of success, particularly in the distribution and access to these government benefits—typically it was the large and well-connected farmers that were able to benefit from these programs. Anuradha Mittal, "The Blame Game: Understanding Structural Causes for the Food Crisis," in *The Global Crisis,* eds. Jennifer Clapp and Marc J. Cohen (Waterloo: Wilfrid Laurier University Press, 2009), 24-5.

[41] Furthermore, the registration of land required a trip to Accra and the process of securing a loan was arduous. Girdner et.al. "Ghana's Agricultural Food Policy: Operation Feed Yourself," *Food Policy* 5, no.1 (1980): 20.

The role of the state in agricultural development changed from being a manager to an enabler during the 1980s African economic crisis when African countries sought the financial assistance of the World Bank and International Monetary Fund.[42] Support for African countries was given on the condition that programs such as input subsidies and guaranteed minimum pricing were reversed and state support for agriculture was cut significantly.[43] Austerity measures in African countries contributed to a dramatic decrease in public-sector expenditures for plant breeding: expenditures dropped from 347 million in 1985 to 99 million in 2005.[44] Additionally, donor funding for agricultural research and development declined dramatically in the mid-1980s.[45] The Ghanaian government's agricultural spending in 2007 was .39% of total government expenditures, down from 12.23% in 1980.[46] During this time, agricultural research institutions were restructured to shift agricultural research to the private sector and the national agricultural research system was further integrated into the international agricultural research system, particularly the network of the Consultative Group on International Agricultural Research

[42] Holmén, "The State and Agricultural Intensification in SSA," 93.
[43] This change in World Bank policy, which had previously financed state-led agricultural modernization programs, to 'structural adjustment' was heralded by the influential 1981 report *Accelerated Development in Sub-Saharan Africa*. The World Bank, *Accelerated Development in Sub-Saharan Africa: An Agenda for Action* (Washington, D.C.: World Bank, 1981).
[44] These figures from the FAO (2011) are both adjusted to 1993 international dollars. Chambers et.al. 2014. Chambers et.al., *GM Agricultural Technologies for Africa* (Washington, D.C.: International Food Policy Research Institute, 2014), 28. Kojo Amanor discusses how structural adjustment policies in the 1980s undermined successes of public plant breeding in the 1970s. Amanor, "From Farmer Participation to Pro-poor Seed Markets."
[45] David J. Spielman, Fatima Zaidi, and Kathleen Flaherty, "Changing Donor Priorities and Strategies for Agricultural R&D in Developing Countries: Evidence from Africa," Working Paper 8 presented at the ASTI-IFPRI/FARA Conference, Accra, Ghana, December 5-7, 2011.
[46] Chambers et.al., *GM Agricultural Technologies for Africa*, 27.

(CGIAR).[47] This economic crisis led to a mass exodus of qualified staff from African countries, undermining the capacity of the NARIs to conduct research and impacting their research agendas. [48]

Drops in spending by both governments and donors on agricultural research and development continued to occur during the 1990s. A decade later there was widespread recognition[49] that such spending cuts were detrimental to African development because of the central role of agriculture in African economies. In 2003, the African Union issued the Maputo Declaration on Agriculture and Food Security that called on all African states to increase spending on agricultural research and development to a minimum of 10% of their national budget because of concerns that existing expenditure levels were stifling the development of African agribusiness.[50] Ghanaian public sector expenditures have come close to meeting this goal in a single year (2013) with 9-10% of the total national budget spent on agriculture, but this goal has not been consistently met.[51]

One manifestation of this underinvestment in agriculture in Ghana is agricultural extension: the current ratio of agricultural extension officers to farmers is

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[47] Korbla P. Puplampu and George O. Essegbey, "Agricultural Biotechnology and Research in Ghana: Institutional Capacities and Policy Options," *Perspectives on Global Development and Technology* 3, no.3 (2004): 275.
[48] Puplampu and Essegbey. "Agricultural Biotechnology and Research in Ghana," 275, 277.
[49] One example of this is in the UN Millennium Development Goals that generated some of the political will to reverse policies that cut social spending.
[50] Shenggen Fan, Babatunde Omilola and Melissa Lambert, "Public Spending for Agriculture in Africa: Trends and Composition," *Regional Strategic Analysis and Knowledge Support System Working Paper No. 28.* Washington, D.C.: Regional Strategic Analysis and Knowledge Support System, 2009.
[51] For comparison, Kenya and Uganda have only allocated less than 5% of their national budgets to agriculture in the last few years. Nigeria's spending on agriculture is 3.5% between 2007-11, four times less than its military budget. Mark Curtis and David Adama. *Walking the walk: Why and how African governments should transform their agriculture spending* (Washington, D.C.: ActionAid, 2013), 7.

1:1,000, and in some cases the disparity is as great as 1:1,500.[52] Deficits of government investment in agricultural development of this kind create a demand for the private sector, aid agencies, and international agricultural research centers to fill in these gaps. The global food price crisis of 2007-8, combined with increased commitments to agricultural spending by national governments and foreign aid agencies, attracted greater private sector investment in agriculture.[53] The World Bank, the Group of 8, bilateral aid agencies, as well as the Alliance for a Green Revolution in Africa (AGRA) have also identified the transformation of African agricultural systems as a key development objective. Public-private partnerships in Africa have proliferated as a response to these conditions.[54] Governments are able to gain from advances in research and development and additional financial support that the private sector brings to the table. Companies benefit from an investment climate where risk is distributed and local knowledge of the uses of plants is accessible.

With the state reliant on private sector support of agriculture, the private sector has had the opportunity to exert a greater influence on agricultural priorities in countries such as Ghana. The lack of state capacity to substantially fund agricultural research "accounts for the donor-driven nature" of research in the region."[55] One such agricultural issue that has become a priority as a result of PPPs is the introduction of genetically modified crops in African countries. In Lois Muraguri's (2010) study of agricultural biotechnology (hereafter "agbiotech") PPPs in Kenya she finds that the

[52] Presentation by Northern Region Regional Director of Ministry of Food and Agriculture Plant Protection Unit at the Mango Value Chain Workshop, Tamale, Ghana, July 18, 2012. These ratios were repeated in conversations with other informants.
[53] Spielman, Zaidi, and Flaherty, "Changing Donor Priorities."
[54] See Amanor, "From Farmer Participation to Pro-poor Seed Markets"; Scoones and Thompson, "The Politics of Seed in Africa's Green Revolution."
[55] Puplampu and Essegbey. "Agricultural Biotechnology and Research in Ghana," 279-80.

partnerships are mostly donor-led, time-bound, and often disconnected from the "end users"—that is, the farmers that will utilize these genetically modified crops.[56] However, the resources and experience provided through these partnerships can be important for building national research capacity, as it did with the Kenya Agricultural Research Institute (KARI). Muraguri's study of agbiotech PPPs is significant both because of Nairobi's position as the epicenter of the new Green Revolution in Africa[57] and because of the leading role that KARI has provided in initiating some of the first transgenic field trials in Africa. The Kenya Agricultural Research Institute partnership with Monsanto formed in the early 1990s to develop a virus-resistant sweet potato was one of the first of its kind.[58]

Muraguri argues that biotechnology research in Kenya operated for decades in a "legal and political vacuum."[59] By contrast, I find that the recently formed Cowpea Productivity Improvement PPP in Ghana is shaped by a politics of contestation over GMOs and deeply entangled in legislative change, of which some partners are actively involved in influencing. Additionally, Kenya's national research agenda is no longer operating in a political vacuum since a government ban on GMOs instituted in 2012 has put a halt to biotech research in the country.[60] In my analysis of the

[56] Muraguri is referencing one of the first agbiotech partnerships between KARI and Monsanto in developing a virus-resistant sweet potato. As a result of a disconnect between the farmers and the product developers, the sweet potato was engineered to be resistant to a virus that was uncommon in the area, and did not have the intended effect of reducing crop loss. Lois Muraguri, "Unplugged! An Analysis of Agricultural Biotechnology PPPs in Kenya," *Journal of International Development* 22, no.3 (2010): 298.
[57] Both AGRA and the AATF are headquartered in Nairobi.
[58] See Jennifer A. Thomson, *Genes for Africa: Genetically Modified Crops in the Developing World* (Landsdowne, South Africa: University of Cape Town Press, 2002).
[59] Muraguri, "Analysis of Ag Biotech PPPs in Kenya," 304.
[60] AgroNews, "Kenya Banned Importation of All GMO Foods," *AgroNews,* November 22, 2012, accessed July 3, 2015. http://news.agropages.com/News/NewsDetail---8425.htm; Jeff Otieno, "Researchers in a Fix Over GMO Ban," *The East African*, August 16, 2014, accessed July 5, 2015,

development of *maruca*-resistant Bt cowpea in Ghana, I show the important role of both legislative change and donation in simultaneously attracting private investment and mitigating concerns regarding GMOs in Africa. It is to the Cowpea Productivity Improvement public-private partnership in Ghana that I turn to next.

IV. PPPs and the Promotion of Biotechnology: Bt Cowpea in Ghana

Scientific advancements in biotechnology in the 1970s and 1980s enabled more sophisticated and specific modifications of living organisms. Yet this was not the only significant breakthrough of this period: this new techno-scientific complex heralded both a greater corporate consolidation of the seed industry and a more rapid growth of genetic engineering firms.[61] This pattern of consolidation in the life sciences industry has since continued: the agribusiness corporation DuPont Pioneer (itself the product of a merger in 1999)[62] purchased the South African seed company Pannar in 2013;[63] Syngenta has rejected Monsanto's second offer to merge, which effectively would consolidate the two biggest agribusiness corporations.[64] The relative size of these multinational corporations in comparison to local seed industries has raised concern regarding the influence that global agribusiness may have on

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http://www.theeastafrican.co.ke/news/Researchers-in-a-fix-over-GMO-ban/-/2558/2421314/-/item/0/-/qprcmnz/-/index.html.

[61] See Kal Raustiala and David G. Victor, "The Regime Complex for Plant Genetic Resources," *International Organization* 58, no. 2 (2004): 282; and Jack Ralph Kloppenburg Jr., *First the Seed: the Political Economy of Plant Biotechnology*, 2nd ed. (Madison, WI: University of Wisconsin Press, 2004).

[62] George Gunset, "Dupont to Buy Pioneer Hi-Bred as Agribusiness Mergers Heat Up," *Chicago Tribune*, March 16, 1999.

[63] "Media Statement: DuPont Pioneer Completes Acquisition of Pannar Seed," DuPont Pioneer, October 29, 2013, accessed July 6, 2015, http://www.pioneer.com/home/site/about/news-media/news-releases/template.CONTENT/guid.2A29ED4E-7EE4-A71B-46BB-49973731A7A1.

[64] Syngenta reported sales of $15.1 billion in 2014. Although they have rejected the merger as of July 6, 2015, Syngenta has recently outlined what would be needed in a takeover deal in order for it to be taken seriously. Chad Bray, "Syngenta Chairman Sets Criteria for Further Monsanto Talks." *The New York Times,* June 23, 2015.

African agricultural systems.[65] An illustration of this is the African Centre for Biodiversity's (2009) report, *Africa Bullied to Grow Defective Bt Maize: The Failure of Monsanto's MON810 Maize in South Africa*, that claims that South Africa was "bullied to grow [Monsanto's] defective Bt maize," which resulted in Monsanto's domination of the seed market, with troubling results.[66] In this context of contestation, the development of agbiotech for African markets has necessitated partnerships with the public sector and local research institutions. As the Country Coordinator for the Program for Biosafety Systems in Ghana told me in May 2015, "If Monsanto was the one pushing it, I'm sure that farmers would be a bit hesitant. Because it's being pushed by their indigenous research institutions, through a government negotiation, that's easier to accept."[67]

The global resistance to GMOs makes the introduction of GM crops politically challenging. This resistance to GMOs is found across the African continent, particularly in South Africa, where Bt maize is cultivated at a commercial scale with seed and agro-chemicals provided by agribusiness corporations Monsanto and Syngenta. Proponents of GM crops have sought an image makeover to ease the diffusion. Efforts to push commercialization of GM crops in African markets have not focused on genetically modified Bt maize and glyphosate-resistant soyabean, two

[65] To give some idea of the relative economic weight, consider that the entire GDP of Ghana in 2013 was $48.14 billion, whereas the net sales for the Monsanto Company were $14.86 billion in 2013. "Data: Ghana," The World Bank, accessed July 6, 2015, http://data.worldbank.org/country/ghana. "Monsanto Company 2013 Annual Report," Monsanto Company, accessed July 6, 2015, http://www.monsanto.com/investors/documents/annual%20report/2013/monsanto-2013-annual-report.pdf .

[66] African Centre for Biosafety, *Africa Bullied to Grow Defective Bt Maize: The Failure of Monsanto's MON810 Maize in South Africa* (Melville, South Africa: The African Centre for Biosafety, 2009), 12-13. The activist organization is now called the African Centre for Biodiversity.

[67] Author interview with Country Coordinator for PBS, Accra, May 5, 2015.

of the most popular genetically modified crops in the world. Rather, the greatest research and commercialization efforts have been placed on the development of 'pro-poor' biotechnology—that is, the development of transgenic crops to suit the needs of the small farmer and the diets of the local people—like Bt cowpea or in Bt cotton.[68] Biotechnology outreach supported by the Program for Biosafety Systems and the development of 'pro-poor' biotechnology work to change perceptions about this new technology.

The public-private partnership that has worked to develop and introduce a transgenic Bt (*Bacillus thuringiensis)* cowpea to West Africa exemplifies some of the distinguishing characteristics of this new Green Revolution in Africa. The development of *maruca*-resistant cowpea as part of the Cowpea Productivity Improvement project attempts to appeal to the crop selection and challenges of small farmers.[69] Cowpea is a major part of peoples' diets in Ghana and Nigeria and serves as an inexpensive source of protein; its leaves and stems an important source of animal feed.[70] Just as the first Green Revolution focused on the staple crops of maize in Mexico and rice in India, this new Green Revolution includes the introduction of a

[68] Bt cotton has rapidly diffused to many poor countries including Ghana's northern neighbor, Burkina Faso, and has had what many would consider agricultural success. Multiple conversations with informants have validated my intuition that Bt cotton adoption has met less obstacles to cultivation because of its nature as a fiber, rather than a food, crop.

[69] Author interview with agricultural research scientist Dr. I.D.K. Atokple at SARI, Nyankpala, February 13, 2013.

[70] The cowpea, referred to as *local beans* in Ghana or Nigeria, is the main ingredient to Northern Ghanaian dishes *waakye, kosi* and *tubaani. Waakye,* a delicious, simple dish of beans and rice cooked with tomatoes and *pepe,* is one of the most common roadside dishes found in any *tro-tro* or shared taxi station across Ghana. It is inexpensive and immediately satisfying. *Tubaani* is more of a special treat, something you may eat on Sundays or during *sala*, at the end of Ramadan. It is essentially cowpeas cooked and processed with shea nut oil to create a condensed shape, spongy and dense, which is soaked in an incredibly spicy *pepe* sauce. Cowpea displays this kind of versatility and significance in the Northern Ghanaian diet—a legume that can be prepared and eaten as either an ordinary dish or as a special treat.

modified version of the staple West African legume, developed in part through the collection of local germplasm.

Before genetically modified cowpea could be tested, there needed to be legislative change. Following years of deliberation and the outreach of the Program for Biosafety Systems, Parliament unanimously approved the Biosafety Act 831 in December 2011. This legislation enabled the approval of research on Bt cowpea. In Ghana, Bt cowpea trials were approved October 2012 and planting commenced in September 2013. Bt cowpea is one of four GM crops on the horizon in Ghana: if experimental trials and political conditions are favorable, Bt cotton will likely be commercialized first, followed by Bt cowpea, micronutrient-enhanced sweet potato, and nitrogen-use efficient, water-use efficient, and drought-tolerant rice.[71]

The Rockefeller Foundation and USAID are the most active donors for biotechnology capacity building and research support.[72] USAID supports plant biotechnology at all stages: from lab research and field trials to the delivery of technology and building effective regulatory systems.[73] USAID supports outreach activities by the Program for Biosafety Systems (PBS) in order to "ensure that stakeholders have the necessary resources to make informed decisions about

[71] This timeline is based on expectations that less time in continuous field trials will need to be done for Bt cotton and Bt cowpea due to commercial activity (Bt cotton in Burkina Faso) and research (four years of confined field trials in Nigeria prior to confined-field trial approval in Ghana) in similar agroecological environments. The rice is known as NEWEST rice and confined field trials are being held at CSIR Kumasi. See Appendix 1 for more information. The micronutrient-enhanced sweet potato has faced funding issues and research has been delayed. Author interviews with agricultural research scientist Dr. I.D.K. Atokple at SARI, Nyankpala, February 13, 2013 and May 7, 2015.
[72] Walter Alhassan, *The Status of Agricultural Biotechnology in Selected West and Central African Countries* (Ibadan, Nigeria: International Institute of Tropical Agriculture, 2001).
[73] USAID, *Agricultural Biotechnology for Development* (Washington, D.C.: United States Agency for International Development, no date).

biotechnology."[74] PBS works alongside the U.S. State Department and the Forum for Agricultural Research in Africa (FARA), as well as the Open Forum on Agricultural Biotechnology (OFAB).

These efforts to support biotechnology capacity building culminated in the formation of the African Agricultural Technology Foundation (AATF) in 2003.[75] Supported by USAID and the Rockefeller Foundation, the AATF is identified as a "new and unique public-private partnership" that is designed to assist in the access of agricultural technologies for smallholder African farmers.[76] USAID adds that it is also intended to facilitate the transfer of technology to national agricultural research institutions:

> The public sector in developing countries often lacks the institutional capacity to acquire the intellectual property (IP) rights needed to conduct research and develop new crops, as well as to promote transfer of technology to the local private sector for commercialization. Through organizations such as the AATF and U.S. universities, USAID partners assist developing country researchers to access proprietary technology.[77]

AATF currently collaborates with agricultural companies Monsanto, Syngenta, Dow, and DuPont and receives additional funding from the Bill and Melinda Gates Foundation, the Howard G. Buffet Foundation, the Syngenta Foundation for Sustainable Agriculture, and PepsiCo. The AATF has a mandate to facilitate and promote public-private partnerships by finding "solutions to the complex intellectual

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[74] Ibid.
[75] The AATF is an initiative led by the Rockefeller Foundation, founded with support from USAID as well as the UK Department for International Development.
[76] USAID contributes $500,000/yr to AATF of core support. The AATF "is a new and unique public-private partnership designed to assist small-holder farmers in Africa to gain access to existing agricultural technologies, including biotechnology, with the goal of relieving food insecurity and alleviating poverty." *Plant Biotechnology Research and Development in Africa: Challenges and Opportunities, Hearing Before the Subcommittee on Research Committee on Science House of Representatives,* 108th Cong., p.31 (June 12, 2003) (statement by Andrew Natsios of USAID).
[77] USAID, *Agricultural Biotechnology for Development.*

property arrangements that often hamper plant biotech research and development in Africa."[78] The AATF assists countries in access to genetic material to develop new agricultural technologies by negotiating with companies like Monsanto to donate genetic material for public sector research.

AATF negotiates royalty-free transfers of technology for use during the crop development stage. One of its most prominent projects is the leadership of the Water-Efficient Maize for Africa (WEMA) project, a public-private partnership of the Bill and Melinda Gates Foundation, the Howard G. Buffet Foundation, USAID, the National Agricultural Research Institutes (NARIs) in Kenya, Mozambique, South Africa, Tanzania, and Uganda, the International Maize and Wheat Improvement Center (CIMMYT), and Monsanto. The AATF has also been active in supporting the development of both the *maruca*-resistant cowpea and nitrogen-use efficient, water-use efficient, and salt tolerant (NEWEST) rice in Ghana (see Appendix: Philanthrocapitalism and Agbiotech Public-Private Partnerships in Africa).[79] The Bt gene used to develop this transgenic cowpea is a result of the AATF's negotiations with Monsanto.[80]

The Bt cowpea public-private partnership is the product of collaboration among international and national agricultural research institutes, governments, foundations, and agribusiness corporations. The international agricultural research institute that has taken the lead on cowpea is the International Institute for Tropical

[78] "Our Donors," AATF, accessed July 3, 2015, http://aatf-africa.org/about-us/governance/our-donors; *Plant Biotechnology Research and Development in Africa, Hearing*, 7.
[79] For details on the public-private partnerships that AATF is involved in to develop 'pro-poor' biotechnology in Africa see Appendix 1: Philanthrocapitalism and Agbiotech Public-Private Partnerships in Africa.
[80] Author interview with lead agricultural research scientist on cowpea, Dr. I.D.K. Atokple, at SARI, Nyankpala, February 13, 2013.

Agriculture (IITA) in Ibadan, Nigeria whose mandate is improving food production in the humid tropics. The development of improved seeds of staple crops to meet the needs of small farmers in the tropics is one expression of this. The IITA has been researching cowpea resistance to *maruca* for over 30 years, and failed to find a variety resistant to this pod-borer that could damage cowpea crops by 30-80%.[81] The difficulty in identifying a resistant variety through conventional means motivated the institution's pursuit to explore genetic modification of the cowpea.[82] The research and genetic material of cowpea lines from Nigeria, Burkina Faso, and Ghana is supplied by the national agricultural research institutes of these three countries, the Institute for Agricultural Research (IAR), the Institut de l'Environnement et de Recherches Agricoles (INERA), and the Savannah Agricultural Research Institute (SARI), respectively. The variety that successfully accepted the introduction of the Bt gene was the cowpea line provided by Nigeria's IAR. Following negotiations with the AATF to initiate a royalty-free transfer to the project, Monsanto provided the Cry1AB (Bt) gene that expresses the desired insect resistance trait. The "transformation event" took place at the Commonwealth Scientific and Industrial Research Organization (CSIRO) in Australia, where the Bt cowpea product is being developed.[83]

In Ghana, national agricultural research institutions like the Savannah Agricultural Research Institute (SARI) conduct agricultural research as part of the

[81] Ibid.
[82] This led to the creation of the Network for Genetic Improvement of Cowpea for Africa that includes Purdue University, the University of Zimbabwe, International Institute for Tropical Agriculture (IITA), University of California-Riverside, Michigan State University, the University of Virginia-Charlottsville, Kirkhouse Trust, and Monsanto Company. See Chambers et.al., *GM Agricultural Technologies for Africa* (Washington, D.C.: International Food Policy Research Institute, 2014), 31.
[83] Author interview with Dr. I.D.K. Atokple, at SARI, Nyankpala, February 13, 2013.

Council on Scientific and Industrial Research (CSIR), the main government research organization in Ghana. SARI is a participatory research institution that focuses on the savannah agroecological context.[84] The Ministry of Food and Agriculture is the agency responsible for the implementation of agricultural policy. BNARI, the Biotechnology and Nuclear Agriculture Research Institute, does work on crop irradiation and tissue culture but does not have advanced research capacity to conduct genetic modification. The confined field trial research for Bt cowpea in Ghana is taking place at the Savannah Agricultural Research Institute in Nyankpala, a village outside of Tamale. It is the site of field trials and farmer demonstration fields to educate local people about Bt cotton and Bt cowpea. Whereas the Bt cotton fields are multi-locational open trials, the field where Bt cowpea is cultivated is enclosed and isolated with 24-hour security.[85]

What the Bt cowpea project highlights is three dimensions of novelty of this new Green Revolution in comparison to the earlier phases of rapid agricultural change. First, as discussed in the previous chapter, the contestation over genetic modification has motivated a set of strategies to change the perception of this new technology. The emergence of a discourse and practices around 'pro-poor' biotechnology has helped to change the reputation of genetically modified crops by highlighting its potential role in food security in African countries. Second, this new technology operates within shifting legal and technocratic regimes that deem this

[84] As one of the agricultural research scientists at SARI explained, "We represent people, we do what farmers want, researchers don't just sit down and say, "ok, this is what I want to do" and dump it on the people. We get feedback from the farmers, what is it that they want to address and from the farmers it comes to us, and then we sit down together and see how research can address them. There are some programs and we may not be able to do them, but what we can do, we do." Author interview with agricultural research scientist at SARI, Nyankpala, February 13, 2013.

[85] When I asked why, I was told that it was to scare away the animals that may come. Author interview with Dr. I.D.K. Atokple at SARI, Nyankpala, May 7, 2015.

technology both as property and as risk. The first Green Revolution lacks similar legislative and risk perception dimensions. Third, the work of the African Agricultural Technology Foundation in persuading Monsanto to "donate" the Bt gene used to develop the *maruca*-resistant cowpea can be understood as an example of philanthrocapitalism. Donation offers reputational benefits to Monsanto, and this may help expand Monsanto's market reach in the future. The donation of proprietary material in the case of Bt cowpea normalizes the perception of the seed as patentable material, advancing Western notions of property as enclosure. I will now discuss the latter two points.

V. Legislative Change in the African Seed Sector

> We must revive and rebuild Africa's battered capacity for applied research and make research institutions a cornerstone of our efforts. This process should encourage a spirit of entrepreneurship and the incubation of private companies that commercialize innovations that come out of Africa applied research centers at various universities…We must help Africans create legal certainty, predictability, transparency to help spur investment from the public sector and to nurture an entrepreneurial spirit. And we must act very quickly because technology is moving so fast, and if Africa is already behind and nothing is done, it is unbelievable what is going to happen in 10 or 15 years. We have seen Asia move, we have seen South America move. Africa is moving backwards.[86] –Dr. Kilama, President of the Global Bioscience Development Institute

This statement by Dr. Kilama, President of the Global Bioscience Development Institute,[87] at a 2003 U.S. Congressional Hearing on "Plant Biotechnology Research and Development in Africa" summarizes the rationale

[86] *Plant Biotechnology Research and Development in Africa: Challenges and Opportunities, Hearing Before the Subcommittee on Research Committee on Science House of Representatives,* 108th Cong., p. 48-9 (June 12, 2003) (statement by Dr. Kilama, President of the Global Bioscience Development Institute).

[87] "GBDI is a not for profit institute, working to help industries gain excess (sic) to emerging markets by directly linking industries with key policymakers, regulatory authorities and health, agricultural and biodiversity professionals in emerging markets." "Welcome to GBDI," GBDI, accessed July 6, 2015, http://www.gbdi.org/.

behind the push for legislative change and applied research to support biotechnology: to nurture an entrepreneurial spirit that "commercializes innovation" as a way to move Africa forward. During this hearing, actors including Gordon Conway of the Rockefeller Foundation, Andrew Natsios of USAID, and Robert B. Horsch, Vice President, Product and Technology Cooperation for Monsanto testified to the need and business potential of agricultural biotechnology development in Africa. This is when the AATF, formed earlier that year, was introduced to Congress and eagerly received. Two weeks prior to this hearing, the Forum on Agricultural Research in Africa, a lead organization in the agenda of the New Program for Africa's Development (NEPAD) held a meeting in Dakar where the participants declared their commitment to building capacity "…to be able to engage with global public and private sector partners to capture the advances needed to sustainably intensify African agriculture."[88] With this turn of attention to the potential of agricultural biotechnology in Africa came a push for legislative change.

The World Bank and International Finance Corporation's "ease of doing business" rankings celebrate and encourage laws that make business regulation more predictable and transparent.[89] The desire of countries to be highly ranked within this influential indicator motivates legislative changes in line with Western models of property rights, dispute resolution, and land registration. In a similar vein, the G8[90] New Alliance for Food Security and Nutrition have identified key policy

[88] *Plant Biotechnology Research and Development in Africa, Hearing*, p.31 (statement by Andrew Natsios of USAID).
[89] World Bank, *Doing Business 2014: Understanding Regulations for Small and Medium-Size Enterprises*, 11th ed. (Washington, D.C.: World Bank Group, 2013).
[90] Now G7 after Russia was suspended from the Group of Eight in 2014. Members are France, Germany, Italy, Japan, UK, US, and Canada.

commitments of the Ghanaian government that to improve agricultural productivity and thereby food security in the country. Such measures include "regulations developed to implement the new seed law," a "new agricultural input policy for fertilizer and certified seed use developed," a "database of suitable land for investors established," "clear procedures to channel investor interest to appropriate agencies," and "private sector representatives of key grain value chains appointed to the Ministry of Food and Agriculture (MoFA) Post Harvest Committee."[91]

While the G8's New Alliance strategy lays out commitments for the Ghanaian government to follow in exchange for funding, other actors such as the Alliance for a Green Revolution in Africa work alongside the New Alliance to reform the Ghanaian seed sector. One of the programs to achieve this goal is AGRA's Program for Africa's Seed Systems (PASS).[92] This program includes policy and advocacy in legislation over seed and provides "toolboxes" for African seed company entrepreneurs.[93] The seed laws promoted by PASS are a form of investors' protections for plant breeders. AGRA's Policy and Advocacy Program for the seed sector worked with the Ministry of Food and Agriculture as well as ACDI/VOCA to influence seed and fertilizer legislation in Ghana such as the Plant and Fertilizer Act,

[91] G8 New Alliance for Food Security and Nutrition, *G8 Cooperation Framework to Support the "New Alliance for Food Security and Nutrition" in Ghana*, accessed July 1, 2015, http://www.state.gov/documents/organization/190626.pdf.

[92] "AGRA's progress report 2007-2014 mentions the following: "AGRA's policy node in Ghana has helped the government to revamp its seed policy law and regulations, and is now involved with others in a review of the country's land policies. AGRA's Seed Policy Action Node in Ghana has helped the government to revamp its seed and plant variety protection laws and regulations, which in turn has helped to increase the production of foundation and certified seed several fold." Alliance for a Green Revolution in Africa, *Progress Report 2007-2014* (Nairobi, Kenya: Alliance for a Green Revolution in Africa (AGRA), 2015), 15.

[93] For a discussion of AGRA's work in this domain see "The African Seed Company Toolbox," AGRA, accessed July 6, 2015, http://www.agra.org/agra/en/what-we-do/the-african-seed-company-toolbox/.

2010 (Act 803).[94] The World Bank describes Ghana's Plant and Fertilizer Act, 2010 (Act 803) as opening "the door for an increased role for the private sector in producing seeds for a number of grains."[95] AGRA has provided the most financial support for the Ghanaian seed sector, funding plant breeding in Ghana's National Research Institutes, providing post-graduate training for plant breeders, distributing grants for small private seed companies, and supporting the development of agro-dealers. USAID's Feed the Future initiative has also outlined means to support seed production and regulatory reform.[96] The Program for Biosafety Systems has offered regulatory reform guidance for the Plant Breeders' Bill, as it had in the lead up to the passage of Ghana Biosafety Act, 2011 (831) that allowed GMOs into the country.[97] The hotly debated Plant Breeders' Bill is an extension of the Plant and Fertilizer Act, 2010 that AGRA's policy and advocacy work promoted.

The Plant Breeders Bill that is currently being debated in Ghana is in line with the policy commitments found in the G8 cooperation framework to support *The "New Alliance for Food Security and Nutrition" in Ghana* report. As stated in the report,

> The Government of Ghana intends to improve incentives for private sector investment in agriculture, in particular, taking actions to facilitate inclusive access to and productive use of land; developing and implementing domestic seed regulations that encourage increased private sector involvement in this

[94] ACDI/VOCA refers to the Agricultural Cooperative Development International/Volunteers in Overseas Cooperative Assistance. "Update on AGRA Programs and Grants in Ghana," Ministry of Food and Agriculture, Republic of Ghana, accessed July 6, 2015, http://mofa.gov.gh/site/?page_id=7588; Alliance for a Green Revolution in Africa, *AGRA in 2012: Moving from Strength to Strength* (Nairobi, Kenya: Alliance for a Green Revolution in Africa (AGRA), 2013).
[95] World Bank, "Agribusiness Indicators: Ghana," *Report Number 68163-GH* (Washington, D.C.: World Bank, 2012). Whether this includes the local private seed sector is a source of contention and one reason why the Plant Breeders' Bill has been contested in the streets of Accra.
[96] Robert Tripp and Akwasi Mensah-Bonsu, "Ghana's Commercial Seed Sector: New Incentives or Continuing Complacency?" *IFPRI Working Paper 32* (Washington, D.C.: International Food Policy Research Institute, 2013).
[97] Phone interview with a senior advisor to the Program for Biosafety Systems, May 15, 2015.

area; and supporting transparent inclusive, evidence-based policy formulation.[98]

If this seed law passes, it would strengthen the rights of foreign and certain domestic plant breeders. As stipulated in Clause 23 of the Plant Breeders Bill, subsequent Ghanaian legislation could not override these rights: "A plant breeder right shall be independent of any measure taken by the Republic to regulate within Ghana the production, certification and marketing of material of a variety or the importation or exportation of the material."[99] The Coalition for Farmers' Rights and Advocacy Against GMOs (COFAM), which includes Food Sovereignty Ghana, organized protests against the bill. Some of their concerns over this legislation regard its ability to override Ghanaian legislation and the requirement that seeds be stable and uniform in order for these protections to be applied. As these activists identified, this may be a bar set too high for local plant breeders, but protects foreign plant breeders capable of meeting these standards.[100]

The overall thrust of these efforts to transform the Ghanaian seed sector is a part of continent-wide move to harmonize seed laws in order to encourage investment in the seed sector. The USAID-funded Program for Biosafety Systems has also identified and tracked the evolution of Plant Breeders' Rights in Eastern and Southern

[98] G8 New Alliance, *Cooperation Framework, Ghana*, 3.
[99] Plant Breeders Bill, Ghana, Clause 23. "Plant Breeders Bill," accessed July 6, 2015, http://media.peacefmonline.com/docs/201312/919280493_445860.pdf.
[100] "The language in Clause 3 defining what can be protected is so restrictive, it creates huge financial barriers to Ghanaian breeders. To breed seeds in quantity that hold these characteristics over many plant generations costs in the millions of dollars. This astronomical expense will drive Ghanaian breeders out of business and assist the multinationals to consolidate their power." "COFAM Press Statement," Food Sovereignty Ghana, January 28, 2014, accessed February 2, 2014, http://foodsovereigntyghana.org/category/our-campaigns/national-campaign-against-upov-plant-breeders-bill/. It should be noted that COFAM and FSG have both framed the Plant Breeders' Bill erroneously as the "GMO bill," despite the fact that it was prior legislation, Biosafety Act 831, that permitted GMOs in Ghana.

Africa.[101] Whereas countries like Ghana have adopted legislation (such as Biosafety Act 831) that is more risk acceptant, the African Model Law on Biosafety adopts the precautionary principle.[102] Activists groups like the South African-based African Centre for Biodiversity (ACB) highlight that such harmonization of seed law could make it difficult for countries opposed to GMOs to prevent them from entering their country. For example, a uniform Southern African seed law, via the Southern African Development Community (SADC), could assist the spread of GMOs, which southern African countries have been able to resist thus far in spite of South Africa's commercialization of GM crops.[103] In West Africa, Ghana is the only country to attempt to pass a bill like the Plant Breeders' Bill, however, it is expected that if it passes Nigeria and Burkina Faso will follow suit.[104]

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[101] Theresa Sengooba, Joel I. Cohen, and Barbara Zawedde, eds. "Regulatory Cooperation, Using Information, Regional Policies, and National Expertise," (proceedings of an East Africa Policy Roundtable, Entebbe, Uganda, April 18-20, 2005).

[102] Regarding the more risk-acceptant approach of countries like Ghana, the African Centre for Biosafety states that "USAID has taken advantage of the lack of capacity for biosafety in Africa and provided funding, capacity building and infrastructure in a bid to influence weak biosafety law making." African Centre for Biosafety, *Understanding the Impact of Genetically Modified Crops in Africa: ACB Activist Handbook* (Melville, South Africa: African Centre for Biosafety, no date), 45. USDA Foreign Agricultural Service celebrates the "user friendly" biosafety law of Ghana. See USDA Foreign Agricultural Service, "Ghana Agricultural Biotechnology Annual." *Global Agricultural Information Network (GAIN) Report*, September 3, 2013.

[103] Carol B. Thompson, "Philanthrocapitalism: Appropriation of Africa's Genetic Wealth," *Review of African Political Economy* 41, no. 141 (2014): 400.

[104] Phone interview with a senior advisor to the Program for Biosafety Systems, May 15, 2015. Dr. Florence Wambugu, the Chief Executive Officer of Africa Harvest and an influential advocate for biotechnology in Africa stated recently "'Ghana's progress towards setting up robust biotech policy is an excellent model that other African countries can emulate…Ghana has, step by step, built a strong regulatory system, based on historically strong legal systems and a strong adherence to the rule of law.'" Florence Wambugu, "Ghana's Biosafety Law is Model for Africa—Dr. Wambugu," *Graphic Online*, July 1, 2015, accessed July 3, 2015, http://graphic.com.gh/business/business-news/45481-ghana-s-biosafety-law-is-model-for-africa-dr-wambugu.html.

V. New Forms of Capital: Biocapital and Philanthrocapital

Biocapital

The natural characteristics of the seed serve as a biological barrier to its commodification, as seeds are both the means of production and the product.[105] Hybrid seeds, developed during the first Green Revolution, experience reduced fertility following replanting. Yet, it was during the 1970s and 1980s that the seed industry was took further steps to overcome these barriers to commodification. The consolidated seed industry took two paths towards this transformation—through the development of genetic use restriction technology (GURT) and through patents. First, it became technologically possible to make genetically engineered GURT seeds sterile, thereby limiting the use-value to that of a grain rather than to a seed with reproductive capacity. GURT was initially developed by a subsidiary of Monsanto, a major producer of genetically modified (GM) seeds, together with the U.S. Department of Agriculture (USDA) in order to prevent farmers from saving seeds for subsequent harvests.[106] Following activist pressure, Monsanto pledged in 1999 not to commercially release this technology.[107]

The second path involved the transformation of the seed into a commodity, enabled by the lobbying of large agricultural interests, pharmaceutical, and genetic

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[105] Kloppenburg, *First the Seed,*10-11.
[106] Kloppenburg, *First the Seed,* 11.
[107] ETC Group was one of the activist organizations that drew attention to GURT, framing it the "terminator" gene. Monsanto states the following on their website: "Monsanto has never commercialized a biotech trait that resulted in sterile – or "Terminator" – seeds. Sharing the concerns of small landholder farmers, Monsanto made a commitment in 1999 not to commercialize sterile seed technology in food crops. We stand firmly by this commitment, with no plans or research that would violate this commitment." "Myth: Monsanto Sells Terminator Seeds," ETC Group, accessed July 6, 2015, http://www.monsanto.com/newsviews/pages/terminator-seeds.aspx.

engineering industries for a global and uniform patent regime.[108] The initial steps to legally enclose[109] the seed as a form of private property coincided with major developments in biotechnology. This effort encountered little resistance from advanced industrialized nations as these new technologies—and the economic gains they promised—provided justification for stronger intellectual property protection. Subsequent legal developments in intellectual property law like the 1991 revision to the Union for the Protection of New Varieties of Plants (UPOV) removed the farmer's privilege, making it possible to infringe upon the tradition of seed-saving, although the 1991 agreement did provide an avenue to limit breeders' rights.[110]

The interpretation of biological material as "patentable" was globalized in 1994 through the World Trade Organization's Trade-Related Aspects of Intellectual Property Rights (TRIPS) Agreement.[111] This Agreement can be conceived of as a legal means to enclose life as the private property of individual "innovators"[112] by

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[108] Kloppenburg, *First the Seed*, 323.

[109] By enclosure, I am referring to the shift from commons or communal property to private property. For a detailed discussion of this concept refer to the section on "Enclosure" in the introduction.

[110] Susan Sell, citing a GRAIN report, argues that the UPOV 1991 made seed-saving a crime. The farmer's privilege, as it is commonly known, was eliminated in the UPOV 1991. That being said, there is an optional provision (however weak) that allows for the relaxation of breeders' rights: "[Optional exception] Notwithstanding Article 14, each Contracting Party may, within reasonable limits and subject to the safeguarding of the legitimate interests of the breeder, restrict the breeder's right in relation to any variety in order to permit farmers to use for propagating purposes, on their own holdings, the product of the harvest which they have obtained by planting, on their own holdings, the protected variety or a variety covered by Article 14(5)(a)(i) or Article 14(5)(a)(ii)." See "International Convention for the Protection for the Protection of New Varieties of Plants of December 2, 1961, as Revised…on March 19, 1991," UPOV Convention, accessed July 6, 2015, http://www.upov.int/en/publications/conventions/1991/act1991.htm; Susan K. Sell, *Private Power, Public Law: The Globalization of Intellectual Property Rights* (Cambridge: Cambridge University Press, 2003), 143.

[111] The TRIPS agreement challenged the custom of Farmers' Rights (found in the 1992 Convention on Biological Diversity and the FAO's 2001 International Treaty on Plant Genetic Resources for Food and Agriculture), which allowed the right of farmers to save seeds. See Article 27.3 of the WTO TRIPS agreement. "Uruguay Round Agreement: TRIPS," WTO, accessed July 6, 2015, https://www.wto.org/english/docs_e/legal_e/27-trips_04c_e.htm.

[112] This notion of individual "innovators" in the domain of pharmaceutical and seed improvement has been critiqued by many indigenous activists and post-colonial scholars as failing to recognize the

enabling the patenting of biological material and requiring all 153 members to adhere to the intellectual property protections found in this agreement.[113] The discursive effect of these patent laws is that it re-defines *life* as a form of *property*, as a commodity that can be traded. Genetically modified seed is no longer just biological material, but, rather an informational, proprietary *technology* that is licensed to farmers and protected through legal means. The representation of life in informational terms, as a commodity that can be bought and sold, is a way by which "life itself" has been turned into a business plan.[114]

Biotechnology development and the patent regimes that accompany it reflect a form of the commodification of knowledge and what Rajan (2006) considers a new phase of capitalism.[115] Despite the growing corporatization of the life sciences industry, pharmaceutical and plant biotechnology companies have continued to rely on indigenous people to share traditional knowledge of the use of plants in order to develop new drugs and seeds. The indigenous people that share this knowledge, however, did not treat the natural world as something that could be individually owned.[116] Bratspies (2007) argues that one of the reasons that indigenous communities have faced such an uphill battle in trying to gain recognition of their property and culture is based in the incompatibility of Indigenous and Western

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contributions of generations of experimentation by indigenous and traditional peoples. See Rebecca M. Bratspies, "The New Discovery Doctrine: Some Thoughts on Property Rights and Traditional Knowledge," *American Indian Law Review* 31, no. 2 (2007): 315- 40; Ikechi Mgbeoji, *Global Biopiracy: Patents, Plants, and Indigenous Knowledge* (Ithaca: Cornell University Press, 2006); Vandana Shiva, *Biopiracy: The Plunder of Nature and Knowledge* (London: South End Press, 1999).

[113] There was, however, phased in adoption of the provisions of the agreement for developing countries. "Overview of TRIPS agreement," World Trade Organization, accessed July 6, 2015, http://www.wto.org/english/tratop_e/trips_e/intel2_e.htm.

[114] See Kashik Sunder Rajan, *Biocapital: The Constitution of Postgenomic Life* (Durham: Duke University Press, 2006).

[115] It is in this sense that Rajan uses the term "biocapital." Rajan, *Biocapital*.

[116] Mgbeoji, *Global Biopiracy*.

individualistic notions of property.[117] Indigenous knowledge and communal systems of property are disregarded through the globalization of Western intellectual property regimes. As Bratspies explains, "Most legal regimes award the mantle of 'property,' with its attendant rights, only to the tangible goods produced by indigenous cultures, paying no attention to the contexts in which those goods were produced and used."[118]

The formation of biocapital focuses on the gene as the source of market value, rather than the socio-ecological context from which germplasm is reproduced. The plant genetic material used as raw material for genetic engineering is not merely the product of a laboratory, but generations of farmer experimentation and plant breeding. Yet the patented material is isolated from this basis in vernacular knowledge and the socio-ecological context upon which this is developed. Escobar (2008) calls this a "genecentric" view of nature:

> And although biodiversity is seen as encompassing more than genes, the recognition of its genetic foundation suggests that it is in genes, not in the complex biological and cultural processes that account for particular biodiverse worlds, where ultimately 'the key to the survival of life on earth'…is supposed to reside.[119]

The development of gene banks as a conservation strategy, such as the Svalbard Global Seed Vault, can be characterized as genecentric. The dominant approach to biosafety also focuses on the gene with risk assessments that concentrate on the environmental and public health effects of possible gene flow.[120] As Andrée (2005) points out in his analysis of the Cartagena Protocol on Biosafety, the African Group's

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[117] Bratspies, "The New Discovery Doctrine," 317.
[118] Bratspies, p.317. In the next chapter we will see that those involved with developing the land facilitation mechanism of the Ghana Commercial Agricultural Program are mindful of such tensions and incompatibilities when it comes to land.
[119] Arturo Escobar, *Territories of Difference: Place, Movements, Life, Redes* (Durham: Duke University Press, 2008), 140.
[120] Chapter Two discusses the genecentric nature of the dominant biosafety regime.

position that risk assessment should include socio-economic impacts was not adopted in the final protocol.[121] In Ghana, socio-economic risks are considered outside the parameters of the risk assessment study, but would rather be considered at the stage of public comment following field trials of genetically modified crops.[122]

The proprietary material in a genetically modified crop is the transgene, the gene construct that has genetic material from two different species. For example, this would be the insect resistance trait derived from the bacterium *Bacillus thuringiensis* (Bt) introduced into the plant genetic material of the target crop through genetic modification. The 2004 Supreme Court case *Monsanto Canada Inc. v. Schmeiser* defended the patent protection on the glyphosate-resistant gene introduced into Monsanto's RoundUp Ready canola products.[123] The defendant Percy Schmeiser, a Canadian farmer, was found guilty of patent infringement. Schmeiser claimed that he had never purchased RoundUp Ready seeds, but rather the GM seeds had cross-pollinated with his canola plants. Tests conducted by Monsanto identified the transgene on Schmeiser's field. Subsequently, Monsanto sued Schmeiser for patent infringement on the basis of the unauthorized use and replanting of its genetically modified canola seeds. The Supreme Court of Canada refused to weigh in on questions of the moral desirability of genetic modification or on possibility of unintended cross-pollination. Rather the presence of the gene and Schmeiser to replant his seeds, regardless of the intention, was designated as unauthorized use and

[121] Peter Andrée, "The Cartagena Protocol on Biosafety and Shifts in the Discourse of Precaution," *Global Environmental Politics* 5, no.4 (2005): 28. pp.25-46.
[122] Author interview with acting CEO Eric Okoree of the National Biosafety Authority, Accra, May 20, 2015. He suggested that civil society organizations would be the ones to raise issues of the socio-economic impact.
[123] *Monsanto Canada Inc. v. Schmeiser*, [2004] 1 S.C.R. 902, 2004 SCC 34. Supreme Court of Canada, accessed July 6, 2015, http://scc-csc.lexum.com/scc-csc/scc-csc/en/item/2147/index.do.

thereby patent infringement.[124] The court's decision reflects genecentrism: the ecological possibility of cross-pollination was not considered relevant, the use of Monsanto's genetic material was. Monsanto owned the canola plants on Schmeiser's farm because they expressed the transgene that Monsanto had developed.

Biocapital, the commodification of life itself, is also furthered with the work of the AATF in countries such as Ghana. The AATF does more than support the expansion of 'pro-poor' biotechnology. It advances the conception and legal protection of biological life as patentable, "ownable" material to be protected through intellectual property rights. I argue that the work of the AATF represents a form of philanthrocapitalism, an argument that I explore next.

Philanthrocapital

Philanthrocapitalism is a form of charitable giving guided by the logic of, and happening alongside, flows of transnational venture capital. As described in a 2006 article in *The Economist,* "The Birth of Philanthrocapitalism," this new form of charity calls upon philanthropy "to become more like the for-profit capital markets" and is particularly popular among those new philanthropists that have made their millions in finance.[125] It is concerned with "impact investing," which the Rockefeller Foundation describes as efforts to help "address social and/or environmental problems while also turning a profit."[126] As the Global Impact Investment Network states, impact investment is distinguished by its intentionality: its aim to generate

[124] Ibid.
[125] *The Economist,* "The Birth of Philanthrocapitalism," *The Economist,* February 25, 2006.
[126] "Impact Investing," The Rockefeller Foundation, accessed July 1, 2015, http://www.rockefellerfoundation.org/our-work/current-work/impact-investing.

social and/or environmental impact as well as the generation of financial return (or at a minimum, a return on capital investment).[127]

Much of the recent wave of investment in African agriculture can be identified as "philanthrocapitalist:" agbiotech PPPs in Africa, in particular, are characteristic of this idea.[128] Philanthrocapitalism is reflected in the work of the Alliance for a Green Revolution in Africa (AGRA) and the AATF; microfinance, support for legislative changes in the seed sector, and the donation of genetic material for crop research are expressions of this phenomenon. Microfinance provides opportunities for "impact investing": access to small amounts of credit to support farming investments deepens capital's reach into rural towns and villages, allowing new markets to take root.[129] AGRA and the Ghana Commercial Agriculture Project's guidance for legislative changes in the seed and land arenas, respectively, are intended to help small farmers and also to expand the private seed sector. The "donation" of a gene by Monsanto to develop African crops for food security, as in the case of the Bt cowpea project, creates new markets and serves to normalize a Western-style patent regime.

Philanthrocapitalist giving is not just a strategy among the new philanthropists, but also includes some familiar faces in philanthropy. Actors like the Rockefeller Foundation are traditional philanthropic organizations that have

[127] The Global Impact Investment Network (GIIN) defines impact investing as "investments made into companies, organizations, and funds with the intention to generate social and environmental impact alongside a financial return." "About the Global Impact Investment Network (GIIN)," GINN, accessed July 1, 2015, http://www.thegiin.org/cgi-bin/iowa/resources/about/index.html.
[128] See Thompson, Carol B. 2014. "Philanthrocapitalism: Appropriation of Africa's Genetic Wealth," *Review of African Political Economy*, Vol.41, No. 141, pp.389-405.
[129] As an April 2012 World Bank report indicates: "Since 2010, Stanbic Bank has offered a $15 million guarantee fund from AGRA. Recently, an additional $15 million is offered by DANIDA. USAID/DCA also have a credit guarantee program with ECOBANK for $9.3 million. NIB, ADB, and a couple of rural banks have funds from MiDA, AFD, and KFW for onward lending to farmers." World Bank, "Agribusiness Indicators."

advocated new strategies such as impact investing in their philanthropic work. In an environment in which aid-based development has been heavily criticized for creating dependency and failing to substantially reduce poverty, a business approach to addressing developmental concerns has had significant appeal.[130] Philanthrocapitalists critique existing philanthropy as too short sighted and not results-oriented. The idea is for philanthropists to behave more like investors—allocating money in such a way as to maximize 'social returns.'[131] A central tenet in this approach to maximize social returns is the promotion of entrepreneurship.

Philanthrocapitalism recognizes the need for infrastructure in order to support its work, "the philanthropic equivalent of stock markets, investment banks, research houses, management consultants and so on."[132] AGRA, the G8 New Alliance for Food Security and Nutrition, and USAID-supported ADVANCE[133] program demonstrates this work in action: the establishment of linkages to finance, input suppliers, research, with a centralized strategic management plan. 'Venture philanthropists' favor partnerships, are hands-on, and more likely to interact with states that favor neoliberal partnerships. Philanthrocapitalism measures success through tabulation of 'results-based' outcomes, linear progression over time, and a singular system of accounting.[134] This is exemplified in the domain of agriculture with the fixation on yield as a measure agricultural success (where alternate measures could include resource use efficiency or compatibility with local technology,

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[130] See for example William Easterly, *The White Man's Burden: Why the West's Efforts to Aid the Rest Have Done So Much Ill and So Little Good* (New York: Penguin, 2007); and Dambisa Moyo, *Dead Aid: Why Aid Is Not Working and How There Is a Better Way for Africa* (New York: Farrar, Straus, and Giroux, 2010).
[131] *The Economist,* "The Birth of Philanthrocapitalism."
[132] Ibid.
[133] Agricultural Development and Value Chain Enhancement.
[134] Thompson, "Philanthrocapitalism."

knowledge, and context). Charitable 'giving' becomes another form of investment, as 'venture philanthropy' seeks to increase revenue as well as obtain reputational benefits.[135] This form of philanthropy can also lead to contradictions in the foundation's goals.[136] Hands-on venture philanthropy, such as the Bill and Melinda Gates Foundation, has had a significant influence on public policy in the developing world.[137]

Philanthrocapitalism, not unlike traditional philanthropy, is also a legitimating mechanism. It can deflate criticism of the exorbitant wealth of monopolists like Bill Gates: the more he gives to charity, the more his wealth is legitimated. Furthermore, his identity as a successful entrepreneur further validates his project to support other entrepreneurs. Philanthrocapitalism is related to the emergence of global corporate social responsibility initiatives, triggered through a dynamic interplay between actors within civil society and business.[138] Innovative, successful campaigns by activists[139] have highlighted unethical corporate practices such as the use of sweatshops, child labor[140] and war[141], deforestation and habitat destruction[142] and affected change in

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[135] 'Venture philanthropy' is a term coined by a member of the Rockefeller family in the 1960s. *Economist,* "The Birth of Philanthrocapitalism."
[136] Research into the BMGF investments found that "some of the billions spent by the Gates Foundation on improving health in the developing world came from its investments in companies that caused illness and disease through pollution and exploitation." See Sarah Boseley, "Gates Foundation May Shift Billions Into Ethical Stocks After Attack on Investments," *The Guardian*, January 12, 2007.
[137] See Spielman, Zaidi, and Flaherty, *Changing Donor Priorities.* The Bill and Melinda Gates Foundation has also had an impact on education policy in the developed world. The Foundation has donated millions of dollars to educational initiatives like the Common Core Standards Initiative in the United States. See Andrew Ross Sorkin, "So Bill Gates Has This Idea for a History Class…" *The New York Times Magazine*, September 5, 2014.
[138] See for example John Gerard Ruggie, "Reconstituting the Global Public Domain—Issues, Actors, and Practices," *European Journal of International Relations* 10, no.4 (2004): 499-531.
[139] See for example campaigns by Adbusters and activist campaigns against Nike and Victoria's Secret, as discussed in *No Logo.* Naomi Klein, *No Logo* (New York: Picador, 2000).
[140] Virginia Haufler, "The Kimberley Process Certification Scheme: An Innovation in Global Governance and Conflict Prevention," *Journal of Business Ethics*, 89, no.4 (2009): 403-16.
[141] Campaigns against Shell led by Ken Saro-Wiwa in the Nigerian Delta highlighted the company's use of the Nigerian military to brutally oppress the Ogoni people.

these practices. In a context in which so much value is ascribed to a brand, an easily identifiable corporate brand is vulnerable to re-branding by activists. Corporate social responsibility is a means to change public perceptions of corporations, and has in effect changed corporate practices.

Global anti-GMO campaigns have been successful at framing genetically modified crops as dangerous to health and social welfare, and commercialization of maize has faced fierce resistance in South Africa, sub-Saharan Africa's only commercially grown food crop. Presenting genetically modified crops as serving humanitarian ends is a powerful way to re-characterize the work of controversial agribusiness companies like Monsanto and Syngenta. Furthermore, the "donation" by Monsanto of the Bt gene, the $273 million that the Bill and Melinda Gates Foundation gave to agricultural development in Africa, or other such charitable acts wield a certain degree of political influence—political capital—in subsequent relevant decision-making. Spielman, Zaidi and Flaherty (2011) find that the scale at which the Bill and Melinda Gates Foundation gives to support development infrastructure across the domains of agriculture, public health, technology, and education has given the foundation significant political influence in discussions regarding development priorities within multilateral aid agencies.[143] This political

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[142] Deforestation has occurred in locations such as Indonesia for palm oil plantations to meet the demands of palm oil importers like Cargill. This has led to a significant decline in orangutan populations. Rainforest Action Network's has been successful at getting Cargill to commit to the future use of sustainable palm oil, however crucial details in its plan remain missing. "Cargill Releases New Commitment to Fix Its Conflict Palm Oil Problem; Rainforest Action Network Says Crucial Details Still Missing," RAN, accessed July 7, 2015, http://www.ran.org/cargill_releases_new_commitment_to_fix_its_conflict_palm_oil_problem.

[143] Spielman et.al. state that there is little evidence to suggest that the MDGs or CAADP were immediately able to catalyze new resources for agricultural development, rather: "Arguably, it was the entry of the Bill and Melinda Gates Foundation in 2005 that provided a much needed catalyst in support of these initiatives." The Bill & Melinda Gates' Foundation in 2009 gave $273 million in

capital gained through philanthropy encourages African states to cooperate with and facilitate the objectives of entities like the Bill and Melinda Gates Foundation, Monsanto, or the Rockefeller Foundation.

VI. Conclusion

The promise of the dual effects of positive social impact and the generation of profits have been linked to mechanisms of commodification in this new Green Revolution in Africa. This commodification is enabled by the establishment of Westernized property rights regimes in the form of patented seeds and formalized land titles, the latter of which has emerged as a priority among AGRA. The AATF's negotiations of royalty-free transfers of technology create a new proprietary regime protecting transgenic seeds with patents. This facilitates the development of 'pro-poor' biotechnology by encouraging research into locally suitable varieties, at the same time as it normalizes both the patent system and the seed as a commodity. These activities are undertaken under the guise of support for the smallholder farmer, the women whose rights are not recognized, the local plant breeder. But it is unclear whether the establishment of Western intellectual property rights and formalized land titles will have such an effect because the ability of these rights to protect these people is linked to the ability to understand, accept, and exercise those rights. It is clear that Western corporations would fit this criteria; it is less than certain whether

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agricultural development, 43% of comparable investment by USAID and about 11% of the $2.6bill committed to agriculture by multilateral and bilateral donors. "Nonetheless, the Bill and Melinda Gates Foundation's influence on the global agricultural development agenda has been more than proportional to its financial contribution during the past five years….The Foundation's comparative advantage comes from its refreshingly creative perspectives, its willingness to take on a strong leadership role, its openness to partnership with other donors, and its ability to operate without the excess baggage of a large bureaucracy or conflicting constituent interests that hamper many multilateral and bilateral donors." Spielman, Zaidi, and Flaherty, *Changing Donor Priorities,* 4-5.

the targeted rural populations will be beneficiaries of these legislative and proprietary changes that are at odds with local understandings of property.

Bt cowpea could offer benefits to small farmers in places like Northern Ghana because it addresses a pest that has had dramatic impacts on crop yields, and is suited to the local tastes and agro-ecological context. Scientists familiar with the concerns of local farmers guide the project.[144] Yet this project also raises some difficult questions regarding the future distribution of benefits. The Bt cowpea project is an international collaboration, so it is unclear who exactly would be the direct beneficiaries of the commercial sale of Bt cowpea seed. The question of patents, that is who would hold the patented technology upon commercialization, was an issue that many of the agricultural scientists and biosafety experts either preferred to stay out of or preferred to consider later.[145] The AATF has explained to me "The Bt Cowpea plant variety will be owned by AATF in trust for the local partners."[146] The lead scientist of the Bt cowpea project understood that Monsanto would hold the patent. During an interview when I asked about the Plant Breeders' Bill and patents on plants, the Program for Biosafety Systems' Country Coordinator stated "I stay out of this" and referred me to the PBS Senior Advisor to Ghana, Dr. Walter Alhassan. I had spoken to Dr. Alhassan a few years back in his leadership capacity in the Forum for Agricultural Research in Africa (FARA) and as a spokesperson for the benefits of biotechnology for African countries. He was now serving as a Senior Advisor for the Program for Biosafety

[144] The agricultural research scientists at SARI live on a compound in the village of Nyankpala, rather than in the Tamale metropolitan area, which encourages a better understanding of the local needs of farmers.
[145] Author interviews with agricultural research scientists at SARI, Nyankpala, February 13, 2013, February 22, 2013, and May 7, 2015.
[146] Email correspondence with AATF, October 27, 2014.

Systems. He had an unclear answer regarding who would hold the patent in the case of the commercialization of Bt cowpea, though he recognized it as an important question. His initial response was that he was not really sure, that the rights would be with CSIR and SARI, granted on a royalty-free basis by the AATF for "humanitarian purpose." Farmers would be able to save seed as this was "not a commercial thing" but rather a humanitarian gesture, as Monsanto has "donated" the gene royalty-free. When asked about patent rights and Bt cotton, he was much more clear: "that one is definitely patented."[147]

Ultimately, within a genecentric policy environment, Monsanto owns the gene that confers this desirable trait, insect resistance. However, that is one component in the production of Bt cowpea as Nigeria's national agricultural research institution provided the cowpea germplasm. This germplasm was also the product of years of farmer experimentation that would not be recognized by a patent. Monsanto has in the past attempted to enclose future research findings derived from its initial investments as its property. For example, when the Rockefeller Foundation attempted to bring herbicide-resistant maize into Kenya "negotiations broke down after Monsanto demanded full ownership of all future research results derived within Kenya, a demand that Kenyans understandably refused."[148] This legal ambiguity and desire to settle these complicated legal definitions on seed patents at a later date may lead to unequal outcomes when it comes to sharing the benefits of GM crop

[147] Phone interview with Dr. Walter Alhassan, May 15, 2015.
[148] Robert L. Paarlberg, *The Politics of Precaution: Genetically Modified Crops in Developing Countries* (Washington, D.C.: International Food Policy Research Institute, 2001), 48.

commercialization.[149] That is, those that possess the legal expertise to defend their investments in the development of Bt cowpea are unlikely to be the national agricultural research institutes; rather, Monsanto Company and its team of legal experts are more than likely in a position of greater strength. However, one thing that is clear is that the idea of the plants as patentable material, previously part of an excluded category in the Ghana Patents Act of 2003, is gaining some acceptance.[150] With that, the property rights regime in Ghana is shifting away from communal notions of property and towards Western neoliberal ideas about ownership in this new Green Revolution in Africa.

In this sense, the new Green Revolution in Africa generates struggles over property through the treatment of seed as a commodity to be privately owned, sold, or donated. This understanding of the commodity form of seed is reinforced through specific legal regimes that recognize intellectual property and grant greater authority to those actors that possess biosafety and biotechnology expertise. Furthermore, this agricultural model elevates the importance of the laboratory and the legal arena—rather than the farmer's field—to agricultural development.

[149] Author interviews with agricultural research scientists at SARI, Nyankpala, February 13, 2013, February 22, 2013, and May 7, 2015; author interview with Country Coordinator of PBS, Accra, May 5, 2015; phone interview with Dr. Walter Alhassan, May 15, 2015.
[150] Ghana Patents Act, 2003.

CHAPTER FOUR:
Experts and Entrepreneurs:
From Farming as a Way of Life to Farming as a Business

Even though Ghana has achieved the [UN Millennium Development Goal 1], we are working hard to position the country as the "Bread Basket" of West Africa through her accelerated modernization and commercialization of agriculture, with women empowerment and re-orientation from subsistence production to market-oriented production… At the centre of the strategy is the empowerment of small, medium and large scale farmers (with emphasis on women farmers) to enable them[to] acquire and use appropriate modern technologies *to make farming in Ghana a business rather than a way of life*.[1] –Kwesi Ahwoi, former Minister of Food and Agriculture in Ghana, June 27, 2011

I. Introduction

Global aid agencies, agribusiness, and the Ghanaian government have repeatedly identified Northern Ghana as a space that requires a series of professional interventions in order to realize its potential.[2] The wide expanses of land of the Northern Region with "good soil" and access to water promise a future of commercial agricultural success yet to be realized.[3] Global venture capital has also recently turned its attention to 'Africa' as a place of enormous potential, ripe for investment: "Africa is the final frontier—the last sizable area of untapped growth in the global economy.

[1] "Statement by Honourable Kwesi Ahwoi at FAO," Government of Ghana, statement at the 37th session of the FAO Conference, Rome, June 27, 2011, accessed November 11, 2011, http://www.ghana.gov.gh/index.php?option=com_content&view=article&id=6412:statement-of-honourable-kwesi-ahwoi-minister-for-food-and-agriculture-ghana-at-the-thirty-seventh-session-of-the-fao-conference-held-in-rome-italy-25-june--2-july-2011&catid=56:speeches&Itemid=205.

[2] "There is an increasing development gap between the Northern Savannah Ecological belt and the rest of the country. By all indications the North lags behind the South and the gap seems to be increasing. This gap is a critique of the status quo…The Northern Savannah Development Initiative (now referred to as SADA) defines the parameters of a major paradigm shift in stimulating economic growth and sustainable development in the belt." Savannah Accelerated Development Authority, *SADA: Secretariat and Organizational Structure, Strategy and Work Plan 2010-2030* (April 9, 2011), 1.

[3] Author interview with a Northern Region district assemblyman, Tamale, September 18, 2012.

To succeed, companies will need to bring Africa into the boardroom."[4] The 2014 World Economic Forum Annual Meeting echoed this sentiment by pointing out that six of the top ten fastest growing economies are in Africa, where a third of the countries on the continent are experiencing 6% GDP growth. Africa's abundance of natural resources, 60% uncultivated arable land, and the largest global workforce were highlighted as other factors to excite investment on the continent.[5] Investment in African agriculture is perceived to be more profitable now for a number of reasons: at a time of global economic downturn and a global shortage of arable land the African savannah is a frontier for new capital investment and emerging markets; the financialization of agriculture has made the trade in commodity futures possible and lucrative; legislative change within African countries has created a more secure 'enabling environment' for investors; and technological change have increased expectations that agriculture can be profitable in these agricultural frontiers.[6]

Between 2009-2014, the government of Ghana has increased its efforts to modernize Ghanaian agriculture in line with the new Green Revolution in Africa agenda. It has done so through the promotion of agribusiness entrepreneurship, the

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[4] This is also reflected in the increase in magazines focusing on investment in Africa: *Fortune Africa, African Business, African Banker.* Another example of this excitement over African investment is seen in the BBC award-winning documentary (2005) *Africa: Open for Business.* See Carol Pineau, *Africa: Open for Business*, 60 min, released in 2005. Quote from Dupoix et.al., *Winning in Africa: From Trading Posts to Ecosystems*, (Boston: The Boston Consulting Group on behalf of Private Equity Africa, 2014), accessed July 6, 2015, http://www.privateequityafrica.com/wpm/wp-content/uploads/2014/03/2014_January-_Winning_in_Africa_BCG.pdf. Private Equity Africa has a link to Catalyst, which is supported by DFID and a part of the Agriculture Fast Track launched by USAID in 2013.

[5] "Africa's Next Billion," World Economic Forum Annual Meeting 2014, accessed July 6, 2015, http://www.weforum.org/sessions/summary/africas-next-billion.

[6] Ghana's foreign direct investment inflows have increased from $636 million to $2.53 billion at a compound annual rate of 41%. Ghana "has been recognized as one of the most open economies in sub-Saharan Africa for foreign equity investment." "Ghana's Private Sector Investment Plan for Agricultural Development," USAID, May 2012, accessed July 6, 2015, http://pdf.usaid.gov/pdf_docs/PA00JZ75.pdf.

registration of land, and the introduction of modern agricultural technologies such as high yield and genetically modified seeds, fertilizers, and tractors via private sector initiatives and "complementary and targeted public support."[7] The John Mahama administration's Savannah Accelerated Development Authority (SADA) public-private partnership aims to "transform agriculture" in Northern Ghana through the expansion of commercial agriculture and the linkage of smallholder farmers to markets. This commitment to agricultural modernization is further demonstrated by Ghana's participation in the "Grow Africa" partnership, co-convened by the African Union Commission, the New Partnership for Africa's Development Agency (NEPAD), and the World Economic Forum. This is available to countries that have signed a Comprehensive Africa Agriculture Development Programme (CAADP) Compact and that "demonstrate readiness to attract investment aligned to a national strategy for agricultural transformation."[8] Efforts to modernize agriculture in Ghana are not new, as the idea that reforms in small-scale agriculture can lead to a transformation in African economies has been repeatedly invoked in African agricultural policy since the 1960s.[9] What is new is who leads: whereas in the 1960s

[7] This is the language of the Grow Africa first annual report (2013): "Recognizing some of the challenges of past efforts, the government is adopting a new public-private partnership (PPP) approach in which complementary and targeted public support serves to leverage or facilitate private agri-investment." Grow Africa Secretariat, *Grow Africa: Investing in the future of African agriculture, 1st Annual Report* (Geneva, Switzerland, May 2013), 42.

[8] Ghana signed a CAADP compact in 2009. The idea of the CAADP is for countries to identify their own priorities and strategies to improve agricultural development, with support provided by the World Bank. An evaluation of Ghana's CAADP plan by the Washington, D.C.-based International Food Policy Research Institute states that "Though growing, the expenditure shares are short of the CAADP targets. The allocations also suggest that the agricultural sector does not receive funds commensurate with the importance accorded to it in national plans." Kolavalli et.al, "Do Comprehensive Africa Agriculture Development Program (CAADP) Processes Make a Difference to Country Commitments to Develop Agriculture? The Case of Ghana," *IFPRI Discussion Paper 01006* (Washington, D.C.: the International Food Policy Research Institute, 2010).

[9] Alice Wiemers, "A 'Time of Agric': Rethinking the 'Failure' of Agricultural Programs in 1970s Ghana," *World Development* 66 (2015): 104.

the state led efforts to modernize agriculture, now public-private partnerships take the lead.[10]

In this chapter I argue that these agricultural initiatives are targeted not only at the private sector and at national governments, but at also at the micro-political level of social identities. The idea is to change farmers' relationships to farming and even their own self-identifications. A common trope repeated in agricultural development circles and articulated by Kwesi Ahwoi, the former Minister of Food and Agriculture in Ghana, is the need or desirability to "transform farming from a way of life into a business." Development agencies, as well as industry, pursue this transformation through the training, production and dissemination of knowledge about good agricultural practices,[11] the use of demonstration farms, and the expansion of Western-influenced formal education and educational exchanges. These actors promote entrepreneurship as the preferred solution to agricultural development challenges. Farming as a business contrasts with farming as a way of life in its reliance on scientific knowledge as well as its focus on profits and exports, rather

[10] Amanor (2009) makes the following point: "Agribusiness is not a new field of concern for the World Bank and has formed an important part of World Bank interventions in agriculture from the 1960s, when the forerunners of contemporary agribusiness emerged as a statist project, in which the peasantry was locked into various forms of modern capitalist agrarian production, through which they had to produce for parastatal marketing organizations according to specific prescriptions. By the 1980s successful examples of these projects were privatized under structural adjustment, often taken over by large international consortiums." Kojo Sebastian Amanor, "Global Food Chains, African Smallholders and World Bank Governance," *Journal of Agrarian Change* 9, no.2 (2009): 247. See also Hans Holmén, "The State and Agricultural Intensification in Sub-Saharan Africa," in *The African Food Crisis: Lessons from the Asian Green Revolution,* eds. G. Djurfeldt, H. Holmén, M. Jirstrøm, and R. Larsson (Cambridge: CAB International, 2005), 87-112. This shift is discussed in the previous chapter.

[11] The UN FAO identifies four pillars of 'good agricultural practices': economic viability, environmental sustainability, social acceptability, and food safety and quality. In practice, most GAPs are de facto determined by Western countries. For a discussion of "good agricultural practices" see Food and Agriculture Organization of the United Nations. "What are Good Agricultural Practices?" FAO, accessed July 6, 2015, http://www.fao.org/prods/gap/.

than self-provisioning. It also entails more formulaic farming (e.g. the use of prescribed inputs), rather than improvisation and experimentation.[12]

Building on Chapter Three, I argue that such efforts to transform farming from a way of life to a business revolve around three processes: the commodification of seed and land, the commercialization of farming activity, and the professionalization of the farmer. The aim of these processes is to render messy practices of cultivation and land use legible, and to change of what it means to be a farmer. The next section opens with an ethnographic vignette from my fieldwork in Ghana to illustrate how this promotion of entrepreneurship and proliferation of expertise operates at the micro-political level. It analyzes the development of value chains supported by public-private partnerships. It also highlights the role of education and training in support of standardization, professionalization of farming, and integration into the market economy that function as central components of Green Revolution agricultural programs. I consider the connection between the promotion of entrepreneurship and the privileging of scientific expertise in agricultural modernization programs. Next, I discuss the logic of agricultural "exit" and how this logic invokes struggles over identity: who should farm, who is an expert, who is an authority, and whose knowledge counts. However, ethnography allows me to show that these grand plans to reorder rural society become constantly frustrated by existing complexity: multiple, coexisting roles, risk reduction practices, and local notions of entrepreneurship. I provide several examples from my fieldwork and close

[12] For a discussion on the use of improvisation among self-provisioning farmers see, for example, Paul Richards, "Cultivation: Knowledge or Performance?" in *An Anthropological Critique of Development: The Growth of Ignorance*, ed. Mark Hoban, (London: Routledge, 1993) 61-78.

with a discussion of the Ghana Commercial Agriculture Program's ongoing attempt to establish a land bank.

II. The 'Serious' Farmer: Entrepreneurship and the Global Food Economy

…Mango Value Chain Workshop…

We had walked in late to the Mango Value Chain[13] workshop, but it didn't seem to bother Latif, who had just been enskinned[14] as a chief. Though we were all academics and had met through a mutual friend, a professor at the University of Development Studies, we were attending the workshop as representatives of one of the largest agro-chemical dealers in Tamale. It was an uncomfortable affiliation, one that I was fortunately able to distance myself from when we joined the forty participants who had gathered to talk about how to develop and strengthen the mango value chain in Northern Ghana. The workshop was put together by the Market-Oriented Agricultural Programme (MOAP), a German-Ghanaian partnership. It was quite obvious that there was German money involved—everyone was given nametags, a spiral notebook, a pen, and a plastic folder. Bottles of water were at each table in the air-conditioned room, with breaks of fish pies and sodas and a full spread of food at lunch.

After the first coffee break, Nana Ampofo spoke about the experience of mango production in Brong-Ahafo, a region directly south of the Northern Region, which

[13] Organizers of the workshop defined a value chain as that which connects the following: input provision, production, processing, distribution and sales, and consumption. Actors involved in this chain include input providers, primary producers, logistic centers, industry, traders, financiers, and final consumers.

[14] This is the term used to refer to the process of making someone a chief. The reference is to the sheepskins upon which chiefs sit.

had well-established mango plantations and is the center of mango production in Ghana. In a talk entitled "Lessons from Brong-Ahafo," Nana spoke of the need to "target consumers first" and posed as a central question, "what does the consumer want?" The identification of the "consumer" became clear with his follow-up question, "how can mangoes be exported?" Whereas he later addressed local consumer demand, his clear focus was the production for export markets in locations like the European Union. Growers, Nana explained, need to acquire more knowledge of mango production and should look to input providers for fertilizers, agro-chemicals and seedlings. Service providers such as banks also played a role in strengthening value chains. Nana Ampofo spoke of issues like post-harvest loss, certification, the necessity to establish standardized good agricultural practices in Ghana, the damage posed by fruit flies, and the need to use caution when using insecticidal sprays. He then emphasized the importance of training—farmers need to be taught how to spray and how to handle pesticides. He also emphasized that the lack of access to information was a key impediment to success: going into "serious mango business" requires information. He then relayed how the Brong-Ahafo value chain committee meets every two months, evidence of the seriousness of the endeavor.

During the question and answer session that followed, Nana Ampofo stated "we have a motto that says 'mango is a serious business'…If you don't want to get into a serious business, then don't get into mango." One of the facilitators of the event, Al-Hassan, found this articulation of mango farming as a "serious business" so compelling that he led a call and response whereby he would shout "mango" and we

participants would respond "serious business!" Al-Hassan explained that this refrain was important because it expresses the idea that producing mangos for export (that meet international standards) is a different enterprise than meeting local demand. The workshop included value chain role-playing activities that articulated some of the common challenges which different actors along the mango value chain experiences, as well as opportunities to discuss possible solutions. Throughout the nine-hour workshop, a tension arose between producers who thought largely in terms of local markets and service providers in the business of export-promotion like EDAIF (Export Development and Agricultural Investment Fund). As one producer explained—much to the chagrin of organizers—farmers must produce for themselves first, and then for international markets. Sentiments such as these were not the intended outcome of the Market-Oriented Agricultural Programme.

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The 'Serious' Farmer

As one informant working with ADVANCE told me, "farming needs to be seen as a Big Man's job."[15] Another farmer, the son of one of the larger farms in the Northern Region, told me that farming is often associated with being "poor, illiterate" and not as a profitable enterprise, contributing to the loss of young people in agriculture.[16] The thrust of these commercial agriculture programs in Ghana is to change peoples' perceptions about the nature of farming: farming can be a business,

[15] Author interview with representative from the Agricultural Development and Value Chain Enhancement (ADVANCE) Program, Tamale, February 18, 2013. ADVANCE is a USAID-funded project to support the Obama Administration's Feed the Future strategy, implemented by local and international partners led by ACDI/VOCA.
[16] Author interview with large-scale rice farmer in Northern Region, May 9, 2015.

and a profitable business at that. Training events like the Mango Value Chain workshop, which are taking place all over Africa, are more than just opportunities to train farmers in the meaning of 'good agricultural practices.' They are attempts to create new identities. When the adoption of new agricultural practices is framed as part of 'progress,' this adoption produces corollary subjects that are 'modern.' Likewise, the rejection of new agricultural technologies can render those that are averse to these technologies as 'backward' and provide justification for land dispossession, as I discuss in the section on "agricultural exit." The promotion of 'serious' farmers and 'businessmen' indicates not only identity shifts, but also possible ramifications for food security. 'Serious' farmers are farmers who no longer focus only on staple crops, but are looking at production for export and ways to add value to crops. As such, these farmers become more integrated into the global food economy and tend to focus on crops and varieties that are most lucrative, and not necessarily on those that are the most critical for fulfilling the dietary needs of local communities.[17] Furthermore, increased demand for staple crops like maize and yam from external markets may also price out poorer consumers that can no longer afford to pay for such staple foods.[18]

[17] Mango in particular is not a common food consumed by people in Northern Ghana, but an exotic crop more typically eaten by ex-pats.

[18] This is not necessarily new, as farmers have responded to market demand before the advent of these market-oriented programs. In Ghana, there has been significant loss of yam varieties "because of the market" as farmers' focus on the most lucrative yam, the Larbico. One of the agricultural research scientists I spoke to at the Savannah Agricultural Research Institute (SARI) acknowledged that efforts to promote yam for export could likely have the effect of rising the price of this staple crop. Author interview with agricultural research scientist at SARI, Nyankpala, February 22, 2013. During the global food crisis of 2007-8, demand for corn for ethanol in the industrialized world had the effect of causing an increase in price for this staple good. See Walden Bello, *The Food Wars* (New York: Verso, 2009).

Interventions like Grow Africa and SADA are intended to connect farmers to the tools necessary (both material and informational) for increasing aggregate yields. They aim to transform an agricultural landscape rife with subsistence farming into a 'bread basket' of high agricultural productivity through "pro-poor private sector led value chain development."[19] Although lack of technology and access to credit are posited as some of the reasons for low productivity, the lack of information and training are considered the key impediments to agricultural development. Traditional[20] farmers in Northern Ghana are framed not only as under-producing, but also as uneducated, isolated, and backward. 'Serious' farmers, by contrast, are modern, knowledgeable, and connected. With access to 'right knowledge'[21], agricultural training and demonstration, 'sensitization' about land, and seed, technology and property[22], and market linkages, farmers can help to realize Northern Ghana's food production potential.

Such 'serious' farmers are usually conceived as participants in transnational 'value chains' that link African farmers to distant markets and places. The transformation of African agriculture is also linked to discourses about 'feeding the world' emanating from institutions such as the World Bank, the United Nations Industrial Development Organization (UNIDO) and the UN Food and Agriculture

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[19] Republic of Ghana, *Ghana Agriculture Sector Investment Programme (GASIP): Design Completion Report*, February 18, 2014, accessed July 6, 2015, http://www.ifad.org/operations/projects/design/111/ghana.pdf, 4.

[20] I use the term "traditional" as many chiefs and elders I spoke to in my research in farming villages identified as "traditionalists." Other possible terms include: peasant or subsistence farmers, self-provisioning farmers, smallholder farmers (though the latter has been misused by agencies like the World Bank to include farmers with up to 100 ha of land, certainly not the "smallholders" I encountered in Northern Ghana).

[21] This is the language of the Grow Africa platform, see Grow Africa Secretariat, *Grow Africa: Investing in the future of African agriculture*, 12.

[22] This is a reference to 'sensitization' seminars that I discuss in Chapter Two.

Organization (FAO) as well as African governments. They translate concerns about how to reduce vulnerability to food price shocks into mandates to increase agricultural productivity in sub-Saharan Africa. Calls to 'feed Africa' through private donations and governmental food aid compete with assertions that 'Africa' does indeed feed itself[23] or *can* with technocratic market interventions. Such narratives highlight the role of small farmers[24] as agents of development: the promotion of smallholder entrepreneurship and its linkage to markets is seen as an appropriate means to increase production and alleviate poverty.[25]

The promotion of entrepreneurship as a means to alleviate poverty has emerged as a new strategy to address widespread criticisms that traditional aid and philanthropy do not work. Influential development economists such as Dambisa Moyo and William Easterly argue that aid prevents people from searching for their own solutions and can do more harm than good. Rather, when markets are free and incentives are right, people will find ways to address their own problems.[26] From this perspective, aid and philanthropy can maintain conditions of underdevelopment and breed corruption, as aid moneys find their way into the wrong hands or are

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[23] See, for example, "Hungry for Land: Small Farmers Feed the World—With Less Than a Quarter of All Farmland," La Via Campesina/GRAIN Press Release, May 29, 2014, accessed July 7, 2015, http://viacampesina.org/en/index.php/main-issues-mainmenu-27/agrarian-reform-mainmenu-36/1615-hungry-for-land-small-farmers-feed-the-world-with-less-than-a-quarter-of-all-farmland; Miguel A. Altieri and Victor Manuel Toledo, "The Agroecological Revolution in Latin America: Rescuing Nature, Ensuring Food Sovereignty and Empowering Peasants," *The Journal of Peasant Studies* 38, no.3 (2011): 587-612.

[24] "Small farmer" or "smallholder farmer" (often used interchangeably) is commonly used terminology that refers to farmers that participate in small-scale, often subsistence, farming. Subsistence farming is producing food to support the family and not for trade.

[25] The World Bank, *World Development Report 2008: Agriculture for Development* (Washington, D.C.: The World Bank, 2007); Kandeh K. Yumkella and Patrick M. Kormawa, "Agribusiness for Africa's Prosperity," (lecture on behalf of UNIDO at the International Food Policy Research Institute, Washington, D.C., October 25, 2011).

[26] See Dambisa Moyo, *Dead Aid: Why Aid Is Not Working and How There Is a Better Way for Africa* (New York: Farrar, Straus, and Giroux, 2010); William Easterly, *The White Man's Burden: Why the West's Efforts to Aid the Rest Have Done So Much Ill and So Little Good* (New York: Penguin, 2007).

inappropriately used by interventionists that understand little about the local context.[27] The Millennium Villages Project (MVP), led by Jeffrey Sachs, differs in its diagnosis of the causes of poverty: it is too little aid, not too much, that is the root of underdevelopment. However, the MVP not only infuses large amount of aid into programs to address the "poverty trap," it also promotes entrepreneurship: "As the globalized world becomes ever more connected and new markets emerge to meet the demands of growing economies, developing business and entrepreneurship is the next evolutionary step in sustaining the gains of the Millennium Villages Project."[28]

An entrepreneurial farmer is one that sees farming as a business, not just a way of life. He[29] is able to envision scaling up production to 'feed the world.' The entrepreneur is concerned with profits, he produces cash crops for export, and he is able to meet certification requirements. He has received training in the use of inputs, utilizes mechanization, and knows 'good agricultural practices.' He is a part of a value chain and knows how to access capital to scale up his business. He is willing to take risks. He likely comes from a family that owns land, perhaps from a chiefly

[27] Jeffrey Sachs, on the other hand, argues that the problem with aid is that there has been too little of it and that this, subsequently, has not enabled people to overcome the "poverty trap." This trap is understood as the way in which poverty prevents people from investing in their future (for example, not educating African children because families need their labor or not consistently buying fertilizer because the cost is too high) and entrenches people in their own deepening poverty. See Jeffrey D. Sachs, *The End of Poverty: Economic Possibilities for Our Time* (New York: Penguin, 2005). For a further comparison and empirical assessment of these two views on aid, see Abhijit V. Banerjee and Esther Duflo, *Poor Economics: A Radical Rethinking of the Way to Fight Global Poverty* (New York: PublicAffairs, 2011).

[28] "About Millennium Villages Sector Strategy," Millennium Villages Project, accessed July 7, 2015, http://mvs.millenniumvillages.org/about/sector-strategy/.

[29] My choice of the pronoun "he" is deliberate. Although there is a lot of talk about gender inclusion in development circles, in the Northern Region—where many of these agricultural development interventions will take place—the businessman farmer involved in commercial agriculture was typically male. The agricultural experts working in research institutes and the Ministry of Food and Agriculture were also typically male. Women are involved in a larger share of the food production and nutrition by tending to plots adjacent to the household. By contrast, the farming of cash crops such as cocoa, maize, roots and tubers, and tomato are generally in the domain of men.

family, and would be considered a 'big man,' a man of status, for his business know-how. He knows about new technologies and he is eager to use them. He may be a contender for a National Farmer Award on National Farmers' Day and travel to Accra.[30] Rather than rely on communal systems of reciprocal labor exchange during the harvest season, he hires paid laborers to work on his farm. In the terms described by Ghana Commercial Agriculture Project (GCAP) and the USAID-funded Agricultural Development and Value Chain Enhancement (ADVANCE) Program, he has the large "nucleus" farm that is connected to smaller "outgrowers" that sell their product in-kind for the use of his tractor.

Nucleus-Outgrower Schemes: Commercialization and Value Chains

A 2010 World Bank report, *Building Competitiveness in Africa's Agriculture*, specifies that outgrower schemes are generally understood as

> schemes where agribusiness has considerable control over the smallholder production process, providing a large number of services, such as input credits, tillage, spraying, and harvesting. The smallholder provides land and labor in return for this comprehensive extension/input package.[31]

Most nucleus-outgrower schemes that I became familiar with in my research expected farmers to acquire and prepare their own land. These outgrower-schemes are generally linked to global value chains, a buzzword used to conceptualize linkages between businesses, even businesses of significant disparity in size. The concept of value chains advances a vision of linkages between small farmers and global markets: for example, small farmers may produce as outgrowers that sell to nucleus farmers,

[30] Author interview with former recipient of a National Farmer award, Kukuo Yapalsi, September 18, 2012.
[31] Martin C. Webber and Patrick Labaste, *Building Competitiveness in Africa's Agriculture: A Guide to Value Chain Concepts and Applications* (Washington, D.C.: The World Bank, 2010), 133.

who then sell their products to much larger processers that add value to the raw materials. The idea of the value chain perspective is to provide "…an important means to understand business-to-business relationships that connect the chain" in order to increase efficiency, productivity, and add value along the chain.[32] This conceptualization is intended to assist in the identification of needed "improvements in supporting services and the business environment."[33] This arrangement of nucleus-outgrowers servicing global value chains renders legible decentralized farms through creating nuclei to centralize production.[34] These schemes are facilitated by government work to "improve the enabling environment for agriculture" with a "stronger role for the private sector in transforming agriculture."[35] It is for this reason that McMichael (2013) critiques value chains as "a new frontier of publicly subsidised corporate investment, incorporating smallholding farmers into commercial relations to redress apparent food shortages."[36]

The talk of "nucleus-outgrower" arrangements dominates agricultural public-private partnerships in Ghana like the Savannah Accelerated Development Authority and the Ghana Commercial Agriculture Program that seek to support entrepreneurs and link them to the global economy. In a report entitled "Ripe for Change: The Promise of Africa's Agricultural Transformation," Bono's nonprofit organization ONE celebrates GCAP:

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[32] Webber and Patrick Labaste. *Building Competitiveness in Africa's Agriculture,* 1.
[33] Ibid.
[34] A parallel investment to these nucleus-outgrower schemes is financial support for the creation of feeder roads that can connect distant farms.
[35] Grow Africa Secretariat, *Grow Africa: Investing in the future of African agriculture*," 42.
[36] See Philip McMichael, "Value-chain Agriculture and Debt Relations: Contradictory Outcomes," *Third World Quarterly* 34, no.4 (2013): 671.

> A good example of a recent initiative to develop public-private partnerships is the Ghana Commercial Agriculture Project (2012–17), supported by USAID and the World Bank, which has a special focus on linking smallholders to commercial business through contract farming and outgrower schemes. So far, it has identified a number of investment opportunities, including seed and cassava processing.[37]

The stated GCAP philosophy is to promote inclusive agriculture. Yet this inclusive agriculture has a specific design: the GCAP approach understands that "people who want to invest [in agriculture] will only promote a nucleus-outgrower scheme."[38]

The Mahama Administration's SADA initiative focuses its efforts on the Savannah Ecological Zone, which includes the three northernmost regions of Ghana—the Northern, Upper East and Upper West Regions. This initiative can be understood as a public-private partnership that works to reduce "the North-South gap" through the promotion of agricultural modernization and climate change mitigation. According to a 2011 report,

> At the core of the SADA programme is an attempt to transform agriculture from its subsistence base to a high-yield commercial agriculture. In this transformation, ability to attract private sector investors into the agricultural value chain is critical. Such private sector must be animated to support and sustain thousands of small-holder farmers as out-growers, and also provide needed capital, technology and access to large domestic, regional and internal markets for new crops.[39]

Although there has been considerable controversy over the implementation of the program, this logic continues to shape the approach to agricultural modernization in Ghana.[40] The Alliance for a Green Revolution in Africa has recently celebrated

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[37] "Ghana: Ghana Commercial Agriculture Project," Grow Africa, accessed July 7, 2015, http://growafrica.com/initiative/ghana.
[38] Author interview with a representative of the National Lands Commission, Accra, May 20, 2015.
[39] Savannah Accelerated Development Authority (SADA). *SADA Secretariat and Organizational Structure: Strategy and Work Plan 2010-2030.* April 9, 2011, p.3.
[40] There are major issues with corruption within SADA. SADA's afforestation project, in particular, was widely panned as a total disaster. The former SADA CEO Gilbert Seidu Iddi had selected ACI

SADA's rice intensification program, which is reliant on an outgrower scheme, noting the increase in productivity and a decline in the importation of rice.[41]

Likewise, the plans to disseminate genetically modified cowpea seed—if it is approved for commercialization—reveals how this new technology is at once conceived of as 'pro-poor' but also promotes entrepreneurship and nucleus-outgrower structures. Amanor (2011) makes the point that Ghanaian farmers tend to save seed and are reluctant to purchase improved seed. With regard to the development of a certified seed sector in Ghana, Amanor argues that this development is "…is predicated on creating an enabling social infrastructure for seeds, which gradually builds demand among farmers and integrates them into seed, input and food processing markets."[42] The Bt cowpea public-private partnership provides an example of how a market in genetically modified seed may be created. In an interview with the lead scientist at the Savannah Agricultural Research Institute on the Bt cowpea project, he explained, "if you involve too many farmers too soon you won't be able to control it."[43] Rather, they are likely to "identify a few elite farmers" that would be trained on the use of the technology. SARI would make sure that farmers utilize

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Construction Limited, registered by Roland Agambire and Miriam Ajavon, for the afforestation project despite the fact that the construction and electrical company had no experience with afforestation projects. Online news reports by My Joy online, Ghana News Web, the Ghanaian Chronicle, allAfrica.com each reported on the failure of the SADA afforestation and guinea fowl projects. I spoke to more than a dozen different people about SADA's efforts in the North in my return trip in May 2015 and not a single person disputed the claim that the SADA afforestation project had failed. I visited one of the afforestation sites and not a single tree planted had survived. See, for example, "SADA Broke Procurement Laws in Award of 32.4 Million Afforestation Contract to ACI- Audit Report," MyJoyOnline, March 16, 2004, accessed July 7, 2015, http://www.myjoyonline.com/news/2014/april-16th/sada-broke-procurement-laws-in-award-of-324-million-afforestation-contract-to-aci-audit-report.php#sthash.rhBbDDCE.FsJtYGbw.dpuf .

[41] "Ghanaian President Hosts AGRA Board Members at State House, Ghana," AGRA, accessed July 7, 2015, http://agra-alliance.org/media-centre/news/president-mahama-meets-agra-board/.

[42] Kojo Sebastian Amanor, "From Farmer Participation to Pro-poor Seed Markets: The Political Economy of Commercial Seed Networks in Ghana," *IDS Bulletin* 42, no.4 (2011): 48.

[43] Author interview with Dr. I.D.K. Atokple, SARI, Nyankpala, May 7, 2015.

proper biosafety procedures such as the use of refuge zones.[44] These farmers would be the outgrowers that would work with a private Tamale-based seed company, Heritage Seed Company, Ltd., supported by AGRA and owned by seed entrepreneur Zakaria Iddrisu, that would be the nucleus of the operations, producing certified seed from the SARI foundation seed.[45] In the first few years following commercialization, SARI would work only with Heritage Seed Company and a few farmers, but would gradually bring other farmers in during field days that would view the demonstration fields of the transgenic cowpea.[46] This example provides an illustration of the relationship between entrepreneurship and scientific expertise. In the next section, I elaborate on these ideas and specify some of the mechanisms of the professionalization of the farmer.

III. The Professionalization of the Farmer

Many international interventions in rural Africa identify an aging population of farmers and a declining interest in farming among young people. In order to address these dynamics, agricultural interventions need to not only to change the

[44] In order to reduce the chances of insect resistance to the transgene, biosafety protocol specifies that any farmer using genetically modified seed must have fields that cultivate a maximum of 80% genetically modified crops, with the remaining 20% conventional.

[45] It is quite possible that AGRA would work with SARI in providing the training, though this was not specified. AGRA has provided such training in the past as it states here: "Since 2008, AGRA has been providing technical and financial support to seed companies in Ghana as well as a number of other African countries. Heritage Seeds Company Limited is one such company. It has benefitted from AGRA's support in form of grants as well as on-site technical advice through field trips, workshops, training sessions, and coaching over the years. The firm received a grant to produce certified seeds, create awareness among farmers on the new seeds and distribute the new seeds to farmers. Through efficient coaching and other technical support received from Program staff of AGRA, Mr. Idrissu moved from producing Open Pollinated Variety (OPV) to improved variety seeds within a short period, which has resulted in winning this prestigious award." "AGRA Grantee Wins National Award in Seed Production in Ghana: Award Expected to Strengthen Public-Private Partnerships," AGRA, accessed July 7, 2015, http://archive.agra.org/media-centre/news/agra-grantee-wins-national-award-in-seed-production-in-ghana/.

[46] Author interview with Dr. I.D.K. Atokple, SARI, Nyankpala, May 7, 2015.

existing orientations of farmers from producing for households to producing for export-oriented value chains, but also to entice young people into farming. Presenting commercial agriculture as a lucrative enterprise that can rely on mechanization, rather than difficult manual labor, is intended to attract young people into food production. Public-private partnerships have played an influential role in altering such orientations through a discourse of entrepreneurship. The African Accelerated Agribusiness and Agro-Industries Development Initiative, otherwise known as 3ADI, is a collaboration between the United Nations Industrial Development Organization (UNIDO), UN Food and Agricultural Organization (FAO), and the International Fund for Agricultural Development (IFAD). Through assisting in the processing of agricultural commodities (one of the links in the value chain), 3ADI "…can help them make the leap from subsistence agriculture to a thriving business that generates income."[47] The objective is to "transform the rural world to turn it into an attractive career proposition to the eyes of the youth."[48] In this way, farming becomes "…no longer a subsistence occupation carried out from generation to generation as a matter of tradition: it is a complex business with its technological, scientific, human resource, marketing, and accounting demands."[49]

What, then, are the mechanisms by which this transformation takes place? Training events, farmers' associations, access to credit, and the linkage of smallholder plots with larger "nucleus" farms are some of the mechanisms.[50] Training events like

[47] "Why 3ADI?" 3ADI, accessed July 7, 2015, http://www.3adi.org/.
[48] Ibid.
[49] Ibid.
[50] The ADVANCE program connects many small farms with larger "nucleus" farms, as smallholder farmers sell their grain to the nucleus farm in exchange for tractor servicing. The intention of the program is to facilitate the linkages between smallholder farmers and value chains in attempts to

the Mango Value Chain workshop in Ghana are hosted by export-oriented service providers, input suppliers, or the Ministry of Food and Agriculture ("Agric") extension officers. Farmers' associations like Masara N'Arziki are programs that provide a package of inputs and a ready market for maize. Farmers who enroll obtain hybrid maize seed, along with a formula of supporting inputs of fertilizer, pesticides, irrigation and tractor servicing, in exchange for selling back a portion of their harvested grain.[51] Similar programs in Burkina Faso, Ghana's northern neighbor, have facilitated the expansion of genetically modified cotton.[52] Such arrangements encourage standardized agricultural practices and shift the focus of agricultural production to certain commodities. In a similar vein, the nonprofit international economic development program ACDI/VOCA, which has supported value chain development programs in Ghana, explains that their "Farming as a Business" curriculum

> creates profound change in a smallholder farmer's mentality and in her or his prospects for economic improvement. It is not merely a new way of thinking, but also a substantially novel way of operating that puts even a small farm on an enterprise plane and provides tools for proper management.[53]

With proper management, farmers can adhere to 'good agricultural practices' and meet the expectations of export markets.

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develop the profit potential of these farmers. Author interview with a representative of ADVANCE, Tamale, February 18, 2013.

[51] On a billboard on the northern edge of Tamale along the Bolgatonga road, Masara N'Arziki advertises: "Masara Your Association for: better bargaining power; training and education; improved technology; guaranteed markets; sustainable access to credit; higher yields and higher income."

[52] Author interviews with agricultural research scientists at SARI, February 13, 2013 and February 22, 2013.

[53] "Farming as a Business: Development Tool Promotes Both Food and Income Security," ACDI/VOCA, accessed July 7, 2015, http://www.acdivoca.org/farming-as-a-business. ACDI/VOCA stands for Agricultural Cooperative Development International/Volunteers in Overseas Cooperative Assistance.

What kinds of people do the proponents of agricultural modernization want in agriculture? Educated youth, trained technocrats that can use modern farm inputs, 'serious farmers' that view 'farming as a business.' In such efforts to modernize agriculture, 'unproductive', subsistence farmers are identified as those who should "transition" out of agriculture. "Scaling up" is a concern of these agricultural development programs due to the expectation that less young people will choose rural occupations like farming and an aging population of farmers. Farmers' associations and the placement of graduates of agriculture programs in the field are ways to train young people to become 'serious' farmers. A collaboration between Premium Foods, a Ghanaian processing company, the African Union, and the Kwame Nkrumah University of Science and Technology (KNUST) plans to take graduates of the KNUST agriculture and agribusiness program, allot them 100 acres and connect them to "champion" farmers that will be given 5 acre parcels of land. The hope is that the university students' technical knowledge will lead to technical change on the farm.[54]

Building techno-scientific knowledge is a key component in the transformation from farming as a livelihood to farming as a business. As proclaimed in the Grow Africa 2014 Annual Report:

> There is huge potential for smallholder farmers and other rural communities, in particular women, through access to productive resources to increase yields by accessing the right knowledge, tools, seeds, fertilizers, and market opportunities. Additionally, growing populations provide sources of labour and opportunities for greater innovation and entrepreneurship…Africa is on the rise and poised to bring about its own transformation through agriculture.[55]

In 2009, AGRA started a training program for 170 soil scientists and agronomists in Africa. The project responds to a declining investment in tertiary education in African

[54] Phone interview with a high-ranking official of the National Lands Commission, October 28, 2013.
[55] Grow Africa Secretariat, *Grow Africa: Investing in the future of African agriculture*, 12.

universities, particularly since the structural adjustment programs of the 1980s. Farm tours of the United States, many led by private companies, have become another way by which knowledge of commercial agriculture is shared with Ghanaian farmers.[56] Tours of places like Grand Forks, North Dakota led by groups like Praxis Strategy and AdFarm "focused on identifying and developing opportunities in the Ghanaian agricultural sector."[57] Through touring commercial farms in the U.S., participants are encouraged to envision parallel agricultural developments within their home country. Praxis Africa, one of the new outcomes of the collaboration between Praxis Strategy and AdFarm, has developed a Farm Channel that disseminates information in Ghana on how to develop value chains to "promote farm productivity and profitability in Ghana."[58]

Formal education, educational exchanges, and training normalize industrial agriculture and build trust in the ability of expert knowledge to address agricultural challenges. Western, industrialized agriculture is perceived as the model and African agriculture is framed as deficient in this light. Rather than asking what can be learned from traditional agricultural practices, many Western-educated young people no longer view the village as a rich source of knowledge. By contrast, young people with access to education now return to the village as the "experts" to educate the elders. Furthermore, the patterns of who becomes the entrepreneur frequently replicate

[56] Though a few of my agronomist contacts that had traveled to the United States either on tours or to pursue graduate education where not always favorably impressed by the farming practices in the U.S. One remarked that he was struck by how little agricultural diversity was present in the mid-West. Others remarked at how unhealthy Americans appeared and questioned the American diet.
[57] Mikkel Pates, "Transforming Ghana's agriculture is focus of project," *Agweek*, June 6, 2011, accessed July 7, 2015, http://www.agweek.com/event/article/id/18558/.
[58] For more on Praxis Africa's Farm Channel, see "Broadcasting Ghana's Development," Praxis Africa, accessed July 7, 2015, http://www.praxissg.com/praxis-africa/the-farm-channel.

existing North-South divides in Ghana—it is the college-educated KNUST student from Kumasi that is the champion farmer, or the 'serious' mango farmer from Brong-Ahafo. That is to say that the work of entrepreneurial farmers and their nucleus farms and demonstration fields can inspire farmers to become 'serious,' emulate their behavior, and one day become a farmer like them. Yet, few farmers in these programs are likely to realize this ultimate goal. The more common prospect is to find themselves in the position of "outgrowers" with fairly significant constraints on their activities.

IV. Exiting agriculture

What are the implications of this development approach for smallholder farmers deemed not to have "profit potential"? And who decides that? The influential Washington, D.C.-based International Food Policy Research Institute (IFPRI) think tank suggests that such farmers should be aided in transitioning out of agriculture altogether:

> Smallholder farmers in developing countries play a key role in meeting the future food demands of a growing and increasingly rich and urbanized population. However, smallholders are not a homogeneous group that should be supported at all costs. *Whereas some smallholder farmers have the potential to undertake profitable commercial activities in the agricultural sector, others should be supported in exiting agriculture and seeking nonfarm employment opportunities.* For smallholder farmers with profit potential, their ability to be successful is hampered by such challenges as climate change, price shocks, limited financing options, and inadequate access to healthy and nutritious food. By overcoming these challenges, smallholders can move from subsistence to commercially oriented agricultural systems, increase their profits, and operate at an efficient scale—thereby helping to do their part in feeding the world's hungry.[59]

[59] "Main Findings: From Subsistence to Profit: Transforming Smallholder Farms," IFPRI, accessed July 7, 2015, http://www.ifpri.org/publication/subsistence-profit?utm_source=New+At+IFPRI&utm_campaign=60e7f8b31b-

The World Bank Development Report of 2008 echoes a similar sentiment: "Agricultural growth is especially important to improve well-being in geographic pockets of poverty with good agricultural potential. For regions without such potential, the transition out of agriculture and the provision of environmental services offer better prospects. But support to the agricultural component of the livelihoods of subsistence farmers will remain an imperative for many years."[60] Those farmers who "under-produce" are expected to shift out of farming into the wage labor economy as they are not suitable for the project of 'feeding the world.'[61]

As Amanor (2009), points out, such decisions to sell land and enter the wage economy are presented as an individual choice to alleviate poverty rather than evidence of a lack of options.[62] One informant working on the SADA initiative commented that the local farmers' participation in proposed commercial agriculture projects like sugarcane for biofuel will likely be negligible because of the inability of such farmers to operate on such scale. Rather, "local farmers will be turned into

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New_at_IFPRI_August_26_2013&utm_medium=email&utm_term=0_7b974d57a5-60e7f8b31b-69105353. Citation for full report: Shenggen Fan, Joanna Brzeska, Michiel Keyzer, and Alex Halsema. *From Subsistence to Profit: Transforming Smallholder Farms* (Washington, D.C.: International Food Policy Research Institute (IFPRI), 2013). My emphasis.

[60] World Bank, *World Bank Development Report 2008*, 22.

[61] The World Bank states in a project appraisal document for the Ghana Commercial Agriculture Project that these farmers are not included in plans for commercial agricultural activities such as outgrower schemes: "Small holder, family farms can be commercial if they interact sufficiently with the market (for inputs and especially outputs). Agri-business and agro-processing – large- and small-scale – is also included. It would not include extremely poor marginalized households dependent on subsistence farming under extremely fragile and disadvantaged circumstances. *The opportunities created by this project, for instance participation in out-grower schemes, are unlikely to be accessible because of severe capacity and behavioral constraints*." The World Bank, *Project Appraisal Document on a Proposed Credit in the Amount of SDR 64.5 Million (US$100 Million Equivalent) to the Republic of Ghana for a Commercial Agriculture Project,* February 27, 2012, p.6. My emphasis.

[62] Amanor illustrates this point through an analysis of the World Bank's 2008 World Development Report. See Kojo Sebastian Amanor, "Global Food Chains, African Smallholders and World Bank Governance," *Journal of Agrarian Change* 9, no.2 (2009): 247-62.

laborers" to work on those plantations.[63] Through this shift from being in control of the farm to working as a laborer, local farmers may "forget those skills."[64] This, in turn, may undermine one of the driving objectives of SADA: to improve the livelihoods of the most vulnerable citizens in Northern Ghana.

This logic of agricultural exit put forth by these development planners can be thought of in Foucauldian terms as the neoliberal state's exercise of the power of regularization. As part of the normalization of industrial agriculture, the outliers of the state's population, in this case the 'unproductive' small farmers of the North, can be sacrificed.[65] This can help us understand why certain biotech proponents dismiss the critique that the cost of inputs to support the use of improved seed is too high.[66] That is, if these farmers are just outliers in a population that gets normalized around the ideal of farmer-as-entrepreneur, the state is not necessarily going to intervene to bring these farmers in line with the norm by making these inputs affordable for them. Rather, they will be outliers on this curve of normalization that the state will "let die," or exit agriculture.[67]

V. Discourse Meets Reality: Complexity on the Ground

This exercise of the state power of regularization and the logic of agricultural exit would be a lot more worrisome if this outlier population were so dependent on

[63] Phone interview with an official of the National Lands Commission, October 28, 2013.
[64] Ibid.
[65] This is what is meant by Foucault's idea that the modern state exercises a right to make live and let die. See for example, *The History of Sexuality, Vol.1*: "One might say that the ancient right to *take* life or *let* live was replaced by a power to *foster* life or *disallow* it to the point of death." Michel Foucault, *The History of Sexuality, Vol. 1: An Introduction,* translated by Robert Hurley (New York: Vintage Books, 1990), 138. Original italics.
[66] Phone interview with U.S. State Department official based in Accra, April 9, 2015.
[67] Thanks to Casey McNeill for this point.

the Ghanaian nation-state. My ethnographic observations in rural villages in Northern Ghana reveal that many such communities rely little on state resources, but rather practice local forms of risk reduction and communal support.

An examination of the non-market system that is, the system of exchange that exists in the local community, reveals the resources to support the resilience of these outlier populations.[68] Throughout Northern Ghana, the plots adjacent to the family homes were typically planted with vegetables and legumes, often tended to by women (though in the Northern Region this was less common), and grown utilizing little to no inputs. Non-market systems of exchange include exchange of seeds, of food, and of kin through marriage.[69] Informal systems of seed exchange are ways of diversifying the range of crops planted and forms of local innovation, frequently discounted in Green Revolution agricultural programs.[70] The practice of labor-pooling is another important feature of the non-market system and is still an essential part of meeting labor shortfalls within certain families. The preparation of yam mounds in the Eastern corridor of the Northern Region is one such labor-sharing practice. Groups of people from the community will focus their efforts on one family farm, rotating to another family the next day, followed by a few days rest.[71] I have been told that reliance on inputs like herbicide and tractors have begun to displace these labor-pooling practices in Northern Ghana.

Yet this term "non-market" may be a bit of a misnomer: the Gurene people of the Upper East Region speak of the days of the week in terms of their sequence

[68] Author interview with Bakari Sadiq Nyari, Tamale, February 13, 2013.
[69] Ibid.
[70] Ian Scoones and John Thompson, "The Politics of Seed in Africa's Green Revolution: Alternative Narratives and Competing Pathways," *IDS Bulletin* 42, no.4 (2011): 16.
[71] Ibid.

around market days.[72] This organization of time reflects the reality that people do generate enough surplus produce to trade in markets, just not in the markets of the global food economy. Farmers in rural Northern Ghana are frequently termed "subsistence" farmers, suggesting that they only produce to get by, but do not generate surplus. This assumption overlooks the ways in which surplus is in fact generated, but is distributed in different ways. I was told on several occasions of how people would share their harvest with farmers who experienced harvest loss, delivering food discretely after sundown.

These systems of exchange and labor sharing practices are ways that peasants use to reduce their risks and improve food security. Scott (1976) contends that the self-provisioning farmer is risk averse and hesitant to adopt new technologies because "he works close enough to the margin that he has a great deal to lose by miscalculating."[73] Peasant farmers operate by a 'safety-first' principle whose goal is a secure subsistence. This goal "is expressed in a wide array of choices in the production process; a preference for crops that can be eaten over crops that must be sold, an inclination to employ several seed varieties in order to spread risks, a preference for varieties with stable if modest yields."[74] By this logic, stable yields are more important than yield increases; new technologies that promise yield boosts may be regarded skeptically without the environmental learning[75] that can demonstrate the new technology's stability over time.

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[72] The days are organized as day before market day, market day, day after market day, and two days after market day.
[73] James Scott, *The Moral Economy of the Peasant* (New Haven: Yale University Press, 1976), 25.
[74] Scott, *The Moral Economy of the Peasant*, 23.
[75] For a discussion of environmental and social learning in the case of genetically modified cotton seeds, see Glenn Davis Stone, "Agricultural deskilling and the spread of genetically modified cotton in Warangal," *Current Anthropology*, 48, no.1 (2007): 67-103.

This 'safety first' principle is reflected not only in the choice of which crops to grow, but also in the prioritization of efforts. As one of the producers explained in the Mango Value Chain workshop, producing for the local market and community takes precedent over production for international markets. Farmers' associations have been frustrated by the frequency with which smallholder farmers divert inputs like fertilizers and pesticides (intended for the maize that has been purchased through the association) to tend to the crops produced for family consumption.[76] Such observations are consistent with Scott's account that "the villager only attends to his 'selling rice' field *after* his subsistence field tasks are complete."[77] Deviations from this 'safety-first' principle are likely to face criticism. Following the devastation of tomato crops brought on by roundworms called nematodes (resulting from poor crop rotation), one of the chiefs I spoke to in the Upper East, a former farmer, explained that the rush to plant tomatoes was about "quick money" and criticized these farmers' failure to diversify their farming. "This is not good for food security…They should be planting crops that you can store…maize, rice, groundnut…not perishable crops."[78]

"Mixers": Hybrid Farming Practices, Multiple Roles

Fatimata Adongo provides an example of a local entrepreneur that has built locally-appropriate risk reduction strategies into her business plan. During my first visit, Fatimata told me about the 250-acre mango farm that the family ran, a large farm by Northern Region standards. She said that they had actually acquired more

[76] This was articulated at the Mango Value Chain Workshop. See also author interview with farmer Fatimata Adongo in Northern Region, Tamale, March 12, 2013.
[77] Scott, *The Moral Economy of the Peasant*, 23.
[78] Author interview with Chief of Vea, Vea, December 11, 2012.

land than this so that the farmers that work on the farm were given land to grow crops of their own along the boundaries. This way, "the farmers see a direct benefit" and "have a stake in their success." This approach, she explained, "generates more security." The farmers intercrop with peanuts, beans and rice—"leguminous crops." They employ people in the surrounding communities and this better standing in the community generates security.[79]

We can think of Fatimata Adongo's story as one of family entrepreneurship. The family performs different roles to support the various facets of the business enterprise. Whereas Fatimata's family business is meeting export demand, they also recognize the importance of local food security. The way the family structures the 250-acre mango farm to allow their permanent workers to farm crops of their own choice recognizes the importance placed upon providing food for your family, which becomes essential for "having a stake" in the business' success. Providing food for families comes first, followed by production of cash crops. This pattern was also revealed in the Mango Value Chain workshop, whereby farmers insisted on providing for themselves and local markets first, and then on thinking about production for exports. I was also told by multiple sources that a common practice among farmer participants in programs such as Masara N'Arziki was the distribution of inputs such as fertilizer to the staple crops that would feed their families along with the cash crops the inputs were intended for. This indicated a deviation from the formula and would likely lead to lower yields of the cash crops than expected.

Another observation of farming in Northern Ghana was the adoption of what we might call "hybrid" farming practices. Fatimata explained to me that whereas the

[79] Author interview with Fatimata Adongo, Tamale, March 12, 2013.

plants and trees used for traditional healing were grown organically, "they also do commercial…use inputs—some chemicals" on their mango and cashew crops to "make it easier" and "improve upon yields." She explained to me that she "doesn't feel bad because in other ways" she's "doing other things to save the environment."[80] Joseph Abaas, a farmer and assemblyman of one of the districts outside of Tamale, uses fertilizer on his 50-acre rice plot, but is a big proponent of the use of compost in his village.[81] This "mixing" of different farming practices was even found within the local agricultural research community: one agricultural research scientist at the Savannah Agricultural Research Institute imagined genetically modified crops as part of a diversity of crops grown in Northern Ghana, rather than the large mono-croppings of genetically modified crops found in the Americas.[82]

Many people farm in Northern Ghana, and it is not only people that identify as "farmers." I recall two different taxi cab drivers telling me about their diverse sources of income, which also included having plots of maize. While searching for a rental house in Northern Ghana, I began small talk with the man who had shown me the place. This business is not all that I do, he told me, he was also a "serious farmer."[83] He grows soyabeans and corn as part of the ADVANCE program designed to help him make more money through growing "cash crops."[84] In a similar way, Fatimata Adongo is a "serious farmer" who is also involved in education and traditional healing. In Northern Ghana, it is common for entrepreneurs to rely on diversified sources of income and thick networks of mutual assistance.

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[80] Author interview with Fatimata Adongo, Tamale, September 13, 2012.
[81] Fertilizer was more frequently utilized on grains or high-value crops like tomatoes.
[82] Author interview with agricultural research scientist at SARI, Nyankpala, February 13, 2013.
[83] This is when the term "serious farmer" was first on my radar.
[84] Conversation with taxi driver/realtor/maize farmer, Tamale, July 24, 2012.

Complexity and Enclosures on Land

This complexity on the ground is also apparent in the case of land. On the African continent, there has been growing concern,[85] brought to the world's attention by the food sovereignty movement, about the practice of 'land grabbing.' Land grabs can be defined by as the "exploration, negotiations, acquisitions or leasing, settlement and exploitation of the land resource, specifically to attain energy and food security through export to investors' countries and other markets."[86] The combination of an increased value of real estate and plans to develop commercial agriculture has driven up the price of land across Ghana. Chiefs have given up communal land in Northern Ghana to city dwellers from Accra or for agricultural projects like biofuel production.[87] One response to these 'land grabs' has been the formalization of land rights and the institution of a regulatory mechanism by the National Lands Commission for large land leases.

Through its policy and advocacy program, the Alliance for a Green Revolution in Africa has promoted the formalization of land titles. In Ghana, AGRA

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[85] This concern was institutionalized in 2010 through the Principles for Responsible Agricultural Investment (PRAI) sponsored by the World Bank, the Food and Agriculture Organization (FAO) and the United Nations Conference on Trade and Development (UNCTAD). Jennifer Clapp, "Responsibility to the Rescue? Governing Private Investment in Global Agriculture" (paper presented at the International Studies Association, Toronto, Canada, March 26, 2014).

[86] Prosper B. Matondi, Kjell Havnevik and Atakilte Beyene, "Introduction: biofuels, food security and land grabbing in Africa," *Biofuels, food security and land grabbing in Africa*, edited by Prosper B. Matondi, Kjell Havnevik and Atakilte Beyene (London: Zed Books, 2011), 1. For more on the land grab see Philip McMichael, "The land grab and corporate food regime restructuring," *Journal of Peasant Studies* 39, no.4 (2012): 681-701; and the work of the transnational activist network La Via Campesina that characterizes the 'land grab' as an "Old phenomenon, new appearance." La Via Campesina, "International Conference of Peasants and Farmers: Stop land grabbing!" Report and Conclusions of the International Conference of Peasants and Farmers, Mali, November 17-19, 2011, (2012) accessed July 2nd, 2015, http://viacampesina.org/downloads/pdf/en/mali-report-2012-en1.pdf .

[87] Author interview with a district assemblyman of the Northern Region, Tamale, May 11, 2015, which informed me about the increasing incidence of chiefs giving away communal land in the Northern Region. On a case of biofuels and a 'land grab' in Northern Ghana see Bakari Sadiq Nyari, *Biofuel Landgrabbing in Northern Ghana*, 2008, accessed July 7, 2015, http://www.tnrf.org/files/E-INFO-RAINS_Biofuel_land_grabbing_in_Northern_Ghana_Bakari_Nyari_2008.pdf.

has set up a Land Access and Tenure Security Project at the Kwame Nkrumah University of Science and Technology, funded by the Bill and Melinda Gates Foundation. The stated intention is "to secure the livelihood and economic wellbeing of the smallholder farmers, especially women, in Northern Ghana by mitigating against risks of land and property rights."[88] The work of AGRA to establish clearer property rights appeals to a humanitarian concern regarding women's access to land. Activists have raised alarm that such formalization of land rights can lead to land consolidation and dispossession of land access from peasants.[89] However, it is apparent that dispossession is happening at a rapid pace without mechanisms to monitor land access and tenure.[90]

Formalizing land rights is not only a concern of AGRA, but is also central to the World Bank-supported Ghana Commercial Agriculture Project (GCAP). GCAP is focused on "land facilitation" for private commercial agriculture. Ghanaian agriculture is still dominated by traditional smallholder farms: approximately 90% of farm holdings are less than two hectares.[91] The GCAP land bank concept is a means to assist the private sector in acquiring larger tracts of land for commercial agriculture through voluntary arrangements with local communities. This mechanism to centralize land registration is being developed through a private contractor, but under the guidance of the National Lands Commission. The aim is to guide "acquisitions of

[88] "Where we work," AGRA, accessed July 7, 2015, http://agra-alliance.org/where-we-work/where-we-work/#top-link.
[89] See for example the work of AGRA Watch, "Monitoring the Gates Foundation and AGRA, Promoting Food Sovereignty and Agricultural Sustainability in Africa," AGRA Watch, accessed July 7, 2015, http://www.cagj.org//wp-content/uploads/AWbrochure.pdf.
[90] See interactive map of global land grabs (data compiled by GRAIN), "Global Map of 'Land Grabs' By Country and By Sector," Circle of Blue, accessed July 7, 2015, http://www.circleofblue.org/LAND.html.
[91] Republic of Ghana, *GASIP,* http://www.ifad.org/operations/projects/design/111/ghana.pdf, 1.

large tracks of land to protect livelihoods of local communities, guarantee food security, protect land rights of local and indigenous communities and protect the environment."[92] The Ghana Commercial Agriculture Program characterizes the fragmented parcels of farmland across Ghana as an impediment to the development of agribusiness. In order for commercial agriculture to thrive, the land bank would centralize information about available land into a database that has been developed through "voluntary transfer of land" acquired through "open and arms length negotiation" with local communities.[93]

Identifying land to include within the land bank is done with the recognition of the complexity of customary land ownership and local uses of the land that may appear to be "underutilized."[94] In an effort to clarify the meanings of the lease agreements and contracts private investors wish to acquire, there are 'sensitization' seminars to discuss the implications of land sales and discuss lease agreements.[95] Arguably, this is a means to get local people to accept new land rights protected through Western forms of property rights. It is a dimension of this 'participatory' work that is supposed to ease this transition to private commercial agriculture in the SADA zone.

The leadership of the National Lands Commission by Bakari Sadiq Nyari suggests that this work to identify land rights may indeed be participatory. Prior to his political appointment as Chairman of the Lands Commission, Bakari Sadiq Nyari

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[92] Losamills Consult Ltd. "The Establishment of Land Banks," Powerpoint presentation for the National Lands Commission, May 18, 2015. Stephen Kumadoh of the National Lands Commission provided me a copy of this.
[93] Author interview with Stephen Kumadoh of the National Lands Commission, Accra, May 20, 2015.
[94] There are long sections in World Bank Project Appraisal document of the GCAP that discuss this, particularly Annex 6. World Bank, *Project Appraisal for GCAP*, Annex 6.
[95] Ibid.

worked for twelve years in the regional lands commission of the Upper East, taught as a university professor, and has also written an influential article condemning a land grab deal in Northern Ghana by a Norwegian biofuel company.[96] His involvement in this biofuel 'land grab' case led to a return of the land to the community and has been used as an example of success by transnational activists in the struggle against 'land grabs' across Africa.[97] His influence in the design of the GCAP land bank has led to the specification that only a percentage of the land could be sold in the form of limited time leases, appearing to strike a balance between the realities of rural to urban migration and high land values, without denying communities access to land. In explaining the National Lands Commission's decision to only allow communities to sell 40% of their land as part of the land bank, Mr. Nyari told me forcefully, "I am not interested in creating landless people."[98] In its current form, GCAP's land facilitation mechanism reflects Mr. Nyari's concerns to prevent the dispossession of peasants from communal land. The question is whether these policies will be implemented with these concerns in mind.

VI. Conclusion

Farmer participation in nucleus-outgrower schemes in Northern Ghana will expose farmers to techno-scientific approaches to farming and connect these farmers to markets for exports. This effort to professionalize farming may have a particular impact on younger farmers that are lured with the promise of a new, less labor-

[96] See Nyari, *Biofuel Landgrabbing in Northern Ghana*.
[97] Mr. Nyari is also affiliated with the African Biodiversity Network.
[98] Author interview with National Lands Commission Chairman, Bakari Sadiq Nyari, Accra, May 20, 2015.

intensive and more lucrative way to farm. The discourse of entrepreneurship invoked by developing planners signals that this is not your grandfather's farming. The identity of the farmer entrepreneur (the nucleus in the nucleus-outgrower model) figures as an aspiration that farmers seek to achieve, but few can attain. Most farmers that join this undertaking to professionalize farming will perform the role of the outgrower that meets the growing specifications of an externally determined production system. In this sense, the discourse of entrepreneurship has some of the key attributes of hype: it is future-oriented, it exaggerates the promise of entrepreneurship (since most farmers are not likely to achieve the status of the serious nucleus farmer), and it is a bid for attention to attract investment in agricultural development programs.

The aim to transform farming from a way of life to a business in Ghana is unlikely to be fully realized as farmers pick and choose what kinds of "modern" or "organic" agricultural practices to adopt, and hold multiple roles that secure not only income, but also food for their families. Such practices of "mixing" complicate both the agricultural and identity transformations that are crucial components in this change. However, not all agricultural interventions ignore these multiple roles in the diversification of income and means to food security.

Within this array of agricultural development programs, there are divisions, and they often fall along the lines of those that are more publicly funded[99] and those that are private sector-led. The USAID-funded Africa Rising Project in Ghana works in cooperation with scientists from the International Institute of Tropical Agriculture

[99] Here I mean not just national public funding but rather a mix of funding from the national government, international agricultural research institutions, and bilateral aid agencies.

and the Savannah Agricultural Research Institute. One expert involved in the Africa Rising Project described the AGRA and Africa Development Bank of Ghana (ADB) as "myopic" in their focus on commodities. He commented that the Africa Rising program was different than AGRA or ADB because it was a research program that examined the impact of agricultural practices on households and livelihoods. In contrast to the "commodity-specific activities" of organizations like AGRA or ADB, Africa Rising takes a more expansive approach that looks at the interactions between crops and soil and water. The reason for such a systems approach that examines these interactions was that "when you consider a household the farmer handles many things at once."[100]

Another expert working on the rice intensification and community seeds project of Africa Rising described the efforts to understand the "yield gap"—the gap between potential yields using fertilizer and irrigation and actual crop yields (where crops are rainfed and fertilizer may or may not be used) near Navrongo and in the Tolon-Kumbungu districts of Northern Ghana. The project team recruited eighty farmers and clarified that to the farmers that they "are not an NGO, we are not giving you inputs." The participants farmed as usual and the research scientists observed. Later, the experts "sit down" with them and advise the participants on what they have done right and wrong, based upon an "optimal model" developed by the experts. One Navrongo farmer was doing considerably better than the optimal model, frequently

[100] Author interview with lead agricultural consultant and agronomist of Africa Rising, Tamale, October 10, 2012.

tills after the rain, plants in rows, and does not use herbicide. The project team wants to see whether his model is "economically viable."[101]

The University of Development Studies Integrated Community Development undergraduate program is concerned with rural livelihoods and offers undergraduate students interested in development an opportunity to learn through participant observation.[102] In this trimester program, students spend eight weeks living among a rural community and work to assess the development priorities of the community. Students are chosen on the basis of their language skills[103] and work with opinion leaders and conduct surveys in order to understand what those development priorities should be. The idea is that through their lived experience in the community, they should be better able to ascertain some of the challenges faced by members of the community. As such, it is an excellent educational opportunity, provided the students are willing to abandon preconceived ideas about what constitutes development necessities.[104] Such programs allow for the possibility of cross-generational knowledge exchange as the university students are given the opportunity to learn from the community rural living skills and the university student can render legible the development concerns of the community to a wider audience.[105] This is also a way to produce more experts to address rural poverty in Northern Ghana. One of the

[101] Author interview with agricultural research scientist of Africa Rising, Tamale, September 13, 2012.
[102] The University of Development Studies is a university system set up by J.J. Rawlings in Northern Ghana intended to counter-balance the colonial patterns of educational investment in the South.
[103] Although English is the official language of Ghana, some linguists identify more than sixty distinct languages in Ghana. The Government of Ghana sponsors nine languages: Akan, Dagaare/Waale, Dangbe, Dagbani, Ewe, Ga, Gonja, Kasem, and Nzema.
[104] Ivan Illich, "Needs," in *The Development Dictionary: A Guide to Knowledge as Power,* 2nd ed., ed. Wolfgang Sachs (London: Zed Books, 2010), 95-110. It is possible that the students' experience of discomfort could also color their interpretations of what is necessary in a community.
[105] James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven: Yale University Press, 1998).

students that we met who participated in the program claimed to have formed his own NGO "Save the Rurals"—though, when asked, couldn't clearly articulate what his organization would do in order to accomplish this goal (or what the "rurals" were being saved from). Such programs, while offering the opportunity for intergenerational knowledge exchange, may serve to reinforce a shift of agenda setting and knowledge holding away from elders and towards the educated youth.

Analysis of this period of agricultural transformation allows us to see within it struggles over knowledge, identity, and authority. Who possesses the knowledge best suited to promote food security in Northern Ghana? How should farming be organized? Who should determine how farming should be practiced? What does it mean to be a successful farmer? As this chapter reveals, although there are interventions to render legible farming to support the expansion of the market economy, there are existing modes of resistance that make such a total transformation unlikely. That is, the multiple roles that people in rural Northern Ghana perform, their food distribution and risk-reduction strategies, and their tendencies towards a pragmatic hybridization of farming practices suggests that efforts to standardize, professionalize, and integrate farming will encounter obstacles. However, there is one significant trend that presents the possibility that a new Green Revolution may take hold in Northern Ghana: the shift from elders being the bearers of knowledge and authority on farming to that of the educated youth. Through formalized education and training, traditional knowledge held by elders in farming communities may be valued less as young people are encouraged to embrace techno-scientific approaches to

farming. The transition from farming as a way of life to farming as a business is contingent on the outcomes of this generational shift.

CHAPTER FIVE:
Conclusion:
Seed Politics and the Question of Democracy

What actors, expertise, and models of development are advanced by the 'new Green Revolution in Africa'? What struggles over authority, knowledge, identity, and property define this contemporary political economy of agricultural modernization in Ghana? I have argued that legal, techno-scientific expertise and agribusiness work together to advance a model of agricultural development based on new forms of capital, governance structures, and technology. This model of agricultural development is mobilized and legitimated through discourses of emergency, salvation, entrepreneurship, and humanitarianism. In this new Green Revolution in Africa, regions like Northern Ghana are seen by development planners as 'backwards,' with growing 'yield gaps' that undermine food security. What is needed, from this perspective, is capital investment, entrepreneurship, and access to yield-enhancing technologies, such as 'pro-poor biotechnology.' Deficiency frames, the combined use of hype and science, and donations become critical mechanisms to facilitate—or resist—the entry of contested agricultural technologies and models of agricultural development.

Democracy and the Politics of Agricultural Modernization

While at the Savannah Agricultural Research Institute I asked agricultural research scientists about their views on GMOs. During an interview, one of the scientists expressed concern not only regarding GMOs, but the fact that he was the one being asked to assess this controversial technology. "I think the major problem

here is when you say GMO it raises ethical and other questions," he hesitated, and then continued, "whether the scientist may not be the best to answer those questions even though he is at the forefront of the debate."[1] The 'rule of experts' in Ghana's biosafety regime places considerable power, however ambivalently held, in the authority of scientists like him.[2] Determining the safety of this technology has so far operated through a constriction of vision: a focus on testing in confined field trials for gene flow, at the neglect of the socio-economic and ethical impacts of the technology. The Ghana Biosafety Act 831, 2011, which governs biotechnology in Ghana, formalizes this genecentric view. I was told by the acting CEO of the National Biosafety Authority that a consideration of socio-economic concerns is the "duty of the 'anti-group' whatever are the downsides of GMOs."[3] In the view of the Authority, such concerns were to be raised by "civil society" and activists after the confined field trials are completed and approved, and before placing the technology on the market.

Paradoxically, Food Sovereignty Ghana, who has raised such concerns, has turned to the same biosafety legislation to demand a ban on the commercialization of GMOs, de facto legitimating the mechanism that allowed GMOs into the country in the first place. This move, although an understandable strategy to delay further development of GM crops,[4] is at odds with their key aspirations to address broader socio-political concerns regarding GM seeds' impact on the livelihoods of farmers

[1] Author interview with agricultural research scientist at SARI, Nyankpala, February 13, 2013.
[2] Mitchell, *Rule of Experts.*
[3] Author interview with acting CEO of National Biosafety Authority, Accra, May 20, 2015.
[4] At the time of the writ of summons was filed in February 2015, there was not yet a National Biosafety Authority, but rather a National Biosafety Committee years after the passage of the Biosafety Act in December 2011. FSG likely thought that this could be a way to advance the case since the government was apparently not abiding by its own legislation. The National Biosafety Authority was inaugurated on the same date that the court case began.

and consumers in Ghana. This maneuver of bringing the GMO debate to the courtroom reinforces a 'rule of experts,' and has potentially exclusionary, and contradictory, effects for the movement of food sovereignty in Ghana.[5]

This dissertation has argued that the 'rule of experts' is an outcome of the struggles, contestations, and discursive strategies that take place in courtrooms, boardrooms, experimental fields, and the streets. Proponents and opponents of GM seeds use a blend of two discursive strategies—hype and expertise—to facilitate the entry, or to resist, the cultivation of genetically modified crops. The use of hype attracts attention and support, whereas the use of scientific knowledge is a bid for authority. The emergency framing collectively constructed through hype renders incremental approaches, compromises, and deliberation careless in the face of such urgency. Rather, because emergencies are conceived as large-scale, responses are expected to match this scale. From this perspective, global problems require global solutions: local risk-reduction and food security strategies are seen as inadequate; rather, a global class of professional managers that supports farmer entrepreneurs capable of 'feeding the world' is necessitated.[6]

This blend of hype and expertise works in tandem with the law to generate political shifts that grant scientists, biosafety experts, and lawyers greater power in shaping decisions on food and agricultural policy. Hype about GMOs as 'Frankenfoods' and 'terminator seeds' creates a perception of genetic modification as a uniquely "risky" technology that demands management by biosafety expertise and

[5] Again, it should be stressed that the debate over GMOs in Ghana is in an early stage, and this is a period of transition. However, observations at this stage indicate that many of the dynamics I have seen in South Africa and around the world, theorized in Chapter Two, are likely to also play out in Ghana.
[6] Escobar, "Planning."

legislation. In the speculative economy of the life sciences industry, hype about the promise of biotechnology to deliver both economic and humanitarian benefits also solicits the authority of legal experts and intellectual property protection to safeguard investments and handle liability issues. In the courtroom and in Parliament, professional advocates navigate and shape legislation to advance their case. This proliferation and elevation of expertise can marginalize the majority of Africans who lack such expertise, and may ultimately lead to less democratic decision-making on food and agriculture policy.

This contestation extends to broader concerns over the enclosure of seed, land, and knowledge: the patenting of seed and the prevention of seed-saving; 'land grabs' of traditional communal lands; and the exclusion of traditional or local knowledge from food and agriculture policy, respectively. These processes of enclosure reveal three key distinctions between the first and the new Green Revolution in Africa: first, a shift in the role of the state to a state that relinquishes its leadership in service provision and instead "enables" the private sector to take the lead; second, the new composition of legal and techno-scientific expertise above that informs contemporary 'feed the world' strategies; and third, the proliferation of new forms of capital that integrate biotechnology with philanthropy to create new sources of market value. These shifts are engendered by new laws that entail changed relationships to seed and by extension biological life, whereby seed becomes patentable material, with specific regimes of access and use. These legal changes support the expansion of the private

sector in Ghana by securing an 'enabling environment'[7] that purportedly makes investment in agriculture more profitable. Philanthropy and the use of community seminars to discuss issues such as the establishment of formalized land titles and transgenic seeds alter conceptions of seed and land, and lay the foundation for their commodification.

In the face of this contestation, the promotion of 'pro-poor' biotechnology in Africa has been deployed to reframe biotechnology as a humanitarian enterprise. Using the concept of "philanthrocapitalism," I demonstrated how the "donation" of such technology serves to advance new markets in Africa under the pretext of providing a philanthropic response to perceived food insecurity. This "donation" mechanism produces political effects: the "gift" of a proprietary gene by an agribusiness corporation for the development of 'pro-poor' biotechnology reflects a conception of genes and seed as something that can be privately owned first, and then given away. Philanthropy normalizes both the seed as a commodity—rendering it "biocapital"—and a "genecentric" view of biological life that locates biodiversity in the stock of genetic material and divorces the seed from its broader social and ecological context.[8]

At the center of all of these contestations is the figure of the farmer, who is seen as an agent and object of salvation by GM proponents and opponents alike. The farmer entrepreneur, in the view of the World Bank and the Alliance for a Green Revolution in Africa, can save Africans from poverty and can be even capable of

[7] The language of 'enabling environment' is used widely in policy documents, from Ghana's CAADP compact to World Bank reports. It is connected to the concept of good governance and the promotion of clear and transparent legal regimes to encourage economic growth and investment.
[8] See Rajan, *Biocapital;* Escobar, *Territories of Difference*, 140.

'feeding the world,' if only s/he were to gain access to scientific knowledge and modern agricultural technologies. By contrast, food sovereignty activists see the rejection of GM seed as the means to save farmers' livelihoods endangered by the threat of GMOs and corporate domination. My ethnographic findings in Northern Ghana—a space that has been identified by both sides of this debate as deficient and in need of assistance—indicate that farmers are unlikely to buy into much of this hype. Rather, I find that farmers in Northern Ghana are "mixers": they pragmatically use a range of traditional and modern agricultural technologies and do not see traditional, organic farming and the use of modern inputs as mutually exclusive. Furthermore, ethnography allows me to show that these grand plans to transform farming from a way of life to a business are constantly challenged by the existing complexity of Africans' multiple, coexisting roles, risk reduction practices, and local notions of entrepreneurship. This suggests that efforts to construct new farmer identities as part of the new Green Revolution in Africa will be frustrated, and likely incomplete.

Implications and Future Research

What is at stake in the debate over genetically modified crops in Ghana are broader issues of economic development, seed sovereignty, and democratic participation in food and agricultural policy. The cultivation of genetically modified crops is seen as critical for the economic development of countries such as Ghana. African countries have been framed as "laggards" in need to "catch up" with the rest of the world by embracing biotechnology. Such views are captured by the joint

statement by the 'father of the Green Revolution,' Norman Borlaug and Jimmy Carter: "Africa has already missed the industrial revolution and the tractor and fertilizer revolution…there is a risk it will miss the biotechnology revolution as well."[9] This anxiety is reproduced in the words of Dr. Florence Wambugu, an outspoken and influential proponent of GM seeds and the CEO of Africa Harvest Biotech Foundation International:

> We may have missed the green revolution, which helped Asia and Latin America achieve self-sufficiency in food production, but we cannot afford to be excluded or to miss another major global technological revolution.[10]

But "laggards" need encouragement, and biotech proponents have recognized Ghana's developments in biosafety and biotech developments as worthy of emulation. Dr. Wambugu recently celebrated Ghana's biosafety law and biotech developments as "an excellent model that other African countries can emulate… Countries in the region and other African countries can learn from what Ghana has done."[11]

Anti-GM opponents view the introduction of genetically modified crops as a mechanism of indebtedness. Food sovereignty activists have protested on the streets of Accra (and beyond) that the introduction of GM seeds impoverishes both farmers with debt and the environment with ecological degradation. Seed sovereignty, the right of farmers to save, exchange, use, and sell their own seed, is violated by control over seed systems through patents and corporate domination of the supply of seeds.

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[9] Norman Borlaug and Jimmy Carter, "Foreword," in *Starved for Science: How Biotechnology Is Being Kept Out of Africa*, by Robert Paarlberg (Cambridge: Harvard University Press, 2008), x.
[10] Florence Wambugu, "Taking the Food Out of Our Mouths," *The Washington Post,* August 26, 2001.
[11] Florence Wambugu, "Ghana's Biosafety Law is Model for Africa—Dr. Wambugu," *Graphic Online*, July 1, 2015, accessed July 3, 2015, http://graphic.com.gh/business/business-news/45481-ghana-s-biosafety-law-is-model-for-africa-dr-wambugu.html.

Activists argue that these violations are enabling conditions of, rather than exceptions to, the global GM seed regime. In contrast, proponents of Green Revolution programs want to encourage the adoption of 'improved' seed in order to address the problem of "genetic erosion": saving local seed is seen as a bad practice because "genetic potency declines" and "seed fertility declines" over time.[12] This again reflects a genecentric view of biological processes, at odds with the idea of seed sovereignty. From the perspective of seed sovereignty, the seed is more than just the store of genetic information, but rather a central part of cultural and biological diversity. The ability of farmers to manage their own seed systems, to store, share and exchange seeds is viewed as the key to resilience.[13] Many within the food sovereignty movement see genetically modified seed as a vehicle that will destroy these farmer-managed seed systems. Only a ban on the introduction of GMOs will suffice to protect farmers from this threat to their livelihoods.[14]

Protests are not the only site where GM seed is framed as a symbol of larger issues of corporate private sector encroachment and domination. At a Board of Directors interview at the Ministry of Food and Agriculture in Accra in March 2013, I asked board members about the benefits and concerns regarding GM crops. My questions sparked a lively debate. Some board members expressed positions in favor of GM crop cultivation: "agriculture is confronted with lots of issues biotic and abiotic, we need innovative ways to address them," with biotechnology it is possible to "increase yields," "address yield gaps," and "make crops able to deal with the

[12] Phone interview with Dr. Walter Alhassan, March 6, 2013.
[13] Alliance for Food Sovereignty in Africa, *Comments on the FAO Draft Guide for National Seed Policy Implementation* (Alliance for Food Sovereignty in Africa (AFSA), 2014), 7.
[14] This is certainly the stance of Food Sovereignty Ghana and leading anti-GMO activists like Vandana Shiva.

environment." Others emphasized that it would be more appropriate if biotechnology were "home-bred" with "Monsanto and Syngenta [linked] up with our varieties." Yet in that room at the Ministry of Food and Agriculture, much like the activists who were criticizing the Ghanaian government, there was a clear concern about the appropriateness of GM technology, its impact on seed saving, and the dependency GM seed presents, both "financial and material." When talking about implementation of biotechnology and biosafety in Ghana, one particularly influential board member stated "we don't want covert compulsion…for some time we have seen it, and we don't want that. We know that Monsanto and Syngenta funds a lot of research. We need to agree to a course of action."[15]

This cross-section of activists and bureaucrats, which may have many points of contention regarding the desirability of commercial agriculture, are actually in sync in demanding greater democratic participation in food policy —and not "coercion." Yet this idea of democracy may be also taken to mean consideration of the introduction of GM crops, if the latter were understood as one way of diversifying the options on the table, rather than the major viable possibility. One of the agricultural research scientists at SARI characterizes the call to ban GM crops as undemocratic: "give [farmers] a choice, is that not what democracy is all about?"[16] Farmers should be able to choose and decide for themselves, he asserted.[17] Food Sovereignty Ghana has made claims about the undesirability of GM seeds for all farmers in the country,

[15] Author interview with members of the National MoFA Board of Directors at a Ministry of Food and Agriculture Board of Directors meeting, Accra, March 25, 2013.
[16] Ibid.
[17] As I have shown in the dissertation, the ability of farmers to make such a choice is not a neutral technocratic issue, but is rather contingent on access to techno-scientific knowledge and expertise that most farmers, and even most politicians and elected officials, in Ghana lack. In this statement farmers are conceived of as consumers whose democratic participation is reduced to a vote in the marketplace. I thank Anatoli Ignatov for this point.

framing the seeds as an "imposition on Ghanaians."[18] Although they have the support of a farmers' organization in Brong-Ahafo, my research indicates that they have not consulted with farmers in Northern Ghana.[19] If Food Sovereignty Ghana succeeds in obtaining an injunction to halt GMO commercialization without the participation of farmers in the North, does this suggest not only a 'rule of experts' but also a "rule of activists" in the debate over GMOs?

Food Sovereignty Ghana, at least at this stage, appears to be a consumer-based social movement organization with little support from the farmers they claim to speak for. FSG puts forth an agenda of organic farming for all of Ghana. Organic farming is a challenging, labor-intensive (and often cost-intensive[20]) form of farming, and this is unlikely to be well received by all farmers.[21] Rather, with the loss of interest of young people in farming, the use of agro-chemicals and genetically modified seeds may prove more attractive. My ethnographic observations in Northern Ghana indicate that most farmers operate outside of this polarized debate, choosing a mix of modern and traditional agricultural practices to suit their needs. In the future this may or may not include GM seed. Will Food Sovereignty Ghana, like proponents of a new Green Revolution in Africa, need to construct a new farmer in order to advance their objectives?

I have argued that the collective construction of emergency in the GMO debate has created a political environment in which democratic deliberation,

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[18] "Food Sovereignty Ghana Marks Second Anniversary," Food Sovereignty Ghana, March 24, 2015, accessed May 20, 2015, http://foodsovereigntyghana.org/.
[19] Conversations with members of Food Sovereignty Ghana, May 5 (Accra) and May 12, 2015 (phone).
[20] Cost here does not refer to the costs externalized onto the environment.
[21] This was affirmed in a conversation with Professor David Millar of the Open University (and organic farmer) in Bolgatanga on the difficulties of organic farming, Bolgatanga, May 13, 2015.

incremental approaches, and consideration of contingency are not highly valued; rather urgent and transformative action is called upon. What, then, does a politics that allows for contingency and small steps look like? What kind of scholarship would best be suited to analyze such politics? The poles of the GMO debate have received sufficient scholarly attention and this reifies these divisions and serves to perpetuate a politics of hype. Rather, greater attention to nuance, shared strategies, and openings for compromise is called for in order to create a more inclusive space for democratic deliberation over food policy. A better understanding of existing and new alternatives to emergency and big solutions requires further participatory research on how farmers adapt to environmental challenges. The new Green Revolution's emphasis on techno-science and innovation obscures and devalues the wealth and diversity of existing practices of farmers' experimentation and innovation on the ground. In the policy domain, rather than sensitization seminars in which experts lead on a given issue area and farmers can raise questions, a reversal of this relationship—with farmers leading and experts questioning—is called for. Food sovereignty activist organizations already play an important role in awareness creation about the potential problems GM seeds pose. However, they also need to make themselves more cognizant of the challenges that farmers face and not romanticize traditional farming. Rather, they should seek to understand when and why farmers choose to use technologies that they deem harmful. In order to do so, a more sustained dialogue with and inclusion of farmers in such struggles becomes crucial.

The discourse of entrepreneurship within Green Revolution programs is, on the one hand, a discourse of empowerment. African farmers can feed the world with

the appropriate knowledge, technology, and linkages. On the other hand, it is also a discourse that centralizes and produces hierarchies, which ultimately disempowers. The relationship of outgrowers to the nucleus farm advanced by USAID, the Ghana Commercial Agriculture Project, and the World Bank is a debtor-creditor relationship, as the nucleus farmer provides the inputs (the credit) that are paid back with their harvest. Not all farmers, not many at all in fact, will be the nucleus farm that can have a stake in the design of the farming business. Rather, most farmers will be the outgrowers that meet certain specific standards. In my research I heard from many outgrowers that they were dissatisfied with the farming practices that they were required to adopt in order to participate in outgrower schemes. Future research on the new Green Revolution in Africa should consider the degree of participation that farmers have in shaping how food is produced and how to strengthen existing forms of entrepreneurship that offer an alternative to nucleus-outgrower relationships. Does the promotion of public-private partnerships in the agricultural sector promote or hinder the inclusion of local producers in food and agriculture policy? Do these kind of arrangements succeed in improving food security? Do they empower farmers to become more resilient and self-sufficient or do they widen democratic deficits? What kind of accountability exists within these public-private partnerships?

This dissertation reveals that humanitarianism can serve as a legitimating mechanism for shifts in authority—as the private sector plays an increasingly important role in setting development priorities—as well as a mechanism of commodification. The key role that philanthrocapitalist actors play in development projects is legitimated through philanthropic appeals that resonate in a context of

shortages of state funding for development projects. The case of donation of genetic material facilitated by philanthropists like the Bill and Melinda Gates Foundation, AATF, and the Rockefeller Foundation for the development of 'pro-poor' biotechnology is a clear example of this. Yet I would argue that this is part of a larger trend that enables the expansion of capital into frontier markets. The role of the discourse of humanitarianism in legitimating power shifts and economic restructuring is a vital area in African development studies in need of further research.

Appendix: Philanthocapitalism and Agbiotech Public-Private Partnerships in Africa

Philanthrocapitalism and agbiotech public-private partnerships in Africa[1]		
Project	***Countries, national agricultural research institutes involved, and status of biosafety legislation***	***Partners and roles:*** **Bold** indicates private sector. Underline indicates the arbitrator for the royalty-free transfer of technology.
Cowpea Productivity Improvement: Pod-borer (*maruca vitrata*) Resistant Bt cowpea	➢ *Ghana:* Ghana passed biosafety legislation in December 2011 that "is considered user friendly as it does not contain any labeling requirements for biotech or genetically engineered food products or strict liability provisions."[2] The Bt cowpea was planted in September 2013 in confined field trials (CFTs) adjacent to the Savannah Agricultural Research Institute (SARI) research complex. ➢ *Nigeria:* Nigeria has drafted biosafety legislation that permits it to conduct field trials. Confined field trials of cowpea at IAR in 2013. Anticipated commercial release in 2017.[3] ➢ *Burkina Faso:* law in place to allow safe commercialization of GM products[4], passage of approval of GM food crops has been much slower than with fiber. Has commercially produced Bt cotton since 2008. In 2013, 150,000 farmers planted Bt cotton for the sixth consecutive year.[5] Other countries involved: ➢ *Australia:* Genetic modification took place at CSIRO ➢ *US:* Support through the USAID-funded Program for Biosafety Systems and through USAID's support for making SARI a Center of Excellence ➢ *Puerto Rico:* Confined field trials in 2008 before Burkina Faso, Nigeria, and Ghana[6]	Initiated by the Network for Genetic Improvement of Cowpea for Africa[7] that includes Purdue University, the University of Zimbabwe, International Institute for Tropical Agriculture (IITA), University of California-Riverside, Michigan State University, the University of Virginia-Charlottsville, Kirkhouse Trust, **Monsanto** (US)**.** AATF negotiated a royalty-free transfer of the proprietary gene used in the development of the Bt cowpea, and coordinates and manages the project. CSIRO (Australia) under the guidance of CSIRO researcher T.J. Higgins performed the genetic modification with the Bt gene from Monsanto. The CFTs are being conducted at the Savannah Agricultural Research Institute (SARI, Ghana), Institute for Agricultural Research (IAR, Nigeria), and the Institut de l'Environnement et de Recherches Agricoles (INERA, Burkina Faso).[8] The cowpea variety used in the transformation event was provided by Nigeria ARC.
Sweet potato engineered for disease-resistance to feathery-mottle virus	➢ *Kenya:* KARI conducted the contained laboratory and confined field trials. The product was not engineered for the common variant of the virus and trials were less	The International Service for Acquisition of Agri-biotech Applications (ISAAA) developed and financed this research partnership between Kenya Agriculture Research

	successful than anticipated.[9] Kenyan scientists have been trained in both the US and Kenya in genetic modification, the establishment of biosafety systems, intellectual property rights protection, and technology transfer mechanisms.[10] Kenya has enacted biosafety regulation and has an approved biosafety policy.[11] As of 2012, there is a ban on GMOs in the country.[12]	Institute (KARI), **Monsanto**, USAID's Agricultural Biotechnology Support Project (ABSP), Michigan State University, and Kenyan universities. Monsanto "donated" the virus-resistant technology through a royalty-free transfer.[13] KARI conducted the trials and Monsanto provided the virus coat protein gene to use to develop the GM sweet potato.[14]
Water-Efficient Maize for Africa (WEMA)	➢ *Mozambique:* is currently in the process to approve its revised biosafety regulations. If passed, it will allow the first GM plantings in the country.[15] ➢ *South Africa:* South Africa has enacted a biosafety law and has been commercially producing biotech crops since 1998. In 2012, it planted 2.9 million ha of biotech crops.[16] ➢ *Kenya*: Kenya has enacted biosafety regulation and has an approved biosafety policy.[17]As of 2012, there is a ban on GMOs in the country.[18] ➢ *Uganda:* Uganda has drafted a biosafety bill. [19]	AATF negotiated a royalty-free transfer of the proprietary gene used in the development of WEMA, and coordinates and manages the project. **Monsanto** provided the gene *Bacillus subtilis* to help confer drought resistance.[20] WEMA is funded by the Bill and Melinda Gates Foundation, Howard G. Buffett Foundation, and USAID.[21] Other partners include KARI, Instituto de Investigação Agrária de Moçambique, South Africa's Agricultural Research Center, the Commission for Science and Technology (COSTECH), Uganda's NARO, Uganda), CIMMYT, African Seed Traders Association (AFSTA)[22]
Insect-resistant maize for Africa (IRMA)	➢ *Ethiopia:* Ethiopia has enacted biosafety regulation.[23] ➢ *Kenya:* Kenya has enacted biosafety regulation and has an approved biosafety policy.[24]As of 2012, there is a ban on GMOs in the country.[25] ➢ *Malawi:* Malawi has enacted biosafety regulation.[26] ➢ *Tanzania:* Tanzania has enacted biosafety regulation.[27] ➢ *Uganda:* Uganda has drafted a biosafety bill. [28] ➢ *Zambia:* Zambia has enacted biosafety regulation.[29] ➢ *Zimbabwe:* Zimbabwe has enacted biosafety regulation.[30]	**Syngenta** Foundation[31] is the funding agency, partners include[32] the CIMMYT, CGIAR, Bako National Maize Research Project (Ethiopia), Hawassa National Maize Research Project, national agricultural research institutes of Ethiopia, Kenya, Malawi, Tanzania, Uganda, Zambia, and Zimbabwe, Bunda College, Chitedze Agricultural Research Station, Selian Agricultural Research Institute, **SeedCo Ltd,** CGIAR
Virus Resistant Cassava for Africa (VIRCA) Cassava engineered for resistance to cassava mosaic disease	➢ *Kenya:* Kenya has enacted biosafety regulation and has an approved biosafety policy.[33]As of 2012, there is a ban on GMOs in the country.[34] ➢ *Uganda:* Uganda has drafted a biosafety bill. [35]	Donald Danforth Plant Science Center, **Monsanto** Fund[36], USAID, Bill and Melinda Gates Foundation, Cornell University, ISAAA, Kenyan universities, IITA, Bill and Melinda Gates Foundation, and Howard G. Buffet Foundation. [37] Trials are conducted at KARI and the National Crop Resources Research Institute in

		Uganda.
Nitrogen-use efficient (NUE), water-use efficient (WUE), and salt tolerant (ST) African (NEWEST) rice	➢ *Ghana* (CSIR-Kumasi): Ghana passed biosafety legislation in December 2011 that "is considered user friendly as it does not contain any labeling requirements for biotech or genetically engineered food products or strict liability provisions."[38]NEWEST rice was planted was planted at the Council for Scientific and Industrial Research (CSIR) Kumasi in March 2013. ➢ *Nigeria* (National Cereal Research Institute): Nigeria has drafted biosafety legislation that permits it to conduct field trials.[39] ➢ *Uganda* (National Agricultural Research Organization): Uganda has drafted a biosafety bill. [40]	AATF "is contributing its leadership experience in public private partnership management, technology stewardship and project management expertise."[41] **Arcadia Biosciences** "donated" the NUE, WUE, and ST traits for the development of NEWEST rice and the Public Intellectual Property Resource for Africa (PIPRA) is "donating the enabling technologies for plant transformation."[42]The International Centre for Tropical Agriculture (CIAT) is carrying out the preliminary agronomic trials, seed propagation, and field trials for trait gain, whereas the CSIR-Kumasi (Ghana), National Cereal Research Institute (Nigeria), and Uganda (National Agricultural Research Organization) are conducting the field trials for trait gain. Project activities are funded by USAID and initial funding was provided by the UK Department for International Development (DFID) and USAID.[43]
Africa Biofortified Sorghum (Biosorghum)	➢ *South Africa:* Agricultural Research Center (ARC), Council for Scientific and Industrial Research (CSIR) are conducting confined field trials. ➢ *Kenya:* KARI: confined field trials ➢ *Burkina Faso:* INERA is conducting confined field trials. ➢ *Nigeria:* Nigeria has drafted biosafety legislation that permits it to conduct field trials. Institute of Agricultural Research at Ahmadu Bello University in Nigeria is not yet involved in field trials. [44]	The Africa Harvest Consortium led by Florence Wambugu, is the primary grantee to the program. **Pioneer Hi-Bred** "is partnering with Africa Harvest as the scientific lead institution," donating the initial technologies valued at US$4.8 million "to help with the project aimed at improving the nutritional value of sorghum, a staple crop in Africa."[45] The project is led by the AATF "The team enforces core IP [intellectual property] values within the project such as the Charitable Objective that seeks to provide access to the knowledge created by the project and to supply the final ABS product through affordable and accessible means free from royalties and at not at a profit basis."[46] Other partners include Bill and Melinda Gates Foundation, ICRISAT, University of Pretoria, University of California-Berkeley, West and Central African Council for Agricultural Research and Development (CORAF). KARI, the Institute of Agricultural Research (Nigeria), INERA (Burkina Faso), and ARC and Council for Scientific and

		Industrial Research (South Africa) conduct field trials.

[1] **The agricultural biotechnology (agbiotech) public-private partnerships included in this table meet the following criteria: 1) they involve the donation of a proprietary technology for the development of a genetically modified crop in Africa, and 2) such product development is supportive of the idea of 'pro-poor' biotechnology. That is, the technology is intended to be developed to address the needs of small farmers and local food security issues, and research is field trials are based in a national agricultural research institute.**

[2] USDA Foreign Agricultural Service, "Ghana Agricultural Biotechnology Annual," *Global Agricultural Information Network (GAIN) Report*, September 3, 2013.

[3] "Researchers Inventing Pod Borer Resistant Cowpea for Africa," AATF, accessed July 5, 2015, http://cowpea.aatf-africa.org/news/media/researchers-inventing-pod-borer-resistant-cowpea-africa.

[4] Walter Alhassan, "Agricultural Biotechnologies in Developing Countries: Options and Opportunities in Crops, Forestry, Livestock, Fisheries and Agro-industry to Face the Challenges of Food Insecurity and Climate Change," (Forum for Agricultural Research in Africa (FARA) paper presented at the UN Food and Agriculture Organization Technical Conference on Agricultural Biotechnologies in Developing Countries, Guadalajara, Mexico, March 1-4, 2010).

[5] "Biotech Facts and Trends 2014: Burkina Faso," ISAAA, accessed July 5, 2015, https://www.isaaa.org/resources/publications/biotech_country_facts_and_trends/download/Facts%20and%20Trends%20-%20Burkina%20Faso.pdf.

[6] "Nigeria Approves Confined Field Trial of Cowpea," ISAAA, accessed July 5, 2015, http://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=4311.

[7] From AATF: "The development of Maruca-resistant cowpeas was initiated by an international research consortium under the Network for the Genetic Improvement of Cowpea for Africa (NGICA) project at Purdue University. The NGICA network uses a holistic approach to cowpea development that includes NARS, academic, public and private sector participants. AATF coordinates and manages the project and is also responsible for the intellectual property and licensing components of the donated insect-resistant technology. Partners include African scientists at universities and public research organisations, American universities and public sector research organisations, an Australian public sector research organisation, industry, the International Program for Biosafety Systems and international agricultural research institutes in Africa. Partners in the field trial testing phase include research organisations, NGOs and national scientists in participating countries in Africa: Burkina Faso, Ghana and Nigeria. All of these participants share one goal and that is to provide African farmers with safe, high quality cowpea seed." "*Maruca*-Resistant Cowpea: Frequently Asked Questions," AATF, accessed July 5, 2015, http://www.aatf-africa.org/userfiles/CowpeaFAQ.pdf.

[8] It should be noted that I have divergent accounts of which actors are the lead in the development of Bt cowpea. In an interview with the lead researcher on cowpea at SARI, he identified IITA, AATF, Monsanto, CSIRO, T.J. Higgins, and the ARC in Nigeria, INERA in Burkina Faso, and SARI in Ghana (SARI) as participants in the *maruca*-resistant cowpea. There was no mention of the Network for Genetic Improvement of Cowpea that the IFPRI report identifies as leading the research. Author interview with Dr. I.D.K. Atokple at SARI, Nyankpala, February 13, 2013. Chambers et.al., *GM Agricultural Technologies for Africa* (Washington, D.C.: International Food Policy Research Institute, 2014), 31.

[9] Lois Muraguri, "Unplugged! An Analysis of Agricultural Biotechnology PPPs in Kenya," *Journal of International Development* 22, no.3 (2010): 289-307.

[10] Khush, Gurdev S. "Biotechnology: Public-Private Partnerships and Intellectual Property Rights in the Context of Developing Countries," *Biodiversity and the Law: Biotechnology and the Law: Intellectual Property, Biotechnology, and Traditional Knowledge*, ed. Charles R. McManis (New York: Earthscan, 2007), 179-91.

[11] Chambers et.al., *GM Agricultural Technologies for Africa*, 38.

[12] AgroNews, "Kenya Banned Importation of All GMO Foods," *AgroNews,* November 22, 2012, accessed July 3, 2015, http://news.agropages.com/News/NewsDetail---8425.htm; Jeff Otieno, "Researchers in a Fix Over GMO Ban," *The East African*, August 16, 2014, accessed July 5, 2015,

http://www.theeastafrican.co.ke/news/Researchers-in-a-fix-over-GMO-ban/-/2558/2421314/-/item/0/-/qprcmnz/-/index.html.
[13] This partnership was one of the first of its kind and was initiated by ISAAA in 1991. See Khush, "Biotechnology: PPPs and IPRs in Developing Countries."
[14] Muraguri, "Analysis of Ag Biotech PPPs in Kenya," 299.
[15] USDA Foreign Agricultural Service, "Agricultural Biotechnology in Mozambique," *Global Agricultural Information Network (GAIN) Report*, November 1, 2013.
[16] "Biotech Facts and Trends 2014: South Africa," ISAAA, accessed July 5, 2015, https://www.isaaa.org/resources/publications/biotech_country_facts_and_trends/download/Facts%20and%20Trends%20-%20South%20Africa.pdf.
[17] Chambers et.al., *GM Agricultural Technologies for Africa*, 30-32.
[18] AgroNews, "Kenya Banned GMOs"; Otieno, "Researchers in a Fix Over GMO Ban."
[19] Chambers et.al., *GM Agricultural Technologies for Africa*, 38.
[20] "Gene from Japan for Local Maize," AATF, May 19, 2010, accessed July 5, 2015, http://wema.aatf-africa.org/news/media/gene-japan-local-maize.
[21] "Water Efficient Maize for Africa (WEMA)," Monsanto Company, accessed July 5, 2015, http://www.monsanto.com/improvingagriculture/pages/water-efficient-maize-for-africa.aspx.
[22] Chambers et.al., *GM Agricultural Technologies for Africa*, 30-32.
[23] Chambers et.al., *GM Agricultural Technologies for Africa*, 38.
[24] Chambers et.al., *GM Agricultural Technologies for Africa*, 30-32.
[25] AgroNews, "Kenya Banned GMOs"; Otieno, "Researchers in a Fix Over GMO Ban."
[26] Chambers et.al., *GM Agricultural Technologies for Africa*, 38.
[27] Ibid.
[28] Ibid.
[29] Ibid.
[30] Ibid.
[31] Syngenta Foundation is both private sector (Syngenta is the second largest agribusiness corporation) and its foundation acts as an arbitrator of proprietary release of Syngenta's technology.
[32] Chambers et.al., *GM Agricultural Technologies for Africa*, 30-32.
[33] Chambers et.al., *GM Agricultural Technologies for Africa*, 30-32.
[34] AgroNews, "Kenya Banned GMOs"; Otieno, "Researchers in a Fix Over GMO Ban."
[35] Chambers et.al., *GM Agricultural Technologies for Africa*, 38.
[36] Similar to the Syngenta Foundation, the Monsanto Fund is both private sector (Monsanto is the largest agribusiness corporation) and its foundation acts as an arbitrator of proprietary release of Monsanto's technology.
[37] Muraguri, "Analysis of Ag Biotech PPPs in Kenya"; "Virus Resistant Cassava for Africa (VIRCA)," Monsanto Corporation, accessed July 5, 2015, http://www.monsanto.com/improvingagriculture/pages/virus-resistant-cassava-for-africa.aspx.
[38] USDA Foreign Agricultural Service, "Ghana Agricultural Biotechnology Annual," *Global Agricultural Information Network (GAIN) Report*, September 3, 2013.
[39] Chambers et.al., *GM Agricultural Technologies for Africa*, 38.
[40] Chambers et.al., *GM Agricultural Technologies for Africa*, 38.
[41] "Nitrogen-Use Efficient, Water-Use Efficient, and Salt-Tolerant Rice Project," AATF, accessed July 5, 2015, http://www.aatf-africa.org/files/Rice-project-brief.pdf.
[42] Ibid.
[43] Ibid.
[44] "The ABS Project Consortium," Biosorghum.org, accessed July 5, 2015, http://biosorghum.org/abs_consort.php.
[45] "ABS Project Development," Biosorghum.org, accessed July 5, 2015, http://biosorghum.org/abs_consort.php.
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