

DISCURSIVE AND PRACTICAL CHALLENGES IN GLOBAL HEALTH: PESTICIDE-
RELATED HEALTH IMPACTS IN ECUADORIAN BANANA PRODUCTION

by

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Abstract

This dissertation aims to inform more equitable and effective practice in the emerging field of global health. To address this overriding question of how principles of equity and effectiveness can best be implemented, I critically analyze discursive and practical challenges facing Northern researchers as they approach health problems in the global South, and explore solutions to these challenges. This exploration employs a case study on the articulation of a specific problem in a specific, nominally ‘Southern’, setting: pesticide-related health effects in Ecuador's banana-producing El Oro province. I employ three methodological approaches, in three substantive chapters. Chapter 2 uses discourse analysis to understand how Latin American research sites are framed in peer-reviewed pesticide epidemiology articles. These articles often employ geographic representations of Latin America as inexplicably underdeveloped to demonstrate the need for pesticide research and health sector interventions, typically exhibiting ‘mainstream’ (Northern) public health institutional dynamics. I also show how some epidemiologists are pursuing more politically engaged approaches, in an uneasy negotiation with epidemiology's disciplinary norms. Chapter 3 reports on ethnographic pesticide risk perception work in El Oro, drawing on theories from anthropology and human geography. I document how pesticide risk perception narratives reflect El Oro's position in unstable global commodity chains. Scalar elements of these narratives combine *individual* and *structural* explanations for health problems in complex ways. In Chapter 4, I describe a *political ecology of health* explanation of pesticide exposure in El Oro. I employ a modified meta-narrative methodology, complemented by

ethnographic fieldwork, to synthesize literature relevant to the pathways – biological, political economic, environmental and cultural – leading to pesticide-related impacts in El Oro. This analysis complements Chapters 2 and 3 in making the case for empowerment-based participatory approaches to pesticide exposure problems (and, by extension, to global health more generally), with special attention to international linkages, environmental complexity and political economy. The introduction, conclusion and 'linking' material between chapters serve to enhance the coherence of the dissertation by providing additional material not appropriate for inclusion in the three chapters, including elements of reflexivity.

Preface

The research for this dissertation was carried out within a partnership linking universities in Canada and Ecuador to address environmental health issues. The partnership, under the leadership of Drs. Jerry Spiegel and Annalee Yassi in Canada, and Dr. Jaime Breilh in Ecuador, began in 2004 with funding from the Canadian International Development Agency to initiate a Masters Program in Public Health with an Ecosystem Approach (Parkes et al., 2009; Spiegel et al., 2011). I conceived the research described in this dissertation to complement and build on research done by students and researchers involved in studying pesticide-health issues in Ecuador in connection with this Masters program. Building on the CIDA-funded work, a research program has undertaken more recently to address the health effects of the global food system in Canada and Ecuador, funded through a Canadian Institutes of Health Research (CIHR) grant to Dr. Jerry Spiegel. This CIHR-funded research program is entitled Think, Eat and Grow Green Globally (TEG3), and I designed my research – in collaboration with Dr. Spiegel, my supervisor – to inform its ongoing development, especially an epidemiology study within it focusing on pesticides and health in Ecuadorian banana production. In addition, I contributed to the design and grant proposal for TEG3, especially a project within it employing a modification of Greenhalgh et al.'s (2005) meta-narrative synthesis methodology. Chapter 4 of this dissertation employs this methodology, the development of which drew on discussions between Dr. Spiegel, other TEG3 co-investigators, and me. My remaining committee members also obviously contributed to the design of the research reported on in this dissertation through informal

discussions and by reviewing and giving feedback on my dissertation proposal. I independently carried out all data collection and analysis myself.

Chapter 2 has been published [Brisbois BW (2014) Epidemiology and ‘developing countries’: Writing pesticides, poverty and political engagement in Latin America. *Social Studies of Science*, 44(4), 600-624. doi:10.1177/0306312714523514]. This journal is published by Sage. I carried out all of the analysis for this paper, and wrote the manuscript myself. Drs. Jerry Spiegel, Leila Harris and Peter Cramer helped me to conceive the methodology for the paper, and provided comments on a draft version prior to its publication (in addition to the journal’s anonymous reviewers).

The research reported on in this dissertation was approved by UBC’s Behavioural Research Ethics Board, under Certificate #H11-01427 for the project entitled ‘Pesticides, bananas and health’.

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List of abbreviations

CIHR: Canadian Institutes of Health Research

CSDH: Commission on the Social Determinants of Health of the World Health Organization

DBCP: dibromochloropropane

EBM: evidence-based medicine

GKN: Globalization Knowledge Network, Commission on the Social Determinants of Health

IDRC: International Development Research Centre

KT: knowledge translation

LMIC: lower- and/or middle-income

MNS: meta-narrative synthesis

SDH: social determinants of health

SI: semi-structured interview

SPPH: School of Population and Public Health

STS: science and technology studies

TEG3: Think, Eat and Grow Green Globally

Chapter 1: Introduction

1.1 Global health and political power

Colonialism, or European occupation and exploitation of the rest of the world, has been formally over for decades in many African, Caribbean and Asian nations, and for over a century in several South American countries (Said, 1978). Nevertheless, global patterns of health disparities – ‘potentially avoidable differences in health (or in health risks that policy can influence) between groups of people who are more and less advantaged socially’ (Braveman, 2006, p. 180) – still largely reflect the geographies of colonialism (Farmer, 2004). That is, health indicators such as life expectancy and maternal mortality rates tend to be better in Europe, Canada, the US, Australia and New Zealand (referred to provisionally in this dissertation as ‘the North’); and worse in former European colonies (described here as ‘the South’), especially those not dominated by a white majority (Canadian Academy of Health Sciences, 2011). Such generalizations, of course, hold only at the population level. They are complicated by exceptions such as Japan, which cannot be easily lumped in with Europe or North America but nevertheless has excellent health indicators. Cuba, in addition, has ‘paradoxically’ achieved high life expectancy, low infant and maternal mortality, and other statistics generally associated with affluence, despite its chronically low gross domestic product (Spiegel & Yassi, 2004). Nor does the crude concept of North-South disparities adequately capture differences such as those between inner city black Americans (Singer, 1994) or Indigenous Canadians (Adelson, 2005; O’Neil, 1986), and the significantly healthier average citizens of those countries – not to mention within-country health

disparities in the South.¹ Finally, ‘emerging markets’ such as Brazil, Russia, India and China further complicate what is meant by the global South (Sidaway, 2012), and therefore by North-South health disparities.

The concept of North-South disparities nevertheless reflects the reality that people in many (largely poorer, non-white) parts of the world tend to live less healthy lives and die earlier. It is by now commonplace, especially in North America, to refer to the emerging field of inquiry and practice dealing with such disparities as ‘global health’ (Crane, 2013). Prominent efforts to define global health explicitly position it as moving beyond the inequitable North-South power relationships characterizing earlier eras, while also recognizing the ‘global’ nature of health, such as the ability of infectious diseases to ignore national boundaries (Brown, 2011; Koplan et al., 2009). Such definitions reflect the somewhat complex target (or ‘obscure object’) of global health, which also includes security concerns such as bioterrorism and other health problems with ‘global’ dimensions affecting wealthy parts of the world (Fassin, 2012). Nevertheless, global health represents the latest instalment in Northern efforts to confront health problems in the South. It follows on earlier stages such as tropical medicine (accompanying the colonial project) and, in the post-WWII era, international health (Birn, 2009, 2011). While doubts have been raised as to the degree to which global health does, in fact, represent a significant departure from the problematic tendencies of

¹ Representations of the former colonial world have employed terms such as ‘the 3rd World’, ‘developing countries’, ‘the global South’, ‘lower- and middle-income countries’, and the ‘majority world’ (Sparke, 2007). Such terms have, at best, highly limited usefulness in conveying information about the geographic region in question (Mintz, 1975). At their worst, they are grossly racist generalizations that reflect the political ambitions of the (now former) colonial powers far more than they reflect any actual truth about the former colonial world (Said, 1978; Escobar, 1995). While I explore such dynamics at length in Chapter 2, I employ the terms North and South – provisionally and apologetically – in this dissertation to convey continuing resource asymmetries at a very high level of generalization, recognizing that such generalizations should then be problematized and improved upon.

international health (Crane, 2010), the association of global health with the post-Cold-War era is one identifiable difference (Brown, Cueto, & Fee, 2006). Global health also overlaps conceptually and institutionally with emerging fields such as EcoHealth (Charron, 2012; Forget & Lebel, 2001) and One Health (Papadopoulos & Wilmera, 2011; Zinsstag, Schelling, Waltner-Toews, & Tanner, 2011), which attempt to understand the complex interactions of human and environmental health in settings that are also often located in the global South.

Using the example that an African woman is 100 times more likely to die in childbirth than a Canadian one, a recent report by the Canadian Academy of Health Sciences (CAHS, 2011, p. vi) describes the health disparities motivating global health as ‘one of the greatest ethical challenges of our time’. The report outlines a strategy for addressing such health disparities guided by principles of *equity* and *effectiveness* (p. viii; a third principle, *engagement*, also echoes global health’s goal of fair partnerships between Northern and Southern researchers). The principle of effectiveness means, in this report, that ‘the investment of resources must lead to the greatest beneficial impact’. A key finding of much population health research, and a key premise of this dissertation, is that ‘upstream’ interventions preventing illnesses have greater potential to improve population health (‘effectiveness), and at lower cost, than do ‘downstream’ solutions aimed at treating them (Birn, 2005; Labonté, Polanyi, Muhajarine, McIntosh, & Williams, 2005; Rose, 1985; Spiegel & Yassi, 2006). CAHS’s goal of equity specifically targets ‘access to appropriate health care and...health outcomes’, reflecting the increasingly widespread concept of *health equity*. Health equity is defined by Braveman and Gruskin (2003) as ‘social justice in health...the absence of systematic disparities in health (or in the major social determinants of health) between social groups who have different levels of underlying social advantage/ disadvantage’ (p. 254). A major implication of principles of

equity and effectiveness is that North-South health disparities are unfair, and reflect the ineffectiveness of tropical medicine and international health in achieving their ostensible objectives. Taking this relatively uncontroversial observation as a starting point, this dissertation's objective is to explore discursive and practical obstacles to equitable and effective practice in global health, and some strategies for overcoming them.

In addition to previously-mentioned problems with the categories 'North' and 'South', the distinction between research and practice in (global) public health is not straightforward.

Many researchers are also practicing physicians, and university public health departments often have numerous adjunct faculty members (physicians or otherwise) working out of hospitals and public health units. Global health research projects often involve evaluating a clinical or public health intervention, and ensuring medical care after the end of a study.

More generally, even global health research that does not explicitly involve an intervention must typically justify itself to funders and journal editors as contributing to the amelioration of health problems in the South. Finally, principles of 'evidence-based medicine' pervade global health (McInnes & Lee, 2012), meaning that researchers are under increasing pressure to pursue actual implementation of their research results in the form of clinical, public health, or policy interventions. While recognizing this complexity, this dissertation is nevertheless targeted mainly at informing academic research on health problems in the global South as practiced by people who are, like me, situated in university public or population health departments in the global North. While I recognize the importance of clinical interventions, moreover, my focus is less relevant to research on health *care* than it is to research on health *determinants*. These include *social determinants of health* (SDH), defined by the World Health Organization's Commission on the Social Determinants of Health (CSDH) as the

‘structural determinants and conditions of daily life’ (2008, p. 1), such as income, housing, education and safe work; and environmental or ecological dynamics that interact with such SDH to affect health (Parkes, Panelli, & Weinstein, 2003).

1.2 Discursive dimensions of global health

As mentioned above, a common concern in global health is the challenge – often referred to as ‘knowledge translation’ (KT) – of actually improving population health using available research findings to inform policies and interventions (Behague, Tawiah, Rosato, Some, & Morrison, 2009; Lavis, Lomas, Hamid, & Sewankambo, 2006; Pablos-Mendez, Chunharas, Lansang, Shademani, & Tugwell, 2005; Pablos-Mendez & Shademani, 2006). Many of the interventions suggested by health research, however, represent challenges to the economic policy commitments of the world's most powerful countries (Labonté et al., 2005; Medact, Peoples’ Health Movement, & Global Equity Gauge Alliance, 2005), and of those numerous lower- and middle-income countries (LMICs) forced to adopt similar policy stances through loan conditionalities imposed by international financial institutions (Babb, 2005; Pfeiffer & Chapman, 2010; Stuckler & Basu, 2009). This contrast is especially evident with respect to interventions targeting SDH such as ‘decent work’ (work that provides fair compensation, workplace safety and security, freedom of association, social protection for families, gender equality, and opportunities for personal development). Decent work is increasingly threatened by the precarious or flexible labour allegedly required by the ‘globalized’ economy (CSDH, 2008).

Such disconnects are reflected in curious gaps in KT discourse, such as when the director of Knowledge Management and Sharing at the World Health Organization identified barriers to effective KT in global health (Pablos-Mendez & Shademani, 2006) without mentioning inequitable power structures – what Paul Farmer (2004) has termed ‘structural violence’. Indeed, the Commission on the Social Determinants of Health wrote in its landmark 2008 report that ‘social injustice is killing people on a grand scale’ (2008, p. 26). The report’s specific political implications were systematically watered down in the final document, however, by neglecting to identify specific groups of people benefiting from the social injustice in question, or, conversely, past political struggles that have achieved better protection of SDH (Birn, 2009; Navarro, 2009; see also the Peoples’ Health Movement’s constructively critical analysis of the World Health Organization; Medact et al., 2005, pp. 269–292). With respect to more environmentally-focused approaches (EcoHealth and One Health, for example), a similar tendency to gloss over the deep structural roots to health problems in the global South has been documented (Brisbois, 2011; Cole, Crissman, & Orozco, 2006; Dakubo, 2013; Wallace, 2012; a large literature in the field of political ecology also attempts to counter such ‘apolitical ecologies’; Robbins, 2012). Such apparent oversights motivate calls for critical, or power-conscious, analyses of global health and related KT practices, as well as political engagement on the part of global health researchers and practitioners (Adams, Novotny, & Leslie, 2008; Erikson, 2008; Kickbush, 2008).

The existence of these different ways of understanding the causes and solutions of global health problems – technical as opposed to political – illustrates the importance of representations in guiding how global health interventions are justified and carried out.

Different perspectives on global health often start from the same basic facts and data, but

arrive at widely differing healthcare and policy recommendations, leading to calls for better understanding of how different actors – researchers, health professionals, international organizations, NGOs, volunteers, etc. – perceive and characterize global health issues (Brada, 2011; Brown, Craddock, & Ingram, 2012; Kickbush, 2003; Kleinman, 2010; Lee, 2009; Nichter, 2008). Lee (2009) describes global health's 'discursive landscape' as being divided into four major perspectives: a bio-medical model emphasizing technical interventions; economic rationalism based on utilitarian reasoning; bio-security concerns focusing on bioterrorism and emerging diseases; and the view that health is a human right that should be ensured for everyone. McInnes et al.'s (2012) study of the global health governance literature identifies five main frames, which they describe as biomedicine, security, development, economics and human rights. Sparke's (2009) characterization of the geographies of global health connects the spatial and economic implications of different global health approaches; like Lee, he identifies a major focus on market-focused solutions, but also links the application of technical biomedical approaches to a selective historical reading in which poverty and ill health in the global South appear as a kind of geographic accident. In contrast, Sparke also identifies a 'market failure' imaginative geography deployed by researchers and social movements who link health problems in the global South to past and present resource and power inequities, encapsulated by terms such as 'colonialism' and 'neoliberalism'.² Brown (2011) also highlights a biosecurity perspective on global health and links it to geographies of the nation-state, pointing to the symbolic role of

² Neoliberalism is a term used to denote the dominant political and economic policy framework globally over approximately the past four decades. It encapsulates trends such as skepticism toward state intervention in society and faith in the private sector; privatization and deregulation in keeping with this skepticism; reduction of the power of organized labour; and, ideologically, an emphasis on individual responsibility and free markets as opposed to collectivist orientations (Peck & Tickell, 2002). While the term is not universally acknowledged, especially by those who see such developments as beneficial, it conveys useful information and I use it throughout this dissertation.

national borders in excluding dangerous foreign sources of infectious disease. And Jerneck and Olsson (2011) point out dominant biomedical perspectives on HIV/AIDS and malaria and attempt to ‘reframe’ them as social and environmental problems, respectively.

Without attempting here to arbitrate among such diverse ways of framing global health problems and arrive at the ‘best’ perspective, it is clear that a diversity of views exists, with major implications for how global health issues are ultimately addressed. One controversial theme within this diverse set of viewpoints is suggested by criticisms of dominant technical, biomedical approaches to global health (Birn, 2005, 2009; Navarro, 2009). McInnes et al. chose to operationalize the expansive ‘biomedicine’ frame they detected in literature on global health governance by using the relatively manageable concept of ‘evidence-based medicine (EBM)’ (2012, p. S87). As they point out, EBM (a concept that underlies KT) ‘has become the primary mode of scientific, rational enquiry for contemporary biomedicine and clinical practice and the key frame for the health policy community’ (p. S89). As epidemiologic methods play a central role in global health and EBM / KT, furthermore, biomedical ways of knowing and norms concerning ‘objectivity’ in epidemiology (Krieger, 1999; Rothman & Arellano, 2005; Savitz, Poole, & Miller, 1999; Shim & Thomson, 2010) are of relevance to understanding the epistemological dimensions of global health.

Biomedical ways of making sense of the world have been documented and critiqued by medical anthropologists and other social scientists for decades (Foucault, 1973; Kleinman, 1980; Scheper-Hughes & Lock, 1986). Work on ‘medicalization’ shows how the transformation of social problems into medical ones to be addressed through technical interventions tends to depoliticize and naturalize societal inequities (Clarke & Shim, 2011; Scheper-Hughes & Lock, 1986). In Scheper-Hughes’s (1988) poignant ethnographic account

of a sugarcane-producing region of Brazil's Pernambuco state, for example, illnesses related to chronic hunger are explained away as 'nervos' (nerves) and medicated by local doctors, whose complicity serves to mystify and reinforce the inequitable social structures responsible for grinding poverty.

Indeed, historians and other scholars of medicine, science and technology have thoroughly documented the mutually reinforcing development (in both material and discursive senses) of modern medicine and the colonial project (Anderson, 1998; Birn & Solorzano, 1999; Keller, 2006; Mitman & Erickson, 2010). Analyses of more recent time periods (e.g. Packard, 1997) tie technical, biomedical approaches characteristic of the post-WWII international health era to the 'discourses of development' shown by Escobar (1995) to justify the exercise of control over the Third World through international development programming. Contemporary global health stories are largely written in the global North about the global South, and it is therefore reasonable to expect that residual ways of understanding the world characteristic of the colonial project (Crane, 2013; Escobar, 1999b; Harding, 2008; Heron, 2007; Kapoor, 2005; Mohanty, 1984; Said, 1978, 1993) may be relevant to understanding the discursive features of global health. In one illustrative example, pushing EBM on lower- and middle-income countries (LMICs) is characterized as a neo-colonial imposition of Northern priorities on Southern actors (Behague et al., 2009). Unpacking the discursive complexity of global health therefore appears to be a necessary prerequisite to carrying out effective and equitable interventions – a task that is also consistent with the broader need, voiced by postcolonial scholars, to challenge both North-South inequities and the discursive features that reinforce them.

1.3 Practical challenges in global health

A focus on discourse can help to identify the established ways of thinking currently dominating global health research and intervention – and, it seems likely, limiting their effectiveness and appropriateness. In addition to such critiques, however, there is also a need to envision new and better ways of doing things, and build on existing good examples. Robbins (2012, pp. 98–100) refers to this as using a ‘hatchet’ to clear away oppressive discourses, and then planting a ‘seed’ that can lead to positive outcomes. Devising such ways forward must deal with a number of practical challenges to the task of improving health outcomes in the global South – with the discursive considerations outlined above indicating a need to simultaneously pay careful attention to how these challenges are defined.

At the most basic level, these practical obstacles include technical ones such as the much lower overall amount of health research on populations of the global South. The existence of a ‘10-90 gap’ indicates that only an estimated 10% of health research targets the needs of 90% of the world's population (Global Forum for Health Research, 2004). This implies a lack of locally-relevant systematic reviews, the typical material required for evidence-based decision-making (Lavis et al., 2006; Pablos-Mendez & Shademani, 2006). As the Globalization Knowledge Network (GKN) of the CSDH indicates, therefore, understanding the pathways from global-scale forces (‘globalization’) to health outcomes experienced in LMICs must rely on unconventional and multi-disciplinary syntheses of diverse kinds of ‘evidence’ that go well beyond the narrow epidemiologic focus of much EBM (Labonté & Schrecker, 2006). Finally, another challenge is presented by the existence of complex

systemic ‘wicked’ problems that perplex epidemiology and other conventional disciplinary approaches to public health (Cole, Orozco, Pradel, & Wanigaratne, 2011b; Waltner-Toews & Kay, 2005). The exposure of small farmers in LMICs to pesticides has been identified as just such a wicked problem, for example, because of ‘differences among stakeholders in framing, understanding and responding to the problem’ (Cole et al., 2011b, p. 2).

Work that takes seriously the existence and legitimacy of alternatives to dominant biomedical ‘explanatory models’ (Kleinman, 1980) suggests that ways of understanding such global health problems by dominant actors (i.e. Northern global health scientists and practitioners) may ignore or marginalize important ‘local’ perspectives on the same problems (but see Harris, 2009, on problematizing the distinction between expert and local knowledges). In addition to the obvious moral and political reasons to pay attention to these local perspectives, another reason for doing so is the complex nature of the problems involved, necessitating knowledge from multiple perspectives (including those of affected individuals and communities). These perspectives may also include academic disciplines other than epidemiology, including the natural sciences, social sciences and humanities. Methodologies attentive to local context (ethnography, for example), in addition, can help to counter the homogenizing tendencies of ‘universal’ scientific knowledge, with its potential to both disempower local communities and neglect important insights they can contribute to solving problems.

1.4 Case study: Pesticide exposure in Ecuador’s banana-producing El Oro province

In light of the obstacles to equitably and effectively solving global health problems outlined

above, informing how researchers in Northern public health research institutions engage with the global South is not straightforward. In this dissertation I engage with these epistemological and practical challenges as they relate to a specific environmentally-linked health problem in a location typically considered to be ‘Southern’: pesticide exposure of workers, farmers and communities in Ecuador’s southern coastal, banana-producing, El Oro province (see Figure 1). This setting presents a particularly rich case study for engaging with the challenges to global health described above, and the importance of the issue to health researchers, especially occupational and environmental health specialists, is illustrated by the substantial literature on pesticides and health in the global South (a body of work I describe in depth in Chapter 2). By focusing on an issue that is somewhat peripheral to the predominant emphasis of global health research on infectious diseases (especially HIV), I am able to pursue novel lines of inquiry that nevertheless can be related to the overall objectives of the field (an objective I pursue especially in the concluding chapter, Chapter 5). I embed the description of El Oro in a chronological narrative involving both the history of a research program, as well as relevant details of my own personal history vis-à-vis this topic (I leave justification for the inclusion of personal detail to the end of this chapter in the interests of narrative coherence and flow).

As discussed in the Preface, this research builds on a Canada-Ecuador collaboration that uses an ‘ecosystem approach’ to address environmental health problems (Parkes et al., 2009; Spiegel et al., 2011). This collaboration helped to consolidate a network of researchers, students, health professionals, policymakers and community leaders and activists organized around the challenge of improving population health in Ecuador in ways that recognize

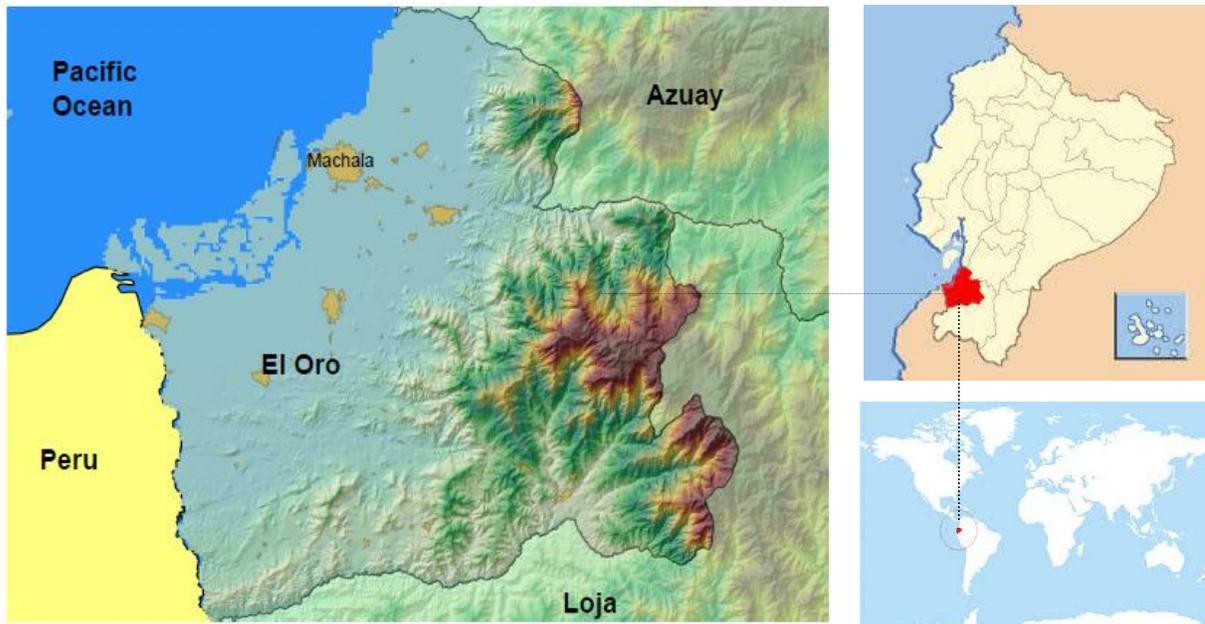


Figure 1.1 El Oro province, Ecuador

complex inter-relationships between human health and the environment. The project's two 'promotions' involved training 60 Ecuadorian Masters students, several of whose action-research thesis projects involved understanding and engaging with the human health effects of pesticide use in Ecuadorian agriculture. I began my doctoral studies in the School of Population and Public Health at UBC in 2008 with a project proposal involving community-based dengue control in southern Ecuador, building on work by three of these Ecuadorian Masters students. I was also admitted to the CIHR-funded Bridge Strategic Training Program ('Bridge Program'), a UBC initiative based on the objective of improving population health through the application of policy and/or engineering knowledge (UBC Bridge Program, n.d.). As part of the Bridge Program requirements (to be fulfilled concurrently with my own degree program requirements), I completed coursework on grant proposal development. In a group

with two other students, I worked on a grant proposal ‘pitched’ to the Bridge class by Dr. Spiegel (my supervisor) and Dr. Annalee Yassi. While the Ecuadorian Masters students had addressed numerous environmental health challenges, from dengue control through mercury contamination due to small-scale gold mining and pesticide exposure in potato production, we ended up choosing a topic *not* previously covered: pesticide exposure in banana production.

Since shortly after the end of the Second World War, Ecuador has been – with the exception of only a few years – the world’s leading exporter of bananas (Harari, Harari, Harari, & Harari, 2011; Larrea, 1987). Export-based banana production occurs overwhelmingly in monocultures. The resulting vulnerability of commercial bananas (*Musa acuminata*) to pathogens, and pressures from supermarkets for perfect fruit, lead to application of large quantities of potentially toxic pesticides (Henriques, Jeffers, Lacher, & Kendall, 1997). These include herbicides such as glyphosate to control weeds on plantations; insecticide-impregnated bags over the bunches in which bananas grow (typically with the organophosphate insecticide chlorpyrifos) to prevent scarring by beetles; massive applications of fungicides to combat the ‘Black Sigatoka’ (*Mycosphaerella fijiensis*) fungal disease, with its potentially devastating effects on productivity; and, sometimes, acutely toxic organophosphate nematicides to control soil parasites (Harari et al., 2011). Banana production has transformed the physical and social geographies of Latin America for over a century (Striffler & Moberg, 2003), and its pesticide-intensiveness is typically accompanied by substandard occupational health and safety conditions (Frundt, 2009; Harari et al., 2011; Pier, 2002; Striffler, 2009).

The occupational and environmental health effects of agriculture are extremely relevant to the challenge of moving from knowledge to action in global health (Hawkes & Ruel, 2006) and the large proportion of the global South's economically-active population working in agriculture makes it of particular public health importance (Wesseling, McConnell, Partanen, & Hogstedt, 1997). In particular, exposure of workers and surrounding communities to toxic pesticides has been repeatedly highlighted as a clear and outrageous example of a 'know-do gap' (London, 2009). We therefore focused our Bridge grant proposal on the challenge of translating research into action with respect to preventing pesticide exposure in El Oro, whose capital Machala is the self-proclaimed 'banana capital of the world'. The resulting grant proposal was later modified and submitted to CIHR by Drs. Spiegel and Yassi, but not funded. The project did, however, have a lasting effect on my doctoral research. As our group became more and more immersed in the social and scientific complexity of Ecuador's banana industry (and more and more overwhelmed by the volume of work this entailed), I decided to concentrate my doctoral research on the issue of bananas and pesticides in El Oro.

In addition to the heavy Bridge workload, and concurrent with work on our 'mock' grant proposal, our group also developed and submitted an actual CIHR grant application, for a workshop bringing together relevant banana industry stakeholders in El Oro to plan a research project on the challenge of reducing pesticide exposure. This proposal was successful and a workshop was held in December, 2009 in Machala to gather various perspectives and priorities from local banana producers, researchers, government officials and health professionals. The CIHR grant also enabled me to visit Ecuador for the first time. This workshop and Bridge Program coursework the following year also enabled me to contribute to Dr. Spiegel's successful grant proposal to CIHR's Programmatic Grants in

Health Equity competition in 2010, as part of a larger research program on understanding and intervening in pathways from the global food system (focusing on Canada and Ecuador) to health (in)equity. This research program – entitled ‘Think and Eat Green Globally’, or TEG3 – employs a multi-disciplinary knowledge synthesis as one of its primary, and overarching, research projects. This ‘meta-narrative synthesis’ (MNS) methodology (which also informs Chapter 4 of this dissertation, as I outline below), recognizes the importance of bringing multiple disciplinary perspectives to bear on complex problems, to make the best use of existing scholarship and knowledge in informing both interventions and future research (Greenhalgh et al., 2005; Wong, Greenhalgh, Westhorp, Buckingham, & Pawson, 2013).

Another of the TEG3 research projects involves a community-based epidemiology study on the health effects of pesticides in Ecuadorian banana production and blueberry production in British Columbia. In re-focusing my own research to inform the TEG3 research program, and especially the Ecuadorian pesticide epidemiology project, I also became more attentive to discursive aspects of this particular research area. A large amount of work attempting to understand and reduce the health impacts of pesticides has been carried out in Ecuador and other countries of Latin America, even being heralded as a model of ‘health sector empowerment’ (Keifer et al., 1997). Since the 1980s, a number of North-South collaborations have generated epidemiological evidence on the health effects of pesticides in Latin America, and attempted to move from evidence to community-, national- and regional-scale policy and social change. These collaborations have typically involved researchers and funding from Europe and North America, as well as Latin American partners, and have generated numerous peer-reviewed research outputs. Previous work on the competing

‘storylines’ by which different players conceptualize pesticide risk shows how some highlight worker and farmer carelessness (Bennett, Cooper, & Dobson, 2010; Ecobichon, 2001), while others employ more structural arguments which place the blame at higher levels, such as farm-, country- and even global-scale economic, political and regulatory factors (Andreatta, 1998; Cole et al., 2006; Galt, 2009; Grossman, 1998; Konradsen et al., 2003; Murray & Taylor, 2000). The relevance of this diversity of views for global health is also demonstrated by Jansen's (2008) demonstration of how a voluntary global code's ‘translation’ into Honduran policy was mediated through competing frames such as the ‘safe-use’ frame and the ‘anti-pesticide’ frame. Understanding the frames used to motivate research on pesticides and health in Latin America therefore became a primary goal of my study (see Chapter 2).

In light of the practical obstacles to global health listed above, furthermore, it is possible to anticipate that health sector interventions will lack effectiveness, or even reproduce and reinforce inequitable power relations, if they are based in a monolithic epidemiologic disciplinary framework. This risk would be heightened if interventions were imposed in a top-down way. This realization has begun to inform pesticide epidemiology and interventions, with an increasing focus on participatory research methods in both industrialized countries (Arcury, Quandt, & Dearry, 2001) and LMICs, including several in Latin America (Barraza, Jansen, van Wendel de Joode, & Wesseling, 2011; Cole et al., 2011; Polidoro et al., 2008; Ríos-González, Jansen, & Sánchez-Pérez, 2013). The need to consider ‘bottom-up’ perspectives is additionally suggested by the existence of competing frames in the pesticide exposure etiology debate, and Jansen's (2008) foregrounding of the role of professional culture and identity in framing pesticide risk. That is, if different framings of

pesticide risk correspond to different professional and disciplinary identities, the danger exists that interventions will neglect the perspectives of individuals without professions or disciplines: namely, farmers, labourers, and other pesticide-exposed individuals in LMICs (Miller, 2000).

Put differently, the health effects of pesticides are a preoccupation in fields such as occupational and environmental health, especially in places such as Europe and North America. How do other academic traditions view this problem – or do they see it as a problem at all? More importantly, do people exposed to pesticides in places such as Ecuador share this sense that understanding and preventing such exposures is a priority? Chapters 3 and 4 respond directly to such concerns. Specifically, the methods they employ are based on the need for global health interventions to be informed by perspectives drawn from affected populations and multiple academic disciplinary traditions.

1.5 Methodology and dissertation structure

In beginning this chapter, I outlined some of the epistemological and practical challenges that, in general, confront the field of global health. Funding of the TEG3 project, which occurred when I was preparing to go to Ecuador to begin fieldwork in 2011, has provided me with a very concrete example requiring engagement with such challenges. The methodology I describe here is therefore designed to critically evaluate the engagement of Northern public health researchers with health problems in the global South, and arrive at recommendations for more socially just and effective practices, by focusing on a specific environmental and occupational health problem in Ecuador. It is also designed to inform a pressing and

important set of decisions related to how the TEG3 research program's pesticide epidemiology component (currently funded but not yet fully planned out) can best proceed to achieve goals of equitable and effective solutions to pesticide exposure in banana production in El Oro. I employ three main methodologies to pursue this objective, corresponding to three manuscript-style substantive chapters (Chapters 2, 3 and 4). Each substantive chapter largely follows a traditional Intro-Methods-Results-Discussion format; this introduction, therefore, contains only literature review and methodological information relevant to the entire dissertation, leaving the specific details for the individual chapters. In addition to this introduction, I employ linking text following chapters 2 and 3 and a Conclusion (Chapter 5) to fit these three methodologies into a coherent whole. For the sake of convenience, and reflecting this dissertation's focus on the importance of discursive features such as genre, I term the stretches of linking text between chapters *entr'actes*. This term is used in theatre to indicate action occurring between acts of a play (from the French *entre acte*, or 'between acts').

A lack of theoretical frameworks to guide practice has been noted with respect to both global health (Kleinman, 2010) and public health research more generally (Carpiano, 2006). I therefore found appropriate theoretical and methodological guidance in multiple academic disciplines, using multiple methodologies— discourse analysis, ethnography and meta-narrative synthesis—to bring multiple relevant perspectives to bear on the problem at hand. The Conclusion similarly is devoted to summarizing the findings of the three substantive chapters, but especially to synthesizing them and identifying implications that emerge from their collective interaction. A brief summary of each of the chapters follows.

1.5.1 Chapter 2: Epidemiology and ‘developing countries’: Writing pesticides, poverty and political engagement in Latin America

Techniques of discourse analysis are drawn from fields such as linguistics, literary theory, and rhetoric. They have been applied widely in environmental, social and health sciences, and are especially helpful in unpacking the discursive dimensions of global health.

Discourses are typically reflected, and studied, in texts. Johnstone (2007) explains that understanding why a specific text is the way it is (and not some other way) can require examination of multiple factors: the text’s medium (e.g. print or electronic); its genre (e.g. news story, scientific article, etc.); prior texts (how it draws on previously written works, either formally or informally); the people represented in it; the author’s intentions (i.e. why did he or she write it?); and the world in which it is produced, and which it reflects or represents. This last point is especially relevant to how global health problems are ‘framed’ – that is, situated in a coherent background story that makes certain courses of action seem reasonable or beneficial, and rules out others (Goffman, 1974; McInnes & Lee, 2012; Miller, 2000). The persistent relationships between discourses and political, economic and other forms of power are especially well documented by *critical* discourse analysts (Fairclough, 2003), although such analyses must take care not to jump to conclusions that are not carefully justified using textual details (Johnstone, 2007; Schegloff, 1997). Conversely, some approaches to discourse analysis can go to the other extreme in disingenuously ignoring power dynamics. Work on ‘collective action framing’ in sociology, for example, systematically passes over an enormous relevant literature on analyses of ideology (Oliver & Johnston, 2000).

In Chapter 2 I use discourse analysis to examine ways of framing pesticide problems in 88 peer-reviewed epidemiology papers produced by Northerners and their collaborators studying pesticide-related health impacts in Latin America. These articles constitute one of the most influential bodies of knowledge that could be drawn on in informing how to approach a situation such as pesticide exposure in Ecuadorian banana production – not least because acquiring research funds to do so would likely involve reading and citing such articles. I examine these texts in this dissertation to explore how problems comparable to the one I am interested in are often framed. I assess whether the frames that have been used in the past serve as useful guidance for future efforts and – if not – why they have nevertheless persisted in common usage.

To pursue this objective, I identify prominent geographic frames (geographic representations in article introductions) in which truncated and selective histories of Latin America are used to justify research projects in specific research sites. These research sites nevertheless function rhetorically as generic ‘developing country’ settings. These frames legitimize health sector interventions as solutions to pesticide-related health problems, largely avoiding more politically charged possibilities. In contrast, however, some epidemiologists appear to be actively pushing the bounds of epidemiology’s traditional journal article genre by engaging with considerations of political power, especially that of the international pesticide industry. I therefore employ a finer-grained (‘sensitivity’) analysis to a sub-sample of 20 papers, to explore how the writing conventions of epidemiology interact with portrayals of poverty and pesticides in Latin America. This involves analyzing a minor scientific controversy, which represents a fertile site for identifying disciplinary norms in epidemiology. Analysis of authorial presence in epidemiology articles (direct instructions to the reader, expressions of

approval or disapproval, use of modal terms such as ‘would’ and ‘should’) further illustrates how these disciplinary norms, but also resistance to them, are expressed within conventional Intro-Methods-Results-Discussion epidemiology articles. Finally, examining articles by these same authors but in other genres (review articles, for example), helps to clarify the influence of genre on the interaction of epidemiology’s disciplinary conventions with geographic representations of Latin America. In particular, this sensitivity analysis illustrates how tensions between ‘objectivity’ and ‘advocacy’ observed in mainstream Northern epidemiology and public health are expressed in North-South interaction. I end by discussing implications for postcolonial and socially-engaged approaches to science and technology studies (STS). STS is a multi-disciplinary field seeking to understand the social dimensions science and technology, and it supplies several theoretical insights I use in this chapter. In particular, the complicated interaction of the conflicted traditions of Northern epidemiology with Latin American settings on paper hints at a far more complex interaction in the form of public health programming involving researchers and research participants of different nationalities, ethnicities, genders, professions and classes. This chapter (manuscript) is published in *Social Studies of Science*, and appears in the dissertation as it appears in the journal.

1.5.2 Chapter 3: 'A question of culture': Pesticides and health in the banana capital of the world

One major take-away point of Chapter 2 is that institutional and discursive forces can push researchers to gloss over the cultural and political economic specificities of sites in Latin

America in the interests of generating scientific knowledge and informing traditional public health interventions. Methodologies focusing in a detailed way on local contexts represent one corrective to such discursive homogenization. Ethnography, which has roots in anthropology but has been adopted and adapted in a range of social scientific and health disciplines, is ‘a systematic approach to learning about the social and cultural life of communities’ that focuses in particular on *locally* specific ways of making sense of the world (LeCompte & Schensul, 2010, p. 1). Ethnographic methods include a range of largely qualitative techniques such as in-the-field (‘participant’) observation and informal interviewing; in-depth and semi-structured interviews; focused group interviews (‘focus groups’); and extensive documentation of the entire process using fieldnotes (Schensul & LeCompte, 2012). The rich characterizations allowed by such labour-intensive methods hold significant potential to counter and nuance the de-contextualized and superficial representations of pesticide-exposed individuals and communities generated by professions and disciplines such as medicine and epidemiology.

In Chapter 3, I describe the results of my ethnographic fieldwork in El Oro, comprising unstructured observation, key informant interviews, semi-structured interviews and discussion of preliminary results with participants (‘member-checking’; Schensul & LeCompte, 2012). The primary research question I address is related to pesticide risk perception in its broad cultural context. Using the anthropological construct of health or illness narratives (Farmer & Good, 1991; Garro & Mattingly, 2000), I seek to understand how affected individuals in El Oro perceive the risk to their health posed by toxic chemicals used in banana production, how this relates to their definition and lived experience of health

more generally, and how risk from pesticides fits into Orense ways of attributing meaning to the world (a commonly recognized component of ‘culture’).

This includes a focus on scalar (especially global) dimensions of local cultural constructions, as is appropriate in a place profoundly linked by trade and other flows to the ‘outside’ world. Human geographic work on scales such as an individual person, a village, a watershed, a nation, or the ‘global’ in global health, recognizes them as unstable ‘social constructions’ (Brenner, 2001; Marston, 2000). That is, the specific content and relative political significance of a given scale – a ‘community’, for example – is not objectively obvious, and must be socially constructed, typically through repeated ‘citation’ or ‘performance’ by people who believe that the scale is, or should be, important (Kaiser & Nikiforova, 2008). Understanding the scalar content of pesticide risk perceptions in El Oro provides insights relevant to the planning of public health interventions, in that such interventions will need to make decisions about appropriate scales of analysis and action.

Another dimension of these health narratives that I examine, therefore, relates to possible roles for health systems and researchers in responding to pesticide risk and other challenges facing people in El Oro. I then apply this understanding of narratives of pesticide risk to the challenge of locating and directing North-South collaborative research so it resonates with local priorities and avoids imposing inappropriate top-down approaches on people in El Oro.

1.5.3 Chapter 4: Bananas, pesticides and the political ecology of health on Ecuador's southern coast: A modified meta-narrative approach to targeting research and interventions in global health

Chapter 3 addresses how pesticide-exposed individuals understand the causes, implications and possible solutions to pesticide exposure in banana production in El Oro, or at least how those elements combine in narratives recounted in an interview context. These narratives complement the frames I identified in Chapter 2 in helping to gather and understand various important perspectives relevant to possible future North-South research collaborations in this area. While focusing on the perspectives of both epidemiologists and pesticide-exposed individuals can help to inform future research and action, a wealth of knowledge in numerous other academic and non-academic knowledge traditions also promises to provide a more complete picture with which to plan such initiatives. More politically-engaged epidemiology efforts documented in Chapter 2 indicate the value of environmental and social scientific knowledge in explaining pesticide exposure, for example, and directing effective responses. The need for knowledge from 'contextualizing' disciplines in the social sciences is also suggested by the cultural complexity revealed in Chapter 3. These chapters do not emphasize other forms of complexity – agroecological dynamics, for example – involved in banana production and the experience of pesticide risk. Issues raised by interviewees in Chapter 3, such as evolving resistance of the Sigatoka Negra disease to fungicides and water contamination from both pesticide use and gold mining, nevertheless attest to the complex environmental dynamics with which the social dynamics studied in Chapter 3 interact. In that the common response raised by researchers to environmentally and socially complex

problems is interdisciplinarity, it appears that additional academic perspectives beyond epidemiology, or social scientific critiques of it, may help promote well-informed decisions.

In Chapter 4, I respond to this challenge using a systematic methodology to synthesize different disciplinary and extra-disciplinary bodies of literature, with the goal of informing future research and interventions targeting pesticide exposure in El Oro. I develop and apply an exploratory evidence-based approach for targeting health action-research projects, focusing on the problem of environmental and occupational pesticide exposure in El Oro. I modify Greenhalgh et al.'s (2005) *meta-narrative synthesis* (MNS) methodology to map knowledge areas relevant to the characterization of complex, globalized environment-health interactions. Meta-narrative synthesis is among a number of novel approaches to systematic review in public health that specifically focus on diverse bodies of evidence from different knowledge traditions. I modify this approach by a) focusing it on a specific geographic area; b) applying it to a question with numerous sub-questions embedded in long causal pathways between globalization and health outcomes; and c) supplementing it with ethnographic fieldwork to consider the knowledge of local stakeholders as well as locally-available literature sources. I first conduct a preliminary characterization of different 'storylines' in prominent knowledge areas of relevance to answering the question 'What pathways to health outcomes are associated with pesticide use in export-based banana production in El Oro?' I next synthesize relevant evidence by elaborating on one such storyline – a *political ecology of health* approach – as it relates to exposure to toxic pesticides. This storyline furthermore allows me to reflect on the role of research and researchers *within* these causal pathways. The results suggest that the application of rigorous epidemiologic methods in empowerment-based, participatory processes would have maximum impact in addressing the health impacts

of pesticide use in banana production in El Oro, particularly if accompanied by global-scale knowledge translation efforts and informed by international political economy and ecology. In addition, the results provide a road-map that could be used for a more resource-intensive application of the MNS methodology to targeting studies and interventions in global health. Finally, I highlight areas in which MNS could achieve greater reflexivity and effectiveness through application of its methodological toolkit to its own institutional location.

1.5.4 Between-chapter material

As previously mentioned, linking text ('entr'actes') are used between chapters to provide coherence to this dissertation. As the chapters employ methodologies that originate in different academic traditions, including some that are peripheral or novel to population health research, one function of this text will be to provide methodological justification, in addition to that which appears in the substantive chapters. This justification is intended to clarify the relevance of the chosen methodologies to each other, and to the main objectives of the dissertation. In addition, I also pursue goals of reflexivity in the entr'actes, as explained in the following section.

1.6 Reflexivity

By now it is considered good practice in social science to include considerations of reflexivity in research accounts (Green & Thorogood, 2004; Latour, 2005; Schensul & LeCompte, 2012). In anthropology, for example, the fact that the investigator *is* the research

apparatus implies that the researcher's own subjective experience of ethnographic fieldwork is relevant to a full, reliable report of the research results (Behar, 1997; LeCompte & Schensul, 2010; Tedlock, 1991), an observation that has also been extended to human geography (Kearns, 1997). My use of ethnographic methods to examine pesticide risk perception in Ecuador therefore indicates a need for reflexive exploration of my experience as a white male Canadian health researcher attempting to understand the lived realities of Ecuadorian banana farmers and labourers. This reflexivity is not only of relevance to the ethnographic portion of the dissertation, however. Scholarship in science and technology studies (STS), especially by feminist scholars, has thoroughly debunked the notion that there is some position separate from and above the world from which scientists (or anyone else) can objectively understand it (Ashmore, Myers, & Potter, 1995; Haraway, 1988; Harding, 2008; Latour, 1987, 2005). I therefore discuss my experience of the entire research process at various points throughout the dissertation – but especially in the Conclusion – in keeping with this realization.

1.6.1 Student life

As a central concern of this dissertation is to understand and challenge traditional biomedical (especially epidemiologic) and Northern ways of perceiving and 'improving' health in the global South, however, there is additional insight to be gained from inclusion of my personal experience in this dissertation. Foucault's (1995) work on the inter-relationship of knowledge and power in modern Western societies identifies discourses as knowledge systems that simultaneously accomplish the description, and control, of aspects of human life

(‘biopower’). A major component of Foucault’s analysis centres on the role of public health as a locus for the development and exercise of biopower. Modern power, in Foucault’s view, is not simply repressive or coercive, but increasingly productive: that is, it relies on self-disciplining tendencies internalized by individuals, so that they themselves become the agents of their own compliance (i.e. they feel that they *want* to act in ways outlined as desirable by particular discourses). Discourses involve both rules on ‘admissible’ and ‘inadmissible’ knowledges (science vs. superstition, for example), but also ‘subject positions’ or allowed ways of being for individuals in society. Such subject positions include the targets of knowledge systems such as criminology, psychology and medicine (e.g. the criminal, the lunatic / deviant, the patient), in roles that are logically consistent with the Discourses governing their dynamics – ideally as ‘docile bodies’ that will play their intended part in the governance of society. Subject positions may also include the *agents* of such discourses, however, such as criminologists, psychologists, physicians – and public health scientists such as epidemiologists.

Viewed in this light, it is worth examining the subject position(s) currently available to global / public health researchers, as well as how they fit, or conflict, with the personal characteristics of individuals being ‘incited’ into global / public health Discourses through their graduate training in schools of public health. As a doctoral candidate in a newly-amalgamated interdisciplinary School of Population and Public Health (SPPH), formerly the Department of Healthcare and Epidemiology, the training process I am nearing the end of is therefore also of relevance to the themes I examine in the substantive chapters. For while the School is open to ‘qualitative’ research on the part of students, as evidenced by approval of my proposal by its Thesis Screening Panel, the compulsory courses for both M.Sc. and PhD

students remain firmly rooted in epidemiology and biostatistics. I underwent this training procedure, as well as the epidemiology-based comprehensive exam and numerous informal and formal discussions with classmates and faculty members. In so doing, I gained additional insight into the formation of epidemiologists, a process with clear relevance to understanding how they make sense of the world and attempt to intervene in it. In addition to my experience as a teaching assistant for SPPH 500 (one of my department's compulsory biostatistics courses), furthermore, my experience as a teaching assistant for SPPH 519 (qualitative methods) has helped me to understand the different paradigms informing population and public health practice, and how students come to adopt them as their own – with or without modification or challenge. In addition to this SPPH-specific experience, my experience developing grant proposals in, and subsequent to, my Bridge program training demonstrates important aspects of the institutional aspects of epidemiology and global health, of direct relevance to the themes explored in the following chapters. I therefore include select details from my graduate education at various points throughout this dissertation, aiming for relevance in place of self-indulgence. In keeping with methodological guidance on auto-ethnography (Ellis, Adams, & Bochner, 2011), I also relate these experiences and my reflections on them to relevant literature.

1.6.2 About the author

When I presented the proposal for my research to the Thesis Screening Panel in early 2011, I was urged by one of the SPPH faculty members in attendance to clarify my 'own frame', in addition to the frames I analyze in pesticide epidemiology papers in Chapter 2 and the

pesticide risk perception narratives I document in Chapter 3. While Chapter 4 synthesizes data from a wide range of disciplines in a way that is guided by the ‘best’ framework I have at my disposal (which I term a political ecology of health synthesis), the work of anthropologists who have thoroughly explored the role of personal accounts in research (e.g. Behar, 1997; Briggs, 2004; Tedlock, 1991) suggests that it might be helpful to go back even further in time than the start of my doctorate. I am often asked at social events to explain a) whether bananas are, in fact, going extinct due to a fungal disease currently spreading globally from its origins in southeast Asia (the short answer is that the commercial viability of the ‘Cavendish’ variety found in supermarkets is at risk, but bananas are in no danger of extinction); and b) how I got involved with such an interesting topic. A relatively full answer to this second question might begin with my paternal grandfather, whose charitable work in Guatemala led him to serve as Guatemala’s representative in Canada in the 1970s (this despite having no Guatemalan or even Latin American background).³ While this grandfather passed away before I was born, I grew up with Latin American connections, as well as an immersion in social justice activism through my parents’ activities. In the early 1980s, for example, I was briefly evicted from my bedroom when my parents housed a refugee family fleeing the civil war in El Salvador, with its linkages to other Central American conflicts such as the US-backed Contra war in Nicaragua (Rochlin, 1994). My father, now a retired high school teacher, also organized ‘development exposure’ trips for high school students to Mexico and the Dominican Republic. My participation in one of these trips in high school

³ To avoid making this sound more heroic than it was, Guatemala in the 1970s was ruled by a series of brutal military dictators. This long run of dictatorial rule began after a CIA-backed coup deposed leftist, democratically-elected president Jacobo Arbenz in 1954. Arbenz had nationalized land belonging to the United Fruit Company, whose legal team included U.S. Secretary of State John Foster Dulles, brother of CIA head Allan Dulles. Arbenz’s actions, and fallout from the coup, were among the factors promoting an industry-wide transition to contract-based based banana production in mid-century, and the accompanying emergence of Ecuador as the world’s dominant banana exporter (Striffler & Moberg, 2003).

led me to Cuernavaca, Mexico, where I encountered Latin America and the words ‘neoliberalism’ and ‘Zapatista’ for the first time. I therefore grew up with a sense that the world is not a fair place, and that some combination of military and economic power meant that people in places such as Latin America are systematically (and often secretly) oppressed, a sense that has only been reinforced by my academic reading and fieldwork over the past decade. Acknowledging this inherited (but also literature- and experience-derived) ‘critical paradigm’ (LeCompte & Schensul, 2010) and its possible influences on my academic work is therefore an important disclaimer.

The specific topics to which I have applied this paradigm over my academic career have increasingly converged on the interaction of health and environment. I have furthermore increasingly come to appreciate the importance of political and economic power in shaping the distribution of environmental harms, and also in shaping the production of knowledge regarding the environment and health (Brisbois & Ali, 2010; King & Crews, 2013; Robbins, 2012). When I encountered Dr. Jerry Spiegel’s work on globalization and health (Spiegel, Labonté, & Ostry, 2004; Spiegel & Yassi, 2004), and ecosystem-focused research program in Latin America (Spiegel et al., 2006), therefore, I knew I wanted to get involved.

In addition, however, my employment experiences have also shaped my approach to academic research and the subject material of this dissertation. Co-op terms in the Clean Air Directorate at Environment Canada in the national capital region during my Masters degree enriched my understanding of how policy gets made in Canada on environmental health issues. In particular, I was impressed at how many bright and well-meaning people work in the federal government, with deep knowledge of physical and health sciences, and of policy

processes. Nevertheless, I was disturbed at the tight controls on sharing of information by public servants, controls which were strict when I began in 2005 under Liberal Environment Minister Stéphane Dion but tightened even more when the Conservatives took power in 2006. I came to see that this secrecy allowed the government to hide from public scrutiny the process by which the implications of atmospheric science and epidemiology for public policy were systematically sidelined in favor of ‘economic’ concerns. In the case of clean air policy, for example, measures that public servants knew would reduce the health effects of air pollution were systematically avoided because they would have affected the profits of industrial interests such as fossil fuel producers. Keeping such decisions a secret meant that government officials or cabinet ministers could avoid having to defend them publicly. To paraphrase Otto von Bismarck, policies are like sausages: it is better not to see them being made.

A subsequent six-month stint in the Climate Change and Health Office at Health Canada only deepened this conviction, as release of the report I was hired to help produce (Séguin, 2008) was repeatedly delayed by a Conservative government not eager to admit that anthropogenic climate change even existed, let alone that it had health implications for Canada. When one of the report’s chapter authors subsequently forced the government’s hand by leaking his chapter to the press (Canadian Press, 2008), the RCMP subsequently investigated whether my former colleagues had encouraged him to do so. While this eventually blew over, the office was prevented by senior Health Canada officials from publicly distributing the hundreds of copies of the report they had printed, for several months after its official ‘release’. These experiences in government made me very skeptical about the prospect that health and environment research would be ‘translated’ into responsible public

policies in Canada, as it appeared that public policymakers often had other interests at heart. When I joined the School of Population and Public Health at UBC, however, I found widespread faith in the concept of evidence-based public health: that is, my colleagues in the department consistently spoke about translating research into action as if doing so was quite possible, often exhibiting a faith in public policy processes that conflicted with my own experience. It also conflicted, I would come to realize, with the burgeoning critical literature on evidence-based approaches (de Leeuw, McNess, Crisp, & Stagnitti, 2008; Denny, 1999; Goldenberg, 2006; Greenhalgh & Russell, 2009; Holmes, Murray, Perron, & Rail, 2006; Mykhalovskiy & Weir, 2004; Mykhalovskiy et al., 2008; Solomon, 2011). A critical take on evidence-based approaches to public health is therefore evident throughout the present dissertation.

Another pre-PhD employment experience of relevance to the premise behind global health – that people from the global North should somehow intervene to ‘fix’ things in the global South – took me to Guyana in 2007 with the Toronto-based NGO Youth Challenge International. As group leader for a team of Canadian, Australian and Guyanese volunteers, I worked with my Guyanese co-leader to plan and implement two months of development programming – including health promotion – in a rural riverine region. We were not the least qualified group of youth volunteers to have undertaken such a project, with several undergraduate degrees and one Masters degree between us, and we did our best to be helpful under the circumstances. Nevertheless, it was abundantly clear to me that our presence in Guyana, while perhaps entertaining or at least unobjectionable for the communities that hosted us, contributed far more to our own personal and professional development than it did to the ‘development’ of Guyana. This contradicted the expectations of some volunteers (see

also Tiessen, 2011, on portrayals of the heroic role of volunteers in comparable Canadian programs). In her analysis of programs targeting ‘gap year’ volunteers in the UK, Simpson (2004) highlights how their marketing material creates geographies stripped of historical context, legitimizing the presence of youth volunteers (I document an analogous phenomenon in Chapter 2). As Simpson puts it, promotional statements such as ‘a culture older than Genghis Kahn needs you!’ imply that ‘Mongolia is crumbling for want of a few British teenagers’ (p. 686). While my volunteers were not British teenagers, and youth volunteering is not exactly the same as global health, such volunteer programs have disturbing parallels to work in global health – and often serve as preparation for careers in it (Ethics of International Engagement and Service-Learning Project, 2011). My experience in Guyana therefore led me to bring a skeptical view to self-serving claims that Northern adventures in the South (my own included) are actually altruistic (see also Harding, 2008; Heron, 2011; Tiessen & Heron, 2012; Tuhiwai Smith, 1999). The engagement with postcolonial theory that informs various parts of this dissertation (especially Chapter 2) is a result of my desire for guidance in making sense of such experiences and, ideally, in finding better models of North-South interaction.

Importantly, however, the contradictions inherent in such enterprises did not completely obscure the enthusiasm and energy my volunteers brought to the project, or the positive social experiences and friendships we shared with our Guyanese hosts. This experience therefore led me to be critical, but constructive, in trying to study – and participate in – global health initiatives during my PhD. In the chapters that follow, I attempt to navigate the tension between critical reflection on, and productive engagement with, global health

problems. My next chapter, Chapter 2, begins this exploration with a critical reflection on how those problems are defined.

Chapter 2: Epidemiology and ‘developing countries’: Writing pesticides, poverty and political engagement in Latin America

2.1 Introduction

Social scientific research on North-South biomedical encounters has increasingly focused on the growing field of global health (e.g. Janes & Corbett, 2009; Pfeiffer & Nichter, 2008; Pigg, 2013). A common theme in such work is what Brown, Craddock, & Ingram (2012) call ‘the differentiated manner in which particular problems, populations, and spaces are rendered visible and amenable to intervention’ (p. 1183; see also Brada, 2011; Labonté, 2008; Leach, Scoones, & Stirling, 2010; Lee, 2009; McInnes & Lee, 2012). The discourse of global health is ‘inherently geographical’ (Brown, 2011, p. 320). For example, Sparke (2009) shows how technical biomedical interventions are often proposed as appropriate solutions for a global South thought to be impoverished more by geographic bad luck than by economic exploitation, and Crane (2011) discusses ways in which ‘molecular maps’ of HIV used in global health research reflect the uneven political economy of health. Analyses such as these echo Said’s (1978) ‘imaginative geographies’ and Mohanty’s (1984) ‘Third World Woman’ in showing how constructions of ‘the Orient’ or ‘the Third World’ can enable Northern scholarship and colonial or neo-colonial political interventions. In a similar vein, Arturo Escobar (1995) demonstrates how the discourse of development constructs ‘developing countries’ in ways that legitimize the exercise of power through international development programming.

Escobar (1988) specifically highlights ‘the application of existing disciplines to Third World problems, or ... the creation of new subdisciplines [whose research outputs construct places] amenable to specific treatments’ in the form of development programs (p. 430-1). With respect to such disciplinary dynamics in the health sciences, Leach et al. (2010) allude to ‘disciplinary cultures – often centred around biomedicine and epidemiology’ in international infectious disease control (p. 373). Avilés (2001) similarly describes ‘epidemiology as discourse’ in an internationally funded consultant’s epidemiologic profile of El Salvador. Emergence of a discipline focused around an emerging infectious diseases ‘worldview’ has been linked to efforts by American biomedical researchers to secure funding for their work in the 1990s (King, 2002), particularly through discursive re-scaling of globalization-related phenomena into the need for laboratory-scale interventions (King, 2004). More recently, Crane (2010b, p. 81) has described a ‘21st century academic “scramble for Africa”’ among North American global health research universities, accompanied by boundary work aimed at defining what does, and does not, count as global health.

In building on such studies, I focus in this paper on the role of disciplinary identity in epidemiology, commonly referred to as the central science of public health (Krieger, 1999; Savitz et al., 1999). Epidemiologic studies are ubiquitous in justifying, planning, targeting and evaluating global health initiatives – and in building the careers of researchers carrying them out. Epidemiology is a heterogeneous field, however, as demonstrated by ongoing debates over the appropriate balance between ‘science’ and ‘advocacy’ (Amsterdamska, 2005; Shim & Thomson, 2010). The tendency toward advocacy is typically associated with a long tradition of public health practice motivated by social justice concerns (Krieger & Birn, 1998). This particular trajectory includes international manifestations such as American

‘health internationalists’ supporting leftist governments in places such as Nicaragua and Mozambique (which were not necessarily free of the development ideologies that Escobar documents) (Birn & Brown, 2013). Pursuing social justice concerns likely brings individual epidemiologists into conflict with more narrowly ‘scientific’ discourses associated with public health. Fairclough (2003) provides tools for detecting such conflict in writing choices, and Hyland’s (2010) work on the interaction of individuality and disciplinary identity further highlights academic writing as a productive site for studying such dynamics.

Analysis of scientific writing can be a powerful and efficient tool for opening up discussion of how scientists work (Callon, Law, & Rip, 1986; Latour, 1987; Myers, 1990). The genre of the scientific journal article reflects how science is funded, carried out, and rewarded, by communities of competing but collegial peers who are adding, often incrementally, to existing disciplinary bodies of knowledge, and whose professional lives depend on doing so in an authoritative but diplomatic fashion (Atkinson, 1999; Myers, 1989). Experienced scientists, including epidemiologists, typically plan and conduct research in a way that is geared towards the eventual preparation of journal articles (Latour, 1987; Rothman, 1998).

In this paper I employ discourse analysis to understand ways of viewing the world, or frames, evident in epidemiologic writing generated through Northern public health research on agricultural pesticide use in Latin America. I relate these frames to the genres and other institutional imperatives of Northern epidemiology to document ways in which these imperatives both determine writing choices and are resisted and negotiated by individual authors. This setting is a particularly rich one for such an analysis, as numerous North American and European researchers have engaged with the issue of agricultural pesticide use

and its effects in Latin America since the early 1980s. One major hub of this involvement began in Nicaragua with the Sandinista government's 'revolution in pesticide policy', in which Northern volunteers played a significant role (Swezey, Murray, & Daxl, 1986). The Nicaraguan experience and concurrent capacity-building work in Costa Rica led to broader Central American initiatives, including a Swedish-funded occupational and environmental health capacity-building project (Partanen et al., 1999), and a Danish-funded Pan American Health Organization pesticide poisoning surveillance and control system (Keifer et al., 1997). In Ecuador, an ongoing International Potato Center research program has examined health and environmental dimensions of pesticide use since the early 1990s, with funding from several international donors (Cole et al., 2011b). Together with numerous smaller projects throughout Central and South America, these initiatives have generated a large body of literature in which to trace the expression of Northern public health sciences in Southern settings. This includes work published by researchers with institutional affiliations in Europe and North America, but also numerous Latin American researchers involved in capacity-building initiatives with them.

2.2 Methodology

2.2.1 Frame analysis (quantitative sample)

Analysis took place in two stages. The first aimed to characterize ways of understanding the world identifiable in quantitative, 'Northern-involved', studies on pesticides and health in

Latin America. Various authors have documented global health's 'discursive landscape' (Lee, 2009), 'discourses' (Brown, 2011), 'narratives' (Leach et al., 2010), 'imaginative geographies' (Sparke, 2009), 'ideologies' (King, 2002, p. 763) and 'frames' (Labonté, 2008; McInnes & Lee, 2012). As a heuristic, I chose 'frame', in keeping with its widespread usage in English-speaking countries. The concept of framing can be traced back to Goffman (1974), who defines frames as 'schema of interpretation' that render events meaningful by fitting them within coherent stories. This understanding can be applied to the analysis of scientific writing by adopting Callon's (1986) description of an 'actor-world' or a coherent, networked collection of human and non-human elements arranged so as to guide the reader through a specific obligatory passage point, which in the case of a scientific paper involves the research activities of the author(s). In light of this insight, I focus on how the introductory sections of the included papers rhetorically establish the 'terrain' of the research area as important (Swales, 1990), then narrow to identify research gaps and highlight the importance of the featured study. Analysis of each paper's discussion and concluding sections provides more detail on the frame(s) being employed, including the role of the study's findings and any explicit or implicit normative dimensions (Skelton & Edwards, 2000; Swales, 1990). I also draw on the observation that texts can encourage agreement with a particular way of seeing the world through omission, intentional or otherwise, of explanations for key premises, thereby making those premises seem inevitable or natural (Fairclough, 2003).

For this stage of the analysis, I assembled a 'quantitative sample' of 88 peer-reviewed journal articles according to the following criteria. The articles must: feature English-language pesticide epidemiology, defined broadly as quantitative work on agriculture-related exposure to pesticides, its causes, or its effects among a population of more than one person;

be carried out in a Spanish-speaking country in the Americas; be published before the end of 2011; and involve at least one Northern co-author (i.e., listing an affiliation or address for correspondence in Europe or North America). While specifically Latin American traditions in epidemiology are sophisticated and historically rich (e.g. Barreto, 2004; Breilh, 2008), I restricted my sample to English-language papers to focus specifically on the influence and travels of Northern epidemiology and public health research traditions. The production of English-language articles also appears to be a high priority in North-South collaborations in Latin America (e.g. Partanen et al., 1999), in keeping with the increasing dominance of English in academic writing (Swales, 2004). I excluded articles dealing with Mexico and Brazil, as the dynamics of North-South biomedical interactions are arguably qualitatively different there – and the volume of research unmanageably large – due to their significant domestic research and scientific publishing capacity. I also excluded studies on pesticide risk perception as somewhat peripheral to epidemiology, and also discursively complex enough to merit separate treatment (e.g. Galt, 2013). Finally, I excluded papers on banned organochlorines such as DDT, as these are no longer in legitimate agricultural use and their environmental persistence means that studies on them typically (though not always) reflect historical use. Texts were identified and acquired over a period of approximately four years through immersion in the topic. In addition, I carried out keyword searches in October, 2012 in Web of Science, LILACS and Google Scholar, and subject heading searches in PubMed/Medline and EMBASE. I also identified papers citing included papers using Google Scholar and Web of Science.

2.2.2 Sensitivity analysis: Disciplinary conventions and writing choices in the mixed sample

A more fine-grained ‘sensitivity analysis’, to use a term drawn from epidemiology, was carried out to explore ways in which the frames identified through the first stage of analysis relate to the genres and other disciplinary imperatives of Northern public health research. For this second stage, I assembled a sample of 20 papers that illustrate prominent themes encountered in frame analysis of the quantitative sample as well as articles that deviate from epidemiology’s disciplinary norms. I chose these papers to cover research carried out in Costa Rica, Ecuador and Nicaragua (the three main centres of activity in this field); both Northern and Latin American first authors; and multiple genres, as discussed below. This ‘mixed sample’ included 14 papers drawn from the quantitative sample, but also some papers encountered in the search that did not meet the inclusion criteria: two that I considered review papers in that they do not present new research results; two reporting on ‘qualitative’ studies; and two letters to a journal editor commenting on one of the included quantitative papers.

In this stage, I first examined rhetorical features of a contentious exchange between two research groups, as scientific controversies provide fertile ground for identifying disciplinary norms and their rhetorical use in defending professional credibility (Pinch, 1990). Next, I examined quantitative papers in the mixed sample for various usages of ‘metadiscourse’, defined as ‘those aspects of the text which explicitly refer to the organisation of the discourse or the writer’s stance towards either its content or the reader’ (Hyland, 1998, p. 438).

Metadiscourse consists of features such as first-person usage, evaluation (expressions of approval or disapproval), hedging and other ‘politeness’ strategies (Myers, 1989), and explicit

directions to the reader such as, 'The reader will notice that ... ' or use of connectors such as 'therefore' and 'on the other hand'. Metadiscourse reflects the social dynamics of scientific research (Hyland, 1998), and I therefore examined its relation to framing strategies. I also made use of the observation that evaluation in scientific writing reflects shared disciplinary assumptions (Hunston, 1993). Finally, I examined papers outside of the quantitative research report genre (but by authors with prominent representation in the quantitative sample) to see how framing varies across genres. Throughout, I drew on my coursework as a doctoral student in a Northern, epidemiology-focused public/population health university department to inform my interpretation of disciplinary norms in epidemiology. Standard texts used in this coursework include Rothman, Greenland and Lash (2008), Szklo and Nieto (2008), and Vittinghoff, Glidden, Shiboski, and McCulloch (2011).

Analysis of the quantitative sample employed Nvivo, V10 (QSR International), while analysis of the mixed sample was done by hand. In addition to the methodological discussion above, more illustrative examples with respect to relevant discourse-analytic techniques are provided in the Results and Discussion sections. Any emphasis in these examples has been added to highlight the discursive features being discussed, and citations within them have been removed (except when relevant to my analysis). A complete list of analyzed papers is provided in Appendix A.

2.3 Results

2.3.1 Frame analysis

2.3.1.1 Geographic framing

The major finding that emerged from analysis of the quantitative sample was that most texts employ representations of Latin America to motivate studies in allegedly representative ‘developing country’ sites. In numerous papers, geographic representations play a central role in motivating studies, and introductory sections are framed as contributing to knowledge on pesticide problems in the developing world through examination of a specific case study in a particular Latin American country. Sixty-eight of the 88 identified papers explicitly indicate that the featured research site is in a ‘developing’, ‘less developed’, ‘Third World’, ‘lower- and middle-income’ or, in one case, ‘poor’ country, sometimes combining terms within the same article.⁴ In many such cases, the study’s importance to development issues is identified in the title through expressions such as ‘subclinical health effects of environmental pesticide contamination in a developing country’ (McConnell et al., 1999). Alternately, authors often begin article introductions by describing a situation of broad importance, such as overall estimates of pesticide poisonings worldwide, then relate it to ‘developing countries, such as Ecuador’ (Cole et al., 1997, p. 277). In the following passage, 33 farmers from the vicinity of León, Nicaragua serve as relevant units of analysis for application of an exposure

⁴ Sixty-two papers use the term ‘developing country/ies’ (although two of these use it only in the keywords) and occasionally ‘developing world’; 12 use the term ‘third world’, with only two of these being published after 2000; and three papers published since 2009 use the term ‘lower and middle-income country’. A breakdown of these terms in the included articles is provided in Appendix A.

assessment methodology to 'working conditions in Nicaragua', and by extension to all 'developing countries':

The fluorescent tracer technique has been occasionally used *in developing countries* ... we built up some educational experience with this technique with the intent of expanding this experience towards a robust but valid alternative method for semi-quantitative exposure assessment *in a Third World context* ... it was necessary to adapt it to the particular working conditions *in Nicaragua* Nicaraguan farmers usually do not wear protective clothing and experience more extensive pesticide skin contamination... we scored the dermal exposure of 33 farmers *from the surroundings of León, Nicaragua* ... (Aragón et al., 2004, p. 602)

In contrast, a smaller number of papers typically begin with a scientific question of relevance to a particular field, then introduce a Latin American setting as relevant due to its pesticide exposure profile, without categorizing it with respect to development (e.g. Crissman, Cole, & Carpio, 1994; Keifer, Rivas, Moon, & Checkoway, 1996b; McConnell, Keifer, & Rosenstock, 1994). This does not mean that those papers framed as being about development issues do not also engage with scientific literatures; indeed, these often display a 'recycling' movement (Swales, 1990, 2004) in which they alternately narrow in on a geographically defined research gap and a universal scientific one. The following passage demonstrates both geographic narrowing from all developing countries to Costa Rica and identification of a gap in universal scientific knowledge about the toxicity of the carbamate class of chemicals:

A majority of the pesticide poisonings *in developing countries* is caused by neurotoxic organophosphates and carbamates Cholinesterase inhibitors bind to

acetylcholinesterase, the enzyme that controls the transmission of the nerve impulses at the cholinergic synapses throughout the nervous system ... *few carbamates have been submitted* to extensive neurotoxicity testing *In Costa Rica*, both organophosphate and carbamate nematicides (worm killers) are widely used (Wesseling et al., 2002, p. 27)

These place-linked rhetorical moves, unremarkable at face value, demonstrate important aspects of the geographic framing of epidemiologic and related studies. The researchers involved in producing these studies obviously often have significant personal involvement in the research sites. Nevertheless, in these introductions local specificities are typically reduced to national identity, and that national identity is then taken as a marker of 'developing' status. As I discuss in the next section, furthermore, these representations portray Latin American countries in ways that systematically avoid certain types of historical or political explanation for this underdevelopment.

2.3.1.2 Pesticide exposure, poverty and (a)historical causes

Further analysis of these representations suggests that, somewhat like the 'bad luck' geographies identified by Sparke (2009), they often present abridged and selective histories that justify specific technical interventions. These Latin American settings are variously characterized as lacking adequate technical and human resources for public health activities (Aragón et al., 2004, p. 602), failing to enforce appropriate occupational and environmental health standards (Corriols, Marín, Berroteran, Lozano, & Lundberg, 2009, p. 205;

McConnell, Pacheco Antón, & Magnotti, 1990, p. 1238) and having 'primitive working conditions' (McConnell & Hruska, 1993, p. 1561) such as a lack of personal protective equipment (PPE). In describing these features of 'the developing world', papers seldom discuss causal factors from the pre-WWII period or considerations of political power, focusing instead on 'proximal' determinants of pesticide exposure. Most strikingly, 27 papers discuss pesticide poisonings and related impacts as 'caused' by specific pesticides. For example, 'In Nicaragua, the neuropathic pesticides methamidophos and chlorpyrifos were identified as *causes of these impairments* ... the poisonings for which *the agent* was confirmed *were all due to acute organophosphates* ...' (Delgado et al., 2004, p. 363). Consistent with this tendency is use of the evocative term 'poisoning' without identification of a perpetrator, as in the case of '*workers poisoned with organophosphates* ... [and] organophosphates with which *hospitalized workers were poisoned* ...' (McConnell et al., 1994, p. 332).

While various papers in the sample do contain historical context, this typically deals with topics such as trends in pesticide use or health impacts, or the economic prominence of agroindustries such as banana, cotton and flower production, without exploring political economic reasons for these phenomena (e.g., Grandjean, Harari, Barr, & Debes, 2006; Handal, Lozoff, Breilh, & Harlow, 2007a; Harari et al., 2010; López, Blanco, Aragón, & Partanen, 2009; Rosenstock, Keifer, Daniell, McConnell, & Claypoole, 1991; Valcke et al., 2005; van Wendel De Joode, De Graaf, Wesseling, & Kromhout, 1996; Wesseling, Ahlbom, Antich, Rodriguez, & Castro, 1996). Another frequently identified but seldom explained cause of pesticide exposure is poverty:

In Nicaragua, subsistence farmers use backpack sprayers....The use of any other application technique such as tractor-mounted boom sprayer is out of their economical possibilities. (Blanco, Aragón, Lundberg, Wesseling, & Nise, 2008, p. 536)

they carry a much heavier burden of adverse health and environmental effects with the uncontrolled use of highly toxic pesticides in conditions of poverty.... (Bravo et al., 2011, p. 258)

The vast majority of studies make no attempt to contextualize poverty in light of colonialism and subsequent political economic transformations in Latin America. The geographic framing of such studies thus presents a selectively historicized landscape in which pesticide exposures are related to unexplained poverty, lack of PPE, inadequate policy measures or contemporary (again usually unexplained) changes in agricultural practices. As documented by Fairclough (2003), omission of explanations for key premises can function rhetorically to naturalize those premises, even when done unintentionally. Latin Americans thus often function rhetorically in this genre as units of analysis for the application of universal scientific methods to an unexplained and, by extension, constitutionally poor region of the world. Political economic explanations of poverty and underdevelopment in Latin America would be one way to help frame pesticide problems differently; of course inclusion of such material might make it difficult to concisely make the case for traditional epidemiology and public health studies and interventions in the restrictive genre of the scientific journal article, a point to which I return shortly.

2.3.1.3 Responses

Prominent epidemiologist Kenneth Rothman (1998, p. 335) warns against making ‘superficial recommendations’, or indeed any policy recommendations at all, in papers submitted to *Epidemiology*, the journal he founded. One analysis of 50 medical research articles, a category overlapping epidemiology, however, found that ‘it was remarkable how frequently papers ended with a recommendation which was too imprecise to operationalize, or too grand to be implemented by a decision at much lower than ministerial level’ (Skelton, 1994, p. 459). This suggests the final sentences of an epidemiology article as one of its few sites – albeit a contested one – for expression of individuality or ‘extra-epidemiologic’ content. As Miller (2000) explains, furthermore, the solutions that are proposed for problematic issues are strongly determined by how those issues are framed.

A minority of papers in the quantitative sample contains no explicit indication as to how pesticide-related health issues should be approached or resolved. Schenker et al. (2004), for example, restrict introductory framing of their study of paraquat exposure and respiratory function in Costa Rica to unanswered scientific questions, and end with suggestions for further research.⁵ In contrast, however, the majority of included papers are positioned as helping to generate solutions to health problems, either in the introductions or in final paragraphs or sentences of discussion sections. One common solution offered in the articles is the establishment and improvement of systems for monitoring and surveillance of pesticide exposures and the risky practices leading to them, so as to inform public health interventions

⁵ Interestingly, this study was funded through a large (US\$677,000) grant from pesticide multinational Syngenta (<http://www.universityofcalifornia.edu/news/article/3164>) following controversy over health effects of paraquat in Costa Rica.

(e.g. Cole, McConnell, Murray, & Antón, 1988; Corriols et al., 2008; Keifer, McConnell, Pacheco Antón, Daniel, & Rosenstock, 1996a; McConnell & Hruska, 1993; Wesseling et al., 1996). In contrast, a sizable number of papers conclude that 'safe use' of pesticides in developing country contexts is impossible, and that the elimination of highly toxic pesticides is required to improve health:

One short-term policy option is to substitute less dangerous but similarly effective chemical products for the more highly toxic ones.... Another policy solution approaches the problem from *the public health viewpoint*. Education on the proper management and handling of these dangerous products with clear discussion of the long-term health effects may be useful. However, unless there is a greater supply of personal protective equipment and incentives for their use, such interventions may be ineffective. A longer-term solution is to change potato production technology. Improvements in host plant resistance and development of new pest or disease management technologies may reduce pesticide use without yield reductions.

(Crissman et al., 1994, pp. 596-7)

The above passage illustrates several of the solutions proposed, singly or in various combinations, by most of the authors of studied texts. Furthermore, the passage's reference to 'the public health viewpoint' suggests a particular way of looking at the world characteristic of public health researchers and professionals. From this perspective, public health has a legitimate, self-evident right and responsibility to intervene in health problems in society. Subtle evidence of this frame in the majority of included papers includes the ways in which the logical link between health problems and health sector intervention is elided.

Often, authors will jump from the existence of pesticide-related health problems to the need for physicians and health researchers and policymakers to respond to them. The following example demonstrates this tendency, and also shows how faith in public health's legitimacy persists in the face of questionable efficacy:

The Nicaraguan economy is based on intensive, pesticide-dependent agriculture....
As a consequence, APP [acute pesticide poisoning] is considered a severe health problem, especially for agricultural workers but also in the rural population at large.... In 1979, the National Unified Health System in Nicaragua included APP cases in its list of mandatory reportable diseases. Despite this, reporting of APP was rare through the early 1980s. Regulations and measures to enforce compliance did not exist. The reporting of information *was not linked to any action* on the part of the health sector. (Corriols et al., 2008, p. 774)

The link between the unexplained pesticide-intensiveness of Nicaraguan agriculture and the role of the health sector hides behind the connector 'as a consequence', while the passage clearly implies that the reporting of information *should be* linked to health sector actions. In addition, several papers urge the production of high-quality epidemiologic data on pesticide-related health problems as a way for health researchers to influence policymakers and the public (Cole, Carpio, & León, 2000; Corriols et al., 2008; McConnell & Hruska, 1993). In these and numerous other papers in the quantitative sample, the health sector plays a central role in responding to pesticide-related health impacts. Epidemiologic studies and public health interventions are thus justified on the basis of frequently truncated histories and geographies of Latin America, in which pesticides and poverty cause illness, but nothing

causes poverty – it just *exists*. This framing naturalizes particular intervention routes, and serves to close off debate with respect to others. Political responses such as land reform, income redistribution, macroeconomic policy shifts, removal of incentives favouring export-based agriculture are, accordingly, not discussed.

2.3.1.4 Exceptions to the rule: Political engagement in epidemiology articles

In contrast to this allegedly apolitical (though in reality deeply political) tendency, several early studies done in Nicaragua provide a muted representation of the rise and fall of the revolutionary Sandinista government with whose health system several authors of these studies had worked as 'health internationalists'. Cole et al. (1988) and Keifer et al. (1996a) highlight, for example, the development of a National Unified Health System in 1979, while Keifer et al. (1996b, p. 726) mention the period before 'Nicaragua's recent agro-economic changes' in explaining the production of pesticide exposures. Along with McConnell et al.'s (1990, 1992) descriptions of pesticide-control measures implemented by the Sandinistas in the 1980s, these studies provide historical context inasmuch as it helps to explain pesticide exposures and access to the data they have analysed. McConnell and Hruska (1993, p. 1559) go slightly further, referring to 'a series of social reforms, including redistribution of agricultural land to small farmers, and universal health coverage'. This same paper also attributes pesticide poisonings among children during the mid-1980s to the fact that the young men who traditionally applied pesticides were 'away at war' (McConnell & Hruska, 1993, p. 1561). This paper appears in the relatively hospitable *American Journal of Public Health*, which frequently publishes articles engaging with issues of equity and social justice.

Its references to social reforms are described as they relate to capacity for pesticide poisoning surveillance by the health system, however, while the veiled reference to the US-backed Contra war helps explain the study's results, a typical function of biomedical article discussion sections (Skelton & Edwards, 2000). It is therefore especially illustrative in that it describes revolutionary politics and US-backed resistance to them, but in a way that appears highly influenced by a conventional biomedical journal article structure.

In Ecuador, Handal, Lozoff, Breilh, and Harlow (2007b) similarly engage with political debates over 'new economic endeavors' such as floriculture, and provide a modest recommendation to end their paper in the more restrictive journal *Epidemiology*:

The economic benefits of the flower industry may improve child health in some respects, whereas pesticide exposure and environmental contamination may cause harm in others. Both aspects must be considered when assessing the impact of specific industrial exposures on child development and health. (p. 319)

The influence of *Epidemiology*'s discouragement of policy recommendations (Rothman, 1998) is suggested by an earlier book chapter published out of the same research program, with Handal as tenth author, asserting that '[c]ut flower production in countries like Colombia, Costa Rica, Ecuador and Mexico, illustrates neoliberal mechanisms that have been imposed in rural development' (Breilh et al., 2005, p. 66-67). The chapter also highlights 'surplus value extraction' (p. 75) in floriculture and its negative ecological and social effects, hinting at political thought that Handal et al. (2007b) compress into their article's final two sentences.

A more recent Ecuador-focused paper, in contrast, is published in the relatively new *International Journal for Equity in Health*, which is open to explicitly political approaches. Cole, Orozco, Ibrahim, & Wanigaratne (2011a) employ a typical epidemiology article structure, but also devote space to reviewing relevant Latin American social medicine literature. In contrast to the majority of papers in the quantitative sample, the discussion also explains poverty in highland Ecuador as due to 'a historical legacy of hierarchy and social stratification; persistent ignoring of farmers' rights by politicians and farmers; inegalitarian social policy for decades; declining productivity among smallholder farmers; and unequal globalization, a widespread underlying reason for inequities in health' (Cole et al., 2011a, p. 8). These Ecuadorian and Nicaraguan papers thus illustrate various ways in which some researchers are attempting to navigate the tension between epidemiology's genres and methods, and the implications of the socially stratified settings in which they are working.

2.3.2 Sensitivity analysis

2.3.2.1 Developing countries and (mild) turf wars

I return to this more politically engaged approach to public health shortly. First, however, I trace a slightly acrimonious exchange between two research groups to show how geographic framing is strategically useful in generating scientific journal articles and advancing academic careers. A paper presenting a methodology for assessing dermal pesticide exposures based on assessment of likely exposure determinants (Blanco et al., 2008) is a

particularly illustrative example of scalar framing. This paper identifies a public health need in universal scientific terms, highlights its lack in developing countries, then introduces a methodology developed to remedy this lack and an example of its application in Nicaragua (which is, as a result, an interchangeable 'developing country' in the eyes of science):

In developing countries ... methods for assessment of exposure must be inexpensive and easy to use.... Aragón et al (2006) modified Fenske's VSS to identify patterns of dermal contamination and to estimate dermal exposure to pesticides in Nicaraguan farmers.... Subsistence farmers in developing countries apply pesticides under high-risk conditions ... (van Wendel de Joode et al., 1996; Aragón et al., 2001). Thus, we propose 'determinants of dermal exposure ranking method (DERM) We present here an example of how to use DERM in a group of Nicaraguan subsistence farmers. (Blanco et al., 2008, pp. 535-6)

In this case, the scalar framing is made especially evident by its somewhat precarious dependence on prior texts. A cited study of farmers in a region of western Nicaragua (Aragón et al., 2006) is used to situate Nicaraguan farmers as being 'in developing countries'. The habits of subsistence farmers in apparently all developing countries are then described, citing a study of 11 banana plantation employees in Costa Rica (van Wendel De Joode et al., 1996), and another study in western Nicaragua (Aragón, Aragón, & Thörn, 2001). The paper repeatedly highlights a lack of exposure assessment methods relevant to developing countries, particularly singling out an existing method entitled DREAM (DeRmal Exposure Assessment Method). When the creators of DREAM respond in a letter, their tone is tellingly curt. Beginning with a confrontational title, 'The accuracy of DERM may be a self-fulfilling

DREAM', the letter outlines several 'major concerns with the presented study and the manuscript' (Kromhout, van Wendel de Joode, & van Hemmen, 2008, p. 783) and illustrates the professional currency at stake:

Finally, given the familiarity of the authors with our work, *they should have known* that DREAM has been applied in *a developing setting* among pesticide exposed vineyard workers in South Africa (van Wendel de Joode et al., 2005a). *The authors are therefore wrong* in believing that 'validated semi-quantitative DREAMs for pesticides applicable in developing countries are to our knowledge non-existent'. (p. 783)

The use of quotation is a tell-tale sign of skepticism towards the content of reported speech in scientific writing (Myers, 1990); furthermore, the bald statement that Blanco et al. are 'wrong' goes well beyond the polite tone typical of scientific writing (Myers, 1989), hinting at the degree to which Kromhout et al. feel slighted. The passage also employs the characteristic scalar framing discussed at length above, in that it assumes the equivalence of Nicaragua and South Africa, and presumably all other 'developing settings'. Thus while the overall goal of the two research groups seems to be to benefit workers and farmers in the global South, they are also clearly attempting to benefit themselves professionally – as scientists typically must – by generating new and representative knowledge uniquely attributable to their efforts.

2.3.2.2 Metadiscourse: Authorial presence in the texts

Conflicts such as the DERM-DREAM exchange are consistent with canonical work in STS documenting how scientists must diplomatically contribute novel results to existing bodies of knowledge but without introducing so much novelty that their work lacks credibility (Myers, 1989). Analysis of metadiscourse – first-person usage, evaluation, modals and the like – in the mixed sample similarly reveals familiar patterns related by Hyland (1998) to the social dynamics of science, specifically the need to highlight a paper’s specific contribution to knowledge while simultaneously emphasizing the author’s scientific objectivity (Myers, 1992). The geographic representations of Latin America documented above typically serve to justify the importance of the paper’s original contribution. Finally, some papers employing this characteristic scalar framing and familiar pattern of metadiscourse also make space for comments resisting the implications of a narrowly scientific perspective.

Use of first-person voice, for example, fits with previous studies of scientific writing, but in a way that reflects the challenges of carrying out epidemiologic studies in Latin America.

Following a largely third-person literature review, authors often employ first-person voice to highlight the specific contribution of the study, usually responding to a geographically framed research gap (e.g. Cole et al., 2011a; Monge et al., 2004). This is consistent with the observation that many scientists mark out their specific contribution to science with a transition to first-person voice in article introductions (Myers, 1992). In numerous methodology sections, furthermore, first-person voice tends to mark out specific non-routine methodological steps requiring specialized knowledge:

We excluded those workers whose year of birth was missing.... Differences in cancer morbidity among banana workers as compared to the general population *were assessed* by comparing the observed numbers of all cancers and specific sites with the expected numbers ... to make the reference population comparable to the exposed population, *we only used* the identified subset.... The expected numbers *were derived*.... The standardized incidence ratio (SIR) *was calculated*.... For observed numbers below 20 the exact method *was used*.... As main exposure indicator *we used* categories of number of months of employment. Because of underreporting... by the companies, high job turnover within the region, and intermittent migration patterns... *we also categorized* the number of years.... (Wesseling et al., 1996, p. 1127)

Those activities for which active, first-person voice is used – deciding who to include in the analytic sample, which populations are comparable, which exposure indicator to use, whether to convert a variable of one type into another for analysis – are all ones requiring the professional judgment of an epidemiologist. Those that are described in passive voice – calculating observed versus expected cancer numbers or a standardized incidence ratio, or using the exact method – are all activities taught in basic epidemiology and biostatistics courses. Of relevance here is the observation that passive voice in scientific writing has historically served to convey objectivity and universality (Atkinson, 1999). In Wesseling et al. (1996) and other epidemiology papers in the mixed sample (e.g. Cole et al., 1997; Corriols et al., 2008; Monge et al., 2007), passive voice is largely used to describe methods that a trained research assistant could do; those in active, first-person voice are typically those requiring epidemiologic judgment. In the discussion section of numerous papers, first-person voice is also used when highlighting the study's overall findings and their importance

or novelty, appearing to emphasize the personal involvement of the authors in making a contribution to science: 'In conclusion, *we have demonstrated* the feasibility of adapting the ICF to a new cultural and socioeconomic setting...' (Monge et al., 2004, p. 78). Similarly, discussion sections frequently use first-person as demonstrated below in (a) comparing results to those found by other investigators; (b) discussing the strengths and weakness of the study; or (c) speculating on explanations for results:

- a) *Our results* are in agreement with those of Richter et al in Israel, but *our findings show an even stronger effect* on concentrations of ChE... (Keifer et al., 1996b, p. 729).
- b) *As we were not able* to take direct measures of pesticide exposure in the physical environment of the child, *we had to rely* on indirect or proxy measures (Handal et al., 2007a, p. 316).
- c) *We* find the final explanation most compelling, given the difficulties involved in conducting pesticide epidemiology in developing countries (Cole et al., 1988, p. 129-30).

These patterns of first-person usage are largely consistent with how STS work suggests scientists emphasize their contributions to science, but also employ the geographic representations documented above in justifying why those contributions are important. Such familiar dynamics of science are also demonstrated by a characteristically epidemiologic use of evaluation in papers employing the same scalar framing. A study conducted using data from Costa Rica's population and disease registries flatly states that:

[i]ncreased occurrence of soft tissue sarcomas, various lymphohaematopoietic cancers, and cancer of the brain, testis, stomach and prostate have been observed among pesticide exposed populations.... The use of dibromochloropropane (DBCP) in the 1970s caused the sterilization of approximately 1500 banana workers (Wesseling et al., 1996, p. 1125)

The authors also describe the 'potential *value* for epidemiological research' of the disease registries. They then state that '[k]nowledge about the functioning and quality of these registries was *insufficient*,' and later point out a '*severe problem* in the identification of the deceased' (p. 1127). Their study aims to contribute to '*improvements* of the registries' (p. 1125); indeed, the authors claim that 'one main *virtue* of this study is the effort per se which has *permitted a better understanding* of the registries involved' (p. 1128). Thus cancers and sterilizations are presented without evaluation, while those factors related to epidemiology study design – data availability and quality, for example – receive more personal authorial attention. Evaluative language such as 'value', 'virtue', 'improvements' and 'better ' all suggest a characteristically epidemiologic perspective approving of good data sources permitting proper studies. This tendency is consistent with the authors' view that Costa Rica presents an opportunity to pursue high-quality epidemiology in developing countries:

Despite constraints to conducting research in the third world ... epidemiological cancer studies are increasing, mainly of the case-control type Cohort studies, however, are almost nonexistent, because of scarce population-based cancer registries and limited possibilities to follow populations over time In Costa Rica, high

exposures co-exist with nationwide population and disease registries. (Wesseling et al., 1996, p. 1125)

In stating that '[w]orking conditions in Costa Rica are *insufficiently* controlled,' however, the authors indicate their preference that working conditions in Costa Rica *should be* controlled. In this manner, the paper complements its approval of high quality epidemiology with disapproval of uncontrolled working conditions, a recognizable set of priorities in occupational health.

The pattern of metadiscourse in a study published almost simultaneously in Ecuador (Cole et al., 1997) similarly indicates epidemiologic priorities. The introduction points out, without evaluation, that '[t]he adverse health impacts of agricultural pesticide use has been an ongoing concern among health personnel over the last two decades,' and describes 'wide disparities in levels of education and socioeconomic status between general populations in developing countries and those of northern countries in which neurobehavioral tests were developed' (Cole et al., 1997, p. 277). This neutral tone contrasts with the evaluative language and modals used in the Results and Discussion sections to describe the acquisition of data: '[c]onsiderable success was achieved in obtaining similar levels of age and education across the exposure groups' (p. 280); and:

'[i]deally, studies of cohorts of workers and/or community members in high exposure situations in the developing world or among different immigrant groups in developed countries *would* deal with some of these limitations. Participants *should be more judiciously selected* Exposures *should be more fully characterized* across a wider range of nutritional and occupational factors' (p. 285).

This authorial presence indicates approval of proper epidemiologic methods, consistent with the introduction's framing of the study as responding to '[a]n *opportunity* to carry out such research [i.e. applying sophisticated neurobehavioral methods to a highly exposed population] in another Latin American country' (p. 277). While this contrast certainly suggests disciplinary priorities approving of rigorous epidemiologic methods and opportunities to use them in developing countries, the use of metadiscourse also approves of improved working conditions in the study site:

Although such further research may clarify the reasons for the neurotoxic effects we observed, *we should not* let the call for more research obscure the *glaringly* lower neurobehavioral scores we observed in our potato farming populations. Reductions in clear *overexposure* to pesticides *should not be stalled* pending further exploration of other potential contributors. (Cole et al., 1997, p. 285).

In this manner, a thoroughly epidemiologic paper ends with an explicit recognition that strict adherence to epidemiology's disciplinary imperatives may fall short of actually improving health in Ecuador.

2.3.2.3 Genre effects

The papers of the quantitative sample – even with the selective historical and geographical framing I document above – still provide far more socioeconomic context than might be expected based on descriptions of epidemiologists as 'prisoners of the proximate' (McMichael, 1999) who characterize the 'web of causation' without paying attention to the

spider (Krieger, 1994). The inclusion of such context here is especially unusual in a genre that (a) is typically limited in the amount of text it can devote to historical and political economic explanations and (b) must logically and compellingly arrive at the necessity for a specific epidemiology research project.

I have highlighted a few examples of epidemiologists attempting to engage with political power within this restrictive genre, especially in the final sentences of epidemiology papers. Other strategies allowing engagement with 'extra-epidemiologic' content appear to include publishing in less restrictive journals; in addition, several authors have published review papers and in other less restrictive genres, occasionally co-authored by social scientists or employing social science methods (e.g. Barraza, Jansen, van Wendel de Joode, & Wesseling, 2011; Orozco & Cole, 2011; Sherwood, Cole, & Crissman, 2007). Analysis of two such papers here further suggests that some framing choices in the quantitative sample are due to the restrictive genre, while others persist more broadly.

A review paper involving numerous epidemiologists prominently represented in the quantitative sample provides a programmatic vision for involvement of health professionals in 'solving the pesticide problem in Latin America' (Keifer et al., 1997). Affiliations listed by lead author Matthew Keifer include both the University of Washington and CARE-Nicaragua, a main NGO partner in Sandinista-era pesticide reforms. With respect to geographic framing, the introduction states that, '[d]espite awareness of the problems associated with pesticide use, they have persisted, and are even increasing *in some regions of the developing world*. Nowhere is this more apparent than *in Latin America*' (Keifer et al., 1997, p. 26). In response to these pesticide-related problems, the authors then introduce '[a]

recent initiative *in Central America* ... a significant new direction in the effort to resolve the pesticide problem *in Latin America*' (p. 27). The rhetorical use of scale in establishing terrain (pesticide problems in all developing countries), focusing on a specific representative region, then zeroing in on an initiative in Central America, clearly reflects the general pattern observed in the quantitative sample. That individual developing countries function as interchangeable units of analysis is further suggested by the assumption that 'lessons learned in Nicaragua and Costa Rica can be used to reduce per-country costs as the project expands' (p. 29).

With respect to the causes of pesticide exposure, the article lists agricultural production techniques, different ministerial influences on policymaking, and chemical industry lobbying. In spite of this multi-faceted discussion, however, 'health sector empowerment' is presented as the main solution, bypassing larger political economic power structures driving exposure and vulnerability to pesticides. While the paper later highlights the effects of structural adjustment on health services (p. 30), for example, related effects on agriculture with implications for pesticide-intensiveness are left unexplored. In employing the same scalar framing evident in the quantitative sample, then, the paper thus provides a selective (though not superficial) discussion of political economic causal factors, leading to calls for mobilization of the health sector.

Canadian researcher Donald Cole is lead author of numerous quantitative-sample articles on pesticides and health in Ecuador, as well as an early paper emerging out of the Sandinista-era pesticide surveillance program in Nicaragua (Cole et al., 1988). A more qualitative effort (Cole et al., 2006) combines a summary of the Ecuador research program and interviews

with research officers at Canada's International Development Research Centre (IDRC). The paper does not perform the typical geographic narrowing characteristic of Cole's quantitative papers, although its appearance in a special issue of the *Canadian Journal of Public Health* about Canada-Latin America connections perhaps means it does not need to. In addition, the paper contains information-dense tables that are largely not discussed in the body of the paper, conveying information on Canada-Latin American solidarity movements and political refugees fleeing Latin America in the 1970s and 1980s. (In contrast, the tables and text are tightly linked in Cole's epidemiology papers.) The paper's conclusion critically comments on the IDRC 'EcoHealth' program that funded much of the authors' work:

Can the holistic, almost transcendent systems' frameworks promoted by EcoHealth, reminiscent of other ideals in the "new public health", deal with such heterogeneity? ... A further challenge is the pressure of market capitalism, which pervades even remote agricultural communities, often with the face of multinational pesticide companies Although reduction of toxic pesticide use made sense at a field level for Ecuadorian farmers and at a regional level for communities and health authorities, movement globally is slow.... Crucial issues of differential power and knowledge between different stakeholders have to be confronted, including in EcoHealth discourse EcoHealth's ability to effectively grapple with complex policy environments may depend on its linkages with other research programs that IDRC sponsors on equity, globalization, and international markets. (pp. I12-I13)

The paper's unconventional structure and appearance in a supplement edited by a public health historian suggest that it provides a flexible venue for deeper exploration of themes

briefly discussed in the closing sentences of several of Cole's earlier epidemiology papers. In comparison to Keifer et al.'s earlier paper, furthermore, the references to 'differential power and knowledge' and 'equity, globalization, and international markets' also suggest a more complicated response than just health sector involvement.

2.4 Discussion

One of this study's major findings is that Latin America, with its constituent nation-states, functions rhetorically to allow researchers to establish terrain for research carried out in specific 'developing country' study sites. This scalar framing neatly achieves the narrowing action of a typical scientific journal article, suggesting the influence of genre on this particular discursive feature. The framing channels various types of resources allocated to development problems – research funding or scientific interest, for example – to specific epidemiology or related studies and interventions, consistent with accounts of scale politics in other research settings (King, 2004; Latour, 1983). While many historical commonalities of relevance to pesticide risk are in fact present in Latin America, the frequency with which they are described using truncated and apolitical histories also fits the general pattern of representations of the global South enabling Northern scholarship (Escobar, 1995; Mohanty, 1984; Said, 1978; Sparke, 2009). The linkage of discourses of development with technical biomedical interventions highlighted by Packard (1997) is also relevant, with the majority of papers implicitly endorsing the legitimacy of the health sector in leading responses to pesticide-related health effects. This recalls Foucault's (1973) analysis of the historical development of biomedicine and its role in Western societies. On a related note, work by

anthropologists on medicalization shows how the re-classification of political problems as medical ones serves to depoliticize them and defuse their incendiary social potential (Scheper-Hughes & Lock, 1986).

However, some epidemiologists appear to be operating in a more politically reflexive way. This includes addressing issues such as the political power of the pesticide industry (Cole et al., 2006; Keifer et al., 1997; Wesseling, Corriols, & Bravo, 2005), the structural roots of poverty in Latin America (Barraza, Jansen, van Wendel de Joode, & Wesseling., 2013; Cole et al., 2011a; Orozco et al., 2009), and, occasionally, engaging with the region's social medicine scholarship (e.g. Cole et al., 2011a; Orozco & Cole, 2011). Such work reflects what Sparke (2009) terms the 'market failure' imaginative geography of global health, linked to more politically engaged and critical currents in health research and social movements, and reflecting fault lines observed in public health more generally (Shim & Thomson, 2010). Even while confronting the power of the pesticide industry and advocating changes to agricultural production methods, however, the vast majority of papers still naturalize and endorse the health sector's leadership role. It is largely in the more interdisciplinary and recent outputs of these research programs that actors outside the health sector – social movements, for example – feature as possible agents of change (e.g., Barraza et al., 2013; Orozco & Cole, 2011).

This study's limitations include a rudimentary use of the terms 'Southern' and 'Northern'. The use of institutional affiliation as a marker of 'Northernness' is also a crude proxy that could be improved upon in future studies, and I have largely neglected the issue of joint-authorship of analyzed papers. Time constraints prevented me from examining more than the

small number of ‘extra-epidemiologic’ papers in the mixed sample, and I have only scratched the surface of the full breadth of political engagement and complicated resistance to epidemiology’s norms in this area. In addition, Pinch (1990) has pointed out that the analysis of scientific writing, although powerful, still presents a one-dimensional view of the culture of science. Ethnographies and other methodologies commonly used in STS would be one way to round out the present findings, as would approaches situating these texts historically.

Taking these limitations into account, the present study complements work in postcolonial STS showing the global voyages of Northern science as more than simply the diffusion of knowledge from ‘core’ to ‘periphery’ (Anderson 2002, 2009). In this respect, Crane (2010a) shows how American research ethics travel to Uganda and are applied problematically in places where rigid adherence is impossible. Galt (2011) similarly traces epidemiology and toxicology traveling to Costa Rica in the form of scientifically derived limits for pesticide residues on exported produce and unevenly influencing farmer decision-making. The present study traces the textual record of epidemiology traveling in the form of Northern epidemiologists carrying out studies in Latin America, and negotiating epidemiology’s tension between ‘objectivity’ and ‘advocacy’ in politically charged settings. Due to time and space constraints, this study largely neglects the role of Latin American researchers and research participants, a common pitfall in postcolonial studies of biomedicine (Anderson, 1998). Latin American researchers and social movements have actively challenged dominant Northern approaches to epidemiology and public health, for example in social medicine and collective health traditions that have presaged comparable developments in Northern public health thought (e.g. Barreto, 2004; Breilh, 2008). And as Birn and Brown (2013) point out, the experiences of American health internationalists in Latin America has shaped Northern

public health practice. Exploring such dynamics was beyond the scope of this study, but suggestive trends are evident. Donald Cole's early work, for example, conforms to, but also attempts to criticize the conventions of public health; subsequent work in different genres continues this critique in a more expansive manner; finally, his later epidemiology work attempts to merge contemporary epidemiology conventions with the insights gained over decades conducting epidemiology in Latin America, and working with Latin American co-investigators. A similar trajectory is evident in Catharina Wesseling's work, focused especially on strengthening pesticide-related policy in Central America, and with recent co-authored social science papers representing a further innovation and departure from conventional public health approaches (Barraza et al., 2011, 2013). The role of Latin American researchers working in this area and applying explicitly critical approaches would also be a rich area of study (e.g. Aragón et al., 2001; Barraza et al., 2011; Breilh et al., 2005; Orozco & Cole, 2011).

With respect to an 'engaged program' in STS (Sismondo, 2008), I wish to suggest a focus on disciplinary identity as it relates to frames in global health, both dominant and marginalized. Future research illustrating how the disciplinary identities of epidemiologists relate to the social and institutional dynamics of public health research in North-South interactions could even help to bring about *better* social and institutional dynamics and North-South interactions. The present trend in pesticide-health research appears to involve 'participatory' projects and related social scientific exploration of pesticide risk perception. This suggests a need to better understand the interaction of 'science and other indigenous knowledge systems' (Verran & Turnbull, 1995) with respect to pesticides and health. Following Pigg (2001), '[i]t is necessary to tie questions about the formation and stabilization of scientific

knowledge more firmly to questions about the circulation of this knowledge and to consider local distributions of knowledge in relation to international distributions of knowledge' (p. 489). In this light, interaction of the conflicted traditions of Northern epidemiology with Latin American settings on paper hints at far more complex interactions now occurring in the form of public health programming, involving researchers and research participants who differ by nationality, ethnicity, gender, profession and class.

Entr'acte 1

The preceding chapter has highlighted some of the main frames employed by Northern health researchers and their collaborators in published work on pesticide exposure in Latin America. It has also explored the relationship of those frames to specific institutional contexts and imperatives. These results relate to the overall objective of this dissertation – finding more effective and equitable modes of North-South engagement in public health – in multiple ways. First, they illustrate a tension: what is now known about the importance of political economic factors in generating health inequities (Farmer, 2005; Labonté & Schrecker, 2006; Medact et al., 2005) appears to fit poorly into the genres and accompanying research designs encouraged by the discipline of epidemiology. The channels of career advancement in public health therefore appear to lead *away* from global health approaches that are attentive to power and history. Such power-conscious approaches would be more effective in that they would address more upstream causes of health disparities, rather than pursuing downstream, ‘band-aid’ technical or individualizing interventions. By acknowledging persistent essentializing stereotypes about people in the global South, furthermore, they would lead to more equitable approaches based on ideals such as solidarity (see Birn & Brown, 2013), rather than on principles such as charity or ‘foster care’ (Sparke, 2009). I base such discussion on the particular subset of North-South health research interactions I have analyzed here (namely, pesticide epidemiology in Latin America). The unique features of this setting complicate blanket generalization of the results to other global health settings (infectious diseases such as HIV in sub-Saharan Africa, for example). Careful

analysis of similar themes in other global health settings – especially essentializing and ahistorical geographic framing justifying technical interventions – would nevertheless likely generate important and comparable insights (see also Brada, 2011; Sparke, 2009).

While institutional norms in epidemiology and public health run deep, an implication of Chapter 2 is the need to acknowledge and challenge them, with writing conventions providing a possible starting point for doing so. I was only able to outline such implications for epidemiology and public health practice at a high level in the previous chapter. This is largely due to the review process for *Social Studies of Science*, in which an anonymous reviewer and the Editor both urged me to compress the paper and keep it focused on issues of relevance to scholars of science and technology studies (the traditional readership of the journal). The second anonymous reviewer did suggest that I explore some of these implications for institutional changes in public health, but I was unable to do this within the journal's length restrictions. I therefore pick up these higher-level institutional-change themes again in the Conclusion to this dissertation.

Another concern suggested by the findings of the preceding chapter relates to interlinked issues of methodology and reflexivity. In acknowledging the limitations of the analysis, I pointed out that I employed a very crude indicator of 'Northern-ness', choosing to include papers with at least one co-author listing an institutional home or address for correspondence in Europe or North America. This methodological choice, which I did *not* make lightly, immediately raises questions or, for some, red flags. Am I implying that there is some essential 'Northern' influence that co-authorship immediately confers on a research team? Are the Latin American co-authors (sometimes lead authors) of these papers passive

recipients or victims of this top-down imposition of Northern epidemiology? For that matter, what is ‘Northern epidemiology’, and how is it distinguished from what quantitative public health researchers in the South do?

In that a current preoccupation in global health is the idea of equitable research partnerships (Koplan et al., 2009; Afsana, Habte, Hatfield, Murphy, & Neufeld, 2009), the idea that Southern co-authors are not active, equal members of research programs may generate defensiveness among global health researchers who pride themselves on their equitable collaborations. When formulating my dissertation research in 2010, I had initially hoped to explore the circumstances surrounding the production of the articles analyzed in Chapter 2 using a technique known as ‘discourse-historical analysis’ (Atkinson, 1999). Such an analysis would have investigated how European and North American researchers (and research funders) interact with Latin American colleagues and settings. A further objective would have been to examine the influence of these articles on public health policies, and health indicators, in Latin America. As the analysis in Chapter 2 indicates, pursuing such ‘evidence-based’ improvements in the health of farmers and agricultural workers was a stated goal of numerous researchers working in this area.

While such an analysis would have helped to answer the questions I raise immediately above, I abandoned it as absolutely unfeasible. I was informed by one historian that situating pesticide epidemiology in its historical context in even a single country could easily occupy an entire doctoral research project. Doing so in over a dozen countries in the Americas, as a single chapter, was therefore impractical (and this dissertation is ambitious enough without it). A few key contextual details are relevant, however. For example, the role of the 1980s

Nicaraguan revolution in attracting Northern volunteers should be emphasized. The research carried out by some of these volunteers helped pave the way for a Scandinavian-funded capacity building project in which many of the Central American authors of papers analyzed in Chapter 2 carried out graduate degrees, studying at Sweden's famous Karolinska Institute. In contrast, one of the primary Ecuadorian co-authors of a major research program with significant Canadian funding carried out doctoral studies at a university in Brazil with significant ties to the 'collective health' movement claimed as a uniquely Latin American epidemiology tradition (Barreto, 2004; Breilh, 2008). In both Central America and Ecuador, furthermore, epidemiologists with prominent representation in Chapter 2 have assessed, and lamented, the disappointing degree to which pesticide-health research (including their own) has been 'translated' into actual policies (Cole et al., 2006; Wesseling, Corriols, & Bravo, 2005). One Ecuadorian researcher I had the opportunity to meet told me that this preoccupation with knowledge-to-action processes is a 'very Canadian' idea.

These bits of information help to illustrate some of the complexity I was unable to address in Chapter 2, and I suggest some general avenues for further study in its discussion section. More specifically, though, what role did Scandinavian or Canadian funding have in pushing particular research agendas (or the 'very Canadian' idea of knowledge translation)? How did the Central American participants in the Scandinavian-funded capacity building project negotiate – adopt, contest, modify – the disciplinary assumptions of epidemiology as taught at the Karolinska Institute? For that matter, to what degree had they adopted, or opposed, ideals such as scientific objectivity and the need to 'educate' peasant farmers and workers about pesticides, prior to beginning this Northern-funded educational experience? Finally, and perhaps most controversially, to what degree can those privileged Latin Americans able

to participate in international research collaborations be considered to represent the interests and views of their poorer, rural, less-educated or Indigenous compatriots who are the alleged reason for global health partnerships in the first place (see also Pigg, 2001; Fanon, 1961/2004)? Such questions, which obviously complicate the concepts of ‘Northern’ and ‘Southern,’ could be addressed using methods such as ethnographic STS studies. I would argue, however, that they should more urgently be discussed by global health researchers seeking to carry out new global health initiatives.

Making such recommendations forces me to return to the issue of reflexivity. Who am *I* to second-guess the degree to which researchers in the global South are genuine representatives of the interests of the target populations of global health studies? At first glance, the answer (a white, male, European-descended, born-in-Canada would-be academic) is not encouraging. People like me have played a major role in creating problems in the global South, and – not coincidentally – have tended to internalize and perpetuate the colonial and neo-colonial attitudes that have allowed them to do so. I do not wish to claim that I am free of such attitudes, although I will claim to have worked hard at understanding and countering them. In attempting to analyze situations such as pesticides and health (and health researchers) in Latin America, I am not claiming to have a ‘view from nowhere’ (Haraway, 1988), either in a scientific or a social scientific / discourse analytic point of view. I thus provisionally and tentatively offer a suggestion, based on the analysis and literature review in this dissertation and my own personal experience: that global health go beyond its current focus on inequitable North-South research partnerships and attempt to understand *within*-country inequities in the South and how they may implicate Southern researchers and health professionals. This would then require, logically, that global health researchers in (for

example) Canada themselves acknowledge the political economic inequities allowing their own privilege and relative position of power with respect to Southern research partners and Southern research participants – but also with respect to less-privileged Canadians. That is, what are the structures that create inequities between, but also within, countries of the North and South?

Addressing this question seems likely to raise major issues that I will return to in the Conclusion (Chapter 5). Next, however, I narrow this dissertation's focus from all of Latin America to Ecuador, where the pressing problem of agrochemical exposure in banana production, and the research resources already committed to addressing it, necessitate a more immediate application. The appropriateness of Ecuadorian banana production as a setting for building on the findings of Chapter 2 is suggested by the fact that 15 of the analyzed documents, representing three distinct research programs, describe studies done in Ecuador. Many studies carried out in Central America deal with pesticide use in banana production (Castro-Gutiérrez, McConnell, Andersson, Pacheco-Antón, & Hogstedt, 1997; Koivunen et al., 2005; Lee et al., 2009; Lu, Rodríguez, Funez, Irish, & Fenske, 2006; Penagos, 2002; Penagos, Jimenez, Fallas, O'Malley, & Maibach, 1996; Rodríguez et al., 2006; Schenker et al., 2004; van Wendel De Joode, De Graaf, Wesseling, & Kromhout, 1996; Vergara & Fuortes, 1998; Wesseling et al., 2002; Wesseling, Ahlbom, Antich, Rodriguez, & Castro, 1996). In the next chapter, therefore, I employ ethnographic methods in an attempt to understand the perspectives of individuals and groups affected by pesticides used in banana production in El Oro, so as to better inform health research and intervention activities.

Chapter 3: 'A question of culture': Pesticides and health in the banana capital of the world

3.1 Introduction

The health effects of pesticides have been of concern to numerous public health researchers and practitioners for decades (Galt, 2008; Jeyaratnam, 1985; London, 2009). This reflects global estimates such as one million annual acute unintentional poisonings (World Health Organization, 1990) and 258,000 annual deaths due to intentional pesticide ingestion (Gunnell, Eddleston, Phillips, & Konradsen, 2007), largely concentrated in 'developing' countries. While health professionals and researchers tend to agree on the biological effects of specific pesticides, as revealed by toxicological testing, disagreement exists over whether these represent a public health 'problem'. In part, this uncertainty results from the difficulty of quantifying population-level health impacts of specific pesticides. Conclusive epidemiologic studies are often prevented by factors such as concurrent exposures to multiple pesticides, numerous confounding 'lifestyle' factors and competing health conditions among often-poor agricultural populations, a lack of data on exposures over long latency periods, and uncooperative employers who may not perceive health studies as beneficial to them (London, 2009). The view that exposure results from the carelessness of individual farmers and workers, furthermore, can lead to the conclusion that pesticide exposure does not represent a public health problem so much as a personal one (Galt, 2013).

In keeping with this lack of consensus, diverse public health intervention strategies have been applied to reduce exposure to pesticides (Konradsen et al., 2003). One common

approach involves behavioural-educational interventions, based on the premise that dangerous practices leading to exposure can be improved by changing how at-risk farmers or agricultural labourers understand and handle pesticides. Methodologically speaking, cross-sectional studies – typically questionnaire-based – have often been used to support behavioural-educational interventions by assessing whether pesticide-related knowledge and attitudes are associated with dangerous practices and amenable to modification (e.g. Arcury et al., 2002; Atreya, 2007; Blanco-Muñoz & Lacasaña, 2011; Isin & Yildirim, 2007; Karunamoorthi et al., 2012; Matthews, 2008; Mekonnen & Agonafir, 2002; Polidoro et al., 2008; Recena, Caldas, Pires, & Pontes, 2006). As stated by the author of one multinational cross-sectional knowledge-attitudes-behaviours survey funded by the pesticide giant Syngenta, '[t]he problem is whether it will be possible to change farmers' attitudes to improve the way they use pesticides' (Matthews, 2008, p. 845).

One limitation of such risk perception studies is the impossibility of establishing causation between risk perception and behaviour (Brewer, Weinstein, Cuite, & Herrington, 2004), however, and dangerous practices have been repeatedly observed among farmers and workers with ostensibly 'good' knowledge of pesticides and their health effects (Galt, 2013). Educational-behavioural interventions have also been strongly criticized for reasons including their limited effectiveness in comparison to 'structural' interventions such as changes to workplace conditions or national or international pesticide-control policies (Galt, 2013; Konradsen et al., 2003; Murray & Taylor, 2000). At a more fundamental level, educational interventions in health 'tend to ignore history, politics and environment' and – by directing attention towards individuals and away from social structures – lend support to (often inequitable) political realities (Trostle, 2005, p. 137). While examples of this

phenomenon are ubiquitous in public health, one compelling illustration comes from interventions encouraging Latina women in the US to reduce their HIV risk by requiring that their partner wear a condom: by ignoring unequal gender dynamics, themselves conditioned by political economic inequities, such strategies can both put women at risk of violence, and blame them for creating risks that are, in fact, out of their control (Singer, 1994). An analogous phenomenon is demonstrated in Chapter 2 of this dissertation, which found that educational interventions led by the health sector are frequently justified using ahistorical and apolitical geographies of poverty in Latin America. Such geographies imply that the economic marginalization of small farmers and agricultural labourers is less important in determining their exposure to toxic chemicals than are their individual knowledge, attitudes and behaviours.

If such individualizing cross-sectional studies can be used to justify behaviour-change interventions, then more sophisticated cultural and structural analysis may help to move beyond public health approaches that perpetuate inequitable social structures. As the anthropologically-informed *cultural theory of risk* school of risk perception research has demonstrated, how people view technology-associated risks⁶ is congruent with how they understand their social worlds more generally (Boholm, 1996; Douglas & Wildavsky, 1983; Hirsch & Baxter, 2011; Tansey & O’Riordan, 1999). As developed in Douglas & Wildavsky’s (1983) foundational work, commitments to certain forms of social organization (collectivist vs. individualist, for example) are typically reflected in how people react to novel technology-associated risks. To take one example cited in Tansey’s (2004) review,

⁶ In this chapter, I define 'pesticide risk perception' broadly to represent the ways in which people understand the health effects of pesticides, the origins of exposure to them, and their implications for responses by individuals, public policymakers or other relevant actors.

Lithuanian opposition to a Soviet-backed nuclear power plant, while employing arguments about the riskiness of the technology, also played a role in expressing nationalist opposition to Soviet rule. Insights from cultural theory of risk therefore suggest that methods designed to understand culture – especially ethnography – may yield deeper understanding of pesticide risk perception than narrowly-framed cross-sectional surveys.

A smaller but still substantial number of studies on pesticide risk perception – especially in Latin America, and Latino groups within the US – have indeed employed ethnographic and related qualitative methods and constructs such as 'explanatory models', 'mental models', and 'narratives' (Aragón, Aragón, & Thörn, 2001; Barraza, Jansen, van Wendel de Joode, & Wesseling, 2011; Feola & Binder, 2010; Guivant, 2003; Hirsch & Baxter, 2011; Hunt, Ojanguren, Schwartz, & Halperin, 1999; Mera-Orces, 2001; Orozco et al., 2009; Paredes, 2010; Perry & Bloom, 1998; Popper, Andino, Bustamante, Hernandez, & Rodas, 1996; Ríos-González, Jansen, & Sánchez-Pérez, 2013; Rother, 2005; Salazar, Napolitano, Scherer, & McCauley, 2004; Snipes et al., 2009). These have shown the embeddedness of pesticide risk perception within social realities such as poverty and gender roles. This includes the sense of resignation expressed by farmers in Chiapas, Mexico facing a perceived economic imperative to use highly toxic pesticides, impractical and expensive protective equipment, and gender norms in which enduring pesticide exposures is an expression of masculinity (Hunt et al., 1999). In Nicaragua, Aragón et al. (2001) found that attitudes towards pesticide risk among peasant farmers were rooted in centuries-old beliefs concerning the relationship between people and maize. Farmers experienced an intense distress at the damage done by pests to their maize, almost feeling the pain personally. They viewed pesticides as a 'partner' in the struggle to protect the maize harvest, albeit a partner with acknowledged negative

health effects. In a very different context, Hirsch and Baxter (2011) detected an influence of neighbourhood aesthetic norms concerning appropriate lawn care on the health risk perceived by inhabitants of Canadian neighbourhoods.

With respect to the contested goal of educating workers and farmers, however, such studies often parrot the behaviour-change focus of most cross-sectional risk perception studies, albeit with more sophisticated understanding of the cultural rootedness of the behaviours in question. Many include a caveat (usually in the paper's concluding paragraphs) on the need to consider structural influences on pesticide exposure. The most radical such departures suggest that 'NGOs work with farmers in rural communities to promote social organization around the theme of farmers' rights' (Orozco et al., 2009, p. 267), or call for 'a participatory and multi-actor approach for a risk reduction program at community, regional and national level [sic], involving individuals, NGOs, state regulatory agencies, the multi-national banana companies, and any other pertinent actor, which should go far beyond education, hygienic measures, and use of personal protective equipment' (Barraza et al., 2011, p. 716). These summary recommendations echo the increasing prominence of 'participatory' approaches to pesticide-safety research, typically associated with qualitative risk perception methodologies (Arcury et al., 2000) and sometimes invoking more empowerment-based approaches that confront structural forces (e.g. Galt, 2013; Orozco and Cole, 2011).

In one of the most structurally-aware of these qualitative studies, Barraza et al. highlight 'community, regional and national' levels and even implicate 'multi-national' actors as relevant to addressing the problem of pesticide exposure, but do not appear to have considered how such scales feature *within* the pesticide risk perceptions they characterize. In

particular, Barraza et al. implicate multi-national companies in responding to pesticide exposures, but do not explicitly examine the presence of these multi-national elements *in* the risk perceptions they document among their Costa Rican study population. Thus while the investigators of this study clearly feel that responses to pesticide exposure need to acknowledge structural forces at multiple scales, they do not explicitly seek to understand how such forces are understood, in scalar terms, by the people actually exposed to pesticides. Other qualitative studies similarly refer in passing to 'international macroeconomic policies' (Aragón et al., 2001, p. 300) and 'macroeconomic forces' (Mera-Orces, 2001, p. 38) in explaining pesticide exposures, but not the role of such large-scale forces in shaping how exposed individuals understand pesticide risk. That is, such studies deal with populations whose working lives are in various ways linked to export markets, the international pesticide industry and factors such as agriculturally-focused economic reforms imposed in the global South by international financial institutions (IFIs) through measures such as 'structural adjustment programs' (Babb, 2005). Nevertheless, studies with such populations have typically ignored important scalar – especially *global* – dimensions of pesticide risk perception.

Galt's (2007) use of 'global ethnography' (see also Burawoy et al., 2000; Erikson, 2011) to characterize pesticide use decisions in Costa Rican export vegetable production illustrates the methodological possibilities of examining pesticide-related global forces, connections and imaginations. He furthermore illustrates how Northern epidemiology and toxicology 'travel' to Costa Rica and affect pesticide use decisions through residue limits on exported produce (Galt, 2011). His work focuses primarily on farmer decision-making, however, and addresses health risk perception less comprehensively (Galt, 2013). In this chapter, therefore, I add to

these insights by offering an ethnographic study of pesticide risk perception in Ecuador's banana-producing El Oro province. The work speaks to these overarching concerns by taking a narrative approach and incorporating a focus on different scalar – including global – dimensions of understandings of pesticides and health. To justify this approach, I first briefly review relevant literature in medical anthropology and human geography. Next I describe the study site and its relevance to understanding pesticide risk perception in its multi-scalar cultural and structural context, before outlining the study's ethnographic methodology. In reporting results I explore how individuals exposed to pesticides in El Oro narrate the health effects of pesticides, and health more generally, providing both 'individual' and 'structural' explanations with divergent scalar and political dimensions. Finally, I end by assessing implications for action-research activities addressing the health impacts of pesticides.

3.2 Cultures, narratives and scales

Attempts to relate pesticide risk perception to 'culture' encounter numerous definitions of the term circulating in academic literatures (Hruschka & Hadley, 2008). Mitchell (1995) has pointed out that culture is often defined as nothing more than a long list of social practices and characteristics, problematizing the task of using it as an analytic construct. Nevertheless, Janes (2005) illustrates how careful consideration of culture's political, social and ecological contextual ties can allow understanding of how it 'gets into the body' and affects health. One dimension of culture that is consistently acknowledged consists of ways of representing and making sense of the world (Satterfield, Gregory, Klain, Roberts, & Chan, 2013). Medical anthropological studies of illness narratives, for example, describe 'explanatory models' of

how illnesses are caused, experienced and cured (Kleinman, 1980), often contrasting them to the 'biomedical model' of physicians and other health professionals. While the specific relationship between culture and narrative is not straightforward, it is generally acknowledged that 'narrative offers an avenue for linking personal experience to cultural knowledge, norms, and tenets' (Garro & Mattingly, 2000, p. 28). Studies of illness narratives therefore typically contextualize representations of health and illness, 'insisting on the embeddedness in the social world of all that may be observed or elicited' (Farmer & Good, 1991, p. 134).

One influential subdivision of such work seeks to understand illness representations as 'folk beliefs' that can be changed or worked around in implementing public health interventions (Farmer & Good, 1991). In addition to privileging biomedical knowledge as the truth against which these 'beliefs' are evaluated, such approaches also often fail to acknowledge that 'the behaviors identified are often best understood in relation to structural conditions – gross inequalities, poverty, inferior housing and work conditions – or the irrationalities of health bureaucracies and practitioners, rather than as a result of rational albeit mistaken beliefs' (Farmer & Good, 1991, p. 138). Studies acknowledging such structural influences therefore typically relate illness narratives to political economic forces affecting the sites in which they were produced (e.g. Briggs, 2004; Farmer, 1994; Good, 1977; O'Neil, 1989; Schepers-Hughes, 1988). These studies often aim to document and counter 'medicalization', the phenomenon by which the health effects of inequitable social structures are depoliticized through their transformation into medical issues to be managed by health professionals (Schepers-Hughes & Lock, 1986; Taussig, 1980b; Clarke and Shim, 2011). The transformation of the effects of inequitable social structures into medical problems can

diffuse their incendiary social potential, and simultaneously direct attention and resources towards individual, as opposed to collective, responses.

While the illness narrative tradition excels in interpreting personal experiences of distress in light of cultural causal models, it has not engaged as deeply with environmentally-linked illness narratives involving agro-industrial chemicals such as pesticides. In light of increasing recognition of environmental issues and their health implications, this suggests a need to expand the illness narrative tradition. As Masuda and Garvin (2006) have illustrated, the relationship between culture and risk perception involves a variety of *spatial* dimensions and representations. The relevance of spatial considerations to the present study is also illustrated by the ways in which banana production has transformed the geography of Latin America over the past century (Striffler & Moberg, 2003), through control by fruit multinationals of large amounts of land and Latin American governments ('banana republics'), and through a near monopoly on port and shipping infrastructure allowing the long-distance transport of bananas to North American and European markets. While a growing body of research examines the inter-relationship between culture, place and health (Gesler & Kearns, 2002) including through use of narrative-based methodologies (Wiles, Rosenberg, & Kearns, 2005), human geographic work on *scale* is particularly salient to individual, structural, and even global dimensions of pesticide risk perception. Much human geographic work on scales such as the body/individual, community, region, nation, or globe recognizes that they are not ontologically-given containers for social processes but rather are socially constructed (Brenner, 2001; Marston, 2000). That is, while the existence of bodies and cities and nations and the Earth is not generally disputed, the specific size, composition, interconnectedness and relevance to a particular issue of such scales are socially contested. Scale is analytically

used in several different ways, for example as a measure of size or areal extent or as a level (of government, for example), and is often a locus of *struggle* over appropriate ways to respond to economic or environmental challenges (Kurtz, 2003; McCarthy, 2005; Neumann, 2009; Rangan & Kull, 2009).

Such struggles often seek to establish particular scales as natural or inevitable, and actors are said to 'perform' scales in a bid to achieve or prolong this unstable fixity (Kaiser & Nikiforova, 2008). That is, rhetorical use of scale is *performative* in that it describes a scalar situation, but also attempts to make that description true (i.e. make the allegedly important scale in question actually be of importance). Work on 'scalar narratives' (González, 2006) illustrates how narratives can accomplish this end: Harris (2011), for example, illustrates how personal responsibility for environmental protection was often privileged in narratives recounted by Turkish citizens and environmental activists. This individual emphasis resonated with the individual-focused ideological climate accompanying Turkey's entry into the European Union, as well as with broader neoliberalization trends. With respect to the scale of public health interventions, Masuda et al. (2012) demonstrate how chronic disease prevention strategies in three Canadian provinces similarly deployed either individual or 'collectivist' accounts of responsibility for improving health, roughly corresponding to provincial ideological climates (this analysis transposes the individual/structural division reviewed above in pesticide risk perception research into the disciplinary language of human geography). Harrison's (2006) analysis of the 'scale politics' of pesticide drift activism, furthermore, reveals how the scales at which responsibility for pesticide exposure are located (the individual decisions of farmers as opposed to the regulatory apparatus of the state of California, for example) dictate how public sector responses are organized. Of special

relevance to global dimensions of pesticide risk, the global scale (often invoked by references to globalization) has been a special target of study (Swyngedouw, 1997). Gibson-Graham (2002) emphasizes that descriptions (performances) of the global scale function to frame reality, and that such framing frequently establishes power differentials between allegedly-powerful global forces and actors and relatively passive and powerless 'local' places (see also Tsing, 2000). The ways in which pesticide-exposed individuals in El Oro perform scales such as the individual and the global (and those in between) are therefore of relevance to how they understand and act on the health risks of pesticides. As Janes (2006: 262) points out, understanding 'whether and to what degree different groups come to adopt, aspire to adopt, or reject the systems of meanings that circulate increasingly in the global system' is an important task in designing culturally informed health sector interventions.

3.3 Study site

As described in the Introduction chapter, El Oro is in southwestern Ecuador and is bordered by Peru to the south, and the Pacific Ocean to the west. It accounts for approximately one third of banana exports from Ecuador, itself the world's leading banana exporter, and its capital Machala is the self-described 'banana capital of the world' (Gobierno Provincial Autónomo de El Oro, 2013). The province's population was measured at 600 659 in 2010, of which 245 972 live in the cantón (county) containing Machala (Instituto Nacional de Estadísticas y Censos, 2011). Economic activity in El Oro is largely agricultural, especially banana production, with additional concentrations in cacao and other crops. Aquaculture in the form of shrimp production is a more recent economic focus, as is small-scale gold

mining, with Machala serving as a hub for most of these industries (Astudillo Samaniego, 2009).

Banana production in El Oro differs from in Ecuador's other main banana-producing provinces (Los Ríos and Guayas) in being carried out by large numbers of 'small farmers' [pequeños productores] with less than 30 ha of land, and it accounts for 28% of total banana exports but is home to ~40% of the national total of registered banana farmers (Asociación de Bananeros del Ecuador, 2011). While this situation is slowly changing with increasing land concentration (SIPAE, 2011), it has historically kept poverty in El Oro lower than in many other parts of Ecuador (Larrea, Andrade, Brborich, Jarrín, & Reed, 1996). These figures attest to the economic importance of banana production in El Oro, and large numbers of people live, work or attend school near banana farms (in addition, substantial but unknown numbers of people actually live *on* banana farms). Banana production is often done under contract with an exporter, including the multinational Dole, Chiquita and Del Monte corporations, as well as the Ecuadorian-owned Bonita and Favorita brands and, increasingly, international supermarket chains. A minority of farmers carry out organic (pesticide-free) banana production, selling either to the large multinationals or to small co-operatives who often also have fairtrade certification. On most 'conventional' farms, however, the vulnerability of banana monocultures to plant pathogens (especially the Sigatoka Negra fungus) and the requirement of perfect fruit for largely North American and European markets lead to pesticide-intensive agricultural methods. This typically requires regular applications of insecticides, herbicides and nematicides, as well as fungicides applied by fumigation planes to larger farms, and with backpack sprayers on smaller farms (Harari, et al., 2011). Striffler's (2002) ethnography of banana farmers and workers in the El Oro-

Guayas-Azuay border region highlights the degree to which the Ecuadorian state and transnational banana companies influence life in the region, but also how local resistance – such as land invasions of the United Fruit Company's Hacienda Tenguel in the 1960s – has had international repercussions including the move to a more contract-based model of banana production. While the government of President Correa has recently attempted to improve working conditions, a precarious- or flexible-labour model characterizes contract-based banana production in Ecuador and elsewhere in Latin America (Frundt, 2009; Martínez Valle, 2004; Pier, 2002; Striffler, 2002, 2009), with workers often hired by the day and provided with neither benefits nor job security.

Fumigation with both backpack sprayers and airplanes (the latter typically carried out by agrochemical companies) often occurs in ways that deviate from recommended or legislated application methods, resulting in occupational or environmental pesticide exposure to large numbers of workers and surrounding communities; this exposed population would likely include at least the majority of the province's population when taking into account sources such as drift from fumigation planes onto highways. In light of this exposure, birth defects have been attributed to aerial banana fumigations in Ecuadorian news stories in recent years (“20.000 casos de deformaciones por fumigaciones,” 2011, “Pesticidas en los campos bananeros causan discapacidad,” 2012). One study carried out by Ecuadorian researchers also found high levels of hazardous pesticide biomarkers in banana fumigation pilots (Breilh, Campaña, & Maldonado, 2007). Another found suggestive differences in incidence of congenital malformations, the ratio of girls to boys (a possible indication of endocrine disruption by pesticides) and various other symptoms between a community affected by aerial fumigations of banana plantations, and another geographically distant from it

(Maldonado and Martínez, 2007). Studies on pesticide-exposed banana and plantain workers elsewhere in Latin America have found elevated rates of dermatological conditions (Wesseling et al., 2001; Penagos, 2002); long-term neurobehavioral impacts (Wesseling et al., 2002); cancer (Wesseling et al., 1996); eye problems (Wesseling et al., 2001); psychological distress and suicidal ideation (Wesseling et al., 2010); reproductive problems (Slutsky et al., 1999); and respiratory symptoms (Fieten et al., 2009). Firmly establishing causal links between pesticides and health effects in the banana industry is especially difficult, however, as the mix of chemicals to which people are exposed is variable between farms and over time (albeit with some chemicals in more widespread and long-term usage). Exposure to both pesticides and potential alternative causes of illness is also difficult to assess because of complex employment situations, uncooperative employers, and fraught life histories. Thus widespread exposure to pesticides in El Oro represents a health problem of scientifically unknown magnitude.

During fieldwork and at the time of publication, Ecuador was governed by popular president Rafael Correa Delgado, whose policies and rhetoric often evoke comparisons to leftist South American leaders such as Hugo Chavez of Venezuela and Evo Morales of Bolivia but whose critics often accuse him of promoting 'neoliberalism' under the guise of his 'Citizen's Revolution' [La Revolución Ciudadana] (Becker, 2013; Clark, 2013; Harris & Roa-Garcia, 2013; Zorilla, 2013). This conflict appears consistent with Trumper and Phillips' (1995) observation that the 'neoliberalization' of Ecuador remains incomplete, in part due to regional differences precluding the national-scale imposition of free market ideology. These regional differences prominently include those between highland 'Serranos' and coastal 'Costeños' (such as residents of El Oro, or 'Orenses'), the latter group described as an ethnic mix with

mestizo, Indigenous and Afro-Ecuadorian roots and characterized by a distinctive Costeño culture (de la Cuadra, 1937; Roitman, 2008).⁷ One reputed health-related feature of this culture is the 'traditional' health system featuring maladies such as *susto* (fright) and *mal de ojo* (evil eye), and traditional healers (*curanderos*) employing herbal remedies (Pedersen & Coloma, 1983; Phillips, 2004). Phillips' (2004) study of the intersection of individualizing biomedical perspectives and neoliberal reforms in coastal Ecuador in the 1980s and 1990s found that peasant understandings of health involved a selective appropriation of biomedical terminology and concepts, as well as contested understandings of the respective roles of personal responsibility and poverty in the production of health and illness. El Oro is therefore a place with profound links to global forces such as banana markets, a coexistence of traditional and biomedical health systems, and a contested political climate in which elements of both individual-centred and more collectivist political visions are very much in regular interaction.

3.4 Methodology

I employed a multi-stage ethnographic approach beginning with a culturally-rooted risk perception conceptual model developed from existing literature and data. I used this model to inform a succession of ethnographic techniques that in turn allowed refinement of the model over the course of the study (Schensul & LeCompte, 2012). This involved a total of 8 months of fieldwork over a 3-year period, during which time I lived in Machala and travelled to

⁷ 'La Costa' is one of three main geographic regions in Ecuador, the others being the highland 'Sierra', and the Amazonian 'Oriente' (Roitman, 2008).

surrounding communities to carry out research activities. I carried out non-participant observation and informal interviews first, and throughout, in both the Machala urban setting and in surrounding banana-producing communities. This helped to identify local experts for key informant interviews (interview guide provided in Appendix B), allowing refinement of an interview guide for subsequent in-depth, semi-structured interviews with individuals exposed to pesticides through banana production. After I translated this interview guide into Spanish, a bilingual Machala-based university professor corrected any remaining errors in Spanish, and discussed the questions with me to ensure that the Spanish translation captured the meaning of the original English version. Following the first interview, I adapted some language in this interview guide to further improve the understandability of questions. Snowball and targeted sampling were used to select interviewees for both key informant and semi-structured interviews. This covered demographic categories suggested by the literature and ongoing data analysis to be relevant to the research questions, in keeping with methodological guidance on purposive and theoretically-informed sampling (Coyne, 1997). In particular, I sought out both small banana farmers and landless labourers; men and women; individuals with different degrees of formal education; and individuals of various ages (see Table 1 for demographic information on semi-structured interview participants).

| Characteristic | # participants (total = 30) |
|--|-----------------------------|
| Sex | |
| Male | 23 |
| Female | 7 |
| Age (years) | |
| 19-29 | 3 |
| 30-39 | 4 |
| 40-49 | 6 |
| 50-59 | 8 |
| 60-69 | 4 |
| 70-79 | 2 |
| 80 and over | 1 |
| Education | |
| University, completed | 4 |
| University, not completed | 4 |
| High school / technical training | 5 |
| Primary | 16 |
| Data not collected | 1 |
| Profession | |
| Banana farm owner | 14 |
| Small-scale (<30 ha) | 13 |
| Fairtrade certified | 5 |
| Organic and fairtrade certified | 1 |
| Medium-scale (<100 ha) | 1 |
| Banana farm employee (past or present) | 16 |
| Day-labourer | 11 |
| Administrator | 2 |
| Agricultural engineer | 1 |
| Accountant | 1 |

Table 3.1: Demographic characteristics of semi-structured interview participants

Data from the semi-structured interviews form the primary basis for the results described in the following sections (the semi-structured interview guide is provided in Appendix C). The structured portion of these interviews collected demographic data and guided discussion towards important topics as suggested by early fieldwork, while I also asked more open-ended questions about health and pesticides. I began each interview in a way that was intentionally agnostic as to scalar considerations, acknowledging the caution that scaled methodologies can be self-fulfilling prophecies (Marston et al., 2005). Any global dimensions of these narratives were of particular interest to me, however, so I ended interviews with open-ended questions on topics such the participation of people from banana-consuming countries in either causing or responding to problems such as pesticide exposure in Ecuador. While the use of a semi-structured interview format and the focus on specific scalar issues raises the risk of putting words into participants' mouths, social scientists have increasingly come to acknowledge that 'the performance of narrative, and its reading, is a collaborative endeavour' (Garro and Mattingly, 2000, pp. 29-30). I therefore take the interview circumstances into account in the following interpretation of results, in keeping with the understanding that interviews are more a process of co-construction of knowledge than a way of extracting pre-existing information from research participants (Green & Thorogood, 2004). In particular, the observation that the researcher *is* the research apparatus in ethnographic research (LeCompte & Schensul, 2010) motivated me to take careful fieldnotes documenting my personal experiences and feelings during fieldwork in Ecuador (Jackson, 1990; Schensul & LeCompte, 2012), and I discuss these as they relate to the study findings in the Discussion section.

Reflecting carefully on my personal experience with the research is one method I used to enhance the credibility of my findings, as the researcher *is* the research apparatus in ethnography (Schensul & LeCompte, 2012). Concepts of reliability and validity in quantitative research typically rely on rigorous, controlled study designs that are, at least in theory, reproducible. In qualitative research, however, such norms are often described as less applicable than concepts such as trustworthiness and defensibility (Golafshani, 2003). These goals can be pursued through transparency concerning methodological choices, and by employing techniques such as triangulation and attention to negative cases to gain multiple perspectives on the research question. I employed triangulation between the different types of ethnographic data I collected (Mathison, 1988) by comparing my key informant interview results to the semi-structured interview results, and both to my fieldnotes. I also paid attention to how narratives differed between respondents with different social backgrounds (see also Harris, 2009). Finally, I met with both key informant and semi-structured interview participants after preliminary data analysis for 'member-checking' (Stringer, 2007), to obtain their thoughts on my initial findings.

Morse, Barrett, Mayan, Olson, and Spiers (2002), for their part, hold that reliability and validity still represent useful measures of the rigour of qualitative research. They urge that strategies for ensuring these features be built into study design, rather than applied post-hoc to analyzing and interpreting results. These strategies include appropriate sampling strategies, described above for the present chapter; concurrent collection and analysis of data to ensure iterative interaction of data and analytically-derived theories, including constant reflection on evolving understandings and revisiting data as new theoretical elements emerge (see Data analysis section below, and discussion of member-checking above); and

methodological coherence, meaning appropriate choice of methods for the research question. This last point is especially important in that the validity of research depends significantly on the fit between paradigm, methodology and methods (Carter & Little, 2007). In the case of the present chapter (and as the dissertation to this point would suggest), I am largely working within a *critical* paradigm that holds knowledge to be influenced by power, although my approach is also informed by an *interpretive* paradigm that recognizes a plurality of knowledges as valid (see also LeCompte & Schensul, 2010). As I outline at length in the introduction to this chapter, an ethnographic methodology was therefore most appropriate. Finally, the specific ethnographic methods I chose to employ (interviews, observation, ‘member-checking’) are congruent with both the methodology, and its paradigmatic grounding.

A total of 14 key informants participated in interviews, covering the following occupations and roles: health professional; clergy; large banana farm owner; labour leader; cultural organization leader; researcher; university lecturer; government employee; social movement leader. I carried out 15 semi-structured interviews, but in four of these multiple people participated, for a total of 30 participants in the semi-structured interviews. Two of these participants resided in a different banana-producing region of Ecuador (not El Oro). Semi-structured interviews took place in locations chosen by respondents: these included co-operative and non-profit organization offices, farms, homes, and, in one case, a park bench. The study was approved by the University of British Columbia's behavioural research ethics board (certificate #H11-01427).

3.4.1 Data analysis

Semi-structured interviews with individuals living with pesticide exposure were carried out, transcribed and analyzed in Spanish. Preliminary data analysis, prior to member-checking with participants, involved Office-suite software, paper, pens and highlighters. Final data analysis (upon which the following sections are based) was carried out in Nvivo, V10 (QSR). Fieldnotes and data from the key informant interviews were also entered into Nvivo to facilitate triangulation of the semi-structured interview results. This supplementary data helped me to decide on and refine the coding structure used to analyze the semi-structured interview transcripts. I followed the data analysis methodology outlined by LeCompte and Schensul (2013), assembling a conceptual model composed of domains, which are in turn broken down into factors and sub-factors identified as themes in the data. In keeping with Morse et al.'s (2002) recommendation that data analysis constantly revisit and refine theoretical understandings and their relationship to coding structures, I continued reading and re-reading from relevant literatures – risk perception, medical anthropology and human geography – throughout the data analysis and interpretation process (and while writing this chapter). In interpreting the conceptual model that emerged from data analysis (i.e. going beyond descriptive coding of themes present in the data and attempting to say what they mean), I employed narrative analysis (Wiles et al., 2005), based on an understanding of narratives as 'a basic mode of communication able to transform complex situations into an easily understandable chain of events, linked by a causal explanation, which imply a possibility for generalization, contextualization, transferability and closure, and which, most importantly, have ulterior political implications' (González, 2006, p. 840).

3.5 Results

Interviews with both banana farm owners and labourers revealed important aspects of pesticide risk perception, its relationship to understandings of health in El Oro, and how these issues are framed in scalar terms. Narratives emphasized: a) a mix of *lay and biomedical* descriptions of health, but also *health as an ability* enabling the pursuit of livelihoods in uncertain economic circumstances; b) a wide range of *pesticide-related health effects*, again described using both lay and biomedical vocabularies; and the embeddedness of health (including the effects of pesticides) in scalar narratives emphasizing the role of either c) *individual* or d) a variety of *structural* factors (‘extra-individual’ factors, or those outside of the control of the individual in question) in causing and appropriately responding to health problems. A degree of mixing of scalar elements was also observed, with most respondents highlighting e) *both individual and structural* narrative elements, albeit with different relative emphases related in complex ways to the respondent’s social position and characteristics. I substantiate these inter-related themes with examples in this section, before exploring their relationship to existing scholarship and prospects for population health improvement in the final section. I attribute quotes to specific Semi-structured Interview numbers (e.g. SI2), and provide demographic information about the speaker when relevant; in the case of the four interviews with multiple participants (SI3, SI13, SI14, SI15), I quote from only one participant at a time, and again provide demographic details if relevant.

3.5.1 Health in El Oro

In response to a mix of open- and close-ended questions about the nature and causes of good

health, participants tended to employ a mixture of lay and biomedical language and also frequently referenced medical care:

My health...I'm a bit overweight [gordita]...but it's good. Because I'm not sick, I haven't needed to undergo treatment yet. Every time we find ourselves healthy, according to these cholesterol levels, this diabetes exam. I don't have any problems like that. My son always takes me to the doctor we have, the one we know. And I have my exam, and the doctor says I'm good, a bit overweight but still in good health.
(SI9)

For many individuals, answering the question 'how is your health' appeared to require consultation with a physician: 'I would say that my health is good. I recently had a medical check-up and I'm good, according to the doctors, no? No problem with me.' (SI2) In keeping with this prominence of biomedical terms and professionals, the 'traditional' medical system previously documented in Ecuador was initially absent from respondents' accounts of health. While a bustling trade in natural remedies was evident in local markets and shops (including Ecuadorian and Peruvian medicinal plants, and also Asian products such as Korean ginseng), no interviewee mentioned, unprompted, traditional remedies or conditions such as *mal de ojo*. When specifically asked about such practices, one university-educated woman indicated that she would occasionally seek out a *curandero* for conditions, such as *susto*, that were not amenable to biomedical cures; another Ecuadorian acquaintance furthermore indicated that use of traditional remedies is a very private affair in Ecuador. While some of my key informants indicated that the use of traditional remedies in coastal Ecuador is still

widespread, some health professionals suggested that such practices had become much less common in recent years.

Whatever the role in El Oro of ‘traditional’ health beliefs, however, the mainstream biomedical model informing health narratives was also complemented by a number of alternative visions seeming to reflect respondents’ lived experiences, as well as economic realities in Orense society. In particular, health was often defined by respondents (in response to specific questions), as an *ability*: to enjoy life, to procreate, and (above all), to work and support one's family.

For me, health is the optimum state for a person, to have energy to live, to work, to enjoy oneself, no? (SI2)

Health is the primary thing, it's the basic thing for a human being. Without health, there's no progress, there's no work. The body needs to be full of health to develop all of its potential to work. (SI7)

This understanding of health-as-ability (especially to work) would appear to reflect the fact that, for farmers and workers in El Oro, survival and social reproduction largely depend on their ability to participate in the labour-intensive process of banana cultivation. Perhaps reflecting the uncertainty inherent in contract-based banana production, furthermore, this ability was frequently defined as *precarious*. Several respondents, when asked to describe their health (or that of people around them), rated it as good, but hastened to add that they did not know what long-term conditions (cancer, for example), might be lurking within.

I'd say...good, because if I say 'excellent', you never know. You never know what problems are sick inside. You don't know the hour, or the day, when you'll get sick and go to the other side. (SI4)

Another possible explanation for this lack of confidence in future good health may be the fact that participants were qualifying their experiential assessment of their own health as good with an acknowledgement that a full description would require medical attention. Rounding out these descriptions of health are the various factors named by interviewees as promoting or damaging health. These health-promoting factors included adequate (and nutritious) food; medical attention (in keeping with the prominence of biomedicine discussed above); and healthy lifestyles avoiding 'contamination' such as alcoholism and drug use. Health-damaging factors included an absence of these same factors, but also chemicals in food, and environmental contamination from aerial pesticide applications and other sources such as littering and gold mining. A recurring theme, in addition, was the need for financial resources to ensure access to many of the listed health determinants. In the face of the difficult and unstable economic situation facing small banana farmers, some male farmers also discussed how they would sometimes 'lose hope', while one group of four female participants discussed – at length – 'stress' as a factor affecting their health (related to both unstable banana markets and also their family responsibilities). I return to these listed causes below in discussing their scalar and political implications; for now, though, they complete a picture of health as narrated in prominently biomedical terms and dependent on the involvement of health professionals. Conversely, however, the picture also contains more common-sense understandings seeming to reflect the lived experiences of Orenses, and the

stresses and uncertainties caused by their embeddedness in a difficult agricultural commodity market.

3.5.2 Pesticides and their perceived health effects

Participants described a range of health effects as caused by pesticides, employing biomedical terms as well as more lay or experiential language often reflecting personal experience with pesticide exposure. These health effects were listed in response to a specific question on the health effects of pesticides, although qualitatively similar descriptions often emerged when I was discussing the general objectives of my study with participants and other individuals I encountered over the course of my fieldwork. Many of the reported effects featured relatively mild symptoms such as skin irritation or lesions, headaches, sore throats and respiratory issues (coughing, sneezing, shortness of breath, etc.), with one young male labourer commenting, 'It irritates my nose a bit, it makes me want to sneeze – the banana fumigations' (SI1). More serious impacts listed by multiple interviewees (usually ones they had heard about and not experienced personally) included birth defects, sterility (in men), cancers and death.

If they get on your skin then afterwards you get illnesses, vision loss, all of that. This product causes death as well. These liquids leave people sterile. (SI4)

A friend, they gave him leukemia. I'm talking about these products from the airplanes [fumigation planes spraying pesticides], nothing else. (SI8)

Of note here, it is possible that men experiencing reproductive problems might have chosen

not to share these details in an interview experience. Two farmers recounted their own experience with serious pesticide intoxication, while another reported a severe allergic reaction to pesticides forcing him to abandon banana production and convert his small farm to cacao. Thus personal experience with pesticides appears to have played a major role in shaping participants' sense of pesticide risk perception. Other sources of information likely include reports of birth defects attributed to pesticides in local news stories, as well as publicity related to a lawsuit being pursued by former banana workers in multiple countries – including Ecuador – over reproductive effects (i.e. sterilization of men) attributed to the banned nematicide dibromochloropropane (Boix & Bohme, 2012; UROCAL et al., n.d.b). Various banana and agrochemical companies and the Ecuadorian government have also carried out training on safe handling of pesticides; this training would undoubtedly have involved descriptions of the health effects of pesticides (although several interviewees reported a lack of relevant training provided by employers).

Aside from one male farmer with a small, conventional farm who maintained repeatedly that pesticides do not have health effects, the widespread attribution of fairly specific medical conditions to pesticide exposure is noteworthy. As discussed above, the determination of causality between these complex exposures and many of the cited health effects would present major difficulties to even well-funded epidemiologists. The interviewees to whom I spoke were, therefore, expressing more certainty in attributing health effects to the pesticides in use in El Oro than would an 'official' biomedical perspective. I do not highlight this in order to compare these participants' perspectives unfavourably to 'true' scientific knowledge, but rather to demonstrate how biomedical terms and concepts have been incorporated into

illness narratives in El Oro in a way that is shaped by local realities and ways of understanding the world.

3.5.3 Individual-centred narratives of illness and pesticide exposure

The descriptions of health and the effects of pesticides listed above were sometimes embedded in narratives in which causation of health effects, and responsibility for responding to them, were primarily attributed to *individuals*. With respect to health in general, numerous participants located responsibility for health outcomes in individual practices such as healthy eating, caring for one's children, and avoiding drugs, alcohol and cigarettes:

To not have illnesses, nor live sick, principally: give up alcoholic drinks because they cause lots of illnesses. It's the same, with respect to health: eat well, feed yourself well, and you'll do well. (SI4)

Health is the primary thing, because health...how should I say it? Be well, take care of yourself, don't contaminate yourself...(SI8)

This identification of individual behaviours as determinants of health was mirrored in many reported causes of pesticide exposure. Prominent among these was carelessness by workers or small farmers, including improper use (or non-use) of personal protective equipment (PPE). While a small number of participants admitted to being careless with PPE themselves, respondents tended to cite the carelessness of *others* as a reason for their pesticide exposure.

Some people don't want to protect themselves. There are people who don't like it, including workers. You say to them, 'look, you're going to fumigate, put on this hat, put on these goggles to protect your vision, put on gloves, boots...'. They say, 'No, no, no, no, it doesn't affect me, I'm a strong man.' You say, 'put on this mask' and they say 'No, I can't breathe, it's too hot.' They just don't want to. (SI2)

And there's not adequate protection. Because sometimes, the guy going to apply pesticides doesn't want to, because the farmer doesn't feel like it. I'm speaking from experience: if we're going to fumigate for the *sigatoka negra*, he doesn't want to. Because it bothers him, because it's suffocating, because it's uncomfortable with the safety glasses, no? Or with the protective clothing, so some go without it. So, it's also a question of culture, no? *It's a question of culture*. They know that it does damage, but they don't protect themselves. They don't protect themselves. And why? Because...there's no culture. There's no education about this, nothing. (SI14, emphasis added)

In this last passage, individual behaviours are clearly seen as an expression of culture, and both are related to education in explaining the causes of pesticide exposure (and possibly, by extension, appropriate solutions to it). Of relevance here is a prevalent description I encountered in both semi-structured and key informant interviews, as well as in numerous other conversations over the course of my fieldwork. In this description, individuals who work in bananas – often poor and/or young people – do not protect themselves from pesticides, but also do not adequately care for or feed themselves or their children, and tend to abuse alcohol and drugs. As one small banana producer put it:

I've noticed that the people who work near where I live, it's full of banana farms and the people live there, no? That's the zone...pure delinquency. I'm telling you, people...you pay them their week, but people don't know how to make use of their money, and they just devote themselves to drinking. They drink, they drink too much. And their children, also, end up drinking. There's a guy there who works with my father, the son drinks already, the other brother as well. You learn what you see. And they don't pay attention to feeding themselves. And also, they don't protect themselves, because it's necessary to use certain chemical products, right? Over time, this affects your health. And they're thin, not taken care of. But it's not because they're not getting paid, but because they don't use their weekly pay like they should. You see this a lot there. There are a lot of these people. They don't take care of themselves. You give them gloves and everything, but they don't...it's their way, how do you say, of being...*because of their ignorance*, they don't protect themselves. (SI15, emphasis added)

Logically consistent with the attribution of pesticide exposure to factors such as ignorance or a lack of culture and education were common calls for education on the health effects of pesticides and how to avoid them:

Here the primary thing is for people to become aware. Because here you see people who fumigate with backpack sprayers, and they don't use protection, they don't use anything. It's as if their lives don't matter to them. So that's why I say that, primarily, they should be made aware that, with the chemicals they're using, that they affect us, down the road. (SI3)

More generally, individual-focused explanations of ill health in El Oro tended to motivate calls for educational-behavioural interventions aimed at improving nutrition, or reducing behaviours such as smoking, drinking and using drugs.

Well, you have to teach them, right? I don't know, design some talks, so they can be guided, told that if they keep drinking, as I said earlier, alcohol can give them cirrhosis. Not only them, but their family, their children. So talks, then, to motivate them to have better health. And these talks would be, practically speaking, *for people in the countryside*...lots of times people, how do I say it, they don't listen to the advice you give them, no? Lots of times, they say: what's this got to do with me, why are you interfering in our lives, no? So I don't know how to arrive at these people, to be better prepared to arrive at something, at least, *to save them*, no? (SI15, emphasis added)

When combined with the attribution of unhealthy behaviours to ignorance, this last passage clearly identifies a specific group of people (those in the countryside where there is 'pure delinquency') as deficient and in need of saving – or at least in need of education and motivation. Of relevance here is that such narratives were typically recounted by small banana farm owners, most with at least some postsecondary education, about underemployed, rural, poorly educated and economically marginal banana farm workers.

3.5.4 Multi-scalar narratives of illness, pesticide exposure, and structural causes

In contrast to these individual-focused narratives, however, many participants emphasized

more structural pathways to health, illness and pesticide exposure, referencing a variety of more-than-individual scales in doing so. At the most basic level, a small number of female and male respondents described their health in ways that involved their relationship to their family. In a related vein, the following quote invokes the scale of the family while simultaneously pointing out the effects of poverty (typically considered a structural factor) on health:

Because, you know, let's say, a well-fed child...good health, for sure. But if a child isn't well fed, what can you hope for? There's no way. This is what we lack. Because it's not fair, it's not do-able, that peasant farmers are out of breath, working, there's not even a free hour to say 'I'll work until that hour and then rest.' Not what's proper to have. Rain or shine, you have to be there, working and working. I can't even say I'm content as father of a family, arriving at my house, I produced so many cases of bananas, and I'm going to collect my money for them, and I have to buy you kids milk, buy bread, buy you some shoes, some clothing, stuff like that. If you arrive with a little bit, to buy four little things to eat, and also to pay the worker, to give the things that help, buy bags [to protect growing bunches of bananas from insects] and what have you...I have to fumigate, I have to go buy the products [pesticides], I have to irrigate. And it's not enough. So, you end up buying not enough food, no? And because of this they're in poor health. Their health is bad. (SI13)

Another respondent indicated that her health enabled her to contribute to the co-operative of which she was a member:

For me, health is something important. Because if I'm healthy, I can work, I can have

energy for everything. For me, health is important, yes...energy, to continue living, to help with the co-operative, and everything. (SI10)

These two social groupings – family and co-operative – represent more-than-individual scalar configurations characterizing the narratives of several participants. In recounting pathways to pesticide exposure, furthermore, numerous interviewees implicated actions (or lack of actions) by large farm owners and managers with control over *farm*-scale decisions and processes. Some participants highlighted the neglect of banana farm owners and managers to provide PPE and training for employees, while many pointed out the exposure (to which I can personally attest) resulting from aerial fumigations of questionable precision in close proximity to populated areas. In some cases this involved schools and other populated areas adjacent to banana plantations, while in other cases this involved the practice of housing labourers within the plantations themselves.

People live in the banana farms. I'm telling you in the case of my friends, they can't say anything to the boss because they're living on his land. So if they're living on his land then they have to tolerate it, because – all the same – they're working for him, to live...so, because there's not work and this is what they know how to do, then, they have to put up with it...they have to know how to survive this...where they are...so they can't say anything, because if they do they'll be kicked off. (SI1)

Another related exposure route involved fumigation of farms while workers were still in the fields, an illegal but apparently common practice.

When the airplane fumigates, people are inside the plantations. You have to leave for

an hour or a half-hour, but that's not possible, right? It's not being observed. Why? I tell you, it's clearly related to the interests of the owners of the plantations – especially the plantations that fumigate with airplanes. There are situations where it isn't convenient for the boss that his people lose an hour or two, so they have to stay in the plantations all the same, when the airplanes are fumigating. In some cases they fumigate in the afternoons, but in others they fumigate during the day. So you have to tolerate this...We're not going to be able to stop it. Here it would be the authorities, the government, who would get involved in the matter, ideally with some drastic measures, especially where there are settlements inside or near the plantations. They should make a space of some...200 or 300 metres, and not fumigate there, from this space, no? For example, here's the hacienda of [local large banana farm owner]...Yes, I'd like some 200 metres, to arrive there, or there – so they don't fumigate there. Or so they fumigate with backpack sprayers, that's what I say. But this...it's difficult. You can say it, but because you're not the farm owner, the owner...he also has to fumigate. They buy justice, buy the authorities. It's difficult. The rich...the rich have the power.

(SI16)

Thus responsibility for pesticide exposure was often attributed, by several small farmers and labourers, to farm-scale processes and the actors who control them, while appropriate responses were located with 'authorities' or 'the government' (a theme to which I return shortly). I also interpret the frequent self-identification of many interviewees as small-scale banana farmers [pequeños productores] to represent performances of a specifically *small* farm scale. Importantly, a number of co-operatives in El Oro allow small farmers to jointly

market their bananas, as well as benefit from communal resources such as technical support and economies of scale in purchasing farm inputs.

And this is the situation we're living now, no? Now, with respect to bananas, now is the struggle for the official price as well. The price of a case [of bananas]...right now we, those of us who are the producers, we're waiting for this. We're worried, in this we're on the topic of...imagine, you've invested so much...right now the government makes it so we have to insure the workers, so many things. But they don't know that small producers hardly get enough to survive. And in this situation, then, more than anything, in [name of co-operative] we're all small producers....and the economic situation right now is deadly. (SI15)

But I agree, let's say, that the big farm owners, they have lots, and they can do it. They can certify their farm [with GlobalGAP, a good-agricultural-practices certification imposed by European and North American supermarket chains]. But when you're small, let's say, how do you do this? We don't have enough...there's a lot of poverty here, and they're making us do this because...it looks to me like it's a political question, that they want to...that the owners, the big farm owners, they want the small producers to disappear. (SI16)

These invocations of the small farm scale often highlighted the special economic challenges facing small producers, in response to a specific question about the major challenges facing people involved in Ecuadorian banana production. Significantly, these identified challenges only rarely included health effects of pesticides, a theme to which I return shortly. The scale of the small banana farm was ubiquitous in interviews, local news stories, conversations, and

in the specific names and composition of various co-operatives. Although the exact size below which a farm is considered small varies slightly, the small-farm scale is constructed through mechanisms such as the Ministry of Agriculture, Livestock and Fishing (MAGAP)'s classification of all banana farms under 30 ha as small-scale (Ministerio de Agricultura, Ganadería, Acuacultura y Pesca, 2013). The political uses of the small-farm scale were evident in numerous newspaper articles decrying the adverse market conditions facing small producers and the existence of numerous small-producer co-operatives, as well as organizations such as the Front for the Salvation of Small-scale Producers (El Comercio, 2011). As the above quotes suggest, furthermore, this scale was typically (though not always) performed in ways that intersected with structural explanations of, and solutions to, poor health and other problems. In late 2011 when the semi-structured interviews occurred, for example, banana industry stakeholders – small farmer co-operatives, large farmers and exporters – were involved in negotiations with the Ecuadorian Minister of Agriculture to determine the state-mandated 'official price' paid to producers for a case of bananas. Small producers also expressed a desire in several interviews for actual observance of this mandated price, evoking the farmer quoted above who lamented that the rich 'buy justice, buy the authorities'. In keeping with this (problematic) prominence of the Ecuadorian government in life in El Oro, participants also frequently invoked the scale of the nation-state, usually Ecuadorian but occasionally foreign, and often linked to discussions of power and inequity.

Because I tell you, sincerely, the government should first focus on work, on agriculture. Because from that comes the food of *a whole people*, and exports also.

When there's good production, there's enough for everyone, enough to eat. If we

focus anywhere else and forget that then the whole thing's messed up, no? And that's what's happening to us. Here the banana exporting companies do whatever they feel like. They pay, they don't pay. They raise the price when they want to, when they feel like it. There's no respect for our signed contracts. They don't pay the official price, which is in the contract. And the government can't do anything, because they're millionaires. And they pay money under the table, and the poor people...we're always screwed [hodidos]. (SI13, emphasis added)

The national scale was also highlighted through identification of the 'government' or the 'president' as the most appropriate agent of change in addressing pesticide, health or other challenges:

They have to prohibit the banana farms. And prohibit that, keep them from doing this contamination...it would have to be done by the president, the president of the republic, right? He has to give the orders, that the banana farms go back [far from inhabited areas] (SI8)

Another invocation of the national scale is represented by the pride expressed by several interviewees in the quality and taste of Ecuadorian bananas, such as one small farmer with leadership experience in his co-operative:

It would be important if big countries like yours [i.e. Canada] also focus on, or have a social vision. First, come and buy from banana producers in the country of Ecuador, especially the harvest of the small- and medium-scale farmers. And know what it is that you're eating. Because I can say categorically, I can say what I've said

internationally because I've done interviews at the international level, that Ecuadorian bananas are less contaminated. The least contaminated country in the whole big industry, unlike our competitors who contaminate a lot. The product they sell, I'm talking about pesticide residues. But our product is still a wholesome, edible product. (SI14)

As the preceding quote also suggests, a range of rhetorical scales were observed in response to questions about a possible role for actors from the *banana-consuming world* (largely understood by interviewees to map closely onto the global North, especially Europe and North America). Individuals with high-level experience in banana-exporting small-producer organizations were quite savvy with respect to the dynamics of international solidarity such as fair trade banana production, often overlapping with organic certification. Thus establishing market niches for Ecuadorian producers, and educating foreign banana consumers in a bid to influence market (and health and environmental) conditions in Ecuador, represented political strategies transcending the nation-state.

Apart from that, from the rules, undoubtedly, it's good for us to maintain the price, no? Or maintain a stable price to avoid this type of crisis that always comes, no? Every year there's always a banana crisis, so I think that, at the same time that they come to impose rules, they also need to impose a fair price. That would be to live together, both them and us, the producers, and them the consumers, no? (SI5)

The support of another group of people is also important: NGOs. For example, in Europe, there's lots of education of consumers, a lot of hard work by volunteers. People who work in the 'Solidaridad' foundation, for example, in the Netherlands, in

Belgium, in the ONSA foundation in Switzerland, in the Netherlands, in England. Oxfam in Belgium, for example. These organizations work very hard to introduce fairtrade. (SI2)

In addition, some interviewees – including day-labourers who are among the most economically vulnerable in the banana production process – urged me to put pressure on President Correa, by way of my own government, to improve working and market conditions in Ecuador.

Listen, I think that it would be more practical if you would take this message direct to your government. And, in turn, your government would have contact with the Ecuadorian government, so that the two parts...one selling and the other exporting. So then we'd see a better exchange of ideas, to improve these things. (SI16)

As these quotes suggest, the scale of the banana-consuming and banana-producing worlds emerged frequently in interviews. Judging by these interviews, and by my reception as a foreign researcher in Machala, the former is populated (in the minds of many Orenses) with wealthy individuals who have the ability to provide various kinds of capital (physical and symbolic) to individuals in El Oro, most prominently through their banana purchasing decisions but more generally through their identity as conduits to a generally better-resourced part of the world.

I have an idea, now that you're here. You come from another country. We want to have a factory here. We want you to support us, then. If you support us, the small producers, so much the better! Because, you see, we have fruit. There are producers

whose fruit is ripening in the fields. And you see, with machinery, a machine, we could make juice. Yes or no, what do you say? Juices, sweets, so many things. And give them to the schools. Because there are plenty of rural schools, yes or no, friend [compañero]? Since you come from another country, you have more...knowledge, more or better than us, yes or no? This idea came to me some ten years ago. I always tell the friends who come from other countries, other *gringos*. *Gringos*, that's what we call you. Listen, I'm telling you, you should bring us some machinery. You should give some support here. With the president [of the co-operative], we're also supporting you, yes or no, friend? We're supporting you! Some machinery, I'd say. To make a factory, for juice, right here. With the small producers from here. (SI13)

In this quote, I am classified as belonging to a national scale ('from another country'), as well as the large, privileged geographic region from which *gringos* come,⁸ while reference is also made to the small producer's co-operative to which this interview participant belonged. With respect to the role of 'gringos', local newspapers would frequently highlight the nationality of foreign attendees at events in El Oro (including myself on one occasion). This especially included those coming from specific European or North American countries, but also slightly larger and wealthier Latin American countries such as Argentina or Chile (countries which also contain consumers of Ecuadorian bananas, incidentally, although typically bananas not meeting the more stringent quality standards of European or North American importers). The degree of sophistication with which the banana-consuming, *gringo* world was described furthermore appeared to correspond to the affluence and education of individual in question.

⁸ I began my fieldwork under the impression that gringos were from the US, but soon learned that any white foreigner could be referred to using the term.

Thus more affluent individuals, who in general already wore more foreign-made designer clothing, spoke more English and had more experience spending time or sending their children to be educated in Europe or North America, were also more detailed and (in some respects) realistic with respect to how North-South links worked, or could work.

3.5.5 Individual and structural elements in combination

As a counterpoint to the individual / structural divide I have been describing in scalar terms, several interviewees expressed *both* individual and structural narrative elements. As an example, one small banana producer discussed the problems facing small producers due to international market conditions and a lack of Ecuadorian government support; asserted that local labourers sometimes lacked 'culture' and therefore did not protect themselves from pesticides; and spoke heatedly of the tendency for industrialized countries (such as my own) to export pesticides that had been banned in the global North to 'underdeveloped' [subdesarrollados] countries such as Ecuador (pesticides which, he reminded me, return to their origin in the form of residues on bananas).⁹ This individual therefore, in a single interview, highlighted individual, small-scale farm, and national scales as politically relevant, as well as the scale of the banana producing and consuming worlds. He then went on to sum up his thoughts on the causation of ill health: 'On the topic of health, then, I insist: it's the lack of culture, and also necessity, of not having alternatives [to chemical agricultural production methods]' (SI14).

⁹ Such 'circle of poison' arguments have been problematized by Galt (2008), based on the increasing domestic production of pesticides in countries of the global South. While many of the pesticides used in Ecuadorian banana production are, in fact, now manufactured domestically, multinational pesticide giants are nevertheless a major presence in the country.

Several respondents combined both individual explanations of ill health ('culture') with structural ones ('necessity') in this way. Narratives locating responsibility for health problems primarily in individual / 'cultural' characteristics were largely – but not entirely – recounted by property-owners (small- and medium-scale banana farmers) and/or those with at least some post-secondary education. These individuals would often also implicate structural factors in explaining their own problems, however, while some landless labourers would also sometimes highlight carelessness and individual characteristics in explaining behaviour (usually of others, but occasionally of themselves). Such individual/structural mixtures illustrate how scalar elements can combine in complex ways that appear linked to social class, but not in a straightforward manner. Furthermore, the tension between individual and structural elements in the narratives of Orenses echoes the divergent approaches to pesticide safety, and public health more generally, outlined in the introduction to this chapter; they also reflect the fault lines observed in pesticide epidemiology as analyzed in Chapter 2. In the next and final section, I relate these findings to existing scholarship and the task of planning public health interventions in this area.

3.6 Discussion

This chapter has illustrated the coherence of narratives of pesticide risk in El Oro with local understandings of health, and also how both health and pesticide risk perception fit within cultural narratives involving livelihoods and political power. A lexicon combining biomedical and common-sense terms was used to describe the health effects of pesticides, as part of health narratives in which biomedical perception was often required to know, and

thereby protect, health. These narratives also emphasized the role of health in El Oro as an ability that enables livelihoods: supporting a family, pursuing personal development and recreation, and working or bringing in income to support such activities. Health seems to perform this function in a precarious and uncertain manner, however, that could be taken away at any moment. This appears consistent with the uncertainty inherent in the banana trade on which the province's livelihood depends, possibly combined with or mediated through personal experiences with illness or observations of illness among others. This precarious character of health may also reflect the widespread circulation of biomedical terms and concepts in El Oro, if interviewees were hesitant to declare themselves truly healthy without a medical diagnosis.

Harris (2009, p. 701) emphasizes that analysis of divergences and convergences between environmental narratives voiced by diverse actors can allow investigators 'to evaluate resonances and tensions between them and to connect these storylines to broader social, historical, and contextual issues.' Making such connections can help to clarify possible future courses of action, a task with clear relevance to the objectives of this chapter. In scalar terms, many narratives of illness and pesticide risk in El Oro appear to frame these issues as individual matters involving personal behaviours and characteristics; others emphasize more structural influences on illness and pesticide exposure, invoking a variety of more-than-individual scales such as the family, the banana farm (small or large), co-operatives, nation-states and the banana-producing and -consuming worlds.

Generally speaking, narratives emphasizing the role of culture, ignorance and health-damaging individual behaviours as explanations for pesticide exposure and general ill health

in El Oro were voiced by more affluent and educated individuals, often coexisting with a desire to educate, motivate or 'save' poorer people. Mitchell-Foster (2013), similarly, documents the alleged apathy (*quemeimportismo*, or 'what-does-it-matter-to-me-ism') of poor peri-urban residents of Machala, many of whom have precarious employment in the banana industry. This apathy is used by privileged individuals in the health sector and municipal government (many of whom, I would add, have personal or professional ties to the banana industry at the level of farm ownership) to explain their poor health status. Importantly, however, *quemeimportismo* is attributed by Mitchell-Foster to social resentment stemming from endemic corruption in Machala and neglect of outlying neighbourhoods in terms of service provision (e.g. drinking water service). This neglect likely creates environmental conditions conducive to the spread of dengue's mosquito vector, while failures by residents to participate in dengue-preventing environmental clean-ups are attributed to *quemeimportismo* by elites and provide a more politically palatable explanation that avoids confronting corruption and class differences in El Oro. Elsewhere, Pigg and Pike (2001) found that the arrival of AIDS-prevention programming in Nepal was filtered through upper-class Nepalese NGO workers and their value systems, leading to outcomes such as portrayals of rural village women as lacking knowledge and awareness. These examples evoke Mitchell's (1995) call to understand how the *idea* of culture is used to accomplish political objectives, such as attributing the poverty of a particular group in society to their culture, and not to political economic structures (thereby exonerating more privileged groups from culpability for this poverty). Of relevance here is a small banana producer quoted by Isch López et al. (ND: 76) as describing a 'class struggle' [*lucha de clases*] between small and large banana farmers in El Oro, although the struggle between farmers and landless

labourers appears equally relevant to future health interventions. I would follow Harris (2011) in suggesting that the existence of individual-focused narratives in El Oro indicates – at the very least – conditions receptive to imposition of individual responsibility-focused policies and programs. Given the limited efficacy and regressive political implications of individualizing public health approaches outlined in the Introduction to this chapter, such views may present obstacles to effective and equitable public health strategies in the region. Understanding the cultural and affective dimensions of individual-focused narratives in El Oro – what do they accomplish, economically or emotionally, for the individuals holding them? – may allow public health efforts to address some of the more health-damaging aspects of neoliberal ideology.

In contrast, the range of more-than-individual scales narrated by participants indicates ways in which the framing of public health activities could resonate with structural ways in which many pesticide-exposed Orensenses make sense of their world. For example, my findings resonate with those of Isch López et al (n.d.), who found a strong sense of identity among *bananeros* (small banana producers), characterized as being ‘small, but competitive in the face of the large producers’ (p. 77). Given the prominence of small farms and small farmer co-operatives in El Oro, support for social capital in the form of co-operative ties might be one productive form of interaction (see also Elder, Zerriffi, & Le Billon, 2012, on the mechanisms by which participation in Fairtrade cooperatives may strengthen social capital).

As scale theorists have noted, in addition, the nation-state and other ‘scales of governance’ are typically the most prominent scales encountered in daily life, and in geographic inquiry (McCarthy, 2005). The continuing prominence of the nation-state as a reality in the material

and imaginative lives of Orenses is therefore relevant to the design of interventions. In particular, state formation in Ecuador, with its numerous cultures and prominent regional differences, has historically been pursued by elites as a way of advancing their economic and political interests (Whitten, 2003). Consequently, taking the scale of the Ecuadorian state for granted may obscure its role in generating inequities leading to outcomes such as pesticide exposure (see also Wainwright, 2005; Harris & Alatout, 2010). The anti-neoliberal speeches and social program spending of President Correa and the structural explanations for ill health provided by many respondents quoted above nevertheless illustrate the strong presence of more collectivist visions in Ecuador. Harris and Roa-Garcia (2013) explore the tension between ‘neoliberal’ and ‘post-neoliberal’ tendencies in Ecuadorian water governance, updating Trumper and Phillips’s (1995) earlier attribution of the ‘incomplete neoliberalization’ of Ecuador to regional differences within the country. Health action-research could engage with this ideological conflict, and seek to understand its cultural and discursive dimensions for greater effectiveness.

The coexistence of individual and structural narrative elements with respect to pesticides and health in El Oro echoes, but complicates, fault lines found in the pesticide risk perception literature, as well as in public health research and practice more generally (Frohlich, Corin & Potvin, 2002; Krieger, 2008; Rose, 1985; Shoveller & Johnson, 2006). Elsewhere in Ecuador, Mera-Orces (2001) found that attribution of responsibility for pesticide-related illness in the northern Sierra differed based on relation to the means of agricultural production: employers tended to attribute pesticide exposure to carelessness on the part of workers, and suicide using pesticides to insanity; workers, on the other hand, characterized pesticide exposure as an occupational hazard and suicide as an act of desperation.

Ethnographic studies in Costa Rica and Mexico have similarly found attribution of responsibility for pesticide exposure to depend on position in the labour process, with landless labourers, small farmers and wealthy owners of large farms tending to attribute blame differently (Barraza et al., 2011; Rios-Gonzalez et al., 2013). These pesticide-related results are consistent with Phillips' (2004) observation of individual-scale emphases on personal responsibility in responses to the 1991 cholera epidemic in coastal Ecuador, but also resistance in the form of peasant perspectives highlighting poverty as a determinant of health (in place of hygiene and personal responsibility). In Briggs' (2004) study of competing dominant and Indigenous interpretations of the same cholera pandemic's appearance in Venezuela, similarly, state-sanctioned emphases on individual responsibility for health problems were actively contested in marginalized narratives re-focusing attention on more structural causes of cholera. Narratives of Venezuelan public health officials tended to attribute blame for cholera to individual behaviours linked with Indigenous 'culture', while interpretations circulating among Indigenous communities in the region tended to indict dominant actors such as the mestizo-dominated Venezuelan state, and even global forces such as US imperialism. In one sociological analysis, the US-based environmental breast cancer movement is shown challenging the individual- and gene-focused 'dominant epidemiological paradigm' of breast cancer causation by attributing responsibility for breast cancer to environmental (chemical) factors, and the corporate interests behind their presence in the environment (Brown et al., 2006).

Interestingly, however, pesticide-health narratives of Orenses often combined *both* individual and structural elements in ways that attributed the problems of *others* to their individual or cultural characteristics, but the respondent's *own* difficulties to more structural – economic

and political – factors such as corruption in government and power differentials in the banana industry. The present analysis differs from existing scholarship, therefore, in finding this interaction of individual and structural scalar elements occurring within and not simply between individuals of different social classes. Garro (1995), similarly, found that explanations for diabetes in a Canadian Anishinaabe community typically emphasized either individual factors (e.g. diet and exercise) or more 'societal' ones such as changes to traditional food acquisition practices imposed by white colonial Canadian society, but often displayed a mix of the two elements; she thus concludes that individual and societal emphases represent poles on a continuum from which specific people draw selectively. Returning to the goal of targeting public health interventions, this complex picture suggests a need for flexible adaptive participatory methodologies (e.g. Waltner-Toews and Kay, 2005). Within the vast range of community-based methodologies, approaches such as Freirian critical pedagogy approaches (Cargo & Mercer, 2008; Freire, 1970) might best address the clear relevance of structural factors in both affecting probability of pesticide exposures, and how different groups of people make sense of them. Such approaches are increasingly recommended as a promising response to pesticide-related health impacts (Arcury, Quandt, & Dearry, 2001; Barraza et al., 2011; Galt, 2013; Orozco & Cole, 2011). They might provide a way to equitably integrate different narratives (including those originating in biomedical research) in effective solutions to health problems (Leach & Scoones, 2012). Issues debated by social scientists such as the relationship between structure and agency and the usefulness of scalar and other social theories could also be worked through in a grounded and action-oriented way. Important cautions exist, however, on the ways in which allegedly participatory work can subtly reproduce or reinforce existing power relations (Cooke &

Kothari, 2001) or use under-resourced settings to act out the frustrated desires of privileged researchers and development workers (Kapoor, 2005).¹⁰

3.6.1 Limitations

A number of limitations of this study should be considered in evaluating its theoretical and practical significance. First of all, the use of snowball and targeted sampling means that the results should not be taken as representative of El Oro. In addition, the sample size for the semi-structured interviews – 15 interviews with a total of 30 participants – is relatively small by the standards of risk perception research, though not compared to anthropological illness narrative studies (e.g. Farmer, 1994; Good, 1977; Price, 1992). Additional limitations include the multi-sited nature of the fieldwork, which did not achieve the depth of an ethnographic study focused on a single small community. In addition, I was unable to conduct interviews with some vulnerable sectors of the banana workforce – women employed on large farms, for example – meaning that their perspectives are consequently missing from my results. In part this lack can be explained by the politically charged nature of this work, as Ecuador's banana industry has been affected by negative publicity related to environmental and human rights issues on banana plantations (e.g. Pier, 2002). I was repeatedly urged by large banana farm owners not to get the 'wrong idea' about Ecuador's banana industry, and it is likely that many potential interviewees were afraid to risk their jobs by talking to me. Another limitation is that the sample I assembled through snowball sampling is more highly-educated and affluent than the majority of banana farm workers, although I did manage to conduct

¹⁰ I am in no way claiming to be exempt from such criticisms.

interviews with several day labourers. In addition, narratives may have emerged differently between the 1-on-1 semi-structured interviews, and the four interviews in which multiple people (between 2 and 9) participated. These interviews took on more of the flavour of a focus group, a research technique which tends to obtain results more rooted in interactions between participants than a 1-on-1 interview (Green and Thorogood, 2004). ‘Triangulating’ these different sources of data did not reveal any qualitative difference in the content that emerged in these four group interviews, but I did find that richer and more complete narratives would typically emerge quite quickly as participants elaborated on and challenged each other’s statements; in the one-on-one interviews, in contrast, narratives that were similar in content emerged more slowly as participants stuck more closely to the interview structure.

Studies relating locally-relevant forms of suffering to political economy have been criticized on the basis that they impose the researcher's sweeping (typically Marxist) interpretation on the words of unsuspecting participants (Hirschkind, 1994; Kleinman & Kleinman, 1991). On a related note, Marston et al. (2005) hold that the use of scaled methodologies can influence the results that are obtained, and reify particular scales as if they actually exist, independent of their social construction. By specifically asking participants to discuss people and forces 'outside of Ecuador', I may have been guilty of subtly performing particular scales. In that there is no apparent way to talk to people intelligibly without using vocabulary – including scales – that they understand, however, this was unavoidable. In addition, my observation of life in El Oro and the many occasions when participants invoked particular scales in ways that were outside of my control as an interviewer all suggest to me that the scalar elements I describe above have some currency in El Oro, and are not simply an artifact of my interviews. Specifically, individuals in El Oro – through their involvement in the

international banana commodity chain and their experiences of local power dynamics – are well aware of how political and economic power affects livelihoods and health, including through the medium of pesticide exposure. I therefore feel that the awareness of power and international linkages demonstrated by interviewees was not, in fact, an artifact of any enthusiasm on my part to 'anthropologize distress' (Kleinman & Kleinman, 1991: 276), or situate it within a particular scalar framework. While anthropologists have located indirect portrayals of structural power in 'traditional' cultural elements such as 'devil stories' and 'conspiracy theories' (Briggs, 2004; Miles, 1994; Taussig, 1980a), the Orenses quoted in this paper are rather less 'magical' in their implication of elites ('los ricos'), corrupt governments, multinational corporations, and banana consumers, as affecting their health and well-being. Psychometric risk perception research has, in fact, demonstrated that perceived risk decreases as social status and power increase, however: in industrialized countries, for example, educated, affluent, white males with control over technological risks tend to judge them as safer than do individuals with less education and money, women or people of colour (Finucane, Slovic, Mertz, Flynn, & Satterfield, 2000; Satterfield, Mertz, & Slovic, 2004; Slovic, 2000).

Cultural dimensions related to race or ethnicity – acknowledged to be highly relevant in Ecuadorian society (Whitten, 2003) – are also largely absent from my study. None of the interviewees I spoke with claimed Indigenous, Afro-Ecuadorian, Peruvian or Colombian identity (I did not ask for such information in the interview questions). Regional differences in Ecuador are accompanied by a variety of stereotypes, such as the view that Orenses and other Costeños are more hot-blooded, childlike, promiscuous and violent than highland Serranos (Phillips, 2004; Roitman, 2008). Harrison (2006) illustrates how scalar discourses

of causality for pesticide drift in California reproduced longstanding racial prejudices regarding migrant farmworkers. Unfortunately I only began to understand the centrality of race and regional identity in Ecuador near the end of my fieldwork and was unable to pursue such themes in my interviews.

While such limitations are important, however, the goal of this study was not to provide a representative mapping of all pesticide risk perceptions in El Oro, and such a task was not permitted by existing scholarship at the time the study began. Instead, I have identified some of the main fault lines and currents of thought related to pesticides and health in El Oro, and situated them in their cultural, political economic and scalar contexts. Schensul and LeCompte (2012) outline a process for moving from minimal understanding of a cultural domain through to development of a representative survey using progressively more close-ended ethnographic techniques. The present results could indeed inform design of a structured survey instrument to be administered to a representative sample.

As a caveat with respect to the relevance of this study to the overall priorities of Orenses, however, very few interviewees listed pesticide exposure among the major problems facing them (in response to a specific question), and those that did could conceivably have been telling me what they thought I wanted to hear. In addition, numerous interviewees moved the conversation quite quickly from pesticides to their difficult economic situation. As expressed pointedly by one small banana farmer with respect to my own presence in El Oro:

You people are working on questions of health and the environment, no? You can say that the environment is health, no? Part of health, they're two equal complements.

You've come to do research, an analysis of all of these problems, no? So welcome!

But the truth is, we don't concentrate on...I work, and the truth is that if I try to do something else, to improve my health, lots of time we can't because of the economic situation. (SI13)

This finding echoes other studies from Latin America which found that, among individuals who are well aware of the health risks of pesticides, poverty plays an overriding role in determining their pesticide management practices (Barraza et al., 2011; Galt, 2013; Hunt et al., 1999; Mera-Orces, 2001; Ríos-González et al., 2013). It furthermore suggests that – when given a chance by flexible ethnographic methodologies – farmers and farm workers may not share the pesticide-related preoccupations of many occupational and environmental health researchers. Research originating in disciplinary interests in pesticide epidemiology, for example, should engage with these broader social determinants of health if it is to be genuinely aligned with Orense priorities.

3.7 Conclusion: Global (health) preoccupations

As quoted in Chapter 2, Pigg advocates consideration of ‘local distributions of knowledge in relation to international distributions of knowledge’ (2001, p. 489), referring especially to scientific knowledge in postcolonial interactions. A different take on this task, however, is suggested by the strikingly similar fault lines found in Orense narratives about pesticide and health, in the international literature on pesticide risk perception (and structural vs. behavioural approaches in public health more generally), and in the pesticide epidemiology papers analyzed in Chapter 2. That is, one of the insights allowed by the comparison of these

multiple narratives is that both residents of El Oro and international public health researchers are divided on the question of whether individual / cultural /behavioural / constitutional characteristics or structural / political / economic factors are the most important causes of poor health. In addition to tracing the local and international distributions of scientific knowledge, therefore, it would be helpful to also map the local and international distributions of political orientations – individualist vs. collectivist, to use Masuda et al.'s (2012) terminology – as they relate to competing scientific traditions and concepts.

Significantly, the relative importance of structural factors in the imaginative geographies described in Chapter 2 depended prominently on how (or whether) the poverty of 'developing countries' was explained. In the present chapter, the demonstrated awareness of the world as divided into – on the one hand – global North / gringos / banana consumers / developed countries and – on the other hand – global South / Ecuadorians / banana producers / developing countries, and the relevance of this division to the lives and livelihoods of banana farmers and workers, holds major implications. Specifically, research and action should not focus solely at the individual, community or even national level without addressing the transnational flows affecting life in El Oro. As the narratives described above indicate, global elements such as banana transnationals, supermarket chains, and fairtrade and organic certifiers are already present in the narratives recounted by many Orenses. In many narratives, small banana farmers link their health to economic success, and economic success to contacts with partners in the banana-consuming world. Frundt (2009) argues for a social movement based on fairtrade bananas as a path towards fairness and justice in the global banana trade. Existing North-South linkages between banana producers, consumers

and activists provide a framework within which pesticide-health research and interventions could interact.

One final, reflexive, implication of this study's focus on global elements is suggested by the quote in which I am asked to support small banana farmers (who, they point out, are supporting me). Such interactions, and my analysis in Chapter 2, led me to constantly reflect on whether my time in El Oro was actually likely to improve the lives of the people with whom I was working. I worried that I would (probably) gain career advancement by reporting their stories to an academic community, while leaving untouched the structures creating my privilege, and their poverty. While I explore these themes further in Entr'acte 2 and the Conclusion to this dissertation, the complicity of academia with neoliberal political economic structures such as the ones keeping Orense banana workers in poverty is increasingly acknowledged (Chatterton et al., 2011; Reyes Cruz, 2012). The frequently-exploitative nature of research with Indigenous peoples (Tuhivai Smith, 1999) and in the global South (Harding, 2008) has also been well-documented. Such concerns are informing a growing critical literature on the problematic dependency of global health research on North-South resource asymmetries (Crane, 2010; Janes & Corbett, 2009; Pigg, 2013). Descriptions of the potentially exploitative nature of global health research implicate Northern researchers, but also metropolitan Southern collaborators (see also Crane, 2010b; Pigg, 2001) – a point emphasized by the class-linked attitudes towards poor, rural workers recounted by many educated Orenses in the present study. Paulo Freire's famous description (echoing Amilcar Cabral) of the role of privileged individuals in truly participatory processes as 'class suicide' (1978: 103) therefore suggests that effective and empowering pesticide-health

research and action may have larger personal and professional implications than are commonly realized.

Entr'acte 2

The preceding chapter develops recommendations specific to pesticide-health interactions in El Oro. With respect to this dissertation's overarching objective of informing more equitable and effective North-South interactions to improve population health (now typically pursued under the rubric of global health), the chapter illustrates the importance of going beyond gross geographic and scientific generalizations about particular places (as outlined in, for example, Chapter 2) and engaging with the perspectives and values of people who actually live in them. Importantly, it also echoes Harris' (2009) complication of the distinction between 'expert' and 'local' knowledges. The conflict between individual-focused and structural scalar elements in literatures on pesticide epidemiology and public health more generally is present in the pesticide-health narratives of Orenses, many of whom also have a detailed and nuanced understanding of international political economic reasons for ill health in the province. It appears likely that other geographic settings in which global health research and interventions take place are characterized by similarly complex inter-relationships of individual and structural narrative elements. Understanding these elements can help global health researchers pursue effective interventions that more clearly make sense to the people with whom they are working.

A major recommendation for global health researchers, then, would be to devote time and energy to avoiding, or at the very least treating with substantial caution, generalizations about enormous parts of the world such as 'the South'. Corollary to this is the need to avoid similar generalizations about 'the North', which points back to this dissertation's reflexive

objectives. To arrive at the implications of the previous chapter for reflexivity in global health, it is worth highlighting some paths not taken in the previous chapter. I did not draw on the full spectrum of dimensions shown to be profitably studied using narratives, for example, especially their *affective* content (Farmer, 1991; Garro and Mattingly, 2000). Risk perception research has increasingly emphasized the role of emotions – and gender – in mediating how people understand and act on risks (Slovic, 2000). In an intriguing example from El Oro, numerous participants – especially men – expressed a sense of 'losing hope', along with fatalistic sentiments about prospects for improving the difficult lot of small banana farmers embedded in inequitable market structures with dominant transnational players (small farmers with international connections in the form of fairtrade contracts, conversely, cited these as a source of motivation). Gibson-Graham (2002) has explored how portrayals (usually by men) of global forces as unstoppable and inevitable generate 'subject positions' that ensure that this is actually the case (see also Tsing, 2000, on how 'the global situation' has permeated social scientific thought in sometimes-uncritical ways). A female small farmer I interviewed, in addition, described the tendency of certain people in El Oro to drink, neglect their children and expose themselves to pesticides; she also described her own stress levels and difficulties coping with her responsibilities as a single mother in a dangerous world, and a small banana farmer in a highly unstable banana market. Thus individualizing narratives of the problems of *others* would appear to be helping this individual to make sense of her own (slightly) better-off economic position, but the same individual focus applied to herself appears to be causing significant personal distress. Exploration of the intersection of gender, scalar imaginations and understandings of health is therefore one potential avenue for further study.

Of special relevance to this dissertation's reflexive themes, however, my own identity as a white, male, North American researcher was prominent throughout my time in Ecuador. Sundberg (2003) points out that fieldwork interactions in Latin America are invariably affected, albeit in complex ways, by the social location of researchers. This includes the researcher's gender, and the history of inequitable relationships between the US and Latin America (to this I would add the more recent controversial role of Canadian mining firms in Latin America). While there are many ways in which my social location affected my fieldwork interactions, one in particular stands out. Numerous privileged individuals sought me out as a potential source of information and contacts in North America, or simply as a *gringo* accessory to their own personal or political projects. One of my more memorable key informant interviews, for example, was with the Serrano owner of a large banana farm. This individual described her Costeño employees in ways that emphasized their carelessness, ignorance, alcoholism and neglect of their children, furthermore referring to the people of Machala (and Chinese immigrants to Ecuador) as 'very dirty' [muy sucia]. She was frustrated with President Correa's requirement that banana farm owners make payments to provide health benefits for their workers, as well as his combative stance (typically with respect to the United States and 'neoliberalism') on the international stage. This frustration with President Correa's imposition of costly worker-protection measures on banana farm owners, coupled with an emphasis on individual and cultural traits as explaining pesticide exposure and other social ills, combines – in an extreme and occasionally racist manner – narrative elements I have shown above to frequently co-occur in the accounts of many Orensens. Their political implications were chillingly demonstrated when this individual informed me, matter-of-factly, that what was required in Ecuador was a coup, like the bloody one that

brought General Augusto Pinochet to power in Chile in 1973.¹¹ While it is tempting to dismiss this colourful individual as idiosyncratic, the Chilean example still is said to represent a success story for the neoliberal economic model, and 'Ecuador looks south to Chile to legitimate transformations in how the “modern” state should regard the relation between labour and capital' (Trumper & Phillips, 1995, p. 172).

My discomfort at receiving the above message about ‘dirty’ others and the need for a coup in Ecuador – delivered as if to a sympathetic ear – raises the issue of my personal involvement in the research. In another particularly surreal experience, I accepted this same individual’s invitation to an evening of playing cards, thinking that ethnographic research required such immersive experiences. The banana farm owners in attendance casually discussed the need for a ‘black list’ [lista negra] of uncooperative workers to help ensure a competent workforce. The use of such lists is a major factor highlighted in the most damning indictment of unfair working conditions in Ecuadorian banana production (Pier, 2002), the Human Rights Watch report commonly credited with increasing international scrutiny of the sector. Nevertheless, and seemingly oblivious to the ‘inherited critical paradigm’ I expend significant energy explaining in this dissertation, these individuals treated me as a safe audience.

I did not attempt to argue with them or express my distaste for their political views, as I assumed that doing so would not be very ethnographically productive. While my presence at this card game was not actually enjoyable, its resemblance to other enjoyable social experiences in my life (card games with friends, for example) is significant. There were few

¹¹ Of relevance here is that Ecuador experienced a coup attempt – or simply civil unrest, depending on who is describing it – in September, 2010.

places where I could socialize in Machala, leading to feelings of isolation that I documented in a research journal. Any evening out was, for me, a break from being cooped up in my apartment due to safety concerns and my presence in a novel social context. The presence of good coffee, a card game and people with whom to socialize – with experiences living in the US and wanting to try out their English on me – signalled a social environment more familiar to me than the majority of those contexts I encountered in El Oro. Being invited to participate in this intermingling of hospitality and extreme right-wing political views led me to reflect that such social gatherings, and the affective benefits they confer through camaraderie and laughter, likely play a role in perpetuating particular narratives. In addition, such experiences led me to reflect on a possible analogous role of social gatherings such as those associated with particular university departments or research programs. For example, narratives voiced and reinforced through these interactions might include individual-focused health promotion messages or, in contrast, the more social justice-oriented perspectives I personally find compelling.

My silence at the expression of political views I found repugnant also forced me to reflect afterward on just what I *was* doing in response to such views. As mentioned in the previous chapter, I was not sure that the research I was carrying out would contribute much to improving the situation facing pesticide-exposed Orensens (who are also exposed to a number of other health-damaging factors). Meanwhile, some of the people most eager to befriend me socially were exactly those carrying out the practices I most disagreed with. This made me wonder if there was something about me – perhaps my profession, my nationality, the colour of my skin, my assumed level of wealth – that effectively *was* in agreement with such people. That is, is it possible for others to deduce from my identity as a white male Canadian

doctoral candidate that I share common interests with wealthy, racist Ecuadorian banana farm owners who admire bloody Chilean dictators? If so, what are those interests? To hazard a guess, the sense of familiarity I felt during the social evening playing cards may indicate a set of material but also emotional benefits conferred on privileged minorities by hierarchically organized societies – ones whose general organization (capitalism, for example) is based on individualist, rather than collectivist scalar visions.

I return to such concerns in the concluding chapter of this dissertation (Chapter 5). As the implications of this reflexive discussion are quite profound with respect to the basic premises underlying global health research, however, I put them aside here in order to pursue more immediate concerns in Chapter 4. This chapter is aimed at informing decisions that must be made in the near future concerning how to proceed with a specific health research project. I therefore engage with more ‘practical’ challenges to targeting global health projects posed by factors such as political economic, ecological and chemical complexity in El Oro’s banana industry. I nevertheless keep one eye on the bigger picture I have begun to sketch with the reflexive discussion so far.

As a preparatory comment to readers, this next chapter is formatted as a single manuscript, but consists of one recognized academic approach (political ecology of health) nested within another (systematic reviewing in public health, specifically using a meta-narrative synthesis methodology). As such, the chapter could, and likely will, be separated into two different journal articles. For example, one manuscript could illustrate the relevance of political ecology to understanding and addressing health effects of globalization, and be published in a journal such as *Globalization and Health*, or *Global Public Health*; another could illustrate

methodological opportunities for political ecologists to use public health science systematic review techniques, and be published in a geography journal such as *Antipode*. For the purposes of this dissertation, however – especially the task of drawing upon the most relevant knowledges in targeting a specific intervention in Ecuador – it was more important to present it as a single manuscript, to illustrate the complementarity between the two approaches and their conjoined usefulness in informing research and action in global health.

Chapter 4: Bananas, pesticides and the political ecology of health on Ecuador's southern coast: A modified meta-narrative approach to targeting research and interventions in global health

4.1 Introduction

The need to engage with intensified global-scale economic and social change and integration (often lumped together under the term 'globalization') is increasingly recognized as a central challenge for the growing field of global health as it attempts to operationalize what consideration of a 'global scale' entails (Labonté & Spiegel, 2003). As summarized by Spiegel, Labonté, and Ostry (2004), globalization is comprised of factors such as increasing global interconnectedness through advances in travel and communication technologies; growth of global markets and progressive elimination of international barriers to trade; reduction (or reorientation) of the traditional role of the state in favour of private and civil society actors; and the spread and interpenetration of cultures worldwide, but especially the spread of American culture into all corners of the globe (extending economic trends occurring over decades and even centuries; Wallerstein, 2000). Such changes have prompted a variety of attempts at conceptualizing globalization's health effects (Brown & Labonté, 2011; Lee, 2003). A split is observable between approaches emphasizing recognition of the health benefits of globalization, typically attributed to overall economic growth (e.g. Feachem, 2001; Martens, Akin, Maud, & Mohsin, 2010); and others highlighting globalization's negative impacts on the social determinants of health (SDH, e.g. income inequality), public sector support for health services and determinants, and culturally-linked

factors such as the global homogenization ('coca-colonization') of diet (Cornia, 2001; Koivusalo, 2006; Labonté, Mohindra, & Schrecker, 2011; Labonté & Schrecker, 2007a, 2007b; Labonté & Schrecker, 2007; Spiegel et al., 2004).

In likely the most comprehensive analysis to date of pathways leading from globalization to health outcomes, the Globalization Knowledge Network (GKN) of the WHO's Commission on the Social Determinants of Health (CSDH) outlined an approach accounting for the lengthy causal pathways involved, as well as the uneven nature of 'evidence' available to characterize them. This approach involves the assembly of 'narrative syntheses' incorporating hundreds of observations in support of deductive claims about causal pathways (Labonté & Schrecker, 2006, p. 10). These observations come from studies with different disciplinary and scalar foci, and 'it is necessary to recognize that rarely, if ever, can conclusions be stated with the degree of confidence in findings that is possible in a laboratory situation or even in many epidemiological study designs, where almost all variables can be controlled'. Using this approach, the GKN conducted a sophisticated and wide-ranging analysis of pathways from globalization to health outcomes, but a number of factors limit its applicability in targeting specific global health research projects and interventions. Both the work of the GKN and earlier work on globalization and health (Koivusalo, 2006; Spiegel et al., 2004) focus explicitly on *economic* globalization, stating that other facets (increased global interconnectedness, cultural homogenization, etc.) are largely driven by economics. While this concentration on economic factors generates important insights, consideration of other dimensions remains critical to fully appreciating specific interactions. In this regard, subsequent work has highlighted how local cultural dimensions are especially relevant to understanding the specific manifestations of

globalization's health impacts in specific contexts (Brown & Labonté, 2011). In particular, exploring the cultural dimensions of globalization may even help to identify sites of resistance to globalization's health-damaging economic manifestations. Accordingly, the GKN's perceptive take on international political economy and health appears to require further operationalization to be of greatest value for application to decision-making at scales smaller than the global level (how a specific research team might target interventions to achieve maximum health equity goals in complex situations, for example). As environmental considerations were somewhat secondary to the GKN's focus on *social* determinants of health, furthermore, this is an area where such attention is particularly warranted.

Brown and Labonté (2011) provide more recent methodological guidance for studying the effects of globalization on health, advocating a 'dialectical' approach that goes beyond polarized good or bad characterizations, and that employs ethnographic methods to show how aspects of globalization are linked in nuanced and place-specific ways to health. The authors conclude that 'it is by looking at these intersections, that we can have a better chance of understanding what globalization is, how its processes work, and how these processes transform our lives in profound and meaningful ways – both collectively and in particular settings' (p. 11). Importantly, however, this approach appears to stop well short of any consideration that 'we' (researchers, communities, etc.) might in turn play a role in transforming the processes of globalization that are affecting health. Such considerations of how the subjects affected by globalization can be so engaged may benefit from further theorizing, especially considering strong normative calls for action to promote health equity.

In this chapter, I engage with the challenge of synthesizing existing knowledge on pathways from global-scale forces to health outcomes, so that it can inform ways of intervening to promote health equity. In doing so, I specifically focus on the problem of occupational and environmental pesticide exposure in Ecuador's banana-producing El Oro province. To address this knowledge synthesis challenge, I present an exploratory modification of Greenhalgh et al.'s (2005) *meta-narrative synthesis* approach, supplemented by ethnographic fieldwork. In assembling evidence from different knowledge traditions ('storylines') describing aspects of this complex-systemic problem, I then explore in detail one such storyline with particular relevance to characterizing the system in a comprehensive, reflexive and action-oriented way: a *political ecology of health* approach. The chapter is organized as follows. I first outline the meta-narrative synthesis approach and how I modified it for the present study. Next I briefly describe some of the most prominent storylines I encountered in mapping relevant literatures. I then present a synthesis of evidence organized according to a political ecology of health storyline. Finally, I discuss the findings as they relate to the challenge of targeting global health interventions in the context of complexly-interrelated environmental and social pathways from globalization to health outcomes. I also envision a strategy by which an interdisciplinary team could pursue a more in-depth meta-narrative synthesis on this topic.

Based on this synthesis, I conclude that pesticide exposures in El Oro are produced by the combined influence of: biological effects of specific chemicals used as pesticides, as revealed through epidemiologic and toxicologic studies; working conditions, labour relations and the national and international labour markets that condition them; highly unequal banana market dynamics including major multinational and Ecuadorian corporate players,

incentivizing intensive agro-industrial production methods; the ‘environmental rootedness’ of banana production (Grossman, 1998), in which ‘actors’ such as precipitation, soil, and fungal pathogens play major roles in determining how bananas are produced; cultural considerations such as the scalar narratives described in the previous chapter, especially how the individualizing ‘idea of culture’ serves to naturalize inequitable political economic realities; and finally, how science affects (or fails to affect) health policy in Ecuador. Based on this complex picture, I end by recommending that health researchers wishing to reduce pesticide exposure in El Oro and improve population health more generally employ rigorous and reflexive participatory methodologies, and pursue knowledge-to-action activities that draw on transnational linkages and solidarity.

4.2 Methodology

4.2.1 Context

Addressing the numerous health effects of agriculture in the contemporary ‘globalized’ era is increasingly recognized as a pressing but challenging task for public health researchers and practitioners (Dixon, Omwega, Friel, Burns, Donati, & Carlisle, 2007; Hawkesworth et al., 2010; Neff, Palmer, McKenzie, & Lawrence, 2009). Ecuador’s prominence in agro-industrial production of bananas, commonly ranked as the most consumed fruit in the world, makes it an especially relevant setting in which to explore this challenge. As previously mentioned, the vulnerability of banana monocultures to plant pathogens such as the devastating and

constantly-evolving Sigatoka Negra fungus (*mycosphaerella fijiensis*) combines with the dynamics of banana and labour markets to produce occupational and environmental exposure to a cocktail of pesticides, including insecticides, fungicides, nematicides and herbicides (Harari et al., 2011; Henriques et al., 1997; Martínez Valle, 2004; Pier, 2002; Striffler, 2002). Further to Chapter 3's discussion of responses to exposure by those directly exposed, attempts by the Ecuadorian state to regulate this situation encounter local barriers such as a lack of enforcement capacity, as well as entrenched political interests in the form of politically influential banana farm owners with an interest in preventing enforcement of existing occupational and environmental laws (Harari et al., 2011; Striffler, 2009). Furthermore, the global nature of the banana industry means that Ecuador is limited in its ability to protect health and the environment in ways that might increase production costs, as large banana multinational and Northern supermarket chains have repeatedly demonstrated their ability to move around Latin America – and foil attempts by governments, labour movements and plant pathogens in individual countries to cut into their profits (Fruendt, 2009; Glover & Larrea Maldonado, 1991; Striffler & Moberg, 2003). The mobility of capital in search of advantageous labour market and regulatory conditions is considered a hallmark of contemporary globalization (Labonté et al., 2011), but the banana industry has exhibited this dynamic for over a century (Brown, 2013; Hough, 2012). The early-20th century phenomenon of 'banana republics' under the sway of large transnational fruit companies, for example, foreshadowed the present ability of corporations to sue non-compliant governments under the terms of multilateral trade agreements.

The complexity of banana production is summarized by Jansen (2004, p. 154) as involving 'yields, pests, pesticide producers, pesticides, biological control, population dynamics of pests and natural enemies, workers, environmental movements, consumers, retailers/buyers, soils, climate, pesticide registrars, certifying consultants, GPS flight-control systems, local residents, laws and so on'. The complex and changing composition of the chemical cocktail used in banana production represents a challenge to targeting studies, as it is not obvious which chemicals to examine (singly or in combination), or which potential health outcomes (with different latency periods). Assessing such causal pathways, furthermore, is methodologically difficult from an epidemiologic point of view, in light of the challenges posed by complex chemical mixtures, confounders stemming from the fraught life histories of workers and farmers, and uncooperative farm owners operating in a climate of secrecy and unlikely to facilitate epidemiology studies (Melo & Wolf, 2005). Finally, the degree to which a particular research effort is likely to inform actual policy or social change is also not easy to determine in advance.

4.2.2 Meta-narrative synthesis

Recent years have seen the development of several methods for applying diverse bodies of evidence from multiple disciplines to the challenge of making decisions in healthcare and health policy (Curran, Burchardt, Knapp, McDaid, & Li, 2007; Dixon-Woods et al., 2006; Greenhalgh & Peacock, 2005; Humphreys et al., 2009; Karunanathan, Wolfson, Bergman, Beland, & Hogan, 2009; O'Neill, Jinks, & Ong, 2007; Pawson, Greenhalgh, Harvey, & Walshe, 2005). Bringing multiple perspectives to bear on the problem at hand is thought to

represent an improvement over knowledge synthesis techniques (an epidemiologic meta-analysis, for example) whose narrow exclusion criteria and quality assessment standards may ‘disqualify’ types of knowledge of relevance to answering the complex question. As outlined by Greenhalgh et al. (2005), meta-narrative synthesis (MNS) is a systematic review methodology developed to grapple with complex questions and inform decision-making through review of ‘evidence’ provided by different knowledge systems (e.g. academic disciplines). Briefly, it begins with a fairly open-ended question and mobilizes a multi-disciplinary team to ‘map’ areas of knowledge relevant to answering the question. These knowledge areas are then characterized with respect to their underlying paradigm (Kuhn, 1962), typical research methods and standards for assessing research quality. Finally, relevant content from each knowledge area is synthesized as it pertains to the original research question (which, by this point, may have evolved). An additional component of this synthesis step involves critically examining the implications of contradictory answers to the research question provided by different research traditions. The resulting synthesis describes multiple ‘storylines’ (also referred to as ‘meta-narratives’) attempting to answer the research question and characterized as to their underlying assumptions, methods and standards of research quality.

The research question guiding the present analysis is as follows: ‘What pathways to health outcomes are associated with pesticide use in export-based banana production in El Oro?’ This differs from the research questions typically used to begin meta-narrative syntheses in two ways: first, it is focused on a specific geographic location; and second, it involves long causal pathways interacting in complex systemic ways to produce a given health outcome,

thereby comprising numerous sub-questions corresponding to the specific steps in the causal pathways. I therefore modified the meta-narrative review methodology by geographically restricting the reviewed evidence to sources dealing specifically with Ecuador. This geographic restriction had the secondary effect of helping to clarify how different storylines are distributed geographically in academic literatures. I also supplemented the meta-narrative review with eight months of ethnographic fieldwork in Ecuador carried out over a four-year period. One output of this fieldwork is the previous chapter on pesticide risk perception in El Oro, while I also made use of time in the field to acquire texts and other resources not available from Canada (or even in large cities in Ecuador). An additional benefit of the use of ethnographic methods is that the data I collected represents a very locally-grounded representation of perspectives from affected individuals in El Oro; in addition, I developed personal relationships and participated in various meetings that helped to inform the present synthesis. This begins to counter the tendency of much evidence-based decision-making to neglect the values and lived experiences of those most affected by it (Mykhalovskiy et al., 2008), and I end the paper by discussing further actions that could help in this respect.

The evidence I review in this paper is limited by the topics that are treated in existing literature on Ecuador, the banana industry, pesticides and their health effects. For these reasons, the strength of evidence for different ‘links’ in the causal chains I outline varies, in keeping with Labonté and Schrecker’s (2006) comments regarding the methodological challenges of describing pathways from globalization to health outcomes. I acquired documents for analysis over a five-year period through a combination of database searches (Web of Science, Google, Google Scholar, Ovid/Medline; Lilacs); following references in

documents I had read; tracing references forward using Web of Science and Google Scholar; physical searching of libraries and bookstores in Canada and Ecuador; and personal recommendations from colleagues and research participants in my fieldwork in El Oro. My choice of which documents to review and incorporate into this analysis was also guided by my own sense – informed by input from numerous academic and non-academic experts – of whether they contributed to describing pathways linking agro-industrial banana production and health outcomes in Ecuador. Such decisions drew on my evolving understanding of the situation over the course of my five-year immersion in it. Given this unorthodox literature-gathering strategy (at least by health sciences systematic review standards), documenting total search results and numbers of included and excluded documents was impractical, as were multi-reviewer assessment of inclusion decisions and calculations of inter-rater reliability. In the Discussion section I explore prospects for building on the present effort using such systematic review strategies. With respect to Greenhalgh et al.'s (2005) MNS methods paper, my search strategy corresponds most closely to the first step in the 'Search phase': 'Initial search led by intuition, informal networking and 'browsing', with a goal of mapping the diversity of perspectives and approaches' (p. 420). Greenhalgh & Peacock (2005) explain that this approach may, in many situations, be more efficient than protocol-driven search strategies. While the Search phase is typically preceded by a 'Planning phase', in this case the exploratory nature of my study means that it is intended to inform ongoing planning of a larger, methodologically challenging MNS, and the research program within which it is embedded. Specifically, my project is linked to an ongoing CIHR-funded research program on the effects of the global food system on health in Ecuador and Canada; the

present study benefited from early consultations related to this research program, and is also intended to inform its progress.

Importantly, a full MNS approach also involves characterizing the different knowledge traditions as to their epistemological basis (Kuhnian paradigm), typical methodological toolkit, and standards for evaluating research quality. This step draws on the expertise of a multi-disciplinary team with expertise in the different knowledge areas; as a single graduate student (albeit one focusing on this topic for six years), therefore, my characterization of the different knowledge areas is more uneven. As understanding the pathways to health outcomes from complex global-scale entities such as the global food system represents a novel challenge, my exploratory modification of the MNS methodology is intended to serve as a pilot study to inform the more resource-intensive synthesis described immediately above. In addition, the larger MNS is also intended to guide the planning and conduct of a pesticide epidemiology project and related knowledge translation activities in Ecuador's banana zone. My study provides a baseline for initial action that can be updated with findings from a more resource-intensive MNS effort, in keeping with an 'adaptive management' approach to community-based health research (Waltner-Toews & Kay, 2005). I therefore carry out a partial and non-systematic application of the latter stages of Greenhalgh et al.'s methodology (Mapping, Appraisal, Synthesis, Recommendations). This chapter is an attempt at tracing the contours of a big-picture scenario, with some areas of that picture described more completely than others. The language I use to describe this picture is intentionally calibrated to reflect its provisional and incomplete nature, and I return to the implications of this approach for action and further research in the Discussion section.

4.3 Results

4.3.1 Storylines

While Greenhalgh et al. (2005) were able to identify 13 different meta-narratives or storylines about their topic (diffusion of innovation), the task of identifying different storylines on pathways to pesticide exposure in El Oro is complicated by the numerous sub-questions embedded in the causal pathways from global forces to health outcomes. As an example, multiple competing storylines are evident in literature on whether individual behaviours or structural factors are more important in determining pesticide exposure of workers and farmers (Galt, 2013; Murray & Taylor, 2000; Chapter 3 of this dissertation); with respect to one such structural factor, for example, different storylines can be identified regarding whether market-based certifications are effective means of promoting ‘sustainability’ (and, by extension, reduced workplace pesticide exposures) in banana farming (Melo & Wolf, 2005; Melo & Wolf, 2007; UNEP, 2002). I therefore restrict my analysis here to highlighting some of the prominent currents of thought I detected in the reviewed sources. Selection of these currents of thought was done opportunistically, based on narratives that struck me as interesting from a discourse-analytic point of view (in section 1.5.1 I outlined discursively important features of texts, following Johnstone’s, 2007, heuristic for discourse analysis). I present them here to illustrate the discursive complexity

involved in answering this particular research question, but a full meta-narrative synthesis would employ a more systematic approach to identifying and characterizing storylines.

Two knowledge traditions of special relevance to the biological effects of pesticides are represented by toxicology and epidemiology (often combined in ‘weight-of-evidence’ summaries of the health effects of a particular chemical; Boyes et al., 2007). A toxicology storyline is characterized by a positivist paradigm and focuses on the interaction of laboratory animals or living cells with specific chemicals, using experimental methods and statistical analyses to explore dose-response relationships (Calabrese & Baldwin, 2003). While epidemiology often builds on toxicology research and also employs a positivist paradigm, the analysis in Chapter 2 shows epidemiology to be characterized by multiple storylines, often featuring epidemiologists in different roles vis-à-vis the conduct of ‘objective’ scientific research, the improvement of public health, and engagement with some of the social and political obstacles to doing so (Shim & Thomson, 2010). With respect to pesticide epidemiology in Latin America, furthermore, these storylines are often translated to North-South encounters in which unexplained poverty justifies health research and interventions (carried out by ‘characters’ such as epidemiologists, physicians and health promoters) in generalizable ‘developing country’ sites. As I discuss in Chapter 2, however, some pesticide studies done in Ecuador feature well-developed histories and a more socially-engaged role for epidemiology. Such studies often also include social movements as possible ‘protagonists’ in the storyline of responding to pesticides. In addition, epidemiology carried out in the Latin American social medicine / collective health / critical epidemiology traditions represents a distinct storyline (Birn, 2011) that has been applied to the health

effects of pesticides in banana production in Ecuador (Breilh, Campaña, & Maldonado, 2007). This storyline originated in the co-evolution of health sciences and structural inequalities in Latin America and takes those structural inequalities as a starting point for understanding how health outcomes are ‘socially determined’. It does this using some methodologies drawn from mainstream (Northern) epidemiology, but explicitly rejecting some of its epistemological assumptions such as the ‘web of causation’ and portrayals of risk factors as randomly or probabilistically distributed (Barreto, 2004; Breilh, 2008).

Multiple storylines were also evident in literature describing labour relations and banana market dynamics. First, much Ecuadorian work on the political economy of bananas is explicitly informed by dependency theory and other Marxist-inspired historical materialist traditions. Marx’s *Capital* (1867/1992), which provides the epistemological foundation of these works, uses micro-economic analysis of the nature of commodities in capitalist societies to develop concepts such as ‘commodity fetishism’ and ‘extraction of surplus value’ from labour by capital(ists). Work building on such concepts departs from more positivist approaches in emphasizing the role of power differentials (specifically those associated with capitalism) in structuring both inequities in society, and ways of thinking about those inequities. Words such as ‘neoliberal’, ‘capital’ and ‘labour’ are therefore common in these works, as is recognition of colonial and neo-colonial international relations linking Ecuador with the global North. These approaches generally share the ‘critical paradigm’ I refer to at various times throughout this dissertation. They typically start from the premise that society is structured by exploitative capitalist dynamics, and often seek evidence of this exploitation, or work out its details in novel contexts (see also Schegloff, 1997; Latour, 2005 for cautions

against the blanket application of Marxist concepts to social analysis). Ethnographic work done in Ecuador by North American anthropologists and my own analysis in Chapter 3 tend to also critically examine the workings of capitalist political economy, albeit with less overt use of Marxist vocabulary and more attention to issues of identity, culture and discourse. The major sociological intervention in this area – Frundt’s (2009) book assessing prospects for worker-farmer-consumer alliances around fairtrade bananas – takes development theory and the sociology of social movements as its theoretical basis, and is, significantly, hopeful about the prospects for improving social and environmental conditions within the current macroeconomic climate.

The view that banana production has generated social goods through economic growth is actually only present in a small number of the reviewed sources. This storyline also contains different types of characters: Roberts (2009), for example, uses personal anecdote and biography to emphasize the role of entrepreneurial spirit and leadership in Ecuador’s continuing dominance of world banana exports. Alternately, work commissioned by a small, organic banana producer organization appears to look favorably on overall growth in demand for bananas, but also to promote alternative market mechanisms to protect small producers and the environment (Burgos Villamar, 2004). A report commissioned by the United Nations Environment Programme (UNEP, 2002) is notable in that – unlike the majority of critical political economy studies of the banana sector described above – it describes Ecuador’s experience with structural adjustment in the 1980s and 1990s in neutral, technical language. Structural adjustment, imposed on LMIC governments by international financial institutions such as the World Bank and International Monetary Fund, is one of the hallmarks of

neoliberalism (Harvey, 2007). The UNEP report, however, describes it in language that makes it look like a routine, agent-less response to the failures of import substitution policies (allied with the dependency-theory economics informing some of the studies described above):

Structural adjustment policies have arisen in Latin America in response to the grave economic crisis that many countries faced in the 1980s. In response to the explosion of external debt, the first measures for structural adjustment and policies for economic stabilization were enacted. (p. 9)

Importantly, no mention is made – in a report commissioned by an international organization – of the role of any external actors in Ecuador’s structural adjustment. This ‘storyline’ therefore presents particular aspects of globalization as inevitable in the face of responsible economic analysis and policymaking, in keeping with the view that ‘there is no alternative’ to globalization (see also Fairclough, 2003; Koivusalo, 2006). Interestingly, this study also cites market-based certification systems as ‘among the most effective’ measures for reducing the environmental impact of banana production (UNEP, 2002, p. 25), suggesting a storyline in which market liberalization is inevitable, and market mechanisms can be used to correct its negative impacts (although the same report later advocates ‘command and control policies’ to protect the environment (p. 62), perhaps suggesting that not all of its authors and editors were on the same page).¹²

While Greenhalgh et al. (2005) describe conflict between storylines as ‘higher order data’ which can be analyzed and then used in informing the knowledge user’s final decision, this

¹² This report was carried out for UNEP by a Quito-based environmental law NGO.

borders on a disingenuous radical relativist position that counts all different knowledges as equally valid. Without claiming that any perspective is ‘objectively’ best – a ‘conquering gaze from nowhere’ (Haraway, 1988, p. 581) – it is nevertheless possible and necessary to decide on approaches that are most appropriate to the current situation. Indeed, Greenhalgh et al.'s (2004) lengthy report on the development and initial application of the MNS methodology involves construction of a single conceptual model synthesizing results of different storylines related to their review’s topic. While the authors emphasize the limitations of this model in terms of predictive value, they nevertheless make decisions about which causal pathways are suitable for inclusion in *their* model, rather than simply describing the multiple models they encounter in different knowledge traditions. In the following section, therefore, I describe one particularly comprehensive storyline in more detail, using it to organize the synthesis of evidence.

4.3.2 Political ecology of health overview

A research tradition with a particularly well-developed set of concepts and methods for describing situations such as pesticide exposure in Ecuadorian banana production is *political ecology*, defined in its early stages as combining ‘the concerns of ecology and a broadly defined political economy’ (Blaikie & Brookfield, 1987, p. 17). For decades, work in anthropology, human geography, development studies, environmental studies and other interdisciplinary fields has attempted to explain environmental change as related to power-laden social dynamics. In Robbins’ (2012) recent overview, political ecology is described as a reaction to *apolitical* ecologies that ignored such power dynamics. Sundberg and Dempsey

(2014, p. 175) describe political ecology as ‘a political stance toward the world and, therefore, research’. Robbins similarly holds political ecology to be less a methodology than ‘a *community of practice* and...a *certain kind of text*’ (2012, p. 5, emphasis in original).

Specifically, political ecology texts:

address the condition of change of social/environmental systems, with explicit consideration of relations of power. Political ecology, moreover, explores these social and environmental changes with an understanding that there are better, less coercive, less exploitative and more sustainable ways of doing things (p. 20).

Robbins also highlights political ecology’s methodological pluralism, while acknowledging the pre-eminence of ethnographic case studies in the field’s early decades. Early political ecology drew heavily on political economy, while more recent developments (Escobar, 1999a; Mann, 2009; Peet & Watts, 2004) have emphasized the role of discourse and subjectivities in struggles over politics and the environment. A key concern in political ecology is *scale* (Kurtz, 2003; Neumann, 2009; Rangan & Kull, 2009), initially viewed as a heuristic for locating relevant actors and forces (e.g. global forces impacting local decision-making) and more recently as a socially constructed locus of struggle in environmental conflicts (e.g. framing pesticide drift as a failure of California state policy rather than individual farmer irresponsibility; Harrison, 2006). Work in feminist political ecology has also incorporated a strong focus on the gendered distribution of access to environmental resources (and of harms from environmental contamination), gendered environmental knowledges, and women’s environmental movements. A primary recent concern is how the formation of gender (and other forms of) identity is linked to human-environment

relationships more generally (Hawkins & Ojeda, 2011; Rocheleau, Thomas-Slayter, & Wangari, 2013), and also forms of social difference such as race and class (Mollett & Faria, 2013). Finally, Goldman, Nadasdy, and Turner (2011) highlight the social construction of even the scientific and social scientific knowledges through which social-environmental systems and struggles are known, though without giving up on the goal of using such situated knowledges to achieve goals related to equity and sustainability.

A smaller group of scholars has attempted to extend analysis of the ways in which political economy and ecology interact to include the human health implications of those interactions, describing such efforts as *political ecology of disease* (Mayer, 1996; Turshen, 1977) or *political ecology of health* approaches (Baer, 1996; King, 2010; Richmond, Elliott, Matthews, & Elliott, 2005; see also Janes & Chuluundorj, 2004, for a 'social ecology' approach to maternal mortality). Turshen's (1977) political ecology of disease analysis pre-dates Blaikie and Brookfield's (1987) foundational work by a full decade and is firmly rooted in Marxist political economy, linking clinical biomedical paradigms to the capitalist social relations within which they developed. In contributions to King and Crews' (2013) recent edited volume, in contrast, development of conceptual models appropriate to complex systems such as infectious disease dynamics and smallholder agriculture in frontier settings suggests a policy-focused, technocratic approach in which scientific knowledge is applied by experts to the solving of real-world problems. More generally, Crews and King (2013, p. 9) focus on 'the ecological dimensions of health and vulnerability, the socio-political dimensions of human health, and the intersections between the ecological and social dimensions of health' in ways that also incorporate the role of discourse in such interactions.

Within the voluminous political ecology literature, several studies are particularly relevant to understanding the multi-dimensional and multi-scalar causes of pesticide exposure. An early but still relevant treatment of pesticide exposure in Costa Rican banana production is Thrupp's (1988) doctoral dissertation, as well as several peer-reviewed publications stemming from it. Thrupp combines agroecology, political economy and decision theory to understand the multiple causes of pesticide misuse, focusing on environmental impacts but also human health effects such as sterility caused by the nematicide dibromochloropropane (DBCP). A central conclusion of Thrupp's analysis is that such impacts have higher-level causes such as differential access to scientific information by multinational fruit and chemical companies, North and Central American governments, and on-farm actors in Costa Rica. Galt's (2009) exploration of pesticide use among Costa Rican vegetable farmers found that decisions over whether and how carefully to apply pesticides were best explained with an eye to structural constraints including different regimes of pesticide residue testing required by international and domestic markets. As a follow-up to this empirical work, Galt (2013) presents a conceptual model for understanding the 'complex subjectivities' of farmers faced with pesticide use decisions, integrating personal decision-making with structural constraints. Additional relevant work on bananas in political ecology includes Grossman's (1998) book-length focus on eastern Caribbean banana farmers, which emphasizes the interaction of farmers' individuality and creativity with structural constraints related to international markets and trade regimes. Andreatta (1997), in addition, links pesticide-related health effects of banana production in St. Vincent and the Grenadines to power structures in the international banana industry. One Ecuadorian treatment of the political ecology of bananas, focusing on small producers in El Oro, remains an unfinished manuscript (Isch

López, Rodríguez, & Carrión, n.d.). Preliminary results of this study, however, show the inter-relationships of banana production type (conventional vs. organic) with environmental consciousness and gendered forms of identity, mediated through spatial dimensions of banana production and influenced by international forces such as organic certification requirements.

In light of this demonstrated usefulness of the political ecology framework to understanding situations such as pesticide exposure in Ecuadorian banana production, I next synthesize evidence to characterize this situation in keeping with Robbins' summary that political ecologies 'track winners and losers to understand the persistent structures of winning and losing; are narrated using human-non-human dialectics; start from, or end in, a contradiction; [and] simultaneously make claims about the state of nature and claims about claims about the state of nature' (Robbins, 2012, p. 87). This way of describing human-environment interactions helped me to organize the present account into six main domains I observed in the reviewed literature (see Figure 2 for a schematic representation of this storyline): a) the health effects of pesticides; b) labour relations and labour market dynamics affecting the probability of pesticide exposure; c) dynamics of the banana trade in Ecuadorian and global contexts; d) environmental dimensions of banana production and pesticide use; e) cultural dimensions of 'Orense' (El Oro's) society and their interactions with political economic and environmental factors; and f) aspects of the relationship between health science, policy and social change in Ecuador.

4.3.2.1 Agrochemicals and their health effects

A small number of studies employing epidemiologic methods have been carried out on the health effects of pesticides used in banana farming in Ecuador. These studies have all been done by Ecuadorian investigators, and are published in Spanish; they have not been formatted for peer-reviewed publication and are typically available as reports (and sometimes no longer available at all). Puente (2003, cited in Burgos, 2004) compared causes of death in El Oro's El Guabo cantón (the leading banana producing cantón in Ecuador) with the Ecuadorian and El Oro averages, finding suggestive excesses of perinatal abnormalities. Puente then compared these leading causes of death with the known effects of pesticides in use in banana production, again finding suggestive correspondences. An ecological study (i.e. one employing group-level comparisons, rather than individual-level) carried out by civil society groups in 2007 in the province of Guayas compared health conditions in a community adjacent to banana farms with those in a comparable community outside of the range of drift from aerial fumigation (Maldonado & Martínez, 2007). Suggestive findings included the much higher levels of birth defects, and higher proportion of female children, in the community with exposure to pesticides used in banana farming (endocrine disruption is a suspected effect of numerous pesticides). A contemporaneous study (Breilh et al., 2007) focused on 190 banana fumigation pilots, phytosanitary technicians and workers responsible for refilling fumigation plane tanks with pesticides in the three main banana-producing provinces of the coastal region (El Oro, Guayas and Los Ríos). This study involved interviews to determine self-reported health impacts; analysis of blood samples for biomarkers of pesticide exposure; and psychological assessments. Findings included elevated

levels of self-reported illnesses with plausible linkages to pesticides; elevated levels of several biomarkers of pesticide exposure; and elevated levels of psychological distress, possibly related to the effects of neurotoxic pesticides used in banana production. In addition, an undergraduate thesis written by three students at the Universidad Técnica de Machala (Jadan Delgado, Quirola Quezada, & Vivanco Mijas, 2011) also reports on interviews and analysis of blood samples conducted among 28 workers on banana farms near Machala. Workers in this study attributed health effects such as nausea, eye irritation, headaches, skin problems, fatigue, sore throat and vomiting to pesticide exposure. Blood samples failed to reveal abnormalities in blood cholinesterase levels, however, a common biomarker of exposure to neurotoxic organophosphate and carbamate pesticides (but not to other common pesticides used in banana production). A book published by civil society groups, including a national worker and peasant organization, summarizes several health studies carried out over a period of years (Harari et al., 2011). These studies are said to have demonstrated neurological, dermatological, reproductive and other health effects of pesticides used in Ecuadorian banana production. In addition, the book documents use of a fluorescent tracer technique showing pesticide exposure occurring even when banana farm workers and fumigation pilots employed personal protective equipment. Finally, litigants in the lawsuit being filed by former banana workers in several Latin American countries against Dole and Dow Chemical (Boix & Bohme, 2012; UROCAL, FENACLE, & FCTO, n.d.-b) include some living in El Oro and other parts of the Ecuadorian coast, attesting to the continuing experience of reproductive effects (i.e. sterility in men) of the now-banned nematicide DBCP. Based on my fieldnotes and the chemicals identified in the above studies, Appendix D lists pesticides currently used in banana production in El Oro, as well as some that are no

longer in use but may still be epidemiologically relevant. While DBCP is no longer in use, for example, it has likely effects over the life course of men who were exposed decades ago. It also lists known and suspected health impacts of each chemical, using the Pesticides Action Network's compilation of 'weight of evidence' reviews of epidemiology and toxicology (Kegley, Hill, Orme, & Choi, 2010).

The literature synthesized in this sub-section suggests that researchers seeking to address the health effects of pesticides in Ecuadorian banana production are faced with a likely large burden of disease, but the preliminary study designs employed so far do not constitute proof of causation by epidemiologic 'hierarchy of evidence' standards (Bradford Hill, 1965; Rychetnik, Frommer, Hawe, & Shiell, 2002). The setting in El Oro presents a 'wealth' of exposure contexts, as well as a wide variety of chemicals. Deciding on specific epidemiologic studies will likely require review of existing epidemiologic and toxicologic evidence in other settings, consultation with local affected communities, and possibly algorithms for prioritizing chemicals for epidemiologic studies (e.g. Valcke et al., 2005). The special challenges posed by complex mixtures, long latency periods, difficulties in exposure assessment, politically charged settings and numerous confounders may represent an obstacle to carrying out epidemiologic studies in this area, but also opportunities for methodological innovation (e.g. Breilh et al., 2012).

4.3.2.2 Labour relations and labour market dynamics

As outlined in an additional body of literature, these probable health effects are related to

unequal power relations in the Ecuadorian banana industry, especially with respect to working conditions. This work includes some of the health studies described in the previous section, as Harari et al. (2011) link unsafe working conditions to the continuing lack of strong unions in Ecuador's banana sector, a problem to which co-optation of labour leaders and intimidation by banana farm owners is said to contribute. This same study also documents exposure of houses, schools and communities near banana plantations, which the authors attribute to both non-observance of relevant labour and environmental regulations, and the warm Ecuadorian climate's effect on factors such as housing construction. Breilh et al. (2007) similarly point out the 'exploitation' faced by fumigation pilots, phytosanitary technicians and employees responsible for loading pesticides into fumigation planes. These authors group together adverse working conditions such as low pay, long hours, lack of vacation time, and exposure of workers to pesticides. Pilots are exposed to pesticides when they permeate into the allegedly closed cabins of their planes, while technicians must direct fumigations from on the ground within range of the falling pesticides, and often must re-enter freshly-sprayed fields before the appropriate re-entry period has elapsed.

Complementing these studies are others that focus on working conditions, but not necessarily on their health implications. These studies are typically done by Ecuadorian researchers employing social science and political economy methods and frameworks, and are published in Spanish. Cepeda's (2011) summary of labour market dynamics in banana production portrays farm owners attempting to evade legal worker protection measures, and block the establishment of unions. This study highlights a number of factors through which a 'minor part of society' accomplishes the 'exploitation of the workforce' (p. 94). These include the

use of various categories of worker, corresponding to differing degrees of stability and bargaining power. Seasonal variations in demand for bananas, and also in availability of migrant workers from the Sierra, lead to variations in the size of the unemployed labour force. Such migrants (and Peruvian workers in El Oro), furthermore, typically receive lower salaries. These flexible arrangements are said to be facilitated by a contract-based hiring system, in which workers gather in urban centres early each morning and some are selected to work by ‘captains’. One of the main results of such a system is the precarious nature of banana farm work, and the inability of workers to organize for either better pay or safer working conditions (including pesticide safety measures).

A study involving interviews with banana farm workers in the provinces of Los Ríos and Guayas also illustrates some of the factors influencing worker health and safety in general, and pesticide safety more specifically (SIPAE, Broederlijk Delen, & Oxfam, 2012). In particular, the lack of land ownership by most workers limits their livelihood options and makes work on large banana farms – however dangerous, insecure and poorly-paid it might be – a necessary evil. This study differs from earlier accounts in showing relatively good compliance with Ecuadorian labour legislation regarding salaries and contracts on plantations owned by major banana exporters (especially Dole). This situation was considerably worse on plantations not owned by the major exporters, but nevertheless selling bananas to them under contract (the report estimated that this category included the majority of workers) and without any obligation for independent suppliers to maintain standards. A majority of workers employed by the large Ecuadorian-owned exporters (Bonita and Favorita) reported not being represented by a worker health and safety committee, while 100% of Dole

employees reported having such committees at their workplaces, as is currently required by law. A majority of Dole employees reported the presence of a union at the workplace, while employees of Bonita and Favorita reported either no union, or a company-backed or 'phantom' union. With specific respect to pesticide safety, workers on all categories of farms reported being left in the field during aerial fumigations, although Dole's technicians disputed this claim and cited an elaborate company policy designed to avoid such exposures. Provision of personal protective equipment ranged from non-existent on farms owned by Bonita to 100% on Dole's farms, with a range of figures in between observed on smaller farms. Worker protection measures therefore appear to differ by category and size of farm, with better observance on those farms likely to be subject to public, national or international scrutiny. These sources provide updates on earlier work by both Ecuadorian (Larrea, Espinosa, & Charvet, 1987; Martínez Valle, 2004) and international (Pier, 2002; Striffler, 2002) researchers documenting precarious employment, dangerous working conditions and child labour on Ecuadorian banana plantations. Undergraduate theses at UTM have documented child labour in El Oro's El Guabo cantón as recently as 2008 (Albarracín Chávez, Arámbulo Pisco, & Davis Palomino, 2009), although eliminating such problems has been a primary goal of the present government.

An important dimension of such dynamics is their gendered effects, as men and women (and children) play different roles on large- and small-scale banana farms, as well as in the rural areas where environmental pesticide exposure occurs (Harari et al., 2011; Martínez Valle, 2004; Striffler, 1999). An important additional consideration is raised by Striffler's (2009) description of the role of Ecuador's non-unionized banana farms in 'disciplining' labour

through Latin America's banana industry, by providing a low-cost alternative if social protections in Central America or Colombia threaten the profits of exporters and supermarkets. Frundt (2009, p. 54), in contrast, documents the role of North American labour representatives in working with the Ecuadorian labour and peasant organization FENACLE, a major player in the quest to organize labour on Ecuadorian banana farms. Frundt also documents links between Ecuadorian groups and COLSIBA, the organization of Latin American banana unions, and describes how a European network of NGOs and trade unions has linked Northern union leaders to Ecuadorian labour organizers facing illegal repression of unionization efforts (p. 61). On numerous occasions, U.S. and European labour and environmental groups have mobilized to exert pressure on banana multinationals – as well as the Ecuadorian Bonita brand – in the face of threats such as intimidation of labour organizers in Latin America. COLSIBA has also incorporated the monitoring of pesticide-related health and environmental impacts into their organizational mandate, in keeping with numerous labour actions throughout the Americas in which workers mobilized against on-farm pesticide-related safety hazards.

Importantly, the Alianza País government of President Rafael Correa, when it came to power in 2007, 'credited its union backers with playing a crucial electoral role. It promised fresh legislation on subcontracting, wages, debt assistance, loans for the poor, and support for single mothers' (Frundt, 2009, p. 195). Accordingly, the Correa government has enacted legislation designed to eliminate contracting through 'captains', and to ensure that banana farm workers receive contracts and 'seguro' (health benefits). Nevertheless, Harari et al. (2011), SIPAE et al. (2012) and the U.S. Labor Education in the Americas Project (2012a,

2012b) document continuing efforts by farm owners – especially in Los Ríos and Guayas provinces – to evade their legal obligations, and discourage worker organizing.

With respect to the objective of designing health research and interventions in this context, the literature reviewed in this section shows that the probable pesticide-related health effects documented in the previous section are likely only a component of the broader health implications of unsafe, poorly paid and precarious work. Pesticide exposures may be indicative of even greater health impacts related to social determinants of health such as income, education, nutrition and a variety of factors shown by recent studies to affect health (CSDH, 2008). Participatory research approaches that are flexible enough to target health outcomes and determinants of relevance to banana workers are therefore most appropriate. Whatever the relative importance of pesticides and other determinants of illness, however, the literature reviewed here suggests a need for interventions to improve working conditions by governments, employers or a strengthened labour movement, with international solidarity or linkages providing one tool for pursuing such improvements.

4.3.2.3 Banana market forces and players: Supermarkets, transnationals, agro-industry and small producers

Labour market dynamics and labour relations such as those discussed above take place in an international banana market with numerous Ecuadorian and transnational players.

Understanding how pesticide exposures happen, and could be effectively prevented, requires examination of the dynamics of this market. Literature documenting these dynamics is

largely, but not entirely, comprised of Ecuadorian studies employing the same social science and political economy frameworks described in the previous section on working conditions (indeed, often done by the same authors).

Larrea's (1987) early but comprehensive study of the Ecuadorian banana sector is cited by most subsequent work in the field. This study traces the historical development of a situation in which large farms owned by wealthy Ecuadorians compete with numerous small farmers, selling fruit to a small number of multinational exporters (Chiquita, Dole and Del Monte, but also the Ecuadorian Bonita and Favorita labels). One small banana producer in Isch López et al.'s (n.d.) unfinished political ecology of bananas in El Oro expresses this as a 'class struggle [lucha de clases] between small and large producers' (p. 76). While Ecuador underwent agrarian reforms intended to improve the distribution of land in the 1960s and 1970s, Rodríguez's (2008) case study of Barbones parish in El Guabo demonstrates significant land re-concentration between 1994 and 2007, largely due to land acquisitions by the Machala-based Palmar corporation. Palmar is described as a vertically integrated agribusiness comprising banana farms, an aero-fumigation business, cardboard production, exporting and plastics, in keeping with Carrillo's (2013a, p. 388) description of vertical integration in large Ecuadorian banana companies. In Rodríguez's account, Palmar has been able to use economies of scale, its significantly greater reserve capital and also extra-legal tactics such as monopolization of public irrigation resources to convince small banana producers – especially vulnerable in light of seasonal instability of banana prices – to sell their land. These small producers are said to then move to urban centres such as Machala or

Guayaquil, and frequently join the landless banana workforce, with a likely decrease in their overall income, autonomy and standard of living.

In response to such unequal power dynamics in the banana commodity chain, small farmers are said by Tamayo and Cepeda (2007) to alternate between individuality and co-operation. Demand for bananas fluctuates seasonally, as the Northern hemisphere's summer corresponds to both a decline in demand for bananas, and peak production of Central American bananas. Both of these factors drive down prices received by Ecuadorian producers, in spite of the existence of a state-mandated official price. In such times, co-operation is more frequent between producers, with participation in associations helping to improve bargaining positions vis-à-vis banana exporters. Co-operatives can negotiate more stable contracts with exporters, requiring observance of the official price in the low season in exchange for agreeing to provide a quota [cupo] of bananas in the high season. In the high season, however, there is incentive for independent producers to receive a higher price for their bananas by leaving the co-operative. Astudillo's (2009, p. 99) economic history of El Oro highlights the cupo arrangement as the 'backbone of the system of exploitation' of banana producers by exporters, who can dictate how many cases of bananas they will buy from producers, and employ a number of tricks to avoid paying the legally-mandated official price. Carrillo García's (2013a) doctoral dissertation describes a small producer co-operative in the El Oro-Guayas-Azuay border region, illustrating the ways in which small producers attempt to survive in the face of their competitive disadvantage vis-à-vis large agri-business by forming associations to improve their economic and political strength in dealing with banana exporters and governments. Carrillo García (2013b) also documents how two of the

main strategies pursued by such co-operatives in El Oro and the rest of southern Coastal Ecuador – fairtrade and organic certification to exploit protected market niches – are themselves under threat as large banana producers increasingly obtain organic and fairtrade certification in an effort to colonize even those minor market segments.

It is not clear if recent efforts by the Alianza País government of President Correa to crack down on exporters paying less than the official price have substantially changed this inequitable situation. The government's rhetoric and policy measures in support of rights for workers, small farmers and the environment appear to represent a positive movement likely to improve pesticide management and the ability of workers to organize and demand better working conditions. On the other hand, Alianza País has been criticized by many of its former allies for abandoning its initial goals and covertly pursuing a neoliberal agenda (Becker, 2013; Clark, 2013; Harris & Roa-Garcia, 2013). In the field of agriculture, such criticisms have focused on Correa's alleged bias toward large-scale agribusiness and neglect of food sovereignty considerations and the interests of small farmers (Berry & North, 2011; Clark, 2013).

Situating such dynamics in international perspective, work done by the Ecuadorian NGO SIPAE (Montenegro, Chiriboga, Cepeda, & Brassel, 2009) examines the role of EU tariffs on Ecuadorian bananas. According to SIPAE's calculations, tariffs on Ecuadorian bananas entering the EU amounted to a full 19% of the purchase price of a fairtrade banana in Europe, or 23% of the purchase price of a conventional banana, both figures amounting to several times the profit realized by producers in Ecuador. The total tariffs imposed by the EU were calculated at almost \$900M (USD) in the 2006-2008 period, compared to a

development assistance figure flowing in the opposite direction of \$159M (USD) over the 2007-2013 period. This figure emphasizes the small proportion of the total price of a banana in Europe that reaches Ecuador (a small amount of which, in turn, reaches small producers and workers). Frundt (2009) also documents the lengthy and convoluted saga of European banana quota and tariff regimes, driven by ongoing trade liberalization and efforts by nations in the Americas and Europe to further various national interests. The practice of preferentially buying bananas from former colonies by some European nations was complicated by efforts at European integration; in light of this integration, continuing protections for producers in Africa, the Caribbean and the Pacific spurred large transnationals to drive challenges under the General Agreement on Tariffs and Trade (GATT) and its successor, the World Trade Organization (WTO). Specifically, Chiquita (a regular contributor to both Democrats and Republicans in the US) urged the US to lead challenges to the EU's banana-import rules, teaming up with some – but not all – Latin American banana-producing countries. Two decades of jockeying have followed, with difficult-to-pinpoint impacts on different actors in the banana supply chain. A common theme in Frundt's analysis of this conflict has been the role of large corporate actors in driving modifications to trade regimes, with nominal or nonexistent consideration of the interests of labour and small producers. On the other hand, Chiquita responded to public pressure in 2001 by signing a worker-rights agreements in which it committed to following International Labor Organization conventions in all countries, and to ensure compliance from its independent suppliers as well (p. 137).

SIPAE et al. (2012) report the increasing influence of transnational supermarket chains in dictating prices throughout the banana commodity chain, gaining power previously held by the large exporters. In particular, certification systems such as GLOBALGAP (formerly EUREPGAP) are altering production practices. Mirabá Romero (2008) case study of the implementation of EUREPGAP standards in a large farm in El Guabo (the leading banana-producing cantón in El Oro, and Ecuador as a whole) indicates some of the complexity of meeting such standards, as well as the not-insignificant costs required, especially in the initial stages. Another certification system – fairtrade – is the subject of Frundt’s book employing interviews, case studies, participant observation and secondary document review. Frundt assesses the possibility that a transnational alliance of small banana producers, unionized banana workers and banana consumers could make the banana trade more equitable through use of fair trade labels. Pesticide exposures for Frundt represent examples of some of the workplace hazards that a labeling system could help to minimize or eliminate. A major concern is the use of non-unionized labour in fairtrade-certified production, and Frundt gives the example of fairtrade bananas produced in El Oro costing significantly less than ‘union-produced bananas from Panama’ (2009, p. 183). A Fairtrade Labeling Organizations International-commissioned evaluation of the effects of fairtrade certification (Smith, 2010) included a case study on Ecuador, where investigators found some beneficial effects of worker organization through fairtrade worker committees and Joint Bodies, but continuing reluctance to unionize and limited progress in pursuing traditional collective bargaining activities. The report also found some ‘confusion’ over the treatment of contracted labourers within a fairtrade small-producers co-operative (p. 93).

In addition to players in the banana supply chain, the market dynamics of pesticides are an important consideration in determining on-farm patterns of use. Relevant factors include exchange rate effects on pesticide imports and costs (Lee & Espinoza, 1998), although the adoption of the US dollar by Ecuador in 2000 might eliminate uncertainty in this regard (UNEP, 2002). Also relevant is the trend towards increasing domestic production of pesticides noted by Lee and Espinoza (1998). Other factors influencing pesticide use identified by Lee and Espinoza (1998) and UNEP (2002) include government subsidies or credit to producers for purchase of agricultural inputs, and the ability of farmer co-operatives to import pesticides directly, avoiding the influence of large Ecuadorian chemical firms such as Ecuaquimica and Agripac. A number of sources have also pointed out the major influence of petroleum prices, and government interventions to influence them, on activity levels in the Ecuadorian banana sector, and Ecuador's economy as a whole (Larrea, 2006; Sylva, 1987; UNEP, 2002). The establishment of Bonita as a major player in the global trade, for example, is linked in part to arrangements such as subsidized petroleum prices provided to the company's shipping fleet by the Ecuadorian government over a period of decades (Sylva, 1987). Other factors linked to overall banana production and environmental impacts (including pesticide pollution with health implications) by UNEP (2002) include customs duties on machinery used in banana production; taxes and subsidies; government restrictions on planting new land with bananas; and trade agreements affecting banana import duties, which Ecuador has previously signed with North American, European, Asian and other South American nations. Krupa (n.d.) documents the role of international finance in spurring floricultural production in the Ecuadorian Sierra in the 1990s, reinforcing existing class and racial divides and motivating attempts to create a disciplined or docile Indigenous labour

force. This ethnographic analysis suggests that inter-relationships between the banana sector and both national and international banks may play an important, though under-studied, role in influencing the distribution of land and power, and by extension production methods, in the banana industry.

Based on the literature synthesized in this section, hazardous working conditions and the pesticide exposures they lead to therefore appear strongly conditioned by a large and complex international banana market, with countless ties to the broader political economic contexts of both banana-producing and –consuming nations. These insights complement the labour focus of the previous section in strengthening the case for health interventions to target ‘upstream’, political economic causes of both pesticide exposure of Orenses, and other social determinants negatively affecting their health. The role of market-based and social justice solidarity movements in affecting the actions of large multinational corporate actors suggests one possible avenue for pursuing knowledge-to-action goals, albeit in a way that acknowledges the possibility of creeping neoliberalization and inequitable North-South partnerships.

4.3.2.4 Environmental influences on pesticide use in banana production

A common element in many of the above discussions of health impacts, labour relations and banana markets is the role of non-human actors, exhibiting what Grossman (1998) has termed the ‘environmental rootedness’ of banana production. Understanding these environmental dimensions is crucial for thoroughly characterizing the root causes of

pesticide exposure – and, therefore, for changing them. Banana farmers interact with environmental challenges on a daily basis, while large-scale changes have had dramatic impacts on the entire industry at numerous points over the last century. Both Ecuadorian (Spanish-language) and Northern (English-language) researchers have studied these environmental dimensions from natural- and social-scientific perspectives. Koelle's (2006) conference paper synthesizing knowledge on environmental characteristics of the Ecuadorian coastal region documents the influence of the Humboldt oceanic current, and of periodic flooding associated with the El Niño Southern Oscillation (ENSO) climatic phenomenon. Microclimatic dynamics were also affected by the huge deforestation caused by the early 20th century 'cacao boom' and clearing of additional land for banana production following the collapse of the cacao industry in the 1930s. Larrea (2006) points out the role in these processes of massive migration from the Sierra. Deforestation in the Sierra also increases sedimentation of rivers originating in the mountains and passing through the banana-producing region – with its problems of water distribution and availability – on their way to the Pacific Ocean.

The effects of ENSO on banana production have been studied in depth in an Ecuadorian analysis pointing out correlations between El Niño years and catastrophic declines in aggregate banana production over the second half of the 20th century (Arroba Salvador, 2002). UNEP (2002, p. 24) similarly noted this trend, stating also that 'the diseases that appeared after El Niño' necessitated increased applications of fungicides and nematicides, with dynamics possibly including increased pathogen resistance. UNEP further documents technological changes including improvements to drainage systems on plantations and

modernization of aerial fumigation systems after the 1982 ENSO event, suggesting that this technological change was unevenly distributed within the banana sector and served to further differentiate banana farms based on level of ‘technification’ (p. 40). Another dimension of climatic influences on the entire global banana industry is explored by Frundt (2009), through his analysis of the effects of Hurricane Mitch, which struck Central America in the El Niño year of 1998. According to Frundt, the devastation of banana plantations in places such as Honduras prompted the multinationals to purchase bananas from independent producers in places including Ecuador. This improved bargaining position in turn allowed major Ecuadorian banana producing companies such as Bonita and Favorita to bypass the large multinationals and negotiate contracts directly with supermarket chains – themselves increasingly able to dictate terms in the banana supply chain. In addition to establishing itself as a major player in the international banana market, Bonita was also successful, with Ecuadorian government support, in eliminating or preventing labour organizing on Ecuadorian banana plantations. Responses by multinationals included Dole’s purchase of the 3rd-largest Ecuadorian banana producing company, as well as attempts to translate their relative expertise into a reputation for more environmentally sound and socially just bananas (p. 28-9). Frundt also documents how Del Monte, Dole and Chiquita used Hurricane Mitch as a pretext for laying off unionized workers in Central America, converting some banana plantations to African palm (with its lower workforce requirements) and transferring banana production to non-unionized plantations in places such as Guatemala.

Tracing the root causes of pesticide exposure therefore implicates atmospheric actors, but especially responses to them by human actors with varying degrees of resources. Of

relevance to such interactions in the future, ecological models loaded with climate change projections show changes in the distribution of land suitable for economically-viable banana production in Latin America, with Ecuador showing a small net increase (Machovina & Feeley, 2013). This projection is based on a single emissions profile and has other uncertainties built into its modelling procedure; nevertheless, it highlights a possible role of anthropogenic climate change in altering conditions for banana production. On a related note, Soluri (2006) has pointed out that the historical establishment of bananas as a staple of North American markets is inseparable from the development of transportation infrastructure, specifically steamships and railroads (the latter transporting fruit to ports in producing countries, and to inland markets in North America); the use of (historically inexpensive) fossil fuels to power these (and subsequent) modes of transport illustrates some of the inter-relationships between export-based agribusiness and generation of greenhouse gas emissions. Such analyses thus situate pesticide exposure in the fossil fuel-based model of development characterizing the global agro-industrial food system.

In addition to atmospheric actors – air, water, heat, etc. – the above sources also illustrate the importance of ‘on the ground’ actors. The influence of Panama disease in mid-century on the development of the current contract-based system producing the Cavendish variety of banana is widely acknowledged (Larrea et al., 1987; Striffler, 2002; UNEP, 2002). Striffler (2002) further illustrates the complex interactions of such environmental change, United Fruit Company decision-making, Ecuadorian government activity (or inactivity), local Ecuadorian capitalists, and labour and peasant organizing in Ecuador in the 1960s, 70s and 80s. Frundt (2009, p. 71) describes the environmental consequences of conventional banana production

– irrigation practices leading to erosion, alleged increased vulnerability of cleared banana land to flooding, massive use of pesticides (now directed at the sigatoka negra fungus and other pathogens) – as creating ‘structural opportunities that stimulated fresh networks and group identities’. Such networks and identities among banana workers, community groups and European consumers allowed for pressure to be exerted on banana multinationals, leading to environmental protection measures such as Chiquita’s alliance with the conservation NGO Rainforest Alliance and a plethora of environmental standards and certifications. The effectiveness of such environmental protection measures, and their implications for labour rights, however, are still a subject of considerable debate in light of possible greenwashing, feigned compliance and indifference to freedom of association.

Organic and fairtrade production comprised two additional responses to the ‘structural opportunity’ provided by environmentally destructive conventional banana production, with small producers and other actors gaining market share by highlighting their sustainable production practices. Smith’s (2010) evaluation of the effects of fairtrade certification found complex dynamics between organic, agroforestry-based and fairtrade production, within the context of a small producer’s co-operative in Ecuador. For example, the co-op encouraged member producers to convert to organic production, but some already-organic producers found that shifting from agroforestry to monocultural organic production was necessary to improve yields and make ends meet. The participation of larger, conventional producers in the co-op furthermore represented a subsidy to smaller producers through the mechanism of the fairtrade premium, which was paid to the co-op as a whole on the basis of total banana sales. Melo and Wolf’s (2005, 2007) empirical assessments of Ecuadorian ‘ecolabeled’

banana production compared large farms certified with Chiquita's 'Rainforest Alliance' label to other large conventional banana farms, and small fairtrade-certified farms with small non-certified farms. These studies found reduced 'natural resource degradation risk', including improved management of pesticides and other agrochemicals, on the certified or labeled farms. Melo and Wolf nevertheless were unable to determine whether the improved performance was cause, or effect, of the certification; they furthermore concluded that the significant influx of external resources required to make the transition to certified production limited the ability of certification systems to transform more than a small percentage of banana farms.

Finally, pesticide runoff from banana farms typically ends up in waterways and, eventually, the Pacific Ocean, with one estimate putting the amount of pesticide active ingredients arriving in the Gulf of Guayaquil in 1994 at 3200 tonnes (Koelle, 2006). Vallejo Galárraga (2005) combines ecological economics and political economy to calculate substantial transport of pesticides from Ecuadorian banana plantations into surrounding ecosystems, both through losses from aerial fumigation, as well as through erosion and transport of pesticide-contaminated soils. One result was a 1990s controversy in which downstream shrimp farmers attributed a devastating shrimp disease to pesticide runoff, leading to significant political pressure on banana producers and eventual changes in banana production methods (Colburn, 1997). By affecting pesticide regulation by the state, such environmental dynamics also indirectly affect occupational and environmental pesticides exposures.

Accounting for these various complex environmental dimensions of banana production is required to understand production decisions and working conditions, and the health outcomes

they generate. More generally, the literature reviewed in this section indicates that environmental actors strongly condition what pesticides are used in banana production, and how; who has land and capital with which to produce bananas; and how civil society organizations in multiple countries put pressure on banana multinationals. At a profound level, environmental actors even play major roles in determining whether bananas are produced at all, with enormous ancillary economic and social consequences. Health interventions in El Oro will therefore need to carefully study the environmental dynamics surrounding banana production in proposing courses of action, to ensure that those actions are effective and sustainable (both over time and with respect to the environment on which life depends). Ecosystem approaches to health (Charron, 2012; Dakubo, 2013; Forget & Lebel, 2001; Webb et al., 2010) provide one possible avenue for pursuing such environmentally-informed health research in participatory, equity-conscious ways.

4.3.2.5 Culture

Many of the above treatments of health, environment, working conditions and banana market dynamics, in addition, indicate that these dimensions interact with human behaviours, beliefs and identities, commonly termed *culture*. While adding yet another dimension to the complex picture emerging in this chapter might seem overwhelming and unfeasible, consideration of culture is unavoidable in fully characterizing and responding to the roots of pesticide exposure (and other globalization-related health issues). A small number of sources, both Ecuadorian and Northern, documents relevant aspects of culture in El Oro and elsewhere in Ecuador's banana zone. My own fieldwork and analysis in the previous chapter

examined health narratives of pesticide-exposed individuals in El Oro, and situated pesticide risk perception in both overall understandings of health, and political economic influences on Orense culture. I found that some pesticide exposures may come about when small banana farmers and workers in El Oro neglect to protect themselves from agricultural chemicals they know to be risky, but that this ‘neglect’ is situated within local and international political and economic power dynamics that make strict observance of safety rules impossible or difficult, or simply less than a high priority. Chapter 3 also demonstrates how ‘global’ and other scalar elements feature in narratives of pesticide risk in El Oro, in ways that reflect, and in ways that resist, hegemonic discourses of globalization such as a focus on individual responsibility.

In particular, my analysis in chapter 3 shows that the *idea* of culture (Mitchell, 1995) functions rhetorically in the narratives of Orenses with relative degrees of privilege to explain away such structural inequities by emphasizing the carelessness and ignorance of other, relatively disadvantaged, banana farmers and workers. Consistent with this is a Universidad Técnica de Machala undergraduate thesis (Jadan Delgado et al., 2011, p. 89) expressing the authors’ desire to promote a ‘culture’ of environmental responsibility and prevention of health problems [una cultura ambiental y de prevención de la salud] among workers and other involved parties in El Oro. Mitchell-Foster's (2013) ethnographic work on dengue prevention in Machala further explores such dynamics as they relate to the interaction of the health sector with residents of Machala (many of whom work in banana production) living in neighbourhoods vulnerable to dengue (i.e. relatively poor and underserviced ones). The phenomenon of *quemeimportismo* (‘what-do-I-care-ism’) reflects

the real or perceived failure of such residents to protect their health through efforts to eliminate breeding sites for dengue's mosquito vector. Importantly, Mitchell-Foster documents how endemic corruption in Machala leads to neglect of outlying neighbourhoods in terms of service provision (e.g. drinking water service); how such neglect leads to social resentment; and how this resentment may both reduce participation by communities in health promotion activities, and also help privileged individuals in the health sector and municipal governments to explain away the poverty-related illnesses of such neglected communities as due to *quemeimportismo* (i.e. apathy). This work complements my own in showing how interpretations of culture function to naturalize within-El Oro power and class relations structuring the allocation of health determinants. Burgos elaborates on this phenomenon:

The socio-environmental conflict isn't an invention. It exists and is perceived by everyone, but no one says anything. In the population there's a malaise [malestar] that isn't expressed because banana production is the principal source of support for the majority. (Burgos Villamar, 2004, pp. 57–8)

My analysis in Chapter 3 suggests that phenomena such as 'apathy' or 'malaise' are not independent of linkages between El Oro and the banana-consuming world; nor, for that matter, are positive elements such as the sense of motivation provided to some fairtrade producers by their partnerships with NGOs in the global North. With respect to this role of foreign actors in influencing decisions and imaginations in El Oro, Melo and Wolf (2007) relate the forms of 'sustainability' they observe on eco-labeled banana plantations in Ecuador to priorities imposed from abroad. In their unpublished political ecology of bananas in El Oro, Isch López et al. (n.d.) focus on identities of conventional and organic small banana

producers, especially their economic, political, gendered and environmental aspects. They detect ‘a strong sentiment of being *bananeros* [banana farmers or producers]’ (p. 73) among both conventional and small producers, as well as high degrees of political mobilization around the struggle for a fair official price of a case of bananas. The *bananero* identity of small producers is characterized as being ‘small, but competitive in the face of the large producers’ (p. 77), echoing the scalar dimensions of my own analysis. An organic small-producer co-operative operating in El Oro and nearby areas of the coast demonstrates more environmentally-conscious forms of identity, but Isch López et al. point out the strong influence of Northern-imposed certification standards – and the market access they allow – on these identities.

Striffler (2002) complicates this top-down picture, however, in his ethnography of the mid-century transition from ‘enclave’ banana production on the United Fruit Company’s Hacienda Tenguel (overlapping the border region of El Oro, Guayas and Azuay provinces) to the present model of contract-based production. While Striffler’s characterization of contemporary life on the southern coast is not encouraging, his historical analysis emphasizes the role of human agency not just in experiencing globally-linked capitalist transformations in locally-specific ways, but in shaping them through forms of political organizing such as unions and co-operatives – albeit with mixed success. A corollary of the agency of workers and peasants in Striffler’s account is his attribution of specific faces and names to forces such as ‘capital’ and ‘the state’, which furthermore helps to move beyond simplistic and potentially disempowering portrayals in which such entities are part of a faceless and omnipotent ‘structure’. Striffler’s analysis therefore suggests a role for identity

and culture in shaping the contract-based system of production behind present-day pattern of pesticide exposures (among other health determinants). Strangely enough, Roberts' (2009) celebratory biographical history of prominent Ecuadorian banana entrepreneurs, though far from taking Striffler's critical perspective on power dynamics in the banana industry, provides additional support for the task of giving 'structure' a face.

The identities associated with banana production, which appear to serve as a site of complicated capitulations and resistances to structural forces of globalization, are also gendered. Striffler (1999) shows how traditional gender roles were promoted by United Fruit on Hacienda Tenguel as a way of ensuring a compliant labour force. This was accomplished mainly by hiring young, married men and providing relatively good working conditions, which allowed a relatively comfortable 'housewife' identity for their spouses. Ironically, however, the resulting forms of identity helped facilitate labour organizing and peasant resistance to United Fruit when layoffs occurred due to the arrival of Panama disease and threatened these nuclear-family-centred roles. This resistance eventually led (along with national processes of land reform) to United Fruit's departure from Ecuador. Present-day work on banana farms is not associated with such male worker identities, with the arrival of women on plantations (albeit in a subset of tasks such as packaging bananas and applying stickers) corresponding to the devaluation of banana work through the contract-based production and related obstacles to labour organizing. Striffler connects these gendered identity transitions to the lack of unions in the southern coast's banana industry and, by extension, to hazardous working conditions (including pesticide exposures). Isch López et al. (n.d.) also characterize the contemporary small banana producer identity as primarily a

masculine one (although there are female small producers), with differences in gender-environment relationships observable between organic and conventional farms. In general, conventional farms are typically arranged to maximize acreage of bananas (especially on larger farms), and the use of pesticides eliminates opportunities for gardens or livestock. Organic farms, in contrast, are spatially organized in ways that allow more room for gardens, farm animals such as chickens, and other species of plants than bananas (especially in agroforestry farms). The additional spaces on organic farms and the economic and social activities they allow, are largely the terrain of women (the wives of the banana farmers). The organic farm is also said to represent a calming or healing space for some women, whereas it seems unlikely that conventional farms would ever play this role. In keeping with these complex dynamics, Torres Dávila (2005) found men to focus more on the health effects of pesticide exposure in El Guabo, while women included the health of their family members in their concern. A blog detailing the socio-environmental conflict in El Oro further points out that the effects of DBCP on male reproductive health (i.e. sterility) have major implications for conventional Orense ideas of masculinity (UROCAL, FENACLE, & FCTO, n.d.-a), suggesting further gender dimensions to both the struggle for compensation over DBCP exposure, and subsequent opposition to pesticide use in banana production.

These analyses therefore suggest complex interactions of local and global economic and political forces, class relations, gender identities, and the biophysical environment, with relevance to (among many other things) the causes of – and responses to – pesticide exposure. Health action research would need to account for these cultural dimensions to ensure that the framing of interventions – especially in scalar terms – resonates with Orense

ways of making sense of the world. One such way of making sense of the world, however, consists of attributing the poverty of others to their ‘culture’. This phenomenon, which is shared by numerous public health researchers, represents a challenge to which novel public health responses may yet need to be developed. Conversely, the rich tradition of collectivist visions in El Oro, associated with particular gendered and environmental subjectivities (among others), may provide fertile ground for a transnational action-research collaboration to influence globalization and its health-damaging effects.

4.3.2.6 Science and Ecuadorian society

Robbins (2012) points out the importance of examining both ‘claims about nature’ such as those summarized in the preceding sections, but also ‘claims about claims about nature,’ in the sense of understanding the social construction and uses of scientific knowledge. My analysis in Chapter 2 represents one attempt to understand claims about claims on the ‘nature’ of pesticide-health interactions in Latin America. In addition to that detailed and labour-intensive analysis, a number of health science researchers in Ecuador – both Ecuadorian and Northern – have documented the interaction of (their) scientific research with Ecuadorian society, especially the role of health science vis-à-vis social and policy change (or lack thereof).

Several publications document the process of moving from knowledge to action with respect to research on pesticides and health. Breilh (2012) describes a multi-year action-research project on the health and environmental effects of pesticide use in agro-industrial floriculture

in Ecuador's northern Sierra. This project generated epidemiological research outputs (Breilh, Pagliccia, & Yassi, 2012; Handal, Harlow, Breilh, & Lozoff, 2008; Handal, Lozoff, Breilh, & Harlow, 2007a, 2007b), and involved a multi-stakeholder process bringing together labour and environmental groups, national and international researchers, and an international NGO. As summarized by Breilh (2012), impacts of this action-research project included development of a farm certification and monitoring system for floriculture in Ecuador, leading to observance of the International Code of Conduct for Cut Flower Production by approximately 18% of Ecuador's floriculture industry; development of an Ecuadorian Health Rights Network, and subsequent incorporation of health and environmental protection as rights in Ecuador's 2008 Constitution; and strengthening of research and training capacity around ecosystems and health in Ecuador (but see also Breilh, 2013).

Another ongoing research program, on the health effects of pesticide use in potato production in the Sierra, has involved multiple efforts to move from knowledge to action, as well as critical reflection on the political obstacles to doing so (Cole, Crissman, & Orozco, 2006; Cole et al., 2011; Orozco & Cole, 2012; Sherwood et al., 2007). Under the auspices of the International Potato Center (CIP, or Centro Internacional de la Papa), the first main health-focused phase of this research program – EcoSalud I – involved significant efforts to translate scientific knowledge of pesticide impacts into policy and social change in Ecuador (Sherwood et al., 2007). Some results described for EcoSalud I include promotion of Farmer Field Schools (FFS) for integrated pest management, and the incorporation of FFS in the Ministry of Agriculture's Food Security Program (Sherwood, Cole, Crissman, & Paredes, 2005). Other efforts included educational radio broadcasts throughout the northern highland

province of Carchi and lobbying efforts at the local, provincial and national levels. In 1999, the project convened a meeting bringing together representatives from government, industry, development organizations, communities, and the media, the result of which was a ‘Declaration for life, environment and production in Carchi’. This Declaration called for controls on sales of highly toxic pesticides; education on pesticide impacts and integrated pest management; and financial support from the agrochemical industry in carrying out such initiatives. Prior to a follow-up conference in 2001, however, pesticide industry representatives from the US, Central America, Colombia and Guayaquil arrived in Quito to lobby the conference organizers and relevant government officials against acting on the elements of the Carchi Declaration – apparently successfully, as Sherwood et al. (2005) report years of indifference of the Ecuadorian government to their ‘evidence-based’ recommendations for pesticide policy change. In addition, both the Bayer Corporation and CropLife International launched projects in Carchi promoting ‘safe use’ of pesticides (i.e. an approach emphasizing behaviours and knowledge of individual farmers and workers over more structural factors – in addition to the analysis in Chapter 3, see Murray and Taylor, 2000, on problems with the Safe Use approach). A major finding of EcoSalud I concerns the structural limits to community- or regional-scale reduction of pesticide exposure, leading to a call for ‘analyses that tie local conditions to the global level, where geo-politics drive environmental change and market penetration’ (Cole et al., 2006, pp. 113).

In the second phase, EcoSalud II, a greater focus on policy and social change achieved mixed results. In three provinces of the Ecuadorian highlands, health promotion efforts led to ‘better’ knowledge of alternative pest management strategies and the health impacts of

pesticides among farm families (Cole et al., 2011; Orozco, Cole, Ibrahim, & Wanigaratne, 2011). Additional efforts targeted local and national decision-makers and aimed to change structural factors leading to pesticide use. Some promising results included the establishment by farmers' organizations, NGOs and municipal actors of a centre to provide low-cost alternative pest management products; municipal ordinances passed promoting alternative pest management, as well as establishment by one municipality of a dedicated department; and a national ban on pesticides in the 1a and 1b ('extremely hazardous' and 'highly hazardous', respectively) World Health Organization categories. The process of developing 'healthy public policies' was not straightforward, however, with major variation between municipalities in their uptake of health science research and problems with 'clientelism' in municipal politics (Orozco Terán & Cole, 2011). Of special importance to the EcoSalud II project were alliances between researchers, community groups, NGOs (national and international such as the Pesticides Action Network) and journalists, as well as an empowerment-based approach for improving the ability of citizens to ensure observance of their 'right to health' (Orozco & Cole, 2012; Orozco et al., 2009). In connection with EcoSalud II, an action research project in the northern Sierra found that AgroCalidad (the relevant Ecuadorian department) enforced Ecuador's regulations concerning sales of non-registered pesticides, but that they were understaffed and unable to enforce perfect compliance (Proyecto Gobernanza Con Capital Social, 2010). Back in El Oro, Torres Dávila (2005) describes 'clientelistic and patrimonial' (p. 25) features of El Guabo's municipal government in explaining the lack of enforcement of pesticide controls, as well as the fact that municipal politicians also often have significant financial interests in banana production.

Major transnational dimensions are also evident in the interaction of epidemiology, public debate and scientific and business interests in Ecuador, as illustrated by a controversy over the health effects of petroleum development on Indigenous communities in the Ecuadorian Amazon. San Sebastián and Hurtig (2005) describe a ‘popular epidemiology’ process aimed at assessing the health effects of living near oilfields in eastern Ecuador. In the early 1990s, political action to protect the Amazon rainforest from oil extraction led civil society organizations to seek out proof that oil development – carried out historically by Texaco, subsequently purchased by Chevron – was affecting human health. Under the auspices of a doctoral student project at the London School of Hygiene and Tropical Medicine, an epidemiologic study documented environmental levels of oil-related contaminants in local waterways and then carried out a cross-sectional analysis obtaining self-reported values for a range of health outcomes and potential confounders of the relationship between oil-related contaminants and illness. Analysis of the resulting data led to publications showing significantly increased odds of skin, nose and throat irritation, and of spontaneous abortions in exposed communities. Following publication of the studies and their use in legal and public relations efforts, however, Chevron-Texaco commissioned several prominent epidemiologists, both Ecuadorian and North American, to critically appraise the studies. The appraisals, which cast doubt on the study findings and on the authors’ allegedly-incautious interpretation of them, were featured in full-page ads purchased by Chevron-Texaco in national Ecuadorian newspapers. A resulting criticism of the actions of Chevron-Texaco’s consultants was published by several dozen health scientists from Ecuador and around the world. These scientists maintained that the allegedly ‘impartial’ application of epidemiologic reasoning by the consultants was actually a deeply-disingenuous political

intervention on behalf of Chevron-Texaco, and against Indigenous peoples of the Amazon (Breilh et al., 2005). The resulting debate in peer-reviewed publications on the social role of public health research featured prominent epidemiologist (and Chevron-Texaco consultant) Kenneth Rothman ‘elevating the level of scientific discourse’ by emphasizing norms of objectivity in epidemiology (Rothman & Arellano, 2005). Other contributions to the debate recapitulated common themes from recent debates on objectivity and advocacy in public health science (Hurtig & San Sebastian, 2003; Siemiatycki, 2002; Terracini, 2005). The role of US courts as a forum for fighting and influencing such battles is demonstrated by the Chevron-Texaco affair, but also by the ongoing saga of DBCP litigation (Boix & Bohme, 2012). Burgos Villamar (2004) furthermore links the international legal action over DBCP compensation to ongoing pesticide activism in El Guabo with respect to chemicals *other than* the obsolete nematocide (Bohme, 2008, also found that Nicaraguan DBCP activism triggered broader anti-pesticide activism). In another parallel, finally, the legal team representing Dole in the DBCP lawsuit includes at least one lawyer from Chevron-Texaco’s legal team in the Amazon oil lawsuit described above – a lawyer who was formally sanctioned for bullying expert witnesses (Boix & Bohme, 2012). The Chevron-Texaco and DBCP lawsuits suggest that attempts to address pesticide exposure in Ecuador will have to contend with the interaction of Northern and Latin American public health traditions, and debates therein, in carrying out rigorous, defensible epidemiologic studies. This will also bring into play political and economic power of the banana and pesticide industries (among others) and, possibly, legal proceedings in both Ecuador and the global North.

The literature reviewed in this section illustrates a need for health researchers seeking to intervene in El Oro to reassess conventional ideas of ‘knowledge to action’ processes. The Ecuadorian context demonstrates that such processes must be politically savvy and proactive with respect to established interests such as large multinational, and domestic, corporations.

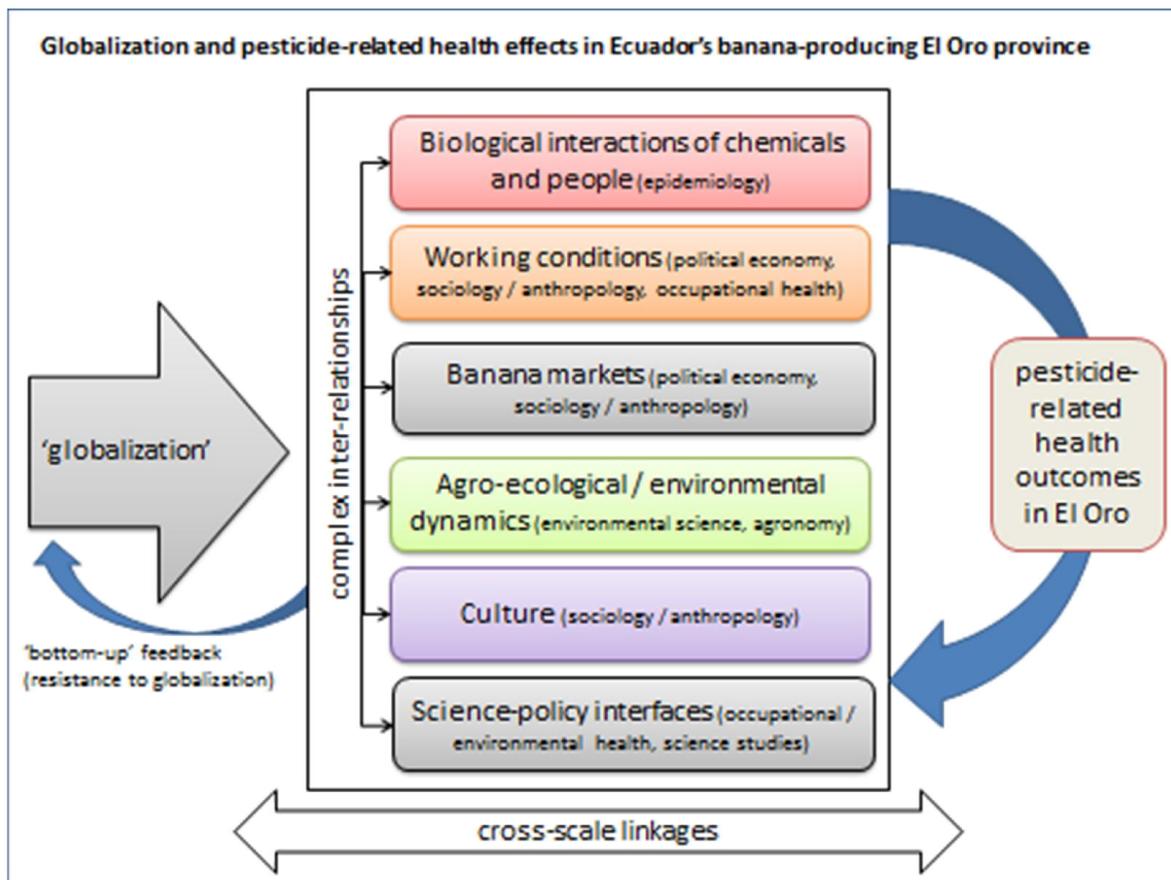


Figure 4.1 A political ecology of health characterization of hazardous pesticide exposures in banana production in El Oro, Ecuador

4.4 Discussion

This chapter has synthesized knowledge from numerous academic traditions to characterize the pathways leading to pesticide-related health effects in Ecuador's banana-producing El Oro province. I identified several different storylines evident in the synthesized literatures, and developed one particularly compelling one – political ecology of health – in more detail. Based on this storyline, intensive application of a constantly-changing cocktail of pesticides appears to have major, but under-researched, health implications in El Oro. Exposure to these pesticides results from exploitative and hazardous working conditions, and a relative lack of labour bargaining power due to state collusion with farm owners and the relative abundance of poor, landless labourers. Large farm owners are therefore able to take advantage of workers, and out-compete and sometimes absorb small banana farms. Small farmers, in turn, organize into co-ops and seek (precarious) niche markets through fairtrade and organic certification. These dynamics are driven and tempered by the influence of the international banana industry, as large banana multinationals and Northern supermarket chains are able to both impose production methods and standards – including pesticide use – on Ecuadorian producers, and purchase bananas from competing places such as Central America if labour movements, governments or environmental conditions drive up the price of Ecuadorian bananas. Transnational solidarity such as international labour organizing and fairtrade certification represents one potential, though complicated, mode of resistance to these inequities and power imbalances. These political economic dynamics are also rooted in environmental realities such as the complex interactions of forests, soils, bananas, pesticides, fungal pathogens, atmospheric conditions and other commercially-valuable species such as

shrimp. Cultural dimensions such as gender roles and their relationship to political organizing and banana production are clearly related to the above political economic and environmental factors, albeit in complex ways. The *idea* of culture (Mitchell, 1995) plays a stabilizing role in the inequitable banana industry, as the poverty (and pesticide exposure) of the poor, rural population in which banana workers originate is often attributed to their ‘culture’ by relatively affluent, educated and urban Orenses (also relevant are stereotypes about the global South held by Northerners such as banana consumers and researchers). This rhetorical use of culture mystifies the structural (class) inequalities generating poverty and vulnerability to pesticide exposure. Finally, attempts to translate health science research into action in the form of pesticide controls and other environmental policies in Ecuador typically run up against corporate power and bring into play disciplinary debates in epidemiology and other public health sciences.

This picture is an unevenly-detailed one in terms of the depth, breadth and strength of evidence related to the various causal pathways involved. One reason for this patchiness is the ambitious scale of the task I attempted as a single graduate student, in synthesizing material from disparate disciplines covering multiple temporal and spatial scales. Another reason is the actual lack of evidence on many of the pathways in question, as research has simply not been done. The only reason I attempted a task of this scope on my own is that the effects of the forces and actors discussed above, while perhaps described most thoroughly through a divide-and-conquer academically specialized approach, are *actually experienced concurrently* by individuals living and working in El Oro. A big-picture analysis of this situation, however imperfect, is still of value in targeting interventions, for example

‘adaptive management’ action-research processes characterized by provisional action and subsequent reassessment (Waltner-Toews & Kay, 2005).

In spite of these limitations, however, the political ecology of health storyline described above is largely consistent with my own fieldwork observations, and with some of the more structural narratives recounted in Chapter 3. With respect to the health effects of pesticides used in banana production, a variety of respondents in my interviews cited a range of pesticide-related health effects they had either experienced or heard about. These were largely consistent with symptoms described by the above studies, with more serious impacts involving reproductive issues, cancer and death. Exploitative and unfair interactions between large banana farmers and both landless workers and small farmers were also frequently described in my interviews, as well as the complicity of public officials with the large farmers. On the one hand, one prominent banana farm owner in El Oro assured me that abuses such as those documented in the Human Rights Watch report (Pier, 2002), while still occurring, are now much less prevalent. On the other, I encountered widespread scepticism from workers about the effectiveness of the Correa government’s reforms, and numerous descriptions of abuses such as those described in studies from the early 2000s. A recurring theme in interviews with small producers was the exploitative behaviour of banana exporters who often ‘pay what they feel like’ [pagan lo que les da la gana] to small producers without fixed contracts, in blatant disregard for the government-mandated official price (and sometimes ignoring signed contracts). Not surprisingly, numerous small producers expressed a desire to get out of banana farming due to its instability and lack of profitability, as well as difficulties faced by small producers in meeting both Ecuador’s legal requirement to insure

workers, and the foreign-imposed GLOBALGAP standards. Several discussed the high cost of pesticides and the development of resistance by the sigatoka negra fungus due to indiscriminate fungicide use (by other, careless, producers). Another major theme was the unwillingness of the profit-hungry chemical industry, whose technicians appear to have a clear conflict of interest when they provide scientific ‘advice’ to banana producers, to consider measures that would reduce pesticide dependence. Several banana farmers expressed scepticism about the possibility of ‘honestly’ producing bananas organically, a sentiment also observed in Mendieta, Padilla, and Calles's (n.d.) interviews with small farmers in El Oro. Another found considerable irony in the concept of Chiquita’s ‘Rainforest Alliance’ certification, with a happy-looking frog in the logo, when conventional banana production is more-or-less antithetical to rainforest conservation and the presence of animals on farms.

Observations from my fieldwork related to cultural dynamics are largely described in Chapter 3, and synthesized above. With respect to the naturalization of poverty, enabled by the idea of a cultural propensity towards carelessness and ignorance among poor, rural Orenses, interventions actually implemented by government and private actors in El Oro have often included education campaigns. Following a pesticide-health workshop I attended at the Ministry of Agriculture office in Machala in 2011, for example, local and national public health personnel began making plans for a three-day training in El Guabo using a Ministry of Public Health pesticide safety training methodology focused on – among other individual psychological elements – self-esteem.

With respect to knowledge-to-action considerations, interviews with key informants suggested that enforcement of pesticide control regulations in El Oro occurs, but is limited by resources and possibly a lack of political will. One key informant described the problem of pesticide exposure as a ‘secreto a voces’ (an open secret), meaning a phenomenon about which everyone knows, but does nothing. Several interviewees (especially large banana farm owners) referenced the almost-decade-old Human Rights Watch report on labour practices in Ecuador’s banana industry, which documented widespread child labour and other hazardous working conditions (Pier, 2002). These individuals, and several of the documents reviewed above, attest to the influence of this report on practices on Ecuadorian banana farms via mechanisms such as increased scrutiny from banana consumers, as well as Ecuadorian government action. A secondary effect I observed (also noted by Melo & Wolf, 2005) is the sensitivity of banana farm owners to negative publicity, and reluctance of both farm owners and some vulnerable workers to participate in research for fear of negative repercussions. In comparison to the effects of this international report, however, students in the Universidad Técnica de Machala have documented the health and environmental impacts of pesticide use in banana production in El Oro more-or-less regularly (e.g. Albarracín Chávez et al., 2009; Asanza Guerrero, Molina Gómez, & Valle Chávez, 2009; Jadan Delgado et al., 2011; Morocho Malla, 2004). Such studies appear to have as a primary impact the acquisition of undergraduate degrees; their impact on changing policies or practices remains unclear, although key informant interviews during my fieldwork in El Oro suggested that such impacts are negligible.

4.4.1 Implications for research and action in El Oro

In reviewing literature in each of the six domains in Figure 4.1, I end by discussing implications for researchers seeking to pursue reductions in pesticide-related health effects, or other improvements in population health. In summary, participatory action research that employs bottom-up perspectives to guide the development of project priorities *and* incorporates existing and new perspectives drawn from political ecology and other relevant approaches may be the most effective and ethically appropriate way to intervene in this situation. In addition, such an ongoing process could help to adapt the ‘patchy’ story recounted in this paper to a specific region within El Oro, and fill in relevant knowledge gaps.

The major themes in descriptions of both working conditions and banana market dynamics are significant power asymmetries between, in decreasing order of influence, Northern and Ecuadorian transnational corporations such as banana exporters and supermarket chains; domestic large farmers and agri-business in Ecuador; small Ecuadorian farmers; and landless labourers. Transnational linkages are a counteracting theme, such as transnational labour organizing and environmental activism. Bohme (2008) also shows the links between social movement activity requesting compensation for DBCP victims in Nicaragua to broader pesticide activism efforts within Nicaragua, also involving American organizations originally founded to support the Sandinista revolution in the 1980s. Another major current of transnational linkages is represented by market-based solidarity efforts such as fairtrade certification, described by Frundt (2009) as a possible basis for bringing together labour movements, small producers and banana consumers for greater equity and sustainability in

the banana trade. Similarly, Andreatta (1997) concludes in her political ecology analysis of pesticide-related health implications banana production in St. Vincent and the Grenadines that ‘As banana eaters, we are all involved...As consumers, we should inform companies like Chiquita, Del Monte, Dole, Fyffes, and Geest that we will not tolerate the human and natural environmental damage resulting from the production, harvesting, and packaging techniques that we imposed on growers and their national governments’ (p. 446). The role of co-operatives and other forms of organizing show some promise in leveling the playing field to a certain degree, but this approach is not without risks. Brown’s (2013) work in Colombia suggests that, while fairtrade certification has brought a reduction in occupational pesticide exposure for some banana workers, it may actually preclude more radical labour organizing by channeling worker participation into fairtrade’s Joint Bodies, in charge of allocating fairtrade premiums. Health action-research in El Oro would therefore need to step carefully in building on existing fairtrade linkages and support from banana consumers; such an effort would need to recognize the possible role of fairtrade in naturalizing the market structures it is allegedly attempting to mitigate (e.g. Fridell, 2006), as well as power dynamics of partnerships in which one party (i.e. Northern consumers) is significantly more influential. In addition, the encroachment by multinationals into the market niches of fairtrade and organic small producers provides another reason for caution in assessing the future potential of these approaches. With respect to certifications such as the GLOBALGAP label now imposed by many Northern supermarket chains, Konefal, Mascarenhas, and Hatanaka (2005) suggest that such standards, in addition to changing on-farm practices including pesticide management, have the secondary effect of squeezing small producers out of the market (a possibility that many small producers I encountered in El Oro echoed). Thus while such standards and

consolidation of banana production on large farms able to meet them may arguably improve some aspects of pesticide management, their effects on land tenure, labour markets and income distribution in El Oro merit serious examination.

On a related note, Bucheli (2004) highlights the importance of business decisions and decision-makers in North America in influencing the actions of United Fruit in Latin America in the mid-twentieth century. Specifically, the uncertainty introduced by labour movements, plant diseases, hurricanes and nationalist governments in Central America in the post-WWII era is widely thought to have led to the present contract-based model. Using United Fruit's records, as well as recommendations for investors put out by Moody's investment rating service, Bucheli shows how the move to divest United Fruit of its large landholdings in Latin America and purchase bananas under contract from local producers actually led to *lower* rates of return, but reduced investor anxiety. While United Fruit is now Chiquita and the transition to a contract-based model is decades-old (though incomplete, as the large multinationals still produce some bananas, especially in Central America), Bucheli's analysis shows another facet of the causes of the contract-based model and, indirectly, the working conditions it entails. Jansen & Vellema's (2004) comparison of environmental management systems on Dole and Chiquita's plantations in Honduras furthermore highlights the role of organizational culture in determining the specific technological decisions made in response to environmental pressure. Chiquita's approach was more 'populist' and involved entrepreneurial development of an eco-label with the Rainforest Alliance conservation NGO, while Dole expressed its culture of carrying out in-house scientific research by continuing with some chemical usages eliminated by Chiquita.

Thrupp (1988) also found that Dole's centralized decision-making structure led to more uniform, and less locally-appropriate, pest-control methods, with corresponding increases in resistance by banana pathogens and pests. The dynamic of multinationals with various organizational cultures marketing Latin American bananas and paying attention to investor opinion still exists, and likely plays a role in present-day decisions by the multinationals over production methods. These dimensions of corporate interests, organizational cultures and investor anxieties also provide potential targets for knowledge-to-action efforts.

The international and Ecuadorian pesticide industries represent one additional piece of this puzzle, albeit one that has not been thoroughly or recently studied in the Ecuadorian context. The rapidly-changing nature of the pesticide industry noted by Dinham (2005), in combination with the arms race between pathogens and chemical companies in the face of pest resistance, suggest a need for more up-to-date and detailed analyses, as does Galt's (2008) call to go 'beyond the circle of poison' and acknowledge recent increases in domestic pesticide production in LMICs. Thrupp's (1988) documentation of social and professional ties between Dole employees and pesticide industry actors in Costa Rican banana production in the 1980s provides one example for analytic approaches to apply in El Oro. In general, the present study is more focused on the political ecology of banana production than the international pesticide industry focus of Thrupp's efforts; in contrast, however, the literature reviewed here goes deeper than Thrupp's analysis in identifying 'final' causes of pesticide-related health impacts. Thrupp describes inequities in access to information about pesticides as a final cause, but does not challenge the overall distribution of land and capital within banana-producing areas; by tracing the conflict between small and large producers in

Ecuador (and North-South inequities in the banana trade), however, the work reviewed in this chapter denaturalizes the inequitable distribution of wealth in El Oro and emphasizes the deep political roots of poverty and pesticide exposures.

Studies on the environmental dimensions of banana farming also indicate a need to carefully examine the complex interactions of human factors with climatic, fungal and other more-than-human entities. Research on the environmental impacts of banana farming (Castillo, de la Cruz, & Ruepert, 1997; Henriques et al., 1997) provides well-developed methodologies for understanding these dimensions, and a sense of the disciplinary (environmental, agro-ecological) knowledge required. An additional possible consideration, given the importance of climatic factors to banana production, is the potential future role of anthropogenic climate change in altering the frequency or intensity of hurricanes, ENSO events, and other atmospheric phenomena. Efforts to understand these dimensions could potentially draw on literature on climate change adaptation, relating to both agriculture and health. A special challenge in studying global environmental change, which would appear to apply to global economic change as well, is the abstract and highly distant nature of such phenomena (Jasanoff, 2010), which are largely out of the control of a single community and mediated by elite networks of scientists, policymakers and NGOs (Adger, Benjaminsen, Brown, & Svarstad, 2001; Taylor & Buttel, 1992). Global change with respect to the distribution of fungal pathogens has also been of relevance to banana production since Panama disease prompted major restructuring in the 1950s and 1960s, and the spread of sigatoka negra has generated a profound dependency on pesticides. A close relative of Panama disease is currently in the process of spreading towards Latin America, and may have similarly

profound impacts on yields (Ploetz, 2005a, 2005b), with difficult-to-predict implications for pesticide exposure, and the larger power dynamics within which it is embedded. Envisioning transitions away from the present agro-industrial model of export-based banana production in El Oro may be one productive avenue for addressing such ‘bigger-picture’ environmental and social trends.

With respect to cultural dimensions, the complex interrelationships between international economics, local environmental and market conditions, and gender, class and other forms of identity suggest a focus on ‘complex subjectivities’ of farmers and farm workers (Galt, 2013). Such an approach appears vastly more productive than simplistic ‘safe use’ educational-behavioural interventions, with their limited efficacy but strange persistence in public health thought (Galt, 2013; Konradsen et al., 2003; Murray & Taylor, 2000). The involvement of social scientists and local cultural experts capable of wrestling with these nuances would be a corollary requirement. These nuances clearly involve gender dimensions, such as the masculinity-threatening effects of DBCP, as well as the threat posed by pesticide use to the marginal farm activities (poultry farming and gardening, for example) found by Phillips (1990) to facilitate Ecuadorian coastal women’s economic independence, and social networks enabling political organizing. On a long-term cultural note, Soluri’s (2006) historical work shows how environmental change in banana zones of Latin America interacted with cultural change in the United States. Specifically, marketing and the changing cultural role of bananas in the US affected consumer behaviour in ways that influenced production decisions in places such as Honduras. Reluctance to change varieties in mid-century both resulted in clearing of huge amounts of land as a way to deal with the advances

of Panama Disease, and (along with political factors including labour organizing and nationalist governments) drove production to Ecuador. The present-day cultural role of bananas in consuming countries is less clear, but likely influences production decisions including agrochemical management, and could be targeted by a transnational knowledge-to-action process.

Regarding knowledge-to-action possibilities within Ecuador, Jasanoff (2010) highlights how the establishment and maintenance of national ‘imagined communities’ has simultaneously relied on – and enabled – the production of scientific knowledge. The government of President Correa simultaneously employs nationalist rhetoric, centralized decision-making and technocratic management structures, suggesting that a focus on the mutual co-production of science and social order (Jasanoff, 2004) would yield academically interesting, but also strategically useful, information. In particular, efforts to move from health science knowledge to policy action and other types of social change in Ecuador reveal a need to account for corporate power to influence the conduct, public presentation and government uptake of science (see also Breilh, 2013). Corporate influence over both the national Ecuadorian and municipal El Guabo governments illustrates the importance of such ‘regulatory capture’ with respect to pesticide control. As a counterpoint, one particularly interesting finding features the role of local and transnational social movements, in partnership with epidemiologists and other health researchers, in mobilizing to protect the health of marginalized groups. Although such processes are painstaking, messy and prone to numerous setbacks, pesticide-health research in Latin America increasingly makes the

argument for such partnerships (Barraza, Jansen, van Wendel de Joode, & Wesseling, 2013; Frundt, 2010; Orozco Terán & Cole, 2011).

Additional science-society considerations that I discuss in Chapter 2 include the role of disciplinary identity and North-South relations. As Pigg (2001) indicates, however, questions on the transnational circulation of knowledge need to be linked to questions on distributions and circulations of knowledge and power *within* countries in the global South. My analysis in Chapter 3 suggests that within-El Oro class divisions affect the circulation of ‘knowledge’ about pesticides and health, including stereotypes about poor, rural Orenses. In addition, banana production has historically strengthened state and civil service formation in Quito through government appropriation of banana revenues. The generation of an ‘urban oligopoly’ in Guayaquil through diversification by banana exporters into banking and other sectors is said by Larrea et al. to have enriched Guayaquil and ‘amplified the breach between the countryside and the city’ (1987, p. 32). The implications of this breach are evident in UNEP’s (2002) description of sectors of Los Ríos with highly productive banana plantations, but also extreme poverty due to the appropriation of profits by landowners largely residing in Guayaquil. Interacting in complex ways with these unequal political and economic relationships are persistent stereotypes of lowland Ecuadorians circulating in public discourse (de la Cuadra, 1937; Phillips, 2004; Roitman, 2008a, 2008b), which may serve as an ideological support to the unequal distribution resources within Ecuador. Importantly, resources for health research in Ecuador often originate with international donors and are channeled through research institutions in large cities, especially Quito, but also Guayaquil and smaller cities in the Sierra. Future studies on the rural banana-producing coast should

therefore also be attentive to within-Ecuador considerations of equity, in keeping with Crane's (2010b) highlighting of the unequal geographic distribution of global health research funding within Uganda.

4.4.2 Implications for meta-narrative synthesis

In addition to informing the early stages of an action-research project in El Oro, this chapter is also intended to inform a more resource-intensive application of the MNS methodology. Such an approach will assemble a multi-disciplinary team of experts to cover relevant knowledge areas outlined in this paper, carefully map out these areas and characterize their epistemological and methodological bases, evaluate the strength of evidence based on quality assessment criteria drawn from the different knowledge areas, and employ systematic search strategies and inclusion and exclusion criteria throughout. The schematic representation of the political ecology of health storyline in Figure 2 provides a basis for developing keyword lists and systematic, well-documented search strategies, both in English and in Spanish. Documentation of databases and search terms employed, and tabulation of numbers of included and excluded citations from among the search results, will provide more reproducibility and transparency than in the present exploratory analysis. On a technical note, the rapidly-changing nature of the banana and pesticide industries, as well as the environmental and cultural dimensions with which they are interconnected, suggests that conventional knowledge synthesis may be always out of date and sub-optimally useful in improving health outcomes if it restricts itself to traditional kinds of public health evidence. Complementing review of published analyses with more fluid methodologies tracing up-to-

the-minute developments in news stories, government documents, web pages and corporate documents may be helpful, potentially employing an ethnographic approach. Additional on-the-ground work in Ecuador would no doubt turn up additional relevant sources, as my acquisition of important documents was limited only by the amount of time I could spend searching, and I have since encountered additional potentially relevant sources in the references of documents already in my possession. This analysis also demonstrates the potentially limitless amount of literature that could be reviewed in understanding the effects of the food system on health. Developing rigorous, systematic and manageable ways for making decisions about inclusion and exclusion criteria represents a formidable and pressing challenge.

While the storylines that I encountered often dealt with different pieces of the puzzle of how pesticides affect health in El Oro, some common themes included a split between critical and neoliberal approaches, with post-structuralist analyses tending more towards a critical paradigm. This suggests a need for MNS to explicitly focus on such political dimensions. The presence of multiple storylines within pesticide epidemiology alone, described in Chapter 2, also suggests that identifying a manageable number of storylines will be a challenge. I chose a political ecology of health storyline as it is unique in dealing with most if not all aspects of the situation at hand, but other approaches are certainly possible. Work on social studies of scientific knowledge is one potential resource for characterizing storylines, supplementing the judgment of the multi-disciplinary team through well-developed methodologies for characterizing ways in which scientists understand and describe the world. As an example, literature on the interaction of health science and society in Ecuador and my

own work in Chapter 2 critically engage with the framing of public health research. Importantly, this analysis can be extended to the field of evidence-based public health and policy more generally, thereby including knowledge-to-action methodologies such as MNS. To illustrate, Roe's (1994) otherwise-perceptive methodology for narrative policy analysis neglects to identify the narratives underlying the field of policy analysis. Compelling arguments characterize evidence-based medicine and public health as itself being a storyline or frame (McInnes & Lee, 2012; Mykhalovskiy & Weir, 2004), based on the social and political role of the medical profession in Northern countries (Denny, 1999), and a potentially neo-colonial extension of that role to the global South (Behague et al., 2009). The critical literature on global health provides one starting point for taking such framing dynamics into account (Brada, 2011; Crane, 2013; Janes & Corbett, 2009; Pigg, 2013; Chapter 2 of this dissertation). Extending the MNS methodology to the justification for conducting knowledge syntheses implies a need to critically examine the assumptions underlying such practices, especially in a global health setting. This would lead to – at the very least – a more extreme 'reflexivity' than the kind discussed by Greenhalgh et al. (2005), which largely deals with conflict between different storylines developed by *others*.

4.4.3 Globalization and health revisited

The situation described in this chapter helps to illustrate some of the ways by which processes of globalization influence health outcomes and, importantly, how those affected by global-scale forces may react to them and – in so doing – change them. It thereby provides a counterpoint to the work of the GKN lead authors, who specifically target their

recommendations at *global* governance for health (Labonté & Schrecker, 2007, p. 2). While they acknowledge the importance of ‘national or subnational level’ actions (ibid), the statement that ‘If health has become inherently global, so, too, must the efforts of public health advocates and policy-makers,’ (Labonté et al., 2011, p. 275) raises the prospect of reifying global-scale processes and taking them as inevitable (Tsing, 2000). Gibson-Graham (2002) have persuasively challenged the assumption that global-scale responses are the only appropriate course of action in the face of economic globalization, and Escobar (2001, 2004) champions small-scale (‘place-based’) action accompanying efforts at global organization. While compelling arguments have been made for effective global health governance (Lee, 2003), it is possible that such efforts may neglect the bottom-up perspectives of those who are their putative beneficiaries. In raising the possibility of new forms of global governance, for example, the GKN lead authors’ list of potential players – ‘communities of practice that link development policy, clinical disciplines, population health and social science fields such as international relations and political economy’ (Labonté & Schrecker, 2007, p. 3) – appears to exclude those most vulnerable to the health effects of globalization (i.e. people in the global South without such qualifications). An emphasis on global governance or foreign policy may in fact legitimize state and other class-linked structures that are implicated in the root causes of the inequities causing global health problems.¹³ Clark (2013) has explored the tension between state and social movements in the Ecuadorian movement for food sovereignty, while geographers have demonstrated how taking scales of governance for granted in attempting to explain conflicts related to the environment can obscure the role of

¹³ See also Holloway (2010) on the possibility that inequality is built into the very nature of the state, and Scott (1999) on how ‘seeing like a state’ implies the imposition of ill-fitting centrally-defined priorities on complex realities not reducible to bureaucratic terms.

those scales – prominently including the nation-state – in the generation of such conflicts (Wainwright, 2005). While I certainly do not wish to support the ‘state-bashing’ of neoliberal rhetoric, it is at the very least worth asking difficult questions about possible complicity between states and their class-linked institutions (including academia and the health sector) in the generation of inequality.

As described above, Striffler (2002) shows how Ecuadorian banana workers were able to mobilize against the all-powerful United Fruit company and contribute to both its exodus from Ecuador, and a transition to a contract-based production system in bananas – and in commercial agriculture more generally. Later linkages of banana labour organizations with international supporters helped to publicize abuses on Ecuadorian banana farms in the 21st century. This ultimately contributed to the eventual victory of President Correa and the ushering in of ‘counter-globalizing’ tendencies such as resistance to the International Monetary Fund and increased protection for workers in the industry (Fruendt, 2009). Bohme (2008) also shows how Nicaraguan banana workers and transnational social movements were able to use the forum of the state, in the form of a Nicaraguan law holding banana multinationals to account for DBCP exposure, to achieve goals in a world where globalization has allegedly made the state less relevant. Such ‘success stories’ have darker sides, of course, as the workers who drove United Fruit out have since fared poorly in the banana market and President Correa’s legacy is the subject of considerable controversy (Becker, 2013). The Nicaraguan law requiring compensation for DBCP-affected victims has also been widely ignored. Nevertheless, such stories help to illustrate some of the mechanisms by which the actors affected by global-scale forces may exert their agency, and

actually affect the structures thought by many to be all-powerful (see also Erikson, 2011, on reconciling structure and agency in global ethnography). Community-university partnerships aimed at improving health in the face of global pressures could learn from these experiences, for example by paying greater attention to phenomena such as transnational labour organizing and international solidarity to achieve protection for workers, small farmers and the environment. The transnational strategies of social movements discussed by Escobar (2001, 2004) are promising in this respect, with their emphasis on place-based forms of action and non-hierarchical (rhizomatic¹⁴, self-organizing) organizational structures, also acknowledging a need to link up these disparate efforts to achieve higher-level goals. Genuinely participatory research processes may be one way for health researchers to partner with affected communities, studiously avoiding the ways such projects can go off the rails (Cooke and Kothari, 2001; Kapoor, 2005). Such bottom-up processes could provide a helpful grounding to efforts at global health diplomacy or governance, and provide for meaningful participation of disenfranchised groups. They could also provide a counter-balance to the admittedly ‘bleak’ story of globalization’s effects on health described by the GKN (Labonté & Schrecker, 2007, p. 10), tempering the sometimes hopeless-seeming picture of international political economic analyses with the (realistic and un-romanticized) energy of grassroots perspectives.

¹⁴ A rhizome is a type of root system in certain plants. As opposed to a tree root, a rhizome has no central axis and instead can send up multiple shoots, all of which are connected underground. The concept of rhizomatic social structures is a direct reaction to the shortcomings of hierarchical structures, drawing on the work of theorists Deleuze and Guattari (1987). Interestingly enough, bananas have rhizomatic root systems.

Chapter 5: Conclusion

In the Introduction to this dissertation, I outlined my main objective: to explore discursive and practical obstacles to equitable and effective practice in global health, and some strategies by which researchers – specifically in the global North – might overcome them. I also outlined my rationale for focusing this exploration on the problem of pesticide exposure in Ecuador’s banana industry. I have employed three main methodological approaches: discourse analysis, ethnography and multi-disciplinary (meta-narrative) knowledge synthesis. As each of these three approaches is elaborated upon in a separate manuscript-style chapter in which I discuss the implications of their findings, I will only briefly recapitulate them here with respect to my overarching objective. I then focus on further implications that I was unable to explore in the manuscript-style chapters, or that only emerged when considering findings of the three chapters jointly.

5.1 Summary of findings

In Chapter 2, I employed discourse analysis to identify and explore prominent frames evident in peer-reviewed literature on pesticide epidemiology in Latin America that was generated in connection with Northern involvement. I found that a majority of the papers that met my inclusion criteria employ geographic representations to establish terrain for their studies, positioning research sites as representative examples of ‘developing country’ conditions. On closer examination, these settings are often portrayed as inexplicably (and therefore inevitably) poor and characterized by unsafe working conditions and other determinants of

pesticide exposure. This problematic situation, typically described without significant historical contextualization, often serves to establish the need for epidemiologic studies, and public health interventions based upon them. This framing implicitly naturalizes the poverty underlying such pressing need for public health intervention. Importantly, I found that these geographic portrayals are linked to (and limited by) the genres and other disciplinary conventions of epidemiology and public health, conventions that have led to criticisms of epidemiologists as ‘prisoners of the proximate’ (McMichael, 1999). Geographic representations, for example, typically carry out the ‘narrowing’ action of a typical scientific journal article introduction, and are truncated enough to fit within epidemiology journal length restrictions. This finding was suggested, in part, by observations of significant resistance to these conventions, especially in a small subset of research that situates pesticide exposure and the backdrop of poverty against which it typically occurs more firmly in its historical and political economic context. A handful of such papers go so far as to propose solutions going beyond a narrow public health intervention frame, and including civil society actors such as farmers’ groups and NGOs as possible protagonists and agents of change (and not simply recipients or beneficiaries of public health programming). The analysis in Chapter 2 therefore suggests that powerful institutional and discursive forces in public health strongly condition the ways in which pesticide exposure in Latin America has been approached by Northern epidemiologists and their Latin American collaborators. As these texts likely shape how many new research and intervention efforts in Latin America are envisioned (and funded), my analysis indicates a need to carefully and thoughtfully engage with and challenge their main discursive features, so as to avoid reproducing the power structures they support. For example, pesticide epidemiology articles often elide the bloody history of Latin

America and its interaction with European and American powers (e.g. Galeano, 1973) in justifying public health studies and programs. This tends to lead to intervention models that fail to confront the political economic disparities resulting from that inequitable history. Resistance to these discursive features in a small number of papers furthermore provides illustrative and even inspiring examples of how this might be done within the confines of academic publishing requirements and other institutional imperatives of public health. These results illustrate some of the institutional obstacles to pursuing – or at least publishing – global health research approaches that are more effective and equitable, in that they are informed by historical, political economic (‘upstream’) considerations. They also highlight some key targets for institutional reform to better overcome these obstacles, which I explore later in this chapter.

The analysis of Chapter 2 focused on perhaps the most influential perspective – an epidemiologic one – involved in efforts such as North-South collaborative projects to address pesticide-related health effects. For a number of reasons, it stands to reason that the perspectives of people actually affected by pesticide exposure due to banana production in El Oro are at least as vital to the task of understanding, and improving, the situation there. This consideration prompted my use of ethnographic methods, described in Chapter 3, to explore how pesticide exposure is understood by farmers and workers occupationally exposed to pesticides, and by individuals exposed off-farm through environmental pathways. Using the anthropologic construct of health or illness narratives to guide my fieldwork, I was able to gain insight into how health is understood by pesticide-exposed people in El Oro, how pesticide risk perception relates to these understandings of health, and how narratives featuring pesticides and health fit into more general cultural, political and economic contexts.

Specifically, health in El Oro appears to be understood using a mixture of biomedical concepts and lived experience, and is seen – above all – as an ability: to work, to play, to support a family. By highlighting questions of scale, furthermore, I was able to identify tensions and interactions between different scalar configurations that carry political implications. Among these, I detected narrative elements ideologically consistent with a neoliberal focus on individual responsibility, a prominent awareness of small farms and small farmer co-operatives as constituting scales of importance, and a variety of stances towards Ecuadorian (national) and global (international) actors and forces. The results of this chapter suggest that educational-behavioural interventions to address the health effects of pesticide are likely to be of limited effectiveness, particularly if they ignore structural and cultural dimensions of the ‘complex subjectivities’ of affected individuals (Galt, 2012; see also Konradsen et al., 2003; Murray & Taylor, 2000). It is not coincidental, furthermore, that educational-behavioural interventions are often linked to unexplained poverty in Latin America in papers analyzed in Chapter 2, consistent with Trostle’s observation that educational interventions ‘tend to ignore history, politics and environment’ (2005, p. 137). A secondary implication of the findings of Chapter 3 is suggested by the observation that some individuals in El Oro *themselves* advocated educational-behavioural interventions addressing ‘culture’ to reduce pesticide exposure among (relatively disadvantaged) *others*. Such observations evoke Mitchell’s (1995) reflection that the idea of culture can be used to explain away and thereby entrench structural inequalities. Viewed in this light, it appears that (relatively) privileged individuals in El Oro and numerous public health researchers in Latin America and the global North share an orientation consistent with interventions aimed at changing the behaviours of pesticide-exposed individuals. By ignoring or downplaying the

importance of structural causes of the poverty in which these pesticide-exposed individuals live, such an orientation naturalizes and reinforces that poverty.

That there has been a systematic failure to recognize and address structural conditions generating poverty and pesticide exposure is therefore a major implication of both Chapters 2 and 3. Although obviously I am not the first person to reach such a conclusion, my analysis suggests that the disciplinary framing of epidemiology, while nominally drawing attention to health concerns, may actually contribute to obscuring consideration of these important influences on health. An additional implication, further to this, involves the need for reflexivity in questioning ways of thinking, typically among relatively privileged individuals, that ignore or naturalize the structural conditions that generate both poverty and privilege. Put differently, such structural inequities generate both health problems and people who feel the need to fix those health problems. One complication of this finding is the need to consider multiple axes of social difference and levels of privilege, as a collaborative research project would involve workers, small farmers, educated individuals in El Oro, researchers and students from Quito and other Ecuadorian cities, and from Vancouver and other cities in the global North (gender and race / ethnicity represent additional relevant axes of social difference). I end Chapter 3 by suggesting that genuinely participatory research methods, such as those that employ Freirian empowerment-based approaches (Cargo & Mercer, 2008; Freire, 1970), are among the most appropriate – and equitable – methods for bringing together Canadian and Ecuadorian researchers and communities. Given the significant global dimensions to these narratives of health, furthermore, considerations of effectiveness suggest that transnational linkages are necessary to match the scale of the intervention to the scale of the problem (Brisbois, 2011).

In Chapter 4, having sought guidance from both discourse analysis of epidemiology and ethnographic work in El Oro, I employed meta-narrative synthesis (MNS) to bring together these and other relevant knowledges. This chapter essentially sought to complement the perspectives identified in Chapters 2 and 3 with evidence, both Northern and Ecuadorian, drawn from other storylines originating in public health, environmental and social sciences. As the task in question was a huge one, I modified the MNS methodology to be geographically specific, and also employed less systematic search strategies and quality assessment criteria than in ‘official’ MNS methodological guidance documents (Greenhalgh et al., 2005; Wong et al., 2013). For this pilot modification of the MNS methodology, I synthesized knowledge in keeping with one particularly comprehensive and compelling storyline, which I termed *political ecology of health*. In recounting this story(line), I explained pesticide exposure in banana production in El Oro as related to a) biological interactions between people and chemicals; b) labour relations influencing occupational exposures; c) local and international banana market dynamics affecting the distribution of land and other determinants of pesticide use; d) the environmental ‘rootedness’ of banana production and resulting implications for pesticide use and exposure; e) Orense culture as it relates to bananas, pesticides and health; and f) science-society relationships in Ecuador. The results of this synthesis are largely consistent with – though more detailed than – some of the health narratives recounted in Chapter 3, tracing complex systemic interactions of people, non-human actors and power dynamics at local and international levels. The more politically-engaged and power-conscious frames used by some epidemiologists in Chapter 2 are also echoed and extended in the political ecology storyline. Other storylines I briefly summarize in Chapter 4 resonate more with the neoliberal individual-focused narratives of

some Orenses in Chapter 3. They also resonate, in complicated ways, with the more apolitical and ahistorical frames detected in Chapter 2 – for example, representations of Latin America as inexplicably poor and in need of health sector interventions to change the behaviours of pesticide-exposed farmers and workers. Chapter 4’s results therefore support Chapter 3’s conclusions on the need for participatory, transnational action research, in pursuing objectives of effectiveness in any Northern research approaches to this setting – not to mention disagreement over what ‘effectiveness’ means. Effectiveness could be enhanced through ‘upstream’ interventions addressing political and economic power (but also ecological and cultural complexity). Finally, enhanced reflexivity (discussed further in section 5.3, below) would allow pursuit of equity goals by highlighting the role of public health researchers in unintentionally perpetuating inequitable political economic structures.

5.2 Strengths and limitations

Strengths and limitations of the approaches taken in Chapters 2, 3 and 4 are outlined in their respective Discussion sections. Here I discuss strengths and limitations of the overall approach taken in this dissertation. One main strength is the use of multiple methodological perspectives to address a problem characterized by both discursive and scientific complexity. Schrecker (2013) points out the importance of methodological pluralism in achieving health equity. Understanding the complex pathways from working conditions to health outcomes, for example, necessitates input from methodologies that do not meet epidemiologic standards of proof or hierarchies of evidence. Similar arguments have been made concerning interventions in situations of environmental complexity (Waltner-Toews & Kay, 2005),

where no single disciplinary approach can adequately characterize pathways to health outcomes. The analysis in Chapter 4 particularly illustrates how synthesizing multiple disciplinary approaches can allow for a more complete, and therefore useful, characterization of factors such as the economic, environmental, cultural and discursive pathways leading to health determinants such as hazardous working conditions (Greenhalgh et al., 2005). These arguments for methodological pluralism are in addition to challenges by feminist scholars to ‘masculinist’ epistemologies that champion the objectivity of dominant scientific ways of knowing (Haraway, 1988; Harding, 1992; Sundberg, 2003). As these scholars explain, there is no detached viewpoint separate from the world from which to make ‘objective’ observations. Multiple ways of knowing are therefore more likely to be reliable, and less likely to obscure the power relationships enabling illusions of objectivity – what Haraway (1988, p. 582) terms a ‘god trick’.

The specific choice of methodologies used in this dissertation also represents one of its strengths. The value of qualitative methodologies in preparing for or contextualizing quantitative public health studies or interventions is by now well-recognized (Behague, Goncalves, & Victora, 2008; Bourgois, 2002; Janes, Stall, & Gifford, 1986; Trostle, 2005). Less well-known, however, is the importance of understanding ways in which many quantitative studies – and even qualitative ones – are framed in ways that implicitly reproduce and endorse discourses with health-damaging consequences. By beginning my search for better approaches in global health with a discourse analysis, I was able to make explicit some problematic tendencies in existing scholarship. These included frames that reflect and reproduce oppressive North-South power dynamics (see, for example, Escobar, 1995). These frames lead, logically, to technical and sometimes individualizing approaches,

while bypassing potentially more effective ‘upstream’ interventions. When I moved on to empirical ethnographic and knowledge synthesis methodologies in Chapters 3 and 4, then, I was able to adopt approaches informed by identification of these problematic discourses. In particular, I was able to carry out my fieldwork in Chapter 3 in a way that was attentive to representations of the global South, attribution of responsibility for health to the behaviour of individuals, and relevant scales in between. This mapped the cultural terrain with which the ‘culture’ of Northern pesticide epidemiology would need to interact in a specific health study. Finally, Chapter 4’s approach was premised on the inevitably partial perspective of any single disciplinary approach such as that of epidemiology, an observation to which Chapter 2’s findings provided added weight and nuance. I used multi-disciplinary knowledge synthesis to bring as much relevant information as I could to bear on design of a specific global health research project.

Viewed differently, of course, these strengths can also be seen as limitations. In adopting three different methodologies, I was unable to pursue any of them in depth to the extent that an entire dissertation would have allowed. From a traditional public health perspective, it could legitimately be argued that the main factor limiting the validity or usefulness of my study is that I did not carry out a quantitative study on the health effects of a specific pesticide or pesticides. The non-representative sample of Chapter 3, for example, does not allow for generalization. The discourse analysis of Chapter 2 would not even register on an epidemiologic ‘hierarchy of evidence’ (Rychetnik et al., 2002). Chapter 4 does not employ quantification of literature in different knowledge areas or quality assessment criteria for included studies, although it does outline a road map for doing so. In response to such criticisms, however, I would say that I did not carry out a quantitative pesticide epidemiology

study in El Oro because I did not see how doing so would benefit anyone there (although it likely would have made my life much easier). Existing knowledge on both the health effects of pesticides (e.g. those listed in Appendix D), and the health effects of SDH such as income or decent work (CSDH, 2008), should arguably already have been enough to motivate improvements to population health in Ecuador – and provoke consideration of how research and intervention priorities are set. As Chapter 4 elaborates, such health-damaging conditions are the product of a complex interplay of political power, economics, culture and environmental change. Throwing more epidemiologic evidence at this situation, however methodologically rigorous I might make it, did not seem like it would actually lead to improvements. It is possible, as outlined in Chapter 4, that strategic deployment of epidemiology *and* advocacy (or ‘knowledge translation’, if that is a less uncomfortable concept) might now help achieve health equity objectives in El Oro. This dissertation was designed to make such a (near) future effort more likely to succeed.

Another limitation of this dissertation is precisely its focus on pesticides. In Chapter 1 I outlined the process by which I chose this topic. This decision also drew on the facts that pesticide epidemiology is an established field of study; that Ecuador produces large amounts of bananas; and that some people (NGOs such as Human Rights Watch and the Pesticides Action Network, for example) are quite concerned about pesticide exposure in places such as Ecuador. As Chapter 3 indicates, however, many people exposed to pesticides are more concerned about their overall economic situation. Chapter 4 echoes this finding by showing pesticide exposure to be accompanied by a number of other determinants of poor health – lack of a stable income, for example – that, quantitatively speaking, would likely dwarf the health impacts of pesticides. Nevertheless, individuals and organizations in El Oro are

pursuing legal and other political strategies that focus, at least rhetorically, on the health effects of pesticides. By employing approaches that are attentive to discourse, I was therefore able to minimize (though perhaps not eliminate) the possibility that focusing on pesticides would represent an uncritical imposition of – for example – a Northern environmentalist perspective on people in Ecuador.

5.3 Implications for research and action

The implications of the three substantive chapters for a specific action-research project (i.e. in El Oro) are developed in their three Discussion sections, and summarized in the section immediately preceding this one. The fact that each chapter builds on the findings of the previous one furthermore means that these implications – especially those outlined in Chapter 4 – are to a degree cumulative, and informed by the dissertation as a whole. Taking into account the strengths and limitation outlined in the previous section, implications not amenable to inclusion in a specific manuscript-chapter remain to be explored. I divide these higher-level implications into those relevant to global health partnerships, journal editorial approaches, training, and global health research more generally.

5.3.1 Partnerships

As mentioned earlier, one of the reviewers of Chapter 2 for *Social Studies of Science* suggested I develop its implications further, enquiring ‘What kinds of shifts in training, nature of partnerships, journal editorial approaches might be needed?’ The topic of

partnerships is a current preoccupation in the field of global health, which is attempting to move beyond the exploitative North-South relations of previous eras (Koplan et al., 2009), referred to by the Canadian Coalition for Global Health Research (CCGHR) as ‘top-down colonial models’ (Afsana et al., 2009, p. 4). To avoid the imposition by Northern researchers on Southern collaborators of projects framed within decontextualizing geographic representations such as the ones identified in Chapter 2, careful attention to the planning of equitable partnerships may help in the short term. The CCGHR’s Partnership Assessment Tool, for example, was designed in collaboration with partners in Bangladesh, Ecuador, Ethiopia, and several other LMICs (Afsana et al., 2009), and may prove helpful in avoiding some of the more egregious inequities of the previous ‘international health’ era (not to mention colonial or tropical medicine prior to it).

As a cautionary note, however, compelling analyses highlight global health’s ambiguous relationship to the disparities that generated previous exploitative North-South interactions, and which also serve as the *raison d’être* for the field (Crane, 2013; Janes & Corbett, 2009). Sandra Harding (2008) describes triumphalist and exceptionalist narratives historically (and, often, currently) characterizing the interaction of Western science and technology with the global South – leading to the sense that, for example, the bloody history of colonialism is less important in the grand scheme of things than the scientific and technological modernization that accompanied it. To illustrate the problems with this perspective, a wealth of research relating economic inequalities to health problems on the one hand (CSDH, 2008; Farmer, 2003; Medact et al., 2005) is complemented, on the other, by research relating the hegemony of Western biomedicine to state formation and related processes that determine class structure and economic inequality (e.g. Anderson, 1998; Denny, 1999; Foucault, 1973). State

and health system formation in Latin America have been influenced by the inequitable insertion of Latin American countries into the global economy (Birn & Solorzano, 1999; Galeano, 1973), in addition to recurrent episodes of more obvious and direct disciplining such as the US-backed Contra assault on Nicaragua. It also should be acknowledged that these processes have indirectly contributed (and continue to contribute) to the health system and research infrastructure allowing Northern epidemiology to develop and then export itself to Latin America. Research on Aboriginal health in Canada illustrates an analogous form of ‘internal colonialism’ which allowed the development of the Canadian state and health and university systems while marginalizing Aboriginal peoples and sowing the seeds for health problems which persist into the present (Adelson, 2005; Big-Canoe & Richmond, 2014; Christian & Spittal, 2008; Richmond & Ross, 2009).¹⁵ To extend this comparison to central areas of global health inquiry such as HIV/AIDS in sub-Saharan Africa would not be difficult, furthermore, as Crane’s (2013) analysis of global health science in the US and Uganda illustrates. A related caveat stems from the observation, not just of problematic North-South biomedical relationships, but also of inequities within countries such as Uganda, Nepal and Ecuador (e.g. Crane, 2013; Pigg, 2001; my own analysis in Chapter 4). These inequities are based on the interaction of privileged Southern physicians, researchers and health workers (the typical ‘partners’ in global health partnerships) with their poor, rural, uneducated or Indigenous compatriots – not to mention gender inequalities. If the movement to improve North-South partnerships in global health is to move past previous injustices, therefore, it must also grapple with the complicit role of (relatively) privileged Southerners in

¹⁵ My own privilege, which has enabled me to pursue the research reported on in this dissertation, has also been enabled by this ‘internal colonialism’.

facilitating colonial rule (Fanon, 1961/2004) and more recent incarnations such as development (Escobar, 1995).

5.3.2 Journal editorial approaches

Extreme reflexivity, going ‘beyond a simple checklist’ (Afsana et al., 2009, p. 6), may be one short-term safeguard against the re-imposition of neo-colonial ways of seeing the world in global health collaborations. The analysis in Chapter 2, however, highlights the obstacles posed to such thoughtfulness by disciplinary imperatives, such as journal article genres and norms of ‘objectivity’, of epidemiology and public health. Simply put, the generation of enough journal articles to succeed in a competitive (global) public health job market may force otherwise-thoughtful researchers and practitioners – both Northern and Southern – into narrowly-framed technical projects that address the symptoms of global inequity but not its root causes. One former SPPH faculty member explained, in a class he had devoted to the issue of activism in public health, that financial and family responsibilities are an obstacle to doing anything other than churning out the publications required to achieve tenure (and financial security). This is in addition to large funding streams such as the Gates Foundation specifically promoting technical interventions, and steering attention away from structural factors (Birn, 2005; People’s Health Movement, Medact, & Global Equity Gauge Alliance, 2008, pp. 240–259).

The anonymous *Social Studies of Science* reviewer raised ‘journal editorial approaches’ as a possible target for efforts to change this situation. Relaxing length restrictions on epidemiology articles could at least provide more space for political economic discussion, for

example, and the inclusion of a social scientist among the reviewers of an article could help improve the quality of such discussion. It probably goes without saying, however, that such changes would damage the credibility of an epidemiology journal in the eyes of many epidemiologists – and, by extension, hiring committees and grant reviewers – for whom ‘qualitative’ research is inherently suspect (Albert, Laberge, & Hodges, 2009; Bourgois, 2002; Janes et al., 1986; Napolitano & Jones, 2006; Trostle, 2005). This suggests that going beyond reform to more profound changes in the structure of academic public health (its competitive nature, for example) may be a more appropriate long-term goal.

5.3.3 Training

The prevalence of common frames or discourses about the global South suggests a need to challenge the ahistorical stereotypes they perpetuate. Heron (2007) suggests anti-racist education techniques as a way to begin addressing such ‘colonial continuities’. Such approaches, which deserve more in-depth treatment than I am able to give them, bear considerable similarity to the Freirian critical pedagogy approaches to participatory research I advocate at various points in this dissertation. Specifically, they deconstruct power dynamics and force participants to confront their own internalized prejudices (hooks, 1994). The inclusion of such historically-informed postcolonial or ‘intersectional’ approaches (ones that simultaneously consider multiple axes of social difference such as gender, ability, race and class) in the training of (global) public health researchers could potentially counter transmission of the frames I document in Chapter 2 (see Janes & Corbett, 2009, on the uses of intersectionality in understanding global health issues). As with the journal editorial

approaches I document above, however, making room for them would come into direct conflict with the need for students to acquire competencies in epidemiology and biostatistics.¹⁶ Academia's competitiveness affects graduate students as well, and likely incentivizes *not* including such (time-consuming) reflexive elements in global health training, or public health training more generally. Once again, changing the competitive structure of academia would appear to be a worthwhile mid- to long-term goal.

In addition to institutional pressures, thinking backward from the existence of common frames to the existence of particular people interacting with them could help to identify emotional or affective reasons for the persistence of the frames I discuss in Chapter 2 (I began to engage with these issues in Entr'acte 2). The concept of 'collective action frames' (Benford & Snow, 2000; Snow, Worden, Rochford, & Benford, 1986) motivating social movements, for example, has led sociologists to identify individual identities associated with particular frames. Other well-known constructs in social theory add similar, or complementary, insights – indeed, the fact that numerous social theories contribute overlapping, seemingly-novel insights illustrates the systematic neglect of certain avenues of inquiry in public health. As I describe in the Introduction, for example, discourses as articulated by Foucault (1995) – coherent institutionalized systems of knowledge and knowledge production intricately tied up with the exercise of power – imply particular 'subject positions'. Following this line of thought, particular frames identified above could be roughly equated with discourses with subject positions such as 'epidemiologist', 'doctor',

¹⁶ As an example of my own clumsy intervention in this conflict, I used my position as teaching assistant for my department's class on regression methods in epidemiology to introduce the concept of data politics. I did so using data from Statistics Canada's Aboriginal People's Survey to illustrate the dependence of epidemiologic data collection on neo-colonial power relationships (O'Neil, Reading, & Leader, 2001). While students seemed to find this interesting, my inclusion of a slide quoting from bell hooks's (1994) *Teaching to transgress: Education as the practice of freedom* in the course wrap-up drew only blank stares.

'health promoter', and possibly oppositional positions such as 'radical' or 'change agent'. Louis Althusser's (1971) description of how individuals are 'interpellated' or brought into ideologies, in addition, suggests a focus on how the education of epidemiologists and other public health researchers and professionals socializes them to see the world in certain ways, and act accordingly. Slavoj Žižek's (1989) work also emphasizes the importance of personal enjoyment in participating in ideologies; that is, common public health frames may have ideological dimensions and therefore various psychological benefits related to individual personal satisfaction. Building on Žižek's work, Kapoor (2005) makes a compelling argument linking participatory development to the frustrated desires of development practitioners who find their home contexts far from 'participatory'. I can personally attest to this phenomenon, which helped to motivate my unsuccessful early attempts at employing (labour- and time-intensive) participatory methods in my doctoral research. I am also still prone to dreams of pursuing genuinely engaged, participatory research as a post-doctoral fellow, perhaps reflecting the degree to which my PhD – especially the last year of it spent in isolation analyzing data and writing – failed to provide connection with a stable community of peers, or a sense of shared purpose and meaningful work.

Antonio Gramsci described – in the 1920s and 30s – an 'esprit de corps' among intellectuals, who 'put themselves forward as autonomous and independent of the dominant social group' (Gramsci 1971, p. 7). In reality, however, Gramsci holds that intellectuals usually serve to reinforce both state coercive power, and 'the "spontaneous" consent given by the great masses of the population to the general direction imposed on social life by the dominant fundamental group' (p. 12). Gramsci's 'esprit de corps' suggests a way of understanding the world – likely an emotionally rewarding one, if Žižek's insights are considered – collectively

shared by many academics and other intellectuals, which serves to disguise their participation in the maintenance of unjust social structures. Other suggestive examples of this phenomenon include Heron's (2007) perceptive study of the interaction of race, gender and 'helpfulness', documenting the insidious persistence of 'colonial continuities' even among progressive Northerners working to remedy the effects of historical injustice in sub-Saharan Africa. Importantly, these elements function in 'containment strategies' by which, in this case, female Canadian development workers explain away the contradictions in the development project in a way that lets them maintain a positive self-image. The above admittedly speculative discussion on the affective dimensions of participation in frames or discourses (or ideology or hegemony) suggests avenues for further research, relevant to addressing manifestations of the lack of health equity in the contemporary world. That is, understanding why we are drawn to particular ways of seeing the world can potentially help increase the effectiveness of educational efforts – such as the anti-racist approaches with which I began this section – designed to promote appreciation of better, more equity- and health-promoting approaches.

5.3.4 Research

The implications of this dissertation are, of course, most immediately visible with respect to the task of informing a specific occupational and environmental health action-research project in El Oro. The generalizability of an epidemiology study depends on the characteristics of the population from which its study sample was drawn, and whether or not that sample was representative of that target population. As I employed methods that do not

allow for such extrapolation, the task of outlining implications for global health practice more generally is more complicated. Adapting the findings of this dissertation to research projects in other parts of the world, on other sorts of health issues, would therefore require careful consideration of the specific contexts in question. As the approach I employed is specifically designed to accomplish such careful contextualization, however, it provides a set of tools that could usefully be employed in targeting other global health research projects. Chapter 2, for example, provides a model that could be followed in systematically identifying the frames employed in a specific research area, and understanding where they come from. The ethnographic approach in Chapter 3, and especially the consideration of global and other scalar narrative elements, can be used in designing appropriately scaled and culturally-informed health research projects. Such methods can use local understandings of how people themselves see their health to complement – and perhaps contest – scientific, externally-derived biomedical models of health (Kleinman, 1980). Making specific decisions in complex situations about what to study, and how to study it, in order to achieve results that are scientifically valid and useful in improving health, furthermore, can be informed by the meta-narrative approach in Chapter 4. More generally, these different analyses suggest that global health should a) be informed by in-depth political economic, environmental and cultural analyses; b) employ empowerment-based participatory methods; and c) come to terms with the privileged position of Northern (but also Southern) researchers and the discursive features that help to justify this privilege.

On this last note, I turn to Janes and Corbett's (2009) observation of 'uses of sites in the global south to study their disease burdens to satisfy the needs of science' (p. 176). These authors point out that 'global health, a field of exploding popularity largely in Europe and

North America, is deeply involved in this manner of knowledge creation, exploitation, and exchange'. They consequently call for academic work that 'contributes to social justice and the remediation of structural violence where it is most severe'. Crane (2010b) similarly points out that 'if global health truly wants to make strides toward its ethic of global partnership, the field must make a more genuine effort to grapple with the unequal terrain on which it operates and which, ultimately, serves as its condition of possibility' (p. 94). To these critiques I would add a slight elaboration, based on the recognition that global health research is carried out by privileged people who gain career advancement from the study of less privileged people. The relative affluence of global health researchers and the relative poverty of participants in global health studies, moreover, are not independent phenomena. If global health researchers are serious about equity or effectively addressing health disparities, we must first acknowledge the economic and political structures generating our own privilege – and then, with humility, take steps to change them.

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Appendices

Appendix A: Documents analyzed in Chapter 2

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|--|-------------------------------|------------------|--------------------------------------|
| <p>Aragón A, Blanco LE, Funez A, Ruepert C, Lidén C, Nise G et al. (2006) Assessment of dermal pesticide exposure with fluorescent tracer: A modification of a visual scoring system for developing countries. <i>Annals of Occupational Hygiene</i> 50(1): 75–83.</p> | <p>Quantitative Mixed</p> | <p>Nicaragua</p> | <p>"developing countries"</p> |
| <p>Blanco LE, Aragón A, Lundberg I, Wesseling C and Nise G (2008) The determinants of dermal exposure ranking method (DERM): A pesticide exposure assessment approach for developing countries. <i>Annals of Occupational Hygiene</i> 52(6): 535–544.</p> | <p>Quantitative Mixed</p> | <p>Nicaragua</p> | <p>"developing countries"</p> |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|--|-----------------------|------------------|--|
| Cole DC, Carpio F, Julian J, León N, Carbotte R and DeAlmeida H (1997) Neurobehavioral outcomes among farm and nonfarm rural Ecuadorians. <i>Neurotoxicology and Teratology</i> 19(4): 277–286. | Quantitative Mixed | Ecuador | "developing countries / world" |
| Cole DC, McConnell R, Murray DL and Pacheco Antón F (1988) Pesticide illness surveillance: The Nicaraguan experience. <i>Bulletin of the Pan American Health Organization</i> 22(2): 119–131. | Quantitative Mixed | Nicaragua | "developing countries"; "Third World governments" |
| Cole DC, Orozco FA, Ibrahim S and Wanigaratne S (2011) Community and household socioeconomic factors associated with pesticide-using, small farm household members' health: a multi-level, longitudinal analysis. <i>International Journal for Equity in Health</i> 10: 54–54. | Quantitative Mixed | Ecuador | "developing countries" (in keywords only); "lower and middle income countries (LMICs)" |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|--|-----------------------|------------------|---|
| Corriols M, Marín J, Berroteran J, Lozano LM and Lundberg I (2009) Incidence of acute pesticide poisonings in Nicaragua: A public health concern. <i>Occupational and Environmental Medicine</i> 66(3): 205–210. | Quantitative Mixed | Nicaragua | "developing countries"; "less developed countries" |
| Handal AJ, Lozoff B, Breilh J and Harlow SD (2007) Neurobehavioral development in children with potential exposure to pesticides. <i>Epidemiology</i> 18(3): 312–320. | Quantitative Mixed | Ecuador | "developing country" |
| Keifer M, Rivas F, Moon JD and Checkoway H (1996) Symptoms and cholinesterase activity among rural residents living near cotton fields in Nicaragua. <i>Occupational and Environmental Medicine</i> 53(11): 726–729. | Quantitative Mixed | Nicaragua | No explicit characterization. |
| McConnell R and Hruska AJ (1993) An epidemic of pesticide poisoning in Nicaragua: Implications for prevention in developing countries. <i>American Journal of Public Health</i> 83(11): 1559–1562. | Quantitative Mixed | Nicaragua | "developing countries / world"; "Third World" |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|---|-------------------------------|-------------------|--------------------------------------|
| <p>McConnell R, Keifer M and Rosenstock L (1994) Elevated quantitative vibrotactile threshold among workers previously poisoned with methamidophos and other organophosphate pesticides. <i>American Journal of Industrial Medicine</i> 25(3): 325–334.</p> | <p>Quantitative Mixed</p> | <p>Nicaragua</p> | <p>"developing world"</p> |
| <p>Monge P, Wesseling C, Engel LS, Keifer M, Zuurbier M, Rojas M et al. (2004) An icon-based interview for the assessment of occupational pesticide exposure in a case-control study of childhood leukemia. <i>International Journal of Occupational and Environmental Health</i> 10(1): 72–78.</p> | <p>Quantitative Mixed</p> | <p>Costa Rica</p> | <p>No explicit characterization.</p> |
| <p>Monge P, Wesseling C, Guardado J, Lundberg I, Ahlbom A, Cantor KP et al. (2007) Parental occupational exposure to pesticides and the risk of childhood leukemia in Costa Rica. <i>Scandinavian Journal of Work, Environment and Health</i> 33(4): 293–303.</p> | <p>Quantitative Mixed</p> | <p>Costa Rica</p> | <p>"developing country"</p> |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|---|-----------------------|-----------------------|--|
| Orozco FA, Cole DC, Ibrahim S and Wanigaratne S (2011) Health promotion outcomes associated with a community-based program to reduce pesticide-related risks among small farm households. <i>Health Promotion International</i> 26(4): 432–446. | Quantitative Mixed | Ecuador | "lower and middle income countries" |
| Wesseling C, Ahlbom A, Antich D, Rodríguez AC and Castro R (1996) Cancer in banana plantation workers in Costa Rica. <i>International Journal of Epidemiology</i> 25(6): 1125–1131. | Quantitative Mixed | Costa Rica | "developing countries"; "third world" |
| Lu C, Rodríguez T, Thiravirojana-Thetkathuek A and Pearson M (2008) Feasibility of using salivary biomarkers to assess human exposure to chlorpyrifos. <i>Toxicological and Environmental Chemistry</i> 90(2): 315–325. | Quantitative | Nicaragua Thailand | No explicit characterization |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|--|--------------|------------------|--------------------------------------|
| García-Santos G, Scheiben D and Binder CR (2011) The weight method: A new screening method for estimating pesticide deposition from knapsack sprayers in developing countries. <i>Chemosphere</i> 82(11): 1571–1577. | Quantitative | Colombia | "developing countries" |
| Vergara AE and Fuortes L (1998) Surveillance and epidemiology of occupational pesticide poisonings on banana plantations in Costa Rica. <i>International Journal of Occupational and Environmental Health</i> 4(3): 199–201. | Quantitative | Costa Rica | "developing nations" |
| Antle JM, Cole DC and Crissman CC (1998) Further evidence on pesticides, productivity and farmer health: Potato production in Ecuador. <i>Agricultural Economics</i> 18(2): 199–207. | Quantitative | Ecuador | No explicit characterization |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|---|--------------|------------------|---|
| Aragón A, Blanco L, López L, Lidén C, Nise G and Wesseling C (2004) Reliability of a visual scoring system with fluorescent tracers to assess dermal pesticide exposure. <i>Annals of Occupational Hygiene</i> 48(7): 601–606. | Quantitative | Nicaragua | "developing countries"; "Third World context" |
| Au WW, Sierra-Torres CH, Cajas-Salazar N, Shipp BK and Legator MS (1999) Cytogenetic effects from exposure to mixed pesticides and the influence from genetic susceptibility. <i>Environmental Health Perspectives</i> 107(6): 501–505. | Quantitative | Costa Rica | "developing countries" |
| Azaroff LS (1999) Biomarkers of exposure to organophosphorous insecticides among farmers' families in rural El Salvador: Factors associated with exposure. <i>Environmental Research</i> 80(2): 138–147. | Quantitative | El Salvador | "poor countries" (as compared to "developed countries") |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|--|--------------|------------------|--|
| <p>Azaroff LS and Neas LM (1999) Acute health effects associated with nonoccupational pesticide exposure in rural El Salvador. <i>Environmental Research</i> 80(2): 158–164.</p> | Quantitative | El Salvador | "poor countries" (as compared to "developed" and "industrialized" countries) |
| <p>Balluz L, Moll D, Martinez MGD, Colindres JEM and Malilay J (2001) Environmental pesticide exposure in Honduras following hurricane Mitch. <i>Bulletin of the World Health Organization</i> 79(4): 288–295.</p> | Quantitative | Honduras | No explicit characterization |
| <p>Blanco LE, Aragón A, Lundberg I, Lidén C, Wesseling C and Nise, G (2005) Determinants of dermal exposure among Nicaraguan subsistence farmers during pesticide applications with backpack sprayers. <i>Annals of Occupational Hygiene</i> 49(1): 17–24.</p> | Quantitative | Nicaragua | "developing countries / world" |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|---|--------------|------------------|---|
| Bravo V, Rodríguez T, Van Wendel de Joode B, Canto N, Calderón GR, Turcios M et al. (2011) Monitoring pesticide use and associated health hazards in Central America. <i>International Journal of Occupational and Environmental Health</i> 17(3): 258–269. | Quantitative | Central America | "developing countries" |
| Cantor A and Young-Holt B (2002) Pesticide-related symptoms among farm workers in rural Honduras. <i>International Journal of Occupational and Environmental Health</i> 8(1): 41–45. | Quantitative | Honduras | "developing world" |
| Castro-Gutiérrez N, McConnell R, Andersson K, Pacheco Antón F and Hogstedt C (1997) Respiratory symptoms, spirometry and chronic occupational paraquat exposure. <i>Scandinavian Journal of Work Environment and Health</i> 23(6): 421–427. | Quantitative | Nicaragua | "developing countries / world"; "third-world countries" |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|---|--------------|------------------|--|
| Cataño HC, Carranza E, Huamaní C and Hernández AF (2008) Plasma cholinesterase levels and health symptoms in Peruvian farm workers exposed to organophosphate pesticides. <i>Archives of Environmental Contamination and Toxicology</i> 55(1): 153–159. | Quantitative | Peru | "developing countries" |
| Cole DC, Carpio F and León N (2000) Economic burden of illness from pesticide poisonings in highland Ecuador. <i>Pan American Journal of Public Health</i> 8(3): 196–201. | Quantitative | Ecuador | "developing countries / nations / world" |
| Cole DC, Carpio F, Julian J and León N (1998) Assessment of peripheral nerve function in an Ecuadorian rural population exposed to pesticides. <i>Journal of Toxicology and Environmental Health-Part A</i> 55(2): 77–91. | Quantitative | Ecuador | "developing countries / world" |
| Cole DC, Carpio F, Math JJM and León N (1997) Dermatitis in Ecuadorean farm workers. <i>Contact Dermatitis</i> 37(1): 1–8. | Quantitative | Ecuador | "developing countries / world" |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|---|--------------|------------------|--|
| Crissman CC, Cole DC and Carpio F (1994) Pesticide use and farm worker health in Ecuadorian potato production. <i>American Journal of Agricultural Economics</i> 76(3): 593–597. | Quantitative | Ecuador | No explicit characterization (but compares Ecuador to "developed countries") |
| Delgado E, McConnell R, Miranda J, Keifer M, Lundberg I, Partanen T et al. (2004) Central nervous system effects of acute organophosphate poisoning in a two-year follow-up. <i>Scandinavian Journal of Work Environment and Health</i> 30(5): 362–370. | Quantitative | Nicaragua | "developing countries" |
| Dowling KC, Blanco LE, Martínez I, Aragón A, Bernard CE and Krieger RI (2005) Urinary 3,5,6-trichloro-2-pyridinol levels of chlorpyrifos in Nicaraguan applicators and small farm families. <i>Bulletin of Environmental Contamination and Toxicology</i> 74(2): 380–387. | Quantitative | Nicaragua | "developing countries" |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|---|--------------|------------------|--|
| Feola G, Rahn E and Binder CR (2011) Suitability of pesticide risk indicators for Less Developed Countries: A comparison. <i>Agriculture, Ecosystems and Environment</i> 142(3): 238–245. | Quantitative | Colombia | "developing countries"; "Less Developed Countries (LDCs)" |
| Fieten KB, Kromhout H, Heederik D and Van Wendel de Joode B (2009) Pesticide exposure and respiratory health of indigenous women in Costa Rica. <i>American Journal of Epidemiology</i> 169(12): 1500–1506. | Quantitative | Costa Rica | No explicit characterization. |
| Grandjean P, Harari R, Barr DB and Debes F (2006) Pesticide exposure and stunting as independent predictors of neurobehavioral deficits in Ecuadorian school children. <i>Pediatrics</i> 117(3): E546–E556. | Quantitative | Ecuador | "developing countries" |
| Handal AJ and Harlow SD (2009) Employment in the Ecuadorian cut-flower industry and the risk of spontaneous abortion. <i>BMC International Health and Human Rights</i> 9: 25–25. | Quantitative | Ecuador | "developing countries"; "low income countries" |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|--|--------------|------------------|--------------------------------------|
| Handal AJ, Harlow SD, Breilh J and Lozoff B (2008) Occupational exposure to pesticides during pregnancy and neurobehavioral development of infants and toddlers. <i>Epidemiology</i> 19(6): 851–859. | Quantitative | Ecuador | "developing country / world" |
| Handal AJ, Lozoff B, Breilh J and Harlow SD (2007) Effect of community of residence on neurobehavioral development in infants and young children in a flower-growing region of Ecuador. <i>Environmental Health Perspectives</i> 115(1): 128–133. | Quantitative | Ecuador | "developing countries / world" |
| Harari R, Julvez J, Murata K, Barr D, Bellinger DC, Debes F et al. (2010) Neurobehavioral deficits and increased blood pressure in school-age children prenatally exposed to pesticides. <i>Environmental Health Perspectives</i> 118(6): 890–896. | Quantitative | Ecuador | "developing countries" |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|--|--------------|------------------|---|
| Hofmann J, Guardado J, Keifer M and Wesseling C (2006) Mortality among a cohort of banana plantation workers in Costa Rica. <i>International Journal of Occupational and Environmental Health</i> 12(4): 321–328. | Quantitative | Costa Rica | "developing countries" |
| Hoyos LS, Carvajal S, Solano L, Rodríguez J, Orozco L, López Y et al. (1996) Cytogenetic monitoring of farmers exposed to pesticides in Colombia. <i>Environmental Health Perspectives</i> 104: 535–538. | Quantitative | Colombia | No explicit characterization. |
| Hughes EA, Zalts A, Ojeda JJ, Flores AP, Glass RC and Montserrat JM (2006) Analytical method for assessing potential dermal exposure to captan, using whole body dosimetry, in small vegetable production units in Argentina. <i>Pest Management Science</i> 62(9): 811–818. | Quantitative | Argentina | No explicit characterization (but Argentina contrasted with "developed countries"). |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|---|--------------|------------------|---|
| Idrovo AJ, Sanin LH, Cole D, Chavarro J, Cáceres H, Nárvaez J et al. (2005) Time to first pregnancy among women working in agricultural production. <i>International Archives of Occupational and Environmental Health</i> 78(6): 493–500. | Quantitative | Colombia | "developing countries"; "less developed countries" |
| Jørs E, Gonzáles AR, Ascarrunz ME, Tirado N, Takahashi C, Lafuente E et al. (2007) Genetic alterations in pesticide exposed Bolivian farmers: An evaluation by analysis of chromosomal aberrations and the comet assay. <i>Biomarker Insights</i> 2: 439–445. | Quantitative | Bolivia | "developing countries" |
| Jørs E, Morant R, Aguilar G, Huici O, Lander F, Bælum J et al. (2006) Occupational pesticide intoxications among farmers in Bolivia: A cross-sectional study. <i>Environmental Health: A Global Access Science Source</i> 5: 10. | Quantitative | Bolivia | "low income countries" |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|---|--------------|------------------|--------------------------------------|
| Keifer M, McConnell R, Pacheco F, Daniel W and Rosenstock L (1996) Estimating underreported pesticide poisonings in Nicaragua. <i>American Journal of Industrial Medicine</i> 30(2): 195–201. | Quantitative | Nicaragua | "developing countries / world" |
| Koivunen ME, Gee SJ, Park E-K, Lee K, Schenker MB and Hammock BD (2005) Application of an enzyme-linked immunosorbent assay for the analysis of paraquat in human-exposure samples. <i>Archives of Environmental Contamination and Toxicology</i> 48(2): 184–190. | Quantitative | Costa Rica | No explicit characterization |
| Lee K, Park E-K, Stoecklin-Marois M, Koivunen ME, Gee SJ, Hammock BD et al. (2009) Occupational paraquat exposure of agricultural workers in large Costa Rican farms. <i>International Archives of Occupational and Environmental Health</i> . | Quantitative | Costa Rica | No explicit characterization |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|--|--------------|------------------|--|
| <p>Leyk S, Binder CR and Nuckols JR (2009) Spatial modeling of personalized exposure dynamics: the case of pesticide use in small-scale agricultural production landscapes of the developing world. <i>International Journal of Health Geographics</i> 8: 17–17.</p> | Quantitative | Colombia | "developing countries / world"; "less-developed regions" |
| <p>López L, Blanco L, Aragón A and Partanen T (2009) Insecticide residues on hands: Assessment and modeling with video observations of determinants of exposure: A study among subsistence farmers in Nicaragua. <i>Journal of Occupational and Environmental Hygiene</i> 6(3): 157–164.</p> | Quantitative | Nicaragua | "developing countries" |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|--|--------------|------------------|--------------------------------------|
| Lu C, Essig C, Root C, Rohlman DS, McDonald T and Sulzbacher S (2009) Assessing the association between pesticide exposure and cognitive development in rural Costa Rican children living in organic and conventional coffee farms. <i>International Journal of Adolescent Medicine and Health</i> 21(4): 609–622. | Quantitative | Costa Rica | No explicit characterization |
| Lu C, Rodríguez T, Funez A, Irish RS and Fenske RA (2006) The assessment of occupational exposure to diazinon in Nicaraguan plantation workers using saliva biomonitoring. <i>Annals of the New York Academy of Sciences</i> 1076: 355–365. | Quantitative | Nicaragua | No explicit characterization |
| Magnotti RA, Dowling K, Eberly JP and McConnell RS (1988) Field measurement of plasma and erythrocyte cholinesterases. <i>Clinica Chimica Acta</i> 176(3): 315–332. | Quantitative | Nicaragua | "developing countries" |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|---|--------------|------------------|---|
| Magnotti RA, Eberly JP, Quarm DE and McConnell RS (1987) Measurement of acetylcholinesterase in erythrocytes in the field. <i>Clinical Chemistry</i> 33(10): 1731–1735. | Quantitative | Nicaragua | "developing countries"; "Third World" |
| McConnell R and Magnotti R (1994) Screening for insecticide overexposure under field conditions: A reevaluation of the tintometric cholinesterase kit. <i>American Journal of Public Health</i> 84(3): 479–481. | Quantitative | Nicaragua | "developing countries" |
| McConnell R, Cordón M, Murray DL and Magnotti R (1992) Hazards of closed pesticide mixing and loading systems: The paradox of protective technology in the Third World. <i>British Journal of Industrial Medicine</i> 49(9): 615–619. | Quantitative | Nicaragua | "developing countries / world"; "Third World" |
| McConnell R, Pacheco Antón F and Magnotti R (1990) Crop duster aviation mechanics: High risk for pesticide poisoning. <i>American Journal of Public Health</i> 80(10): 1236–1239. | Quantitative | Nicaragua | "developing countries" |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|---|--------------|------------------|--------------------------------------|
| <p>McConnell R, Pacheco F, Wahlberg K, Klein W, Malespin O, Magnotti R et al. (1999) Subclinical health effects of environmental pesticide contamination in a developing country: Cholinesterase depression in children. <i>Environmental Research</i> 81(2): 87–91.</p> | Quantitative | Nicaragua | "developing countries" |
| <p>Miranda J, Lundberg I, McConnell R, Delgado E, Cuadra R, Torres E et al. (2002) Onset of grip-and pinch-strength impairment after acute poisonings with organophosphate insecticides. <i>International Journal of Occupational and Environmental Health</i> 8(1): 19–26.</p> | Quantitative | Nicaragua | "developing countries" |
| <p>Miranda J, McConnell R, Delgado E, Cuadra R, Keifer M, Wesseling C et al. (2002) Tactile vibration thresholds after acute poisonings with organophosphate insecticides. <i>International Journal of Occupational and Environmental Health</i> 8(3): 212–219.</p> | Quantitative | Nicaragua | "developing countries" |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|--|--------------|------------------|---|
| <p>Miranda J, McConnell R, Wesseling C, Cuadra R, Delgado E, Torres E et al. (2004) Muscular strength and vibration thresholds during two years after acute poisoning with organophosphate insecticides. <i>Occupational and Environmental Medicine</i> 61(1): e4.</p> | Quantitative | Nicaragua | "developing countries" |
| <p>Monge P, Partanen T, Wesseling C, Bravo V, Ruepert C and Burstyn I (2005) Assessment of pesticide exposure in the agricultural population of Costa Rica. <i>Annals of Occupational Hygiene</i> 49(5): 375–384.</p> | Quantitative | Costa Rica | "developing countries" (only in keywords) |
| <p>Orozco F, Cole DC, Muñoz V, Altamirano A, Wanigaratne S, Espinosa P et al. (2007) Relationships among productions systems, preschool nutritional status, and pesticide-relate toxicity in seven Ecuadorian communities: A multi-case study approach. <i>Food and Nutrition Bulletin</i> 28(2): S247–S257.</p> | Quantitative | Ecuador | No explicit characterization. |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|--|--------------|------------------|--|
| Orozco FA, Cole DC, Forbes G, Kroschel J, Wanigaratne S and Arica D (2009) Monitoring adherence to the international Code of Conduct: Highly hazardous pesticides in central Andean agriculture and farmers' rights to health. <i>International Journal of Occupational and Environmental Health</i> 15(3): 255–268. | Quantitative | Ecuador and Peru | "developing countries"; "lower and middle income countries" |
| Park E-K, Duarte Tagles H, Gee SJ, Hammock BD, Lee K and Schenker MB (2008) Recruiting strategy and 24-hour biomonitoring of paraquat in agricultural workers. <i>Journal of Agromedicine</i> 13(4): 207–217. | Quantitative | Costa Rica | "developing countries" |
| Partanen T, Chaves J, Wesseling C, Chaverri F, Monge P, Ruepert C et al. (2003) Workplace carcinogen and pesticide exposures in Costa Rica. <i>International Journal of Occupational and Environmental Health</i> 9(2): 104–111. | Quantitative | Costa Rica | "developing countries" |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|--|--------------|------------------|--------------------------------------|
| Penagos H, Jimenez V, Fallas V, O'Malley M and Maibach HI (1996) Chlorothalonil, a possible cause of erythema dyschromicum perstans (ashy dermatitis). <i>Contact Dermatitis</i> 35(4): 214–218. | Quantitative | Panama | No explicit characterization. |
| Penagos H, Ruepert C, Partanen T and Wesseling C (2004) Pesticide patch test series for the assessment of allergic contact dermatitis among banana plantation workers in Panama.. <i>Dermatitis</i> 15(3): 137–145. | Quantitative | Panama | "developing countries" |
| Restrepo M, Muñoz N, Day N, Parra JE, Hernandez C, Blettner M et al. (1990) Birth defects among children born to a population occupationally exposed to pesticides in Colombia. <i>Scandinavian Journal of Work, Environment and Health</i> : 239–246. | Quantitative | Colombia | No explicit characterization. |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|--|--------------|------------------|--------------------------------------|
| <p>Restrepo M, Muñoz N, Day NE, Parra JE, De Romero L and Nguyen-Dinh X (1990) Prevalence of adverse reproductive outcomes in a population occupationally exposed to pesticides in Colombia. <i>Scandinavian Journal of Work, Environment and Health</i>: 232–238.</p> | Quantitative | Colombia | No explicit characterization. |
| <p>Rodríguez T, Younglove L, Lu C, Funez A, Weppner S, Barr DB et al. (2006) Biological monitoring of pesticide exposures among applicators and their children in Nicaragua. <i>International Journal of Occupational and Environmental Health</i> 12(4): 312–320.</p> | Quantitative | Nicaragua | No explicit characterization. |
| <p>Rojas M, Reid J and Rincón R (1999) Pesticide exposure in a farming village in Venezuela – A developing country. <i>Archives of Environmental Health</i> 54(6): 430–435.</p> | Quantitative | Venezuela | "developing countries" |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|---|--------------|------------------|---|
| Rosenstock L, Keifer M, Daniell WE, McConnell R and Claypoole K (1991) Chronic central-nervous-system effects of acute organophosphate pesticide intoxication. <i>Lancet</i> 338(8761): 223–227. | Quantitative | Nicaragua | "developing countries / world" |
| Santamaría-Ulloa C (2009) The impact of pesticide exposure on breast cancer incidence. Evidence from Costa Rica. <i>Población y Salud en Mesoamérica</i> 7(1): 1. | Quantitative | Costa Rica | "developing countries" / "less developed countries" |
| Schenker MB, Stoecklin M, Lee K, Lupercio R, Zeballos RJ, Enright P et al. (2004) Pulmonary function and exercise-associated changes with chronic low-level paraquat exposure. <i>American Journal of Respiratory and Critical Care Medicine</i> 170(7): 773–779. | Quantitative | Costa Rica | No explicit characterization. |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|---|--------------|------------------|--|
| Valcke M, Chaverri F, Monge P, Bravo V, Mergler D, Partanen T et al. (2005) Pesticide prioritization for a case-control study on childhood leukemia in Costa Rica: A simple stepwise approach. <i>Environmental Research</i> 97(3): 335–347. | Quantitative | Costa Rica | "developing countries" |
| Van Wendel De Joode BN, De Graaf IAM, Wesseling C and Kromhout H (1996) Paraquat exposure of knapsack spray operators on banana plantations in Costa Rica. <i>International Journal of Occupational and Environmental Health</i> 2(4): 294–304. | Quantitative | Costa Rica | "developing countries" |
| Wesseling C, Antich D, Hogstedt C, Rodríguez AC and Ahlbom A (1999) Geographical differences of cancer incidence in Costa Rica in relation to environmental and occupational pesticide exposure. <i>International Journal of Epidemiology</i> 28(3): 365–374. | Quantitative | Costa Rica | "developing country"; "Third World" |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|--|--------------|------------------|--|
| Wesseling C, Castillo L and Elinder CG (1993) Pesticide poisonings in Costa Rica. <i>Scandinavian Journal of Work Environment and Health</i> 19(4): 227–235. | Quantitative | Costa Rica | "developing countries"; "third world" |
| Wesseling C, Hogstedt C, Fernandez P and Ahlbom A (2001) Time trends of occupational pesticide-related injuries in Costa Rica, 1982–1992. <i>International Journal of Occupational and Environmental Health</i> 7(1): 1–6. | Quantitative | Costa Rica | "developing countries" |
| Wesseling C, Hogstedt C, Picado A and Johansson L (1997) Unintentional fatal paraquat poisonings among agricultural workers in Costa Rica: Report of 15 cases. <i>American Journal of Industrial Medicine</i> 32: 433–441. | Quantitative | Costa Rica | "developing countries"; "third world" |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|--|--------------|------------------|--|
| Wesseling C, Keifer M, Ahlbom A, McConnell R, Moon JD, Rosenstock L et al. (2002) Long-term neurobehavioral effects of mild poisonings with organophosphate and n-methyl carbamate pesticides among banana workers. <i>International Journal of Occupational and Environmental Health</i> 8(1): 27–34. | Quantitative | | "developing countries" |
| Wesseling C, Van Wendel de Joode B and Monge P (2001) Pesticide-related illness and injuries among banana workers in Costa Rica: A comparison between 1993 and 1996. <i>International Journal of Occupational and Environmental Health</i> 7(2): 90–97. | Quantitative | Costa Rica | "developing countries" |
| Yearout R, Game X, Krumpke K and McKenzie C (2008) Impacts of DBCP on participants in the agricultural industry in a third world nation (an industrial health, safety case study of a village at risk). <i>International Journal of Industrial Ergonomics</i> 38(2): 127–134. | Quantitative | Unspecified | "underdeveloped country"; "third world" |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|--|--------------|------------------|--------------------------------------|
| Yucra S, Rubio J, Gasco M, Gonzales C, Steenland K and Gonzales GF (2006) Semen quality and reproductive sex hormone levels in Peruvian pesticide sprayers. <i>International Journal of Occupational and Environmental Health</i> 12(4): 355–361. | Quantitative | Peru | No explicit characterization. |
| Yucra S, Steenland K, Chung A, Choque F and Gonzales GF (2006) Dialkyl phosphate metabolites of organophosphorus in applicators of agricultural pesticides in Majes-Arequipa (Peru). <i>Journal of Occupational Medicine and Toxicology</i> 1: 27. | Quantitative | Peru | "developing countries" |
| Blanco LE, Aragón A, Lundberg I, Wesseling C and Nise G (2008) Reply - The accuracy of DERM may be a self-fulfilling DREAM. <i>Annals of Occupational Hygiene</i> 52(8): 784–785. | Mixed | Nicaragua | "developing countries" |

| Source | Sample(s) | Geographic focus | Terms used to represent global South |
|--|-----------|---------------------------|---|
| Keifer MC, Murray DI, Amador R, Corriols M, Gonzalez D, Jenkins Moliere J et al. (1997) Solving the pesticide problem in Latin America: A model for health-sector empowerment. <i>New Solutions: A Journal of Environmental and Occupational Health Policy</i> 7(22): 26–31. | Mixed | Central America | "developing countries / world"; "Third World" |
| Kromhout H, Van Wendel De Joode B and Van Hemmen J (2008) The accuracy of DERM may be a self-fulfilling DREAM <i>Annals of Occupational Hygiene</i> 52(8): 783–784. | Mixed | Nicaragua South Africa | "developing countries / setting" |
| Wesseling C, Corriols M and Bravo V (2005) Acute pesticide poisoning and pesticide registration in Central America. <i>Toxicology and Applied Pharmacology</i> 207(2): 697–705. | Mixed | Central America | "developing countries / world" |

Appendix B: Key informant interview guide

Brisbois

Date:

Pesticide/health/banana/Ecuador study

Location:

Key Informant Interview Guide

Interviewee Code:

Occupation of interviewee and relationship to banana/pesticide/health issues:

As I mentioned, I am doing a study on how people in Ecuador understand the effects of pesticides on human health, specifically focusing on the use of pesticides in banana production. I hope to use this information to help inform future research projects, or intervention projects, aimed at understanding and improving the health of people exposed to pesticides as a result of banana production. I will be doing interviews with banana farm workers, small producers, community members and other people exposed to pesticides, to understand how they perceive the effects of pesticides on human health. In talking to you, I hope to get a better sense of what questions I should ask in these later interviews, by learning your understanding of how Ecuador's banana industry works, how the pesticides used in banana production affect human health, and what different groups of people think and do about it.

1. In order to understand how the pesticides used in banana farming affect health, it would be helpful to know a bit about how the banana industry works. Can you please tell me some factors that affect the use of pesticides in the industry?
2. Can you please describe any ways you know of in which workers, small farmers, or communities surrounding banana plantations are exposed to pesticides? (Probe: how and why are people exposed to pesticides in the process of banana production?)
3. Are you aware of any health effects that individuals or groups claim to be suffering, or to have suffered, as a result of pesticide use in banana production?
4. How important are pesticide-related health effects to people in Ecuador (Probe: with respect to other problems, health-related or not...)
5. Can you please describe any ways that individuals or groups are attempting to protect peoples' health from pesticides? (Probe: individual workers, small producers, majordomos, farm owners, corporations, physicians, government departments, international organizations?)
6. A special focus of my research is related to international linkages. If you have not already done so, can you please discuss pesticides and health in light of the relationship between Ecuador and other countries – especially banana consuming and banana producing countries? (Probe: how are actors in other countries involved in causing or responding to pesticide exposure in Ecuador's banana industry?)

7. Is there anything else you would like to tell me about pesticides, health or banana production in Ecuador?

Version: October 30, 2011

Appendix C: Semi-structured interview guide

Brisbois

Date:

Banana/pesticide/health/Ecuador

Location:

Preamble: As I mentioned, I am doing a study on the way people living and working with pesticides perceive them. By pesticides I mean any agrochemical used to kill insects, spiders, weeds, worms, fungi (like Sigatoka Negra) or other pests. The reason for doing this study is to see if there are ways that communities, researchers and other partners can work together to improve the quality of life of people living and working with pesticides in connection with banana production in Ecuador. Feel free to provide as much or as little information as you would like to the questions. This can be as little as one word (yes or no, for example), and as much as a story to illustrate your answer. And of course you may refuse to answer any questions you don't wish to answer.

Part 1 (demographic information): First I would like to ask you a few short questions about yourself. This is so I can see if people with different characteristics have different ideas about pesticides and their health effects.

1.0 Gender:

1.1 How old are you?

1.2 Are you married?

1.3 Do you have any children?

- 1.4 Where did your parents come from?
- 1.5 What is your educational background? (probe: highest level completed of elementary school, high school, university)
- 1.6 What is your monthly income?
- 1.7 Where do you live?
- 1.8 Do you come into contact with pesticides in the community where you live? (which ones, if known)
- 1.9 What is your profession? (if it involves banana farm labour, ask follow-up questions, else go to Part 2)
 - 1.9.1. Do you own the farm that you work on?
 - 1.9.2. How big is the farm?
 - 1.9.3. How many employees does the farm have?
 - 1.9.4. What sort of banana production occurs on the farm (probe: conventional / organic)?
 - 1.9.5. Does the farm you work on have any sort of certification (probe: organic / fairtrade / GlobalGap)?
 - 1.9.6. How long have you worked in the banana industry?
 - 1.9.7. What type(s) of work do you do on the farm?
 - 1.9.8. Are you a member of any sort of labour organization or co-operative (probe: for example, a union)?
 - 1.9.9. Where is the farm you work on located?
 - 1.9.10. Do you apply or come into contact with pesticides in your work?

1.9.11. Which company exports the bananas grown on your farm (probe: Chiquita / Dole / Del Monte / Bonita / Bonanza / other)?

Part 2 (health): Now I'm going to ask you some questions about health.

2.1 Different people, including different types of doctors, have different ideas about what 'health' is. What does 'health' mean to you?

2.2 In general, how would you rate your health right now? I'd like you to choose one of five options: excellent, very good, good, fair, or poor.

2.3 Can you please explain what you mean by (answer to previous question)?

2.4 In general, what makes people healthy or sick? (probe: why are some people sick and other people healthy)?

2.5 What can people do to stay healthy, or to get better when they are sick?

Part 3 (pesticides): In this section I would like to talk about pesticides.

3.1 Do pesticides have any effects on nature or the environment?

3.2 Do pesticides have any effects on people?

3.3 Are there some people who are more vulnerable than others to pesticides?

3.4 How do people come into contact with pesticides in banana-producing parts of Ecuador?

3.5 Have you ever experienced health effects that you think were caused by pesticides?

3.5.1. Can you please describe that experience / those experiences?

3.6 Are there things people can do to protect themselves from pesticides?

3.6.1. Do you do these things?

3.7 Are there reasons why people who might like to protect themselves from pesticides aren't able to do so?

Part 4 (responses): In this section I would like to talk about what sorts of things could be done about pesticide exposure.

4.1 What are your plans for the future?

4.2 What are the most important challenges or problems facing people in banana-growing areas of Ecuador?

4.2.1. (If pesticides aren't mentioned) Are health effects from pesticides an important problem for you or other people you know?

4.3 What are some changes that could be made to improve your health, or the health of people in your community?

4.3.1. (if pesticides aren't mentioned in 4.3) Are there any changes that could be made to reduce health effects from pesticide exposure?

4.4 Who should be involved in any efforts to protect peoples' health from pesticides?

Part 5 (international dimensions): In this last section I would like to talk about links between Ecuadorians and people from banana-consuming countries. Ecuador exports more bananas than any other country. In addition, researchers (such as myself), volunteers, missionaries, transnational companies and other foreigners from developed countries have been carrying out various activities in Ecuador for many years now.

5.1 What has your experience been with foreigners from developed countries (e.g. US, Canada, Europe) in Ecuador?

5.2 Should banana consumers play a role in helping to improve the health of people living and working in banana-producing areas in Ecuador?

5.2.1. What should they do to help?

5.3 Should volunteers, researchers (such as myself) or other people from developed countries play a role in helping to reduce pesticide exposure in Ecuador?

5.3.1. What should they do to help?

Concluding statement: As I mentioned before, I will be returning to Canada soon to analyze the results of my research here, and to prepare a report of my findings. I will be returning to Ecuador in the second half of 2012 to share my results with people who participated in the study, and I will contact you when I know the exact dates when I will be here again. Also, I have some resources available on pesticides and health that I can share with you if you like. Thank you very much for your time and for sharing your experiences with me. ***Before I go, is there anything else you'd like to ask me, or tell me?***

Version: October 30, 2011

Appendix D: Chemicals used in banana production in El Oro (past and present)¹⁷

| Active ingredient | Common or trade name(s) | Uses | Acute toxicity | Carcinogen | Cholinesterase inhibitor | Groundwater contaminant | Developmental / reproductive toxin | Endocrine disruptor |
|--------------------------|--------------------------------|-------------|-----------------------|-------------------|---------------------------------|--------------------------------|---|----------------------------|
| alkyl aryl ethoxylates | Indicat 5 | adjuvant | | | | | | |
| azoxystrobin | Amistar 50ws, Bankit, Priori | fungicide | Not acutely toxic | Not likely | No | Potential | ? | ? |
| bacillus pumilus | Sonata | fungicide | ? | ? | No | ? | ? | ? |
| bacillus subtilis | Serenade AS | fungicide | ? | ? | No | ? | ? | ? |

¹⁷ Compiled with data from the Pesticides Action Network North America (PANNA) database (Kegley et al., 2010), which is based on review of existing ‘weight of evidence’ summaries of epidemiology and toxicology data. Empty boxes indicate attributes not listed in PANNA’s summary for the listed chemical.

| Active ingredient | Common or trade name(s) | Uses | Acute toxicity | Carcinogen | Cholinesterase inhibitor | Groundwater contaminant | Developmental / reproductive toxin | Endocrine disruptor |
|---|--|-------------|-----------------------|-------------------|---------------------------------|--------------------------------|---|----------------------------|
| bacillus subtilis, bacillus laterosporus, bacillus licheniformis, bacillus megaterium, bacillus pumilus | CustomBio B5 | fungicide | ? | ? | No | ? | ? | ? |
| bacillus thuringiensis | Dipel, Dipel 2X, Dipel 8L, Dipel SC, Xentari | insecticide | ? | ? | No | ? | ? | ? |
| bifenthrin | Biflex | insecticide | Moderate | Possible | No | ? | Yes | Suspected |

| Active ingredient | Common or trade name(s) | Uses | Acute toxicity | Carcinogen | Cholinesterase inhibitor | Groundwater contaminant | Developmental / reproductive toxin | Endocrine disruptor |
|--------------------------|--------------------------------|-----------------------------|-----------------------|-------------------|---------------------------------|--------------------------------|---|----------------------------|
| bitertanol | Baycor, Bitercor | fungicide | Not acutely toxic | Not likely | No | ? | ? | Suspected |
| boscalid | Cumora | fungicide | ? | Possible | No | ? | ? | ? |
| cadusafos | Rugby, Apache | nematicide | Yes | Not likely | Yes | ? | ? | ? |
| calcium / magnesium | granumax | fertilizer | | | | | | |
| captan | Colcafe, colcap | | Yes | Yes | No | ? | ? | ? |
| carbofuran | Furadan | insecticide / nematicide | Yes | Not likely | Yes | Potential | ? | Suspected |

| Active ingredient | Common or trade name(s) | Uses | Acute toxicity | Carcinogen | Cholinesterase inhibitor | Groundwater contaminant | Developmental / reproductive toxin | Endocrine disruptor |
|----------------------------|--|--------------------|-----------------------|-------------------|---------------------------------|--------------------------------|---|----------------------------|
| chlorothalonil | Bravo, Talonex 720 F, Echo 720 SC, Daconil 720, Odeon 720 | fungicide | Yes | Yes | No | Potential | ? | ? |
| chlorpyrifos | Dursban, Lorsban 48EC | insecticide | Moderate | Not likely | Yes | ? | ? | Suspected |
| citoquinin (cytokinins) | CITOKIN, CYTEX, KINETIN | Plant regulator | ? | ? | No | ? | ? | ? |
| citric acid | Citrex, Dodine? | fungicide | Yes | ? | No | ? | ? | ? |

| Active ingredient | Common or trade name(s) | Uses | Acute toxicity | Carcinogen | Cholinesterase inhibitor | Groundwater contaminant | Developmental / reproductive toxin | Endocrine disruptor |
|--|---|-------------|-----------------------|-------------------|---------------------------------|--------------------------------|---|----------------------------|
| dibromo-chloropropane (DBCP) | fumazone | nematicide | Moderate | Yes | No | Yes | Yes | Suspected |
| diazinon | DIAZINON, DIAZOL, BASUDIN | insecticide | Moderate | Not likely | Yes | Potential | Yes | Suspected |
| difenoconazole | Score, Sico, Sico 250 CE, Helcore 250 CE, Paladium | fungicide | Slight | Possible | No | ? | ? | Suspected |
| diquat (PAN ratings here are for diquat ion) | REGLONE | herbicide | Moderate | ? | No | ? | ? | ? |
| diuron | Diurex, Karmex | herbicide | Slight | Yes | No | Yes | Yes | Suspected |

| Active ingredient | Common or trade name(s) | Uses | Acute toxicity | Carcinogen | Cholinesterase inhibitor | Groundwater contaminant | Developmental / reproductive toxin | Endocrine disruptor |
|-----------------------------|--------------------------------|---|-----------------------|-------------------|---------------------------------|--------------------------------|---|----------------------------|
| endosulfan | Thiodan | insecticide / acaricide | Yes | Not likely | No | ? | ? | Suspected |
| epoxiconazole | Opal 7.5 EC, Duett 25SC | fungicide | ? | Yes | No | ? | ? | Suspected |
| ethoprophos (ethoprop) | Mocap | nematicide / insecticide | Yes | Yes | Yes | Potential | ? | ? |
| fenpropimorph | Volley, Volley 88 OL | fungicide | Not acutely toxic | Not likely | No | ? | ? | ? |
| fensulfothion | Terracur | insecticide / nematicide | Yes | ? | Yes | Potential | ? | ? |
| gibberelic (gyberelic) acid | Ryzup | Plant regulator, post-harvest (crown rot) | ? | ? | No | ? | ? | ? |

| Active ingredient | Common or trade name(s) | Uses | Acute toxicity | Carcinogen | Cholinesterase inhibitor | Groundwater contaminant | Developmental / reproductive toxin | Endocrine disruptor |
|---|--|-----------------------|-----------------------|-------------------|---------------------------------|--------------------------------|---|----------------------------|
| glufosinate-ammonium | BASTA | herbicide | ? | Not likely | No | Potential | ? | ? |
| glyphosate | glyphogan, Ranger, Arrasador 757, Demoleodor, pillaround | fungicide / herbicide | Slight | Not likely | No | Potential | ? | ? |
| humic and fulvic acids and other components | humirossi | fertilizer | ? | ? | No | ? | ? | ? |
| imazalil | fungaflor, imazilil, magnate | p/h fungicide | Moderate | Yes | No | ? | Yes | ? |
| malathion | | insecticide | Moderate | Possible | Yes | Potential | ? | Suspected |

| Active ingredient | Common or trade name(s) | Uses | Acute toxicity | Carcinogen | Cholinesterase inhibitor | Groundwater contaminant | Developmental / reproductive toxin | Endocrine disruptor |
|---|----------------------------------|--------------|-----------------------|-------------------|---------------------------------|--------------------------------|---|----------------------------|
| mancozeb | dithane, Vondozeb, Manzate | fungicide | Not acutely toxic | Yes | No | Potential | Yes | Suspected |
| melaleuca alternifolia | timorex gold | fungicide | | | | | | |
| metaldehyde | Matababosa | molluscicida | Moderate | Possible | No | Potential | ? | ? |
| oxamyl | Vydate | nematicide | Yes | Not likely | Yes | ? | ? | ? |
| phosphorus, nitrogen, potassium, etc. | super raiz | fertilizer | | | | | | |
| polyethylene glycol p-(1,1,3,3-tetramethylbutyl)-phenyl ether | Triton | surfactant | | | | | | |

| Active ingredient | Common or trade name(s) | Uses | Acute toxicity | Carcinogen | Cholinesterase inhibitor | Groundwater contaminant | Developmental / reproductive toxin | Endocrine disruptor |
|--------------------------|-------------------------------------|-------------|-----------------------|-------------------|---------------------------------|--------------------------------|---|----------------------------|
| propiconazole | Bumper, Tilt | fungicide | Moderate | Possible | No | Potential | Yes | Suspected |
| pyriproxyfen | Epingle, Lano, Knack, Juvinal | insecticide | Slight | Not Likely | No | ? | ? | ? |
| pyraclostrobin | Regnum | fungicide | ? | Not Likely | No | Potential | ? | ? |
| pyrimethanil | Siganex, Siganex 60 SC, fjinX | fungicide | Not Acutely Toxic | Possible | No | ? | ? | Suspected |
| spiroxamine | Impulse / Impulse 80 EC | fungicide | Moderate | Not Likely | No | ? | ? | ? |

| Active ingredient | Common or trade name(s) | Uses | Acute toxicity | Carcinogen | Cholinesterase inhibitor | Groundwater contaminant | Developmental / reproductive toxin | Endocrine disruptor |
|---------------------------|---|--------------------------|-----------------------|-------------------|---------------------------------|--------------------------------|---|----------------------------|
| tebuconazole, triademenol | Folicur, Orius, Silvacur, Combi | fungicide | Moderate | Possible | No | Potential | ? | Suspected |
| terbufos | Counter, Forater | nematicide / insecticide | Yes | Not Likely | Yes | ? | ? | ? |
| thiabendazole | Mertec, TB LAB | P/H fungicide | Slight | Yes | No | ? | Yes | ? |
| tridemorph | Calixin (Cal), Tridetox, Musaclean, Bananin | fungicide | Moderate | ? | No | ? | ? | ? |
| trifloxystrobin | Tega | fungicide | Slight | Not Likely | No | ? | ? | ? |