

Greenhouse governmentality: Protected agriculture and the changing biopolitical management of agrarian life in Jamaica

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Abstract

This paper draws upon Foucauldian theories of governmentality and biopower to examine the recent growth of greenhouse cultivation on the island of Jamaica. Greenhouse farming has been widely promoted as a means to enhance the efficiency, technological sophistication, and profitability of the island's traditional small-scale farmers. Following Foucault, and drawing on a series of interviews with greenhouse growers, we read this intervention as form of governmentality acting on the conduct and attitudes of Jamaican farmers. As a form of governmentality, greenhouse farming also represents a new and distinctive regime of biopower, one that intervenes with greater precision into the metabolism between the natural processes of the rural population and the vital properties of growing plants. Viewed as a form of biopower, the greenhouse calls particular attention to the ways in which assemblages of materials and technologies enable new forms of control and surveillance over the life processes associated with crop cultivation, thereby generating new kinds of affective relations and agrarian subjectivities. This capital- and chemical-intensive biopolitics, we argue, threatens to re-engineer Jamaica's agrarian milieu in ways that favor elite agricultural interests at the expense of long-standing traditional farming practices and the forms of socio-ecological metabolism upon which they are based.

Keywords

Agrarian life, biopower, Foucault, governmentality, greenhouse, Jamaica

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In April of 2008, on the heels of an electoral victory by the Jamaica Labor Party (JLP), newly appointed Agricultural Minister Christopher Tufton delivered his first budget presentation before the Jamaican Parliament. He began by praising the work of Jamaica's traditional small farmers, but noted that many of them lacked formal training or an ability to understand the forces of global trade. The Minister then offered a contrast to this image, highlighting three young entrepreneurs who had recently taken up greenhouse farming and were "making agriculture work." Said Tufton (2008: n.p.):

They have seen the new agriculture Mr. Speaker, driven by markets and technological improvements. However, they are in the minority. As a Government, we have a responsibility to encourage and facilitate the movement of this thinking into the mainstream. Mr. Speaker, this is the Government's vision, and the thinking that will drive our policy for the agricultural revolution which we must achieve.

Over the past decade, this vision of a technology- and market-driven agricultural 'revolution' has been advanced by successive governments in Jamaica, as well as by a number of regional and international aid agencies. And increasingly, this "new agriculture" has come to be symbolized by the country's emerging greenhouse sector. Greenhouse cultivation is frequently held up as an example of a new kind of farming, one characterized by technological sophistication, increased efficiency, and enhanced productivity. In this way, the greenhouse has become central to a wider discourse in Jamaica on the need to modernize the agricultural methods of Jamaica's traditional small-scale farmers, by reshaping the materials and bodily practices of agriculture and the identity of the farming subject.

In this paper, we draw upon Foucauldian understandings of governmentality to suggest that the promotion of the greenhouse model can be productively viewed as a shift in the regime of biopower governing rural life in Jamaica. Foucault's account of biopower, we believe, provides rich conceptual resources for understanding the ways in which governmental rationalities seek to manage the "natural forces" of population by shaping the conduct and comportment of subjects toward particular ends. In the Jamaican context, we suggest, what is at issue is not only control over the human population, but the regulation of agriculture as an assemblage of human and non-human vital forces. From this starting point, we can read the development of greenhouse production as a biopolitical intervention aimed at shaping the milieu of the agrarian environment, and thereby the habits and conduct of agricultural subjects. The discussion that follows is derived from three years of fieldwork in support of a larger investigation into agricultural vulnerability and climate change among small farmers in southwestern Jamaica (Moulton et al., 2015; Popke et al., 2016). Our account of the greenhouse phenomenon is informed by more than 100 semi-structured interviews (with farmers, traders, extension agents, and government officials) completed over the course of the project, but draws primarily upon 22 interviews with greenhouse growers that we conducted jointly during seven weeks of fieldwork in 2014. We also make use of public statements and official documents issued by the Jamaican government and by a number of non-governmental agencies that are involved in greenhouse development. By attending to the stated intentions and motivations of greenhouse proponents, as well as the attitudes and experiences of greenhouse growers, we hope to be able to elucidate the key features and implications of this phenomenon as a governmental technology that mobilizes a particular kind of biopower.

The rise of greenhouse cultivation in Jamaica

The agricultural landscape of Jamaica is characterized by a deep structural inequality, a legacy of the island's plantation history (Beckford, 1972; Weis, 2004a). As in most West

Indian colonies, the relatively flat lands of the coastal plain have been given over to export-oriented plantation agriculture, with small-scale peasant cultivators largely relegated to fragmented lands in the hilly interior. According to the most recent agricultural census, 75% of Jamaica's roughly 200,000 farms are less than one hectare in size, and 97% are smaller than five hectares (SIJ, 2007). The typical small farmer could be described as semi-commercial, growing vegetables, fruits, and/or root crops for distribution to local markets as well as a range of crops for household consumption. Most purchase their seeds and basic inputs (fertilizers and chemical sprays), but few keep careful records or integrate business principles into their operations. A significant body of research has demonstrated that Jamaican farmers draw upon a deep store of traditional knowledge and incorporate a range of innovative agro-ecological practices into their farming (Beckford and Barker, 2007; Campbell et al., 2011; Gamble et al., 2010). Nevertheless, small farmers face significant material and financial constraints and a high degree of risk, and incomes for many are low and unstable. It is in this context that greenhouses have been promoted as a strategy to revitalize Jamaican agriculture and "address issues related to low production and productivity, high prices, inconsistent supply and variable quality which has characterized local vegetable production for decades" (Government of Jamaica, 2011a).

Greenhouse cultivation is a form of protected agriculture in which the growing environment is modified in order to maximize plant growth and productivity (CARDI, 2014; USAID, 2008). Greenhouse structures are not new to Jamaica, but their use was previously limited to research stations, nurseries and certain specialized market niches, such as cut flowers. Since the early 2000s, however, greenhouse production has increasingly been touted as a means to improve the fortunes of Jamaica's traditional small farmers. The initial wave of greenhouse development arrived in the aftermath of Hurricane Ivan in 2004, when the United States Agency for International Development (USAID) launched the Jamaica Business Recovery Program (JBRP). The ostensible goal of the project was to assist in the recovery of small businesses that had been damaged by the storm, but USAID and its two subcontractors—Development Alternatives, Inc. and Fintrac, an agribusiness development firm—viewed the program as an opportunity to introduce "new technologies and improved production practices" into the agriculture sector (Development Alternatives Inc., 2005: 5). As a part of this thrust, 11 greenhouses were given to "lead farmers" across the island with the expectation that they would serve as demonstration farms. The aim was not only to showcase the technology, but also to promote the development of agribusiness principles and "market linkages" with local agricultural suppliers (JIS, 2007). Several additional greenhouses arrived a year later as part of the USAID-funded Rural Enterprise, Agriculture and Community Tourism (REACT) project, also implemented by Fintrac and once again oriented around principles of rural enterprise development (Government of Jamaica, 2011b).

A new wave of greenhouses followed in 2009, as the centerpiece of the Improving Jamaica's Agricultural Productivity project. That three-year effort, funded by the Canadian International Development Agency (CIDA), supplied 40 new greenhouses, and established training programs as well as a new Greenhouse Unit within the country's extension agency, the Rural Agricultural Development Authority (RADA). By this time, the effort to expand Jamaica's nascent greenhouse sector was described as a "contribution to the repositioning of agriculture and rural life" (IICA, 2008: 8) and "an opportunity to change the current landscape in the Jamaican agricultural sector to a technology-driven sector with increased efficiencies and productivity" (IICA, 2009: 6). Additional greenhouse projects have since been funded by both CIDA and the European Union, and they have also become central to the agricultural strategy of the Jamaican government.

Greenhouse cultivation has been promoted primarily as a means for farmers to achieve greater yields and increased incomes, and as a way to attract young people into farming. As former Prime Minister Bruce Golding put it, “we want to see agriculture as an avenue to create wealth, and it can be done. But it has to be in a new way of thinking and approach to agriculture. We are doing it with greenhouse technology” (*The Jamaica Gleaner*, 2010). Greenhouses are now promoted in *Vision 2030*, Jamaica’s long range development plan, and in recent sectorial plans for agriculture, and RADA has asserted that it “is committed to a strategically planned program for development of the industry . . . [and] has assigned high priority to these efforts” (RADA, 2015a: n.p).

At the time of our research, the Jamaica Greenhouse Growers Association (JGGA) counted 275 registered houses across the island, a number that is expected to grow to more than 400 in the coming months as part of a new partnership between the Jamaican government and the bauxite industry (*The Jamaica Observer*, 2014). The early donor-funded projects supplied standard, metal-frame structures, and generally focused on the cultivation of either tomatoes or colored bell peppers for the tourism sector. Over time, however, new designs have become available, and small farmers have learned to construct hybrid and low-cost structures using treated lumber or poles cut from the forest. Greenhouse structures now incorporate a wide range of frame and mesh materials, water management and fertilization systems, planting media, and levels of technology. Peppers and tomatoes remain the most common greenhouse crops, but farmers also make use of protected agriculture to grow lettuce, broccoli, cucumbers, hot peppers, cabbage and ginger, among other crops.

Greenhouses are now a common feature of the Jamaican rural landscape, and their purported virtues—efficiency, entrepreneurialism, technological savvy—are extolled publicly in the media and by agricultural extension agents. Nearly every farmer we have met knows what a greenhouse is, and most know of someone who operates one. As one farmer observed, “ah the greenhouse, man, have the talk ‘round here still. Everybody is trying to see if them can get themself together and build a greenhouse” (Grower 1, 2014, personal communication). In this way, the greenhouse has become a kind of universal symbol of the new and modern kind of farming being promoted by the Jamaica government, and therefore represents a much wider biopolitical vision for the transformation of rural livelihoods. We should state here that we find nothing inherently objectionable about attempts to provide greater income-generating opportunities for Jamaican farmers. We do, however, want to ask what this new image might mean for the tens of thousands of farmers who are dependent upon long-standing practices associated with traditional methods of production. To do so, we argue in what follows that the effort to transform Jamaican agriculture is best viewed as a form of governmentality, one aimed at reshaping existing agricultural rationalities, practices, and subjectivities through a biopolitical reconfiguration of the agencies and materialities constitutive of Jamaica’s agrarian milieu.

Governing the rural milieu: Toward an agrarian biopower

Foucault’s ruminations on governmentality have been widely discussed, and the basic contours of his theory are by now well-known (see Ettlinger, 2011; Huxley, 2007; Oksala, 2013; Philo, 2012; Rose et al., 2006). In brief, Foucault sought to trace the development, in the 17th and 18th centuries, of a distinct form of power associated with the modern administrative state. In contrast with sovereign power over territory or disciplinary power over individual bodies, this new form of power sought to work on the habits, dispositions, and self-understandings of subjects:

'Government' did not refer only to political structures or to the management of states; rather, it designated the way in which the conduct of individuals or of groups might be directed . . . modes of action, more or less considered or calculated, which were designed to act upon the possibilities of action of other people. (Foucault, 1982: 790)

Foucault traces the progressive "governmentalization" of the state, showing how "the aim of the modern art of government" is increasingly "to develop those elements constitutive of individuals' lives in such a way that their development also fosters that of the strength of the state" (Foucault, 1981: 252).

Accompanying this growing state concern with government was a shift in the nature and target of state power toward what Foucault calls biopower. The emergence of biopower is associated with a new understanding of human subjects as living, biological beings that can be managed at the level of a population. Biopower thus concerns the aggregated living forces of life, death, health, circulation, and so on, forces that can be tracked and managed in terms of norms, statistical averages, and probabilities. Biopower is thus targeted to "collective phenomena . . . that are aleatory and unpredictable when taken in themselves or individually, but which, at the collective level, display certain constants that are easy, or at least possible, to establish" (Foucault, 2003: 66).

Foucault suggests that the initial shift from disciplinary power to biopower is associated with the growth of towns in 18th century Europe. The planning and management of towns, he argues, are driven by concerns with circulation, security, and the emergence of "the population" as a matter of governmental concern. Foucault writes:

New technologies of power needed to grapple with the phenomena of population, in short to undertake the administration, control and direction of the accumulation of men . . . hence there arise the problems of demography, public health, hygiene, housing conditions, longevity and fertility. (Foucault, 1980a: 125)

As Foucault describes, this new human "accumulation" was now to be managed not through the disciplining of individual bodies, but by the manipulation of the "natural processes" through which the population is "transformed, grows, declines and moves around" (2007: 351). This subjection of a population's natural processes to techniques of power, Foucault notes, corresponds to a new understanding of humankind as a living species, such that "we can say that man appears in the first form of his integration within biology" (Foucault, 2007: 75).

Subsequent commentators have taken discussions of biopower in a number of divergent directions, examining a host of ways in which power may be put to work cultivating, directing, or even abandoning the forces of life itself (see Campbell and Sitze, 2013; Lemke, 2011; Rabinow and Rose, 2006; Rutherford and Rutherford, 2013a; Schlosser, 2008). In the present context, we are most interested in considering how the biopolitical concern with the "natural processes" of the population can also be viewed as a kind of environmental intervention (Agrawal, 2005; Birkenholtz, 2009; Dressler, 2014; Rutherford, 2007). In Foucault's telling, the rise of biopolitical management was effected not so much by the direct control of the population, but through various interventions into the environmental setting, or what Foucault calls the "milieu":

The milieu appears as a field of intervention in which . . . one tries to affect, precisely, a population. I mean a multiplicity of individuals who are and fundamentally and essentially only exist biologically bound to the materiality within which they live. (Foucault, 2007: 21)

Foucault is initially concerned with the urban environment, but he moves to consider the ways in which the rural population is also "biologically bound" to its milieu, highlighting the

ways in which grain supplies became the target of new forms of regulation to combat scarcity (Nally, 2011). In the agricultural setting, Foucault argues, biopower is fundamentally concerned with circulation and security, and it acts upon “men in their relations, their links, their imbrication” with, among other things, “territory with its specific qualities, climate, irrigation, fertility, etc.” (1991: 93). This concern, Foucault states, “reintroduces agriculture as a fundamental element of rational governmentality. The land now appears alongside, and at least as much as and more than the town, as the privileged object of governmental intervention” (Foucault, 2007: 342).

We want to foreground here a key aspect of rural governmentality, and that is its concern with more-than-human forces and relationships. Rural settings make particularly evident the fact that the human-as-species is biologically bound to an environment traversed by non-human forces and materialities of various kinds. This is particularly true in the context of agriculture, which depends upon the management of specific relationships between the “natural processes” of humans and those of crops and livestock (Holloway et al., 2009; Nally, 2011). Agrarian biopower might therefore be seen as acting not on human processes alone, but on the proper metabolism between multiple social and natural forces working in the interest of agricultural production. As Foucault put it,

The population and environment are in perpetual living interrelation, and the state has to manage those living interrelations between those two types of living beings...it wields its power over living beings, and its politics, therefore, has to be a biopolitics. (Foucault, 1988: 160)

We should be reminded here that the “living interrelation” between rural population and environment has progressively become not only a target of governmental intervention, but also a site of capital accumulation. For both Marxists and political ecologists, the agrarian milieu is best viewed through the lens of what Marx (1990: 637) called “the metabolic interaction” between living labor and the natural processes that govern the vital properties of growing plants. As Marx described it, the development of capitalist agriculture disrupted these processes, opening up a “metabolic rift” within the fabric of socio-ecological relations (Foster, 2013; Moore, 2000). In the words of Ellen Meiksins Wood (2000: 39), then, “capitalism was born at the very core of human life, in the interaction with nature on which life itself depends.” As Foucault himself understood, the emergence of modern forms of governmental intervention was therefore tied to the development of political economy and, later, the dissemination of neoliberal rationality.

The work of Hardt and Negri provides an additional window on this relationship, focusing particular attention on the productive forces of cooperative labor. They read into Foucault a tension between biopower and what they call “biopolitical production” or “biopolitical labor,” “whereby the former could be defined (rather crudely) as the power over life and the latter as the power of life to resist and determine an alternative production of subjectivity” (2009: 57). This productive pole of biopolitics is, as Negri (1999) puts it elsewhere in his work, a “constituent power” that defines the multitude, the collective subject of labor that is the creative source of all social being. Hardt and Negri do not provide an explicit analysis of the human-ecological dimensions of biopolitical production, but they offer hints for how we might consider the ways in which the production of the common implies a particular kind of environmental milieu. The biopolitical terrain of the multitude, Hardt and Negri suggest, represents “an ecology of the common...humans and the nonhuman world in a dynamic of interdependence, care, and mutual transformation” (2009: 171). As it relates to our consideration of Jamaica’s changing agrarian relations,

Hardt and Negri remind us that the specific nature of the metabolic interaction shaping rural livelihoods is determined not only by governmental deployments of biopower, but also by the collective agencies and biopolitical labor of rural subjects. The rural milieu, in other words, is less a mere object of governmental power and control than a historically determined site of contestation over the processes regulating multifarious forms of rural life.

A brief genealogy of agrarian biopolitics in Jamaica

A number of scholars have drawn upon Foucault to consider how technologies of government sought to shape the conduct of conduct within the context of colonial and post-colonial development (Frederiksen, 2014; Legg, 2007; Li, 2007; Ove, 2013). One of the key concerns of this colonial governmentality was the biopolitical management of the agrarian milieu. In discussing the shift to biopower, Foucault notes that “the biological traits of a population become relevant factors for economic management, and it becomes necessary to organize around them an apparatus which will ensure not only their subjection but the constant increase of their utility” (Foucault, 1980b: 171–172). In Jamaica, this aim of “increasing the utility” of the population was central to the imperative of colonial wealth extraction, first in plantation settings and later in attempts to transform peasant agriculture over the course of the 20th century. Although we lack the space here for a detailed genealogy of agrarian biopower in the Caribbean, we would point broadly to three distinct eras of governmental intervention that have shaped contemporary agricultural practices and relations in Jamaica.

The plantation era represents the initial effort in the Caribbean to establish the proper ensemble of human and non-human forces to ensure the production of agricultural wealth. The governmental management of the colonies required, as Foucault noted about Mercantilism more generally,

An apparatus that will ensure that the population, which is seen as the source and the root, as it were, of the state’s power and wealth, will work properly, in the right place, and on the right objects . . . population as a productive force, in the strict sense of the term. (Foucault, 2007: 69)

In the colonies of the Caribbean, of course, this “productive force” was mobilized by the institution of chattel slavery, which combined a colonial interest in managing the general forces and biological traits of the agrarian population with brutal tactics of discipline acting upon the bodies of the enslaved (Duncan, 2007; Nally, 2011). The plantation regime thus combined the two technologies of power that Foucault identified in the later development of governmental regimes in Europe—an anatomic-politics of the body and a biopolitics of the population—all in the interest of extracting wealth to enhance the power of the state. Indeed, it is plausible to suggest that plantation slavery provided the initial context for a biopolitics concerned not principally with the fortune of individuals, but rather with the primal, natural forces of a population—forces, indeed, that could be abstracted from the human qualities of the enslaved. As Sidney Mintz (1974: 74) reminds us, “on the capitalistic slave plantation humanity was an obstacle to the maximization of profit.”

If the basic humanity of slaves was denied in the realm of production, however, a certain degree of autonomy was carved out in the spaces of the “provision grounds,” the plots of land granted to the slaves to provide for their own subsistence (and thereby save proprietors the cost of importing food). In Hardt and Negri’s terms, we might view the independent activity characterizing the provision grounds as a form of biopolitical labor, an affirmative production of subjectivity and the common against the biopower of the colonial state. Indeed, Caribbean historians have argued that these self-valorizing activities became the

basis for the development of the West Indian peasantry, and can therefore be seen as deeply embedded in the social relations shaping the milieu of small-scale farming in the contemporary Caribbean (Henke, 1996; Tomich, 1993).

In the wake of emancipation, many ex-slaves took up smallholder agriculture on marginal estate land or in the hilly interior of the island (Marshall, 1972; Mintz, 1979). The immediate concern of colonial authorities was focused on the fading fortunes of the sugar estates, and peasant cultivators were largely left to their own devices. Already by this time, peasant proprietors were engaged in small-scale commercial agriculture, supplying produce to local markets through a network of itinerant traders. By the middle decades of the 20th century, these small-scale farmers emerged as the target of new forms of agrarian biopower, and a host of programs and initiatives were developed to intervene in Jamaica's rural milieu (Crichlow, 2005; Edwards, 1972). These new interventions sought to "raise the whole pattern of living of the rural population" (ECLA, 1969: 17–32) through a combination of broad rural development schemes and more specific efforts to modernize the "backward" production methods of peasant agriculture through the introduction of, *inter alia*, improved planting techniques, better soil conservation and land management practices, and the enhanced utilization of fertilizers (Crichlow, 2005). These kinds of projects are consistent with wider post-war efforts to reshape peasant agriculture in the Global South around the social and technological aspirations of the Green Revolution (Ilcan and Phillips, 2003; Nally and Taylor, 2015). They represent the invocation of a kind of biopower that seeks to act on the milieu of the rural population—its land, community, "whole pattern of living"—in the interest of, as Crichlow (2005: 92) puts it, "the idea that modernization must eliminate backwardness."

In recent decades, this aim of modernizing rural Jamaica has been articulated within a new frame of agrarian biopolitics, one more explicitly concerned with re-envisioning the agrarian milieu as a site of technological innovation and entrepreneurial and market rationalities. The shift can be roughly dated to the electoral victory of the right-of-center JLP in 1982. The JLP's new agricultural policy, *Agro 21: Making Agriculture Jamaica's Business*, was released in 1983 in the context of an IMF structural adjustment program, and sought to bring about "the transformation and modernization of the agricultural sector" (National Planning Agency, 1983: 2.1). Noting that agriculture had "remained essentially traditional in outlook and scope," the plan was envisioned as "a catalytic instrument to transform the agricultural sector into a commercially viable economic operation, through the application of technological innovations" (National Planning Agency, 1983: 1.2–1.1). As elsewhere in the Global South, the new plan represented a major shift toward the neoliberal forms of governmentality that Foucault has diagnosed as a central feature of modern state power (Li, 2014; Ong, 2006). The rural sector in Jamaica was henceforth to be regulated in the interest of "a society subject to the dynamic of competition. Not a supermarket society, but an enterprise society" (Foucault, 2008: 147). Three decades later, neoliberal forms of biopower continue to shape agricultural relations in Jamaica (Mullings, 2012; Weis, 2004b). *Vision 2030* argues that "the revitalization of the agricultural sector and its increased contribution to the national economy is contingent on the reorganization of the sector on the basis of modern technology and management, in order to achieve greater efficiency and competitiveness" (Government of Jamaica, 2009: 3).

It is within this context that we wish to situate our reading of greenhouse production. From one perspective, the greenhouse can be viewed as just the latest in a long line of efforts to introduce new technologies and methods to Jamaica's rural producers. We believe, however, that protected agriculture can be viewed as an emerging new form of biopolitical intervention into the milieu of agrarian subjects and relations in Jamaica.

The greenhouse, we argue, is best viewed as an apparatus of environmental security that works to mobilize new technologies, materials, and affective relations so as to intensify the management of and control over the agricultural milieu. It does so, moreover, in ways that promote the extension and deepening of the neoliberal rationalities already governing Jamaica's rural producers. This is significant, we believe, because the model of intensification exemplified by protected agriculture portends a rural landscape shaped by governmental rationalities that intervene in the interest of elite farmers, and that re-orient Jamaica's agricultural metabolism around technological and chemical agencies, rather than a more just and sustainable form of biopolitical and bioenvironmental production.

The biopolitical management of greenhouse life

For proponents of protected agriculture, securing the future of farming in Jamaica requires nothing less than a dramatic shift in the practices and technologies of agricultural production. Here, for example, is former Prime Minister Golding, responding to a question during his inaugural weekly radio call-in show:

If farming is going to be around in 10 years' time, (then) we are going to have to improve the technology...which refers to things like greenhouses...We have to get cracking on farming. We can't expect to compete with the rest of the world if we are going (to the) bush with the same hoe and cutlass, and riding the same donkey that our grandfathers used to ride, and with the same hamper across the donkey; that is not going to cut it... We have to get serious. (JIS, 2008)

This image of the "serious" farmer, one who is competitive and technologically sophisticated, was invoked frequently in our discussions with both farmers and government officials in Jamaica and is indicative of a long-standing evolutionary narrative in which farmers must make a transition away from the outdated farming methods of the past and embrace a future defined by technological sophistication. There has been a "stigma attached to farming over the years," said one farmer, "the man with the machete and the donkey, the dirty boot and stuff and the fork and the hoe, that's how they see farming" (Grower 2, 2014, personal communication). A female greenhouse grower concurred:

In the past...farmers had this stigma attached to them, where you are in a water boot, dirty clothes, and on a donkey. Now I am a female...I can't manage the hoe and the fork and that sort of thing. And therefore for me the greenhouse farming presents opportunities...a female can actually venture in. (Grower 3, 2014, personal communication)

Thus, the new materials and technologies associated with the greenhouse represents for farmers a means of transcending the past by "going high-tech" (Grower 4, 2014, personal communication) and in the process forging a new agricultural identity. "Let me tell you something," asserted one farmer, "the image of farming is changing...greenhouse farming put a more presentable face out, a more glamorous face on it, you understand?" (Grower 5, 2014, personal communication).

In seeking to reshape the material and corporeal dimensions of the agrarian milieu, the greenhouse is reflective of a certain kind of biopower, one that intervenes with ever-greater precision into the metabolism between human and non-human life forces. Indeed, the primary reference manual for greenhouse growers in Jamaica makes this explicit: "the complex process which leads to plant growth is referred to as metabolism. The grower must possess a fundamental understanding that plants are living entities and as such, interact with their environment to sustain life" (USAID, 2008: 38). For Foucault, of course, the emergence of biopower represents precisely such a shift toward a greater concern

with the vital properties of life. Biopower, he states, is “a power bent on gathering forces, making them grow, and ordering them... a power that exerts a positive influence on life, that endeavors to administer, optimize, and multiply it, subjecting it to precise controls and comprehensive regulations” (Foucault, 1990: 136–137). Foucault was concerned most directly with human life, but we follow a number of recent commentators in suggesting that Foucault’s discussion of “the calculated management of life” (Foucault, 1990: 140) be extended to a consideration of non-human forces as well (Bakker, 2012; Collard, 2012; Lemke, 2014; Rutherford and Rutherford, 2013b; Srinivasan, 2014). When it comes to greenhouse agriculture, then, we wish to focus on the ways in which biopower acts to manage and stabilize the various human and non-human agencies involved in the cultivation of crops.

The greenhouse reference manual reminds growers that “crops interact with other organisms, including the growers who tend them, pests that eat them, and a host of beneficial or benign organisms above or below the soil surface that may assist or hinder nutrient uptake and defense against disease” (USAID, 2008: 26). The greenhouse therefore intervenes at the boundary between inter-species agency, introducing new forms of environmental security that must adjudicate between different kinds of vital life processes, cultivating the emergent properties of plants by protecting them from other living agents deemed “pests.” There is nothing new in this, of course; the cultivation of crops has always involved doing battle with, and frequently exterminating, unwanted life. But as an environmental technology of security, the greenhouse heightens this sense of, and ability to control, life’s forces. The greenhouse, that is, functions not only as a protective barrier, but also as a space of discipline, mobilizing technology and affective relations to effect a more active and conscientious management of the agricultural metabolism. “It’s a controlled environment,” asserted a greenhouse consultant, “so you can determine how the plant grows... because you know what you need to manipulate” (Grower 6, 2014, personal communication). A grower suggested similarly that “the plants are depending on you and you alone, cause it not getting anything from the natural environment” (Grower 3, 2014, personal communication).

In contrast, then, to the extensive management of open field agriculture, the space of the greenhouse concentrates care and attention, and induces different kinds of affective relations and new investments in plant life. Growers noted that “you have to be able to analyze what the plants are saying” (Grower 7, 2014, personal communication), in order to determine “what the plant want and to make the plant happy. The happier the plant, the more it ago produce” (Grower 2, 2014, personal communication). “Just like how you have a baby,” explained another grower, “and if you supposed to feed him every two hours, you have to be on time” (Grower 8, 2014, personal communication). One farmer even compared his greenhouse to a loving and supportive family home and open field cultivation to life on the streets:

You have boys on the road, cleaning windscreen, begging money to buy food. Nobody provides food for them, they don’t live anywhere. Some of them sleep underneath the culvert, they are not being taken care of. They don’t bathe, they don’t do anything. Compare that boy to a boy who is in a proper home, where he gets three meals per day, like my tomatoes, gets a balanced diet, right? He is free, no mosquito, or nothing not biting him up, so he gets Malaria or anything like that. Who do you expect to be the better producer? (Grower 9, 2014, personal communication)

This tending to the vital agencies of growing plants within the greenhouse finds its corollary in the ability of greenhouse growers to deny life to recalcitrant plants.

Here, a grower describes how he deals with pepper plants (“trees”) that appear stunted or unproductive: “when it comes down to the riff-raff, all you have to do is make the trees dead. You lock off the water...right now in the greenhouse, you determine the peppers, them” (Grower 6, personal communication). If we consider this example writ large, we can see the ways in which greenhouse biopower resonates with Foucault’s depiction of its investment in the health and well-being of the population as a whole. In this case, however, what is at stake is not just human life, but the ways in which life’s multiple entanglements are the target of interventions which seek—through careful discrimination, management and control—to effect a transformation from an agricultural sector that is “not taken care of” to one that is defined by health and productivity.

The government of things: The assemblages and affective atmospheres of greenhouse growing

As we have suggested, the biopolitical management of agricultural life within the greenhouse depends not only on the establishment of a protective space, but also on inculcating a new understanding of the technologies, agencies, and embodied practices that shape the agrarian milieu. We want to highlight two additional aspects of this new agrarian metabolism, both of which represent significant departures from the traditional model of small-scale farming in Jamaica. The first is the role of new technological assemblages in modulating the metabolism between the agencies of growers and the ecological processes governing the growth of plants. Foucault stressed that government is at least in part concerned with “the intrication of men and things” (Foucault, 2007: 97), and this opens up a consideration of the ways in which biopolitics may be bound up with, in Lemke’s words (2014: 11), “arranging things or managing complexes of humans and things.” In our view, the greenhouse can be considered just such a complex, one in which the practices of human labor associated with farming are mediated in novel ways by the technologies and materials that are incorporated into the greenhouse assemblage.

In most greenhouse systems, individual plants are given water and nutrients through fertigation networks that can be carefully controlled by the grower or run via automated systems. “Agriculture can go on computer,” said a JGGA official, farmers can “sit down on computer and work out fertilizer program, work out spraying schedule” (Grower 4, 2014, personal communication). Another grower implied that farming no longer requires any work at all: “as a greenhouse farmer, once you set your thing together, you can sit at this desk and everything is being done out there. That’s what we working towards. That’s where we need to get to” (Grower 10, 2014, personal communication). Among other things, the adoption of such automated systems to govern plant growth serves to eliminate much of the risk and uncertainty that characterize the strategy of traditional agricultural production. “I have a timer on it,” explained one grower, “it come in at... 7, 10, 1 and 4... [the timer] is a reliable way of watering the plants. Because when a person will forget, the timer not going to forget to come in. It don’t work like how people work” (Grower 11, 2014, personal communication). This new vision of a technologically-driven agricultural practice represents a dramatic transformation in the subjectivity of the Jamaican farmer, with new understandings of “how people work.” One of the key selling points of this new agricultural milieu is that it is clean, and does not demand what one farmer referred to as “intertwining with the dirt” (Grower 7, 2014, personal communication). As one government official put it, greenhouse farming is good for “persons who do not want to get their nails and hands dirty” (*The Jamaica Observer*, 2012). Many growers with whom we spoke appear to agree.

“It’s a clean work,” said one, “you know, you can come in here in your jacket and your tie” (Grower 2, 2014, personal communication). Another grower drew the distinction this way:

To tell a young man to get into [traditional] farming is like telling him that you see him as a loser. To tell a young man to get a greenhouse and get into farming, kind of lift the status of it . . . [It’s] because of the technology. The greenhouse farmer doesn’t have to get dirty. (Grower 12, 2014, personal communication)

These observations hint at the second characteristic of this new agricultural milieu that we wish to call attention to, namely the new kinds of corporeal and affective experience associated with protected agriculture. Greenhouse growing represents a distinct type of farming practice. It is “not an ordinary sort of ‘dig up ground and throw in there,’” said one farmer, “it is beyond that” (Grower 4, 2014, personal communication). Another stated that “this is not just, what you do on the outside that you go in and do in the inside. No, it’s totally different” (Grower 13, 2014, personal communication). The space of the greenhouse exposes farmers to a new sensory environment and new expectations of agricultural practice. The interior of the greenhouse is hot and humid, and the confined space leads to increased monitoring and discretion over the metabolic processes of individual plants. New practices such as trellising, pruning, and scouting take the place of traditional agricultural chores such as preparing fields, weeding, and watering. In other words, protected agriculture alters the “affective atmosphere” that attends to farming (Anderson, 2011).

The affective milieu of the greenhouse environment is one of constant attention and forms of surveillance. In contrast to the daily and seasonal rhythms of outdoor farming, the greenhouse is a space of perpetual regulation. In a story for its website, for example, Jamaica’s agricultural extension agency touted the fact that “farming is getting sexy and desirable, particularly for young people who are hooked on technology” but cautioned that the operator “must possess the temperament and commitment to pay attention to details because all production operations require constant vigilance” (RADA, 2015b: n.p.). Growers that we interviewed agreed. One described running a greenhouse as a “clinical operation”: “you have to be able to measure, calibrate instruments. You would have to be able to check the pH of your water and modulate it and stuff like that. So it takes sophistication and intelligence” (Grower 12, 2014, personal communication). Another grower described the various probes and meters that must be monitored: You have “[electrical conductivity] probes, pH probes, you have humidity meters, you know. You have tension meter checking for moisture content, you checking EC in, checking EC root zone, checking EC in the leachate, you know?” (Grower 9, 2014, personal communication). We can see here the ways in which the technology that is mobilized within the greenhouse assemblage shapes the bodily comportment and affective sensibilities associated with what it means to be a farmer. Agriculture, in its now modern and sophisticated incarnation, is to be viewed and performed as an activity that intervenes, with ever more care and control, in the micro-environmental milieu of growing plants.

And this surveillant orientation of greenhouse growing is not limited to the reading of instrument panels, but extends to the organic properties and life process of the plants themselves. Each plant must be carefully nurtured to maximize its potential yield. Leaves and stems are inspected on a regular basis for pests or disease, and many crops require frequent pruning and trellising as they grow. “If the plant is not happy,” said one grower, “you walk and you look. You check under the leaves for white flies . . . you do little pruning, cause you know you have to get off the shoots so that they can grow straight and come up” (Grower 2, 2014, personal communication). These kinds of practices are not necessarily limited to the greenhouse, but within the environment of protected agriculture, we would

suggest, they are intensified, and thus come to strongly shape the daily practices and affective orientations of farmers.

The new calculative rationalities of greenhouse governmentality

The greenhouse, we are suggesting, does not represent a mere technological enhancement of existing methods of production, but entails a qualitatively different kind of agricultural model and a new kind of agrarian subject. Central to this new agricultural vision is, as we have seen, the application of technology, energy, water, and a range of chemical inputs in order to intensify the management of the agrarian milieu. In the process, relations between human and ecological agencies are transformed, as are the thoughts, behaviors, and patterns of action of the typical farmer. This new biopolitical regime represents a significant break with traditional rural livelihood strategies and the forms of socio-ecological metabolism on which they depend. As such, we believe, greenhouse governmentality threatens to effect what McMichael (2016: 658) has called “the material and epistemic marginalization” of Jamaica’s traditional producers. In closing, we want to ask, then, what this new model of agriculture might mean for Jamaican communities that remain dependent upon the biopolitical production of small-scale farming.

Materially, the greenhouse provides an example of the ever-increasing tendency of capital to insert itself into the metabolism between human biopolitical labor and the natural processes on which life depends (McMichael, 2009; Moore, 2015). The intensification of agriculture symbolized by the space of the greenhouse depends upon not only an infusion of technology, but an infusion of money into more and more elements of the agrarian milieu. This includes the greenhouse structure itself, of course, but also new hybrid seed, chemical fertilizers, anti-fungal sprays and insecticides, fertigation systems of various kinds, probes and pH meters, different types of growing media, and in some cases fully automatic systems requiring computer hardware and software. Not surprisingly, these expenses place the acquisition of a greenhouse far outside the reach of the typical small farmer. “It is not gonna take just about any farmer to just set up a greenhouse farm,” admitted one grower, “you really have to have good financial standing, you know, resource” (Grower 3, 2014, personal communication). Indeed the greenhouse community has begun referring to its operators as “investors.” An official with the JGGA boasted that the greenhouse sector:

Has attracted a whole new breed of investors. Our investors are medical doctors, lawyers, teachers, engineers, pilots and you know persons who are up to a tertiary level. . . . I believe that we are in the new era of agriculture. (Grower 4, 2014, personal communication)

This “new era” of agriculture requires more than simply the commodification of the agrarian milieu, however; it also demands an epistemological shift in the meaning of farming. Central to this new farmer identity is a more entrepreneurial mindset. “Just as the environment and agriculture are inextricably linked,” notes the greenhouse reference manual, “economics has significant effect on the success of small holding growers” (USAID, 2008: 67). “I think it’s really a function of attitude and intent,” a greenhouse consultant told us, “I think what you looking for are people who recognize that farming is a business. Therefore, the approach you take to agriculture is not different than you take to running a factory or whatever” (Grower 14, 2014, personal communication). A grower agreed, insisting that “we have to inculcate . . . [business practices] within the psyche of the Jamaican farmer” (Grower 15, 2014, personal communication). We can see here the ways in which greenhouse governmentality is an essentially liberal form of government, characterized by what Miller

and Rose call “attempts to transform the calculative procedures of economic actors” (Miller and Rose, 1990: 2).

We should reiterate here that we are not in principle opposed to new agricultural technologies or efforts to enhance the profitability of farming. We do want to register a concern, however, that the governmental desire to re-engineer the materials and the psyche of the Jamaican farmer has the potential to marginalize the practices and ecological relations of traditional smallholders. Greenhouse cultivation, in this sense, appears to us less an avenue for enhancing the fortunes of Jamaica’s existing small farmers than a vision for their replacement by a new class of business-savvy investors. Some of the growers with whom we spoke seemed to agree, suggesting that most traditional farmers “did not have the mental faculty . . . to do this sort of thing” (Grower 9, 2014, personal communication). “Can anyone be a doctor, and cut somebody open?” one grower asked, “people need to understand . . . you cannot say ‘I feel like I want to be a surgeon’ and you run go cut somebody open” (Grower 7, 2014, personal communication). Still another farmer drew the contrast this way:

[we have] to use the technology at hand and let it work for us. You see, I am not in the old time—alright, put it this way, ‘slavery mentality’—to be out there in the field all day watering. (Grower 16, 2013, personal communication)

Such comments reflect not only an aspiration to improve Jamaican farming, but also a denigration of long-standing agricultural practices and the accumulated store of indigenous agro-ecological knowledge upon which they are based. They also reflect a vision in which the collective biopolitical labor of rural producers is replaced by a landscape characterized by individual fortune, capital investment, and market calculation. As such, there is reason to question whether the biopolitical “revolution” announced by Jamaica’s agriculture minister nearly a decade ago is in the best interest of Jamaica’s rural communities and environments.

Conclusion: Biopolitics and agrarian life

Rural spaces in the post-colonial Global South have long been the target of interventions aimed at increasing the efficiency and productivity of agriculture. The recent promotion of protected agriculture on the island of Jamaica can thus be read as simply the latest of such efforts. We have argued in this paper, however, that the greenhouse intervention might better be seen as a shift in the governmental rationality targeting the Jamaican countryside, one that promotes a qualitatively different understanding of agriculture. Drawing upon the insight of Foucault, we can view the deployment of protected agriculture as a biopolitical intervention that seeks to effect a change in the agrarian milieu, intensifying control over the metabolism between human agency and the vital life properties of growing plants. The greenhouse assembles new materials, technologies, and agencies into an affective atmosphere that reshapes the corporeal habits and emotional investments of greenhouse subjects around new imperatives of control and surveillance. The impending agrarian milieu under such a model is one in which capital- and chemical-intensive forms of biopolitical regulation take the place of more natural and sustainable socio-ecological relations, and in which individual forms of calculative rationality come to replace a more collective ethos of biopolitical co-operation.

In making this case, we have focused on the narratives and stated aims of greenhouse proponents, and the practices and opinions of Jamaican farmers who have adopted protected agriculture. This is not meant to suggest that this new form of biopower has seamlessly invested agrarian practices and subjectivities on the island. Indeed, we have

spoken to many farmers who are deeply skeptical of the supposed agricultural transformation brought on by greenhouse growing. Here, for example, are the words of one farmer with whom we spoke:

They want to know what type of technology you using, what's new. But a lot of time what is new doesn't really work. Because in Jamaica now there are certain little things that will do wonders, and there are certain things that our ancestors used to pay attention to that really helps in terms of production and quality. Like knowing the moon and when to plant what, your contouring and your mulching, you know . . . [instead] you go in and you put in a lot of little fancy things. . . it doesn't really help in dollars and cents, but it is more attractive . . . so they say oh, you are cleaner and, you know, things look prettier to them. But it doesn't really help or work. (Grower 18, 2014, personal communication)

The reference here to the ancestors reminds us that there are long-standing agrarian practices, knowledges, and relationships at stake in the agricultural revolution signified by protected agriculture. There is room here to consider possible alternatives to the biopower of greenhouse governmentality, the potential, for example, of a community-based food provisioning system grounded in agro-ecological principles of food and technology sovereignty (Altieri and Toledo, 2011), and sustained by the biopolitical living labor of Jamaica's traditional smallholders.

More generally, we believe that Foucauldian understandings of biopower can open new avenues of inquiry that shed light on the histories of, and contestations over, governmental intervention into what Goodman (1999: 33) has called the "metabolic reciprocities" of rural life. Such an approach can call attention to the ways in which biopolitical interventions into the agrarian milieu are effected via the mobilization of various technologies, materialities, agencies, and rationalities into diverse human-non-human assemblages that condition the habits, desires, and bodily practices of agrarian subjects. For these reasons, we believe that the reading we have offered of rural biopolitics in Jamaica can not only shed light on what is at stake in Jamaica's new greenhouse governmentality, but also facilitate a wider consideration of the changing regimes of power shaping historical and contemporary forms of agrarian life.

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References

- Agrawal A (2005) *Environmentality: Technologies of Government and the Making of Subjects*. Durham: Duke University Press.
- Altieri MA and Toledo VM (2011) The agroecological revolution in Latin America: Rescuing nature, ensuring food sovereignty and empowering peasants. *The Journal of Peasant Studies* 38(3): 587–612.

- Anderson B (2011) Affect and biopower: Towards a politics of life. *Transactions of the Institute of British Geographers* 37: 28–43.
- Bakker K (2012) Water: Political, biopolitical, material. *Social Studies of Science* 42(4): 616–623.
- Beckford C and Barker D (2007) The role and value of local knowledge in Jamaican agriculture: Adaptation and change in small-scale farming. *The Geographical Journal* 173(2): 118–128.
- Beckford GL (1972) Aspects of the present conflict between the plantation and the peasantry in the West Indies. *Caribbean Quarterly* 18(1): 47–58.
- Birkenholtz T (2009) Groundwater governmentality: Hegemony and technologies of resistance in Rajasthan's (India) groundwater governance. *The Geographical Journal* 175(3): 208–220.
- Campbell D, Barker D and McGregor D (2011) Dealing with drought: Small farmers and environmental hazards in southern St. Elizabeth, Jamaica. *Applied Geography* 31(1): 146–158.
- Campbell T and Sitze A (eds) (2013) *Biopolitics: A Reader*. Durham: Duke University Press.
- CARDI (2014) *Tropical Greenhouse Growers Manual for the Caribbean*. St. Augustine, Trinidad and Tobago: The Caribbean Research and Development Institute.
- Collard R-C (2012) Cougar-human entanglements and the biopolitical un/making of safe space. *Environment and Planning D: Society and Space* 30: 23–42.
- Crichlow MA (2005) *Negotiating Caribbean Development: Peasants and the State in Development*. Lanham, MD: Lexington Books.
- Development Alternatives, Inc. (2005) *Jamaica Business Recovery Project (JBRP) Final Report and Evaluation*. Washington, DC: USAID.
- Dressler W (2014) Green governmentality and swidden decline on Palawan Island. *Transactions of the Institute of British Geographers* 39: 250–264.
- Duncan JS (2007) *In the Shadows of the Tropics: Climate, Race and Biopower in Nineteenth-Century Ceylon*. Burlington, VT: Ashgate.
- ECLA (1969) Report of the Caribbean Workshop on Integrated Rural Development, Kingston Jamaica, 6–11 October, 1969. E/CN. 12/846, United Nations Economic Commission on Latin America.
- Edwards DT (1972) The development of small scale farming: Two cases from the Commonwealth Caribbean. *Caribbean Quarterly* 18(1): 59–71.
- Ettlinger N (2011) Governmentality as epistemology. *Annals of the Association of American Geographers* 101(3): 537–560.
- Foster JB (2013) Marx and the rift in the universal metabolism of nature. *Monthly Review* 65(7): 1–19.
- Foucault M (1980a) Truth and power. In: Gordon C (ed.) *Power/Knowledge: Selected Interviews and Other Writings 1972–1977*. New York: Pantheon Books, pp. 109–133.
- Foucault M (1980b) The politics of health in the eighteenth century. In: Gordon C (ed.) *Power/Knowledge: Selected Interviews and Other Writings 1972–1977*. New York: Pantheon Books, pp. 166–182.
- Foucault M (1981) Omnes et singulatim: Towards a criticism of 'political reason'. In: McMurrin S (ed.) *The Tanner Lectures on Human Values, V. 2*. Salt Lake City: University of Utah Press, pp. 225–254.
- Foucault M (1982) The subject and power. *Critical Inquiry* 8(4): 777–795.
- Foucault M (1988) The political technology of individuals. In: Martin LH, Gutman H and Hutton PH (eds) *Technologies of the Self: A Seminar with Michel Foucault*. Amherst: The University of Massachusetts Press, pp. 145–162.
- Foucault M (1990) *The History of Sexuality, Volume 1*. New York: Vintage Books.
- Foucault M (1991) Governmentality. In: Burchell G, Gordon C and Miller P (eds) *The Foucault Effect: Studies in Governmentality*. Chicago: The University of Chicago Press, pp. 87–104.
- Foucault M (2003) *Society Must be Defended: Lectures at the Collège de France, 1975–76*. New York: Palgrave Macmillan.
- Foucault M (2007) *Security, Territory, Population: Lectures at the Collège de France, 1977–78*. New York: Palgrave Macmillan.
- Foucault M (2008) *The Birth of Biopolitics: Lectures at the Collège de France, 1978–79*. New York: Palgrave Macmillan.

- Frederiksen F (2014) Authorizing the “natives”: Governmentality, dispossession, and the contradictions of rule in colonial Zambia. *Annals of the Association of American Geographers* 104(6): 1273–1290.
- Gamble DW, Campbell D, Allen TL, et al. (2010) Climate change, drought, and Jamaican agriculture: Local knowledge and the climate record. *Annals of the Association of American Geographers* 100(4): 880–893.
- Goodman D (1999) Agro-food studies in the ‘age of ecology’: Nature, corporeality, bio-politics. *Sociologia Ruralis* 39(1): 17–38.
- Government of Jamaica (2009) *Vision 2030: Final Draft Agriculture Sector Plan*. Kingston: Planning Institute of Jamaica.
- Government of Jamaica (2011a) Ministry of industry, commerce, agriculture and fisheries. Protected cultivation (greenhouse) project. Available at: [www.moa.gov.jm/Projects/IJAPP_ProtectedCultivation\(Greenhouse\).php](http://www.moa.gov.jm/Projects/IJAPP_ProtectedCultivation(Greenhouse).php) (accessed 31 October 2016).
- Government of Jamaica (2011b) Current project (REACT). Ministry of industry, commerce, agriculture and fisheries. Available at: www.moa.gov.jm/partners/USAID.php (accessed 31 October 2016).
- Hardt M and Negri A (2009) *Commonwealth*. Cambridge: Belknap Press.
- Henke H (1996) Mapping the “inner plantation”: A cultural exploration of the origins of Caribbean local discourse. *Social and Economic Studies* 45(4): 51–75.
- Holloway L, Morris C, Gilna B, et al. (2009) Biopower, genetics and livestock breeding: (Re)constituting animal populations and heterogeneous biosocial collectivities. *Transactions of the Institute of British Geographers* 34: 394–407.
- Huxley M (2007) Geographies of governmentality. In: Crampton J and Elden S (eds) *Space, Knowledge and Power: Foucault and Geography*. Burlington, VT: Ashgate, pp. 185–204.
- IICA (Inter-American Institute for Cooperation on Agriculture) (2008) *IICA’s Contribution to the Development of Agriculture and Rural Communities: IICA Annual Report*. San Jose, Costa Rica: IICA.
- IICA (2009) *Tender for the Construction of Post-Harvest Facility under the Canadian International Development Agency Funded Improving Jamaica’s Agricultural Productivity Project (green house component)*. Kingston: IICA.
- Ilean S and Phillips L (2003) Making food count: Expert knowledge and global technologies of government. *Canadian Review of Sociology* 40(4): 441–461.
- JIS (2007) Agriculture sector owes much to Jamaica Business Recovery Program. Jamaica Information Service. Available at: <http://jis.gov.jm/agricultural-sector-owes-much-to-jamaica-business-recovery-programme/> (accessed 31 October 2016).
- JIS (2008) PM emphasises importance of technology to agriculture, February 2. *JIS News*. Available at: <http://jis.gov.jm/pm-emphasises-importance-of-technology-to-agriculture/> (accessed 31 October 2016).
- Legg S (2007) *Spaces of Colonialism: Delhi’s Urban Governmentalities*. Malden, MA: Blackwell.
- Lemke T (2011) *Biopolitics: An Advanced Introduction*. New York: New York University Press.
- Lemke T (2014) New materialisms: Foucault and the ‘government of things’. *Theory, Culture and Society* 32(4): 3–25.
- Li TM (2007) *The Will to Improve: Governmentality, Development, and the Practice of Politics*. Durham: Duke University Press.
- Li TM (2014) Fixing the non-market subjects: Governing land and population in the Global South. *Foucault Studies* 18: 34–48.
- McMichael P (2009) A food regime genealogy. *The Journal of Peasant Studies* 36(1): 139–169.
- McMichael P (2016) Commentary: Food regime for thought. *The Journal of Peasant Studies* 43(3): 648–670.
- Marshall WK (1972) Aspects of the development of the peasantry. *Caribbean Quarterly* 18(1): 30–46.
- Marx K (1990) *Capital, Volume 1*. London: Penguin Books.
- Miller P and Rose N (1990) Governing economic life. *Economy and Society* 19(1): 1–31.
- Mintz SW (1974) *Caribbean Transformations*. Chicago: Aldine Publishing Company.

- Mintz S (1979) Slavery and the rise of peasantries. *Historical Reflections* 6(1): 213–253.
- Moore JW (2000) Environmental crises and the metabolic rift in world-historical perspective. *Organization and Environment* 13(2): 123–157.
- Moore JW (2015) *Capitalism in the Web of Life: Ecology and the Accumulation of Capital*. London: Verso.
- Moulton AA, Popke J, Curtis S, et al. (2015) Water management strategies and climate adaptation: Lessons learned from the 2014 drought in Jamaica. *Caribbean Geography* 20: 60–73.
- Mullings B (2012) Governmentality, diaspora assemblages and the ongoing challenge of ‘development’. *Antipode* 44(2): 406–427.
- Nally D (2011) The biopolitics of food provisioning. *Transactions of the Institute of British Geographers* 36: 37–53.
- Nally D and Taylor S (2015) The politics of self-help: The Rockefeller Foundation, philanthropy and the ‘long’ Green Revolution. *Political Geography* 49: 51–63.
- National Planning Agency of Jamaica (1983) *Agro 21: Making Agriculture America’s Business. Master Plan*. Kingston: Ministry of Finance and Planning.
- Negri A (1999) *Insurgencies: Constituent Power and the Modern State*. Minneapolis: University of Minnesota Press.
- Oksala J (2013) From biopower to governmentality. In: Falzon C, O’Leary T and Sawicki J (eds) *A Companion to Foucault*. Malden, MA: Blackwell, pp. 320–336.
- Ong A (2006) *Neoliberalism as Exception: Mutations in Citizenship and Sovereignty*. Durham: Duke University Press.
- Ove P (2013) Governmentality and the analytics of development. *Perspectives on Global Development and Technology* 12: 310–331.
- Philo C (2012) A ‘new Foucault’ with lively implications – or ‘the crawfish advances sideways’. *Transactions of the Institute of British Geographers* 37: 496–514.
- Popke J, Curtis S and Gamble DW (2016) A social justice framing of climate change discourse and policy: Adaptation, resilience and vulnerability in a Jamaican agricultural landscape. *Geoforum* 73: 70–80.
- Rabinow P and Rose N (2006) Biopower today. *BioSocieties* 1: 195–217.
- RADA (2015a) Embracing greenhouse technology. Website feature. Available at: www.rada.gov.jm/index.php/component/k2/item/690-embracing-greenhouse-technology (accessed 31 October 2016).
- RADA (2015b) Get into Greenhouse Corp Production – It’s attractive to young farmers. Website feature. Available at: www.rada.gov.jm/index.php/programmes-projects/programmes/item/284-get-into-greenhouse-crop-production-its-attractive-to-young-farmers (accessed 31 October 2016).
- Rose N, O’Malley P and Valverde M (2006) Governmentality. *Annual Review of Law and Social Science* 2: 83–104.
- Rutherford S (2007) Green governmentality: Insights and opportunities in the study of nature’s rule. *Progress in Human Geography* 31(3): 291–307.
- Rutherford P and Rutherford S (2013a) The confusions and exuberances of biopolitics. *Geography Compass* 7/6: 412–422.
- Rutherford S and Rutherford P (2013b) Geography and biopolitics. *Geography Compass* 7/6: 423–434.
- Schlosser K (2008) Bio-political geographies. *Geography Compass* 2(5): 1621–1634.
- Srinivasan K (2014) Caring for the collective: Biopower and agential subjectification in wildlife conservation. *Environment and Planning D: Society and Space* 32: 501–517.
- SIJ (Statistical Institute of Jamaica) (2007) *Census of Agriculture 2007 Preliminary Report*. Kingston: Statistical Institute of Jamaica.
- The Jamaica Gleaner (2010) Farmers urged to get on the cutting edge, October 27. Available at: <http://jamaica-gleaner.com/gleaner/20101027/news/news94.html> (accessed 31 October 2016).
- The Jamaica Observer (2012) Farm, don’t scam – Youngsters urged to bring skills to agri sector, August 30. *The Daily Observer*. Available at: www.jamaicaobserver.com/westernnews/Farm-dont-scam_12380479 (accessed 31 October 2016).
- The Jamaica Observer (2014) JSIF/Bauxite Institute to pump J\$192m into greenhouse agriculture, February 21. *The Daily Observer*. Available at: www.jamaicaobserver.com/news/JSIF-Bauxite-Institute-to-pump-J-192m-into-greenhouse-agriculture (accessed 31 October 2016).

- Tomich D (1993) Une petite guinea: Provision ground and plantation in Martinique, 1830–1848. In: Berlin I and Morgan PD (eds) *Cultivation and Culture: Labor and the Shaping of Slave Life in the Americas*. Charlottesville: University of Virginia Press, pp. 221–242.
- Tufton C (2008) *In the People's Interest: Advancing Agriculture for Sustainability and Food Security. Parliamentary Budget Presentation 2008*. Kingston: Ministry of Agriculture and Fisheries.
- USAID (2008) *Protected Agriculture in Jamaica: A Reference Manual*. Washington, DC: USAID.
- Weis T (2004a) (Re-)making the case for land reform in Jamaica. *Social and Economic Studies* 53(1): 35–72.
- Weis T (2004b) Restructuring and redundancy: The impact and illogic of neoliberal agricultural reforms in Jamaica. *Journal of Agrarian Change* 4(4): 461–491.
- Wood EM (2000) The agrarian origins of capitalism. In: Magdoff, Bellamy JF and Buttel FH (eds) *Hungry for Profit: The Agribusiness Threat to Farmers, Food, and the Environment*. New York: Monthly Review Press, pp. 23–41.

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