Conceiving Earths: Imagining Nature and Society in a Global Environment

By

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Abstract

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The following chapters are the culminating product of a sustained investigation into the entangled relationships between humans and land in the context of global capitalism. Looking specifically at the role of ideas in contests over territory, these pieces address this question via a number of different contexts: the cultivation of a chemicals-based understanding of soils to accompany the spatial expansion of industrial agriculture; new formulations of race in Latin America in relation to anti-imperialist land claims; emergent "land epistemologies" in revolutionary Mexico; and the National Federal of Colombian Coffee Growers' simultaneous investigations of coffee soils and coffee growers in a new science of the nation's biggest export sector. Together, these stories form a meditation on the ways that struggles between social actors for access to land are also about changing relationships between human and non-humans, between society and nature. They also address a foundational geographic theme- the social production of space- with particular attention to the critical role of the production of knowledge in that process.

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Introduction

The following chapters are the culminating product of a sustained investigation into the entangled relationships between humans and land in the context of global capitalism. Looking specifically at the role of ideas in contests over territory, these pieces address this question via a number of different contexts: the cultivation of a chemicals-based understanding of soils to accompany the spatial expansion of industrial agriculture; new formulations of race in Latin America in relation to anti-imperialist land claims; emergent "land epistemologies" in revolutionary Mexico; and the National Federal of Colombian Coffee Growers' simultaneous investigations of coffee soils and coffee growers in a new science of the nation's biggest export sector.

Together, these essays form a meditation on the ways that struggles between social actors for access to land are also about changing relationships between human and non-humans, between society and nature. They also address a foundational geographic theme- the social production of space- with particular attention to the critical role of the production of knowledge in that process. I refer specifically to Henri Lefebvre's notion of the social production of space as the physical and material activities that characterize and sustain a collective human experience of place at given locations and moments.

I have conducted this work specifically in relation to capitalism because if its distinctive capacity to bring social actors into mutually constitutive relation via linked processes of production and consumption. The multi-sited relations in question unfold through richly diverse global landscapes. That diversity includes political, cultural, economic, and geographic differences, what Anna Tsing calls the "friction" of global connection yielding new alliances, new antagonisms, and new forms of value that mediate far-flung relations. It is this question of value that is at the heart of the essays that follow- how places, things, and people have been imagined and re-imagined in place as a result of global commodity exchange.

I undertook this work because of a curiosity about the resonance of the global encounter across scales. As a category, 'global' more often than not stands in for phenomena that are vastly more limited. Indeed, its commonsensical resonance suggests something less about a whole than about a relationship between parts, a relationship of connection across difference- geographic, political, cultural, or otherwise. The scale of those relations requires observers to identify threads of connection recognizable in a diversity of contexts. Such connecting threads can include legal structures, religious or political affiliations, the circulation of objects, or linked changes in the atmosphere. In all cases, those connections must exist with many faces, recognizable both at the scale of the multiple and at each discrete point of connection. It is this multi-faceted aspect of global connection that concerns me here. What happens to linked phenomena as they are filtered through the particular cultural, political, and geographic constraints of a given location?

As such, I approach these investigations with particular attention to the encounter as a moment of deep analytical significance. In the case of Chapter One, "Justus von Liebig Makes the World," I ask how the spatial expansion of industrialized agriculture in the late nineteenth century precipitated a new abstraction of soil nature. Given the extent of territorial repurposing and frontier expansion for commercial agricultural production in this period, such abstractions allowed a nominally straightforward application of a singular logic of production across geographically and politically diverse (and often unfamiliar) landscapes. At the same time, I show how Liebig simultaneously extended the logic of industrial standardization to the laboratory itself, training a new generation of bench scientists in replicable research methods. In Chapter Two, "Polar Bears, Cactus, and Natives," and Chapter Three, "The Other Green Revolution," reformulations of environmental natures in Latin America and in Mexico emerge as a reaction to neo-colonialist incursions, asserting place-based rights over resources that supercede rights won via purchase. Finally, in Chapter Four, "The Blood of Heroes," Colombia coffee growers cultivate a new, place-based identity in direct relation to the geographically distant consumers, a constitutive encounter mediated by the traffic of coffee beans from south to north.

Conceptual practices seemed to me to be an especially useful avenue by which to pursue complex questions of global interconnection, processes of abstraction being infinitely flexible while at the same time wedded to the stubborn materiality of the matter at hand. I wondered, how might a group of people in one particular place imagine materials differently because of their relationship with people elsewhere? And how might conceptions of similar materials be different in a different place with a parallel set of relations abroad? Scholars have done impressive work over the past several decades showing the relationship between knowledge and empire. One body of research has illuminated the extension of knowledge from the metropole outward as part of appropriative processes more broadly. The first essay here, "Justus von Liebig makes the world," is an inquiry in that spirit. Other scholarship has focused on local or indigenous knowledge practices, the persistence of which has paralleled resistance to imperialist dispossession. Historian Dipesh Chakrabarty (2008) has referred to these two general impulses of meaning-making as "History A" and "History B," a reference that can be usefully translated from the category of history to other fields of collective meaning-making.

As important as these two approaches have been to casting light on the role of knowledge production in multi-sited power negotiations, I was most interested in a different kind of practice. While History A and History B represent knowledge with a specific geographic positioning and trajectory, I wanted to know about knowledge with its feet in different places. Particularly, I wanted to know about cosmopolitan thinking by local players thinking as global actors. Thus, my study of Colombian coffee-growers- Chapter Two- tracks ideas about farming and farmers of a domestically-controlled crop produced for predominantly foreign markets, asking how understandings of local actors and materials emerges in the context of a relationship that is simultaneously dependent and constitutive of local sovereignty. Chapter Three's investigation of land epistemologies in revolutionary Mexico tracks the deployment of international anti-capitalist economic theory in new national programs for collective land management. In Chapter Four, I show how Latin American social scientists and public intellectuals strategically engaged European and North American racial theories to naturalize local claims to land. In these different stories, knowledge is strategically adopted and repurposed in light of both local and international commitments.

These essays also share an orientation to questions of governance and the state. To the extent that the state legitimates some forms of knowledge over others via the application of resources and policy, I ask how cosmopolitan knowledge practices have bulwarked nation-building projects despite a heightening intensity and scale of global connections. While such a relation may seem on its face ironic, I argue here that it only by turning outward and engaging transnational forces that nations can emerge as relevant and legitimate arbiters of power among their respective citizenry.

Such a dynamic can take diverse forms according to different political and economic programs. For example, in Chapter One, I show how state forces in what would be Germany tapped laboratory science to galvanize its transition from feudalism to capitalism. In Chapter Two, I show how the coffee grower's association assumed a new role as governmental agent in the absence of a strong central state, mediating between foreign consumers and domestic producers and applying the profits of international commodity exchange to improve conditions among rural small-holders. Chapter Three details the ways that the Mexican state used contemporary, internationally-circulating science and political philosophy to realize revolutionary nation-building efforts. The efforts of Latin American intellectuals described in Chapter Four occurred as part of a broader popular effort in that period to re-orient Latin American governments toward their citizenry and away from ties with elites abroad.

Finally, my research here is focused on changing ideas about the environment. More specifically, I am interested in the different ways that land has been ascribed its own “nature” in different social contexts. The essays here show how those qualities are mutable according not only to different kinds of human use but also according to different relationships between the humans using it. Moreover, I focus specifically on farming, an interest that is both personal and intellectual.

My own formative experiences with land have been on and around farms. As a child and young adult, I both worked on my family's farm and lived in a community where many of

our neighbors made their living from farming. While the landscape along the Delaware River in western New Jersey where I grew up was in many places very beautiful, the land in that economically challenged area was most often understood in its relation to work and livelihoods. That work, in turn, was conditioned by a myriad of other factors- falling market prices, the availability of skilled labor, access to credit, and the growing desire of Manhattanites to consume our landscape in very different ways, either via second homes or as commuters along an increasingly congested highway system. How people lived on the land and why they lived that way was not a rural issue; it reflected the machinations of society on its broadest scales. I respect farming people, who often stay on the land against economic reason and at great personal sacrifice. As some one who came up around farmers, my academic work reflects both my own rural sensibilities and a commitment to rural communities.

Given the complexity of agriculture's place in society, I have found it curious that agrarian communities have been so often excluded from accounts of modernity and ideas in society. The history of science is often a history of laboratories, classrooms, and office buildings; I wanted to engage science from the outside in, as one category of idea-making whose stability does important social and cultural work. While they are frequently conceived of as backwaters- excluded from progress- or reactionary and backward- resistant to progress- rural spaces are contemporary and emergent in ways that are distinct from but connected to urban spaces. In the case of commercial farming, producers align their practice with the conceptual systems that drive the market system of which they are a part. To the extent that contemporary farmers participate in a globalized capitalist industrial food system, they are pressed to adhere to practices that accord with a particular logic of uniformity, efficiency, and transportability, qualities that lean on laboratory-based models that find their footing on the uneven ground of their world's croplands. As such, these essays interrogate the ragged edges of scientific thought, the point at which scientific truth is translated into the practice of daily life, either as a strategy of engaging the natural world or as a strategy of negotiating control over resources.

Theoretical Orientation

I begin these investigations from Karl Marx's contention that social life is a product of ongoing, dialectical engagement between distinct but dynamically inter-relational forces. These include relations between and among differentiated classes of humans as well as between among human and non-humans, particularly in relation to Marx's productive trilogy of land, labor, and capital (Polanyi's so-called fictive commodities). I am particularly concerned with Marx's fundamental contention that capital is first and foremost a social relation, the essential dimensions of which are veiled by a commodity form that confuses people with objects in the systemic, exploitative exercise of power between classes. Second, I ascribe to Henri Lefebvre's assertion that societies produce particular social spaces as a function of historically and geographically specific modes of production, and that, like commodities, these spaces manifest as simultaneously abstract and concrete in the performance of social life. I

attend specifically to Lefebvre's contention that an understanding of social space requires an analytical concentration on the processes of social production rather than on its products. Finally, I follow Antonio Gramsci's insistence that social production is a broad endeavor encompassing language, music, science, literature, party politics, and institutions of governance as well as the industrial production of commodities. I am informed specifically by his attentions to the necessarily historical aspects of social production, in which the diverse materials of social life are dynamically reproduced and recast to sustain hegemonic structures through temporal and spatial shifts.

Much has been made of Marx's contention that social relations between humans assume, under capitalism, "the fantastic form of relations between things...[which] appear as autonomous figures endowed with life of their own." (1990 [1867], p. 165) Articles of exchange, in this sense, transcend the sensuousness of their own material character to objectively embody the social characteristics of human labor processes. Commodity fetishism, which is inseparable from commodity production writ large, emerges as the imaginative form of social life within the capitalist mode of production, deriving from the ongoing conceptual dialectic between abstract and material matters.

Karl Polanyi's *The Great Transformation: The Political and Economic Origins of Our Time* (2001 [1944]) finds such an analytical reification in market society's "dis-embedding" of commodity exchange from other processes of social life, practice that he identifies as particular to the marriage of capitalism and the liberal state. Designating exchange to the so-called "economy"- and separating it epistemologically and institutionally from other forms of human activity- instantiates an exemption of commodity exchange from other processes of political life via the ostensibly "free market." This occurs in spite of, and perhaps because of, the role of the liberal state in actively creating the conditions for capitalist commodity exchange through particular designation of political rights in property. In particular, private rights in land, labor, and money- the "fictive" commodities that gain entrance to the market through legislative action rather than conventional capitalist productive practices- are made possible only through state processes, including a state monopoly on violent coercion. By creating and maintaining these rights, the state secures the access of capitalists to the critical means of industrial production. The social character of liberal political subjects, then, is naturalized according to the inalienable rights of individual subjects over the commodified objects of exchange.

In his analysis of commodified space, Henry Lefebvre argues for the revolutionary potential of an analytical route that de-centers the product- that is, the commodity itself- in favor of production as a dynamic dialectical process. Here, we can read production as not only the transformative application of human labor power but the generative circuit of production, equivalence-based exchange, consumption, and reproduction that underwrites social life. Following the transformation of the commodities in this case allows for a relational analysis of production and consumption that lends insight into changes in social space and time. Lefebvre's analysis calls on scholars of social life to understand social meaning as a system of mutually constituting practices rather than a fixed object of collective attention.

At the same time, a spatial analysis of commodity production lends new significance to the alienable quality of the commodity- that is, its capacity to be physically and analytically separated from the distinct, relational context of its production in order to enter into a relation of value equivalence with other commodities in the marketplace. It is this characteristic, and particularly its analytic aspect, that fundamentally enables the commodity fetish. Rather than the object being socially legible in terms of its unique accumulation of diverse human activities, it achieves its social valuation only via the processes of abstraction and alienation that enable the entry of the commodity into the marketplace. Not only, then, is the collective aspect of social production and reproduction obscured, but the dialectical, socially-embedded relationship between people and things is refigured in terms of an opposition between possessing subjects and alienable (thus trade-able) objects. As capitalist systems of production and exchange expanded in geographic scope and intensity through the nineteenth and twentieth century, the stakes of these elisions became increasingly complex, encompassing not only uneven power relations between capitalist and laborer but also among peoples differentiated by citizenship, race, age, and gender.

Considering specifically the growth and collapse of global agricultural commodity markets in the late nineteenth and early twentieth centuries, these essays ask how the international traffic of capital and commodities has shaped relations between people and land in specific locations. Such transformations have relied on what Polanyi refers to as the disembedding or, in cases of Polanyian counter-movements, the re-embedding of land in society. Notably, while its implications are decidedly material, the process of dis- or re-embedding nature is a conceptual one, relying on changes in laws, ideas, and custom. In his introduction to *The Magical State* (1997), Fernando Coronil offers the useful analytic of cultural materialism, which responds simultaneously to all three of the preceding theoretical concerns. Pointing to the frequent scholarly separation between cultural and material factors, Coronil argues for an analysis of social production that accounts for the fundamental interrelation between the two. Further, he contends that the conventional excision of the non-human or the so-called "natural" world from discussions of society has obscured essential aspects of globally-scaled social production. In the chapters that follow, I engage a version of Coronil's cultural materialism to illuminate new ways of understanding nature- human and otherwise- that emerged in relation to global production and exchange.

Social historians of imperialism have demonstrated the ways that intellectual and cultural processes have been an essential correlate to the concrete assertion and destruction of borders within capitalist imperialist expansion. The latter narratives, in particular, offer insights into the ways that novel modes of hegemonic understanding have emerged in the context imperial encounters. These include the production of scientific knowledge as well as epistemological categories of race, gender, modernity, society, and the individual that extend the geographic limits of Western hegemonic social practice.

A Gramscian mode of analysis is particularly useful for the integration of these lines of inquiry, linking the development of intellectual and industrial production within class-based social domination. Gramsci points to the distinguishing posture of the bourgeoisie under capitalism as "an organism under continuous movement" working to expand its own cultural

and economic program through a program of state-sponsored, assimilative education. However, at the same time that Gramsci elucidates the production and reproduction of hegemonic knowledge systems, he also draws attention to the ways that conceptual differences arising from experience (or the dialectical engagement with the conceiving subject with its world) produce an "organic" knowledge that can be in opposition to or outside of these hegemonic knowledge structures. As such, hegemonic or governmental structures are not, in fact, totalizing or universal. Rather, they exist in relation to their own borders and limitations, against which they are in ongoing, generative tension, what Judith Butler refers to as the productive constraints of everyday life.

Gramsci's category of the organic intellectual becomes particularly salient in light of anthropologist Marilyn Strathern's provocations against conventional notions of the liberal subject within society. Strathern critiques a notion of the discrete, inherently oppositional individual, and with it models of society as 'scaled-up' iterations of the liberal subject. Rather, she raises the possibility of personhood as emergent through collective engagements with diverse assemblages of human and non-human elements. Social identification emerges as imminent, multiple, and relational. Her position is resonant with Lefebvre's contention that Western epistemology has conceptually eliminated the collective subject, an obfuscation that rests in an opposition between a thinking 'I' and the object of its investigation, or, more specifically, between the status of space and the status of the social subject.(4) Such an opposition, for Lefebvre as well as for Strathern, is an anathema to lived practice of social production, in which boundaries between subject and object collapse in the process of mutual transformation. Strathern's reconsideration of the category of society itself allows us to see the imperial encounter as more than the collision of discrete cultures. Rather, these contexts have produced spatially distinct networks of social practice between heterogeneous social actors that mobilize contextually-specific notions of difference to support particular power relations in place.

Lefebvre contrasts the knowing that emerges from direct experience (*connaissance*) from the abstracted knowledge (*savoir*) of hegemony. In the social space of the commodity world, what Lefebvre refers to as "abstract space," following the processes of abstraction that divorce things from the material sociality of their use and production, there is a similar tension. Commodity chains generate particular social spaces as their circuits of exchange expand and intensify. The world market following imperial capitalist expansion, then, is marked by the imbrication of abstracted space with the concrete specificities of particular places, times, and individuals, what Lefebvre refers to as "homogeneity made up of specificities." In truth, the expansion of commodity space relies both on the concrete pluralities of places and things and on the homogenizing forces of abstraction. The work that follows seeks to understand the complex relation between the two.

Summary of Chapters

The first of these chapters, "Justus von Liebig Makes the World: Soil Properties and Property in the 19th Century" details the genesis and dissemination of a chemical model of soil

nature that paralleled the expansion of industrialized agriculture in the nineteenth century. Through an examination of the life and work of chemist Justus von Liebig, the so-called "Father of Modern Agricultural Science," I show how the political and economic developments of liberal industrial capitalism in turn provoked a novel mode of understanding soil as a key means of agricultural production. Drawing on Antonio Gramsci's theories of intellectuals in society, I place Liebig's theories of soil chemistry in conversation with his previously unexamined political theorizing to demonstrate how the two supported a single vision of social transformation. In so doing, I argue that critical interrogations of anthropogenic environmental change require attention to epistemological as well as materialist interventions.

The second chapter, "The Blood of Heroes: Nationalist Bodies, National Soils, and the Scientific Conservation of the Federation of Colombian Coffee-Growers (1927-1946)," explores the scientific research and management programs of Colombia's Federation of Colombian Coffee-Growers (FEDECAFE) as part of a campaign to ensure the long-term viability of the nation's largest and most prominent export crop in the 1930s and early 1940s. Their work served a constituency of largely peasant small-holders in a period of increased erosion and declining coffee yields. Drawing on the organization's internal records and popular publications, this research shows how new ideas about human and ecological natures were an essential component of FedeCafe´ hegemony, conceptually embedding the vitality of Colombian nationhood and citizenship in coffee country's ecological systems. Further, this conceptual reembedding of society in ecological processes was itself the result of concerted challenges to new forms of land and labor exploitation that accompanied the global capitalist commodity booms of the late nineteenth and early twentieth centuries.

Chapter Three, "The Other Green Revolution: Land Epistemologies and the Mexican Revolutionary State" explores the development of Mexican Revolutionary land epistemologies in the years following the global Great Depression. Demonstrating how ideas about agrarian life informed national development efforts across multiple spheres, including public education, state-sponsored media, and governmental conservation projects, I argue that human-nature relations were constitutive of state visions of Revolutionary citizenship. Scholarly work interrogating the role of scientific knowledge in land politics has focused on the ways that territorial dispossessions are routed through expert truth claims; this study deviates from that work by asking how resource conflicts can also produce new knowledge to support progressive platforms for change.

Finally, Chapter Four, "Polar Bears, Cactus, and Natives: Race, Agrarian Reform, and Environmental Determinism in Latin America (1920-1950)," examines environmentalist thought as a function of Latin American anti-imperialist reform movements in the first half of the twentieth century, arguing that progressive Latin American intellectuals emphasized constitutive links between race and place to support community claims to land and subsistence. I argue that environmentalism was attractive to this international cohort of thinkers because of its emphasis on spatial difference. By spatial in this case I indicate not simply geographic location but also the tri-partite engagement of environmental resources, labor, and social systems in place by which social space is continually produced and transformed over time. In a context in which leftist politics emphasized the rights of rural and

indigenous peoples over the power of international capital to control national landscapes, environmentalism lent the weight of international scientific authority to struggles for agrarian reform, naturalizing collective land claims by asserting the deeply-rooted mutual constitution of particular peoples and landscapes. Moreover, by linking racial and cultural formation with specific lands and landscapes, these theories resisted the universalist claims of political subjects' commensurability (if not equivalence) that distinguishes life in liberal capitalist society.

Some Notes on Method

The chapters that follow rely primarily on archived text to illuminate past perspectives. My objective in each piece was to detail the emergence of new forms of knowledge alongside new political and environmental experience. At times these knowledge forms aligned with what is conventionally thought of as science; in other contexts, they did not. In all cases, my interest was in showing how certain social actors endeavored to turn emergent forms of understanding into something like common sense as part of a broader push toward social- and spatial- transformation. As such, I turned to many different forms of text. Scientific publications, conference proceedings, and the personal papers of scientists detailed the emergence of knowledge among so-called experts, while popular books, news journals, and visual culture captured its dissemination, or attempted dissemination, to the public, and particularly to those members of the public who practiced local forms of environmental management. Government documents- including agency field reports, budgets, internal communications, and institutional publications- were frequently revealing about intersections and disconnects between the two.

Like all methods, archival research presents its own limitations and possibilities. In these cases, the people involved in the production of texts for popular consumption- including art and film- were often of a very different social class and educational level than the intended consumers of those texts. Where more working class publics appeared in the archives, their experience was more often than represented by a scientist, bureaucrat, or political leader. In practice, then, I have produced accounts of these more elite social actors while relying on secondary archival and scholarly accounts to illuminate poor and working people's experience.

While all histories are diminished by such omissions, these absences have also been productive of a methodological line of inquiry that runs through all four of these pieces and particularly through the final three. In general, I draw on a Gramscian understanding of the hegemonic form in which dominant forces must wrestle continually with subordinated interests to maintain their social position. New forms of those struggles- via coercion or consent- may not represent the wholesale transfer of power in society; however, they can reflect meaningful changes in affinities and alliances that have real, material impacts on the lives of social actors. I use the archived evidence of elite activity to investigate the resonance of popular interests and activities beyond the sphere of working class life.

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Chapter One

Justus von Liebig Makes the World: Soil Properties and Property in the 19th Century

Chemical fertilizers are a central part of what many critical observers have deemed a global crisis in agriculture in the twenty-first century (Howden et al 2013; Goodman and Watts 1997; McMichael 2011). As a kind of spatial fix (Harvey 2001) for industrialized agriculture, chemical fertilizers deliver mineral inputs from off-farm sources- most frequently in the form of processed petroleum- to spur plant growth at a rate and intensity unsupportable by un-amended local soils. Over the past century, this mode of soil management has returned tremendous yields to growers at the same time that it has visited widespread soil exhaustion, ecologically-devastating chemical run-off, and increased farmer debt on agrarian communities. While human agriculture has long relied on soil amendments to heighten fertility, the logic of chemicals-based soil assessment and amendment is unique to the industrial era. This article asks how that logic moved from a re-fitted army barracks in a German backwater to define a new era of globalized agricultural production. Through an examination of the life and work of chemist Justus von Liebig, the so-called "Father of Modern Agricultural Science," it shows how the political and economic developments of liberal industrial capitalism in turn provoked a novel mode of understanding soil as a key means of agricultural production. Drawing on Antonio Gramsci's theories of intellectuals in society, I place Liebig's theories of soil chemistry in conversation with his previously unexamined political theorizing to demonstrate how the two supported a single vision of social transformation. In so doing, I argue that critical interrogations of anthropogenic environmental change require attention to epistemological as well as materialist interventions.

Introduction

In the case of agricultural production and land management, processes of abstraction have been essential to the centralization, industrialization, and intensification of agriculture, developments that rested on increasingly global markets for agricultural commodities. Noting these transformations in nineteenth-century England, Karl Marx, perhaps the pre-eminent observer of social abstraction in this period, observed that the industrialization of farm production coupled with the spatial separation of food production and consumption had caused soil nutrients to be extracted from British farmland at a rate that exceeded nutrient

replacement.[1] This dissonance between the rate of ecological extraction and renewal he termed the "metabolic rift" of capitalist production, a concept that also implied the spatial disconnect between sites of extraction and sites of use.

Yet just as capitalism's exchange of commodities between disparate locations requires a singular referent of value, so does the movement of ideas and practices necessitate consolidations of meaning through complex fields of people, landscapes, and things. Based in part on his own observation of commodity circulation and waste deposition, Marx's analysis of the former drew on the writings of contemporary German chemist Justus von Liebig, the so-called 'Father of Agricultural Science,' whose Law of the Minimum[2] was a critical analytic vector for new chemistry-based soil management strategies in the late nineteenth century. Marxist political ecologists reflecting on the genesis of industrial capitalism have returned to Marx's notion of metabolic rift and in particular to Marx and Liebig's concepts of soil metabolism to pose more ecologically-sensitive theories of capitalist development (Foster 1999; Foster and Magdoff 2000; Swyngedouw 2004, 2006). While these scholars have invoked Liebig's work to support arguments for the unsustainability of capitalist production, those invocations have neglected to note the centrality Liebig's intellectual contributions to the global development of industrialized agriculture.

Liebig's Law of the Minimum showed that *in situ* growth is constrained by the measure of the least locally available nutritive element; his recommendations to farmers called for chemical assessments and amendments to overcome those constraints. Liebig's own commercial formulas for soil amendment were widely dismissed as ineffective. However, the *idea* that plant growth was reducible to measurable chemical interactions was revolutionary. As transformative was the encumbent practical implication that farmers could reliably overcome the local limits of fertility via capital investment in off-site resources, thus amplifying the overall space of production. Moreover, the chemical theory of organic growth enacted a powerful parallel conceptual transformation, framing a commensurability between the world's diverse soils that could accommodate a singular management strategy across diverse landscapes. These ideas laid the foundation for an international chemical fertilizer industry that allowed industrial agriculture to maintain and even increase production levels over time, a spatial fix that would temporarily bridge Marx's metabolic rift for modern agricultural production.

In a critical examination of Marx's claims about the influence of industrialization on rural soil fertility, Schneider and McMichael (2010) contend that the theory of metabolic rift presented in *Capital* relies on a flawed evidence about rural soil management practices in nineteenth century Britain. Rather, they argue, Marx and more contemporary theorists of the metabolic rift have focused on the *division* of labor without a concurrent attention to the concrete *practices* of labor, a myopia that has left the ecological aspect of capitalist

[1] See, for example, his discussion in the *Grundrisse*.

[2] Liebig's Law of the Minimum holds that plant growth is fundamentally constrained by the least available nutrient in a given ecological context. Thus, given no other changes in the system, a diminished supply of a single input leads to diminished growth because development proceeds according to a consistent chemical/metabolic ratio.

development both under-theorized and overly abstracted. In particular, Marx's claims about the deleterious effects of diminished supplies of "humanore" or night soil following the mass migration of workers to the city from the countryside, they contend, is not supported by more recent historical studies of English farming practices at the time, which show that humanore was only a minor part of complex land management strategies (see Duncan 1996; Friedmann 2000). Schneider and McMichael, in contrast, posit an alternative explanation for the significance of urbanized labor to rural soil fertility. Citing the epistemological break that followed the spatial reorganization of labor, they contend that the central loss to rural land management systems was not humanore but rather place-based peasant knowledge that retreated from the countryside alongside employment-seeking workers. This paper concurs with Schneider and McMichael's conclusion that the epistemic aspect of changing spatial relationships is key to understanding nineteenth century capitalism's widening metabolic rift. However, I argue that as important to that transition was the particularly situated knowledge that *replaced* peasant knowledge, specifically the modern theories of chemical soil fertility propagated by Justus von Liebig, theories that were themselves a product of changing relations between town and countryside.

This article takes up the influential 'Law of the Minimum' as a social product of the burgeoning industrial era, placing Liebig's most famous observation in the quotidian political, geographic, and historical context of its emergence. As key innovations in agricultural and chemical science, Justus von Liebig's contributions involved a profound re-envisioning of organic development, distilling complex processes to a series of chemical relationships. I make a two-fold argument about the form and force of that vision. First, drawing on Liebig's writings on political community and the social function of knowledge- a body of work that has been heretofore overlooked by historians of science and agriculture- I argue that Liebig's theories were directly and self-consciously shaped by commitments to an ascendent bourgeoisie as the German state of Hesse-Darmstadt transitioned from feudalism to liberal democracy. Liebig's political writings argue for the primacy of professional authority over lay knowledge in modern society at the same time that his practical model of soil fertility shifted the power of soil assessment from the farmer to the laboratory. Second, I follow historians of science and agriculture (Brock 1997; Jungk 2009) in arguing that the power of Liebig's innovation lay not in his empirical contributions but rather in the practical utility of his theoretical models and the personal networks by which they were disseminated. However, I push that argument further to show that their utility was strategically particular to nineteenth century industrial capitalist expansion.

Father of Modern Agricultural Science

The professional life of Justus von Liebig, like many iconic figures, is distinguished by both the magnitude of his achievements and the extent to which those achievements have been overestimated. The son of a drysalt and dye merchant, Justus Liebig was born in 1803 in the German state of Hesse-Darmstadt, his early years marked by daily exposure to the practical applications of chemistry. A failed teenaged apprenticeship to an apothecary was followed by several years of university study in Germany and finally doctoral research in two

private French laboratories, where Liebig sought to compensate for the lack of direct laboratory experience offered to students at German universities. Sponsored by Duke Ludwig of Hessen-Darmstadt, Liebig's French study was funded in part with the hope that the young chemist would bring the techniques of new French industries, including the processing of sugar beets and production of pharmaceuticals, back to aid eager German capitalists (Brock 1997, 116).

In 1824, Justus Liebig was finally installed in a professorship in chemistry in the Hessen-Darmstadt University of Giessen, a position he was to retain for almost thirty years as a servant of the state. In the period when it solicited Liebig's services, Liebig's patron state of Hessen-Darmstadt was embroiled in a profound transformation. The 1824 edition of *Encyclopedia Britannica* offered the following description:

> 'The sole government is, at present, the Grand Duke, but he has pledged himself to convene the states this year (1820) and to form a free constitution. The revenues amount to about 500,000 pounds sterling, but are insufficient to meet the expenditure. The taxes are higher than in any other part of Germany, and the debt very heavy. The military forces, though reduced, still reach to nearly 7000 men, and a militia of the whole population... More corn is grown than is generally consumed, but that arises from the lower classes being subsisted principally on potatoes. Some of the best wines are made in this state. It supplies other countries with fruit, nuts, madder, clover-seed, potash, honey, and wax, and with manufactures of yarn and linen.... There are more nobles with extensive estates than in the other parts of Germany, and the peasants were in a state of slavery until they were liberated in the year 1813.'

Moving at break-neck speed from feudal fiefdom to republican territory, Hessen-Darmstadt sustained sharp inequalities between rich and poor. Student and grassroots mobilization for liberal reforms put additional pressure on the state government, which frequently mobilized its military to settle unrest among demonstrators. Liebig's state-sponsored work was part of a larger government developmental program designed to seed and support a nascent bourgeoisie as part of a liberal transition, an undertaking conceived to neutralize local popular uprisings while defending against British incursions into domestic markets. William Brock (2003) links these priorities simultaneously to new fiscal and education policies, noting that Hessen-Darmstadt was one of the first small German states to dispense with traditional border tarriffs and join the *Zollverein* 1828. The Prussian-devised customs union supported free trade across state borders while protecting central European producers with high tarriffs on imported goods. New trade policy would be one important front on which to compete with the growing power of British industry; technical education and expertise would be another (Brock 2003, 35-6).

Under this reform program, the university town of Giessen soon nearly doubled in size, expanding on a modern urban grid plan from a "pastoral market town" to a busy trading hub focused on a newly-installed railway system (33). The career Liebig began in Giessen was marked by two major transitions that would have international implications. First, Liebig successfully petitioned the municipal government of Darmstadt to provide funds for a new

teaching laboratory. Not coincidentally, this lab would be built in old military barracks vacated by the upgrade and expansion of state forces in 1820. Prior to the construction of Liebig's lab, scientific instruction had been most commonly conducted through lecture and demonstration; students would observe the experiments of professors, note their explanations, and craft an understanding of the physical world accordingly. Liebig's students were called on to conduct experiments themselves in his laboratory and report their results to Liebig, a model that attracted students from around the world and led the University of Giessen to unparalleled prominence in the field of chemistry (Browne 7). Though Liebig was not, as is often assumed, the originator of this pedagogical model- historians B. H. Gustin and J. B. Morrell have shown that university-level instruction in lab techniques in Europe pre-dated Liebig's efforts at Giessen- the scale and efficiency of Liebig's lab set an entirely new standard for training in chemistry and transformed popular ideas about effective scientific education (Fruton 5).

The second development foundational to Liebig's career was his shift in 1838 from "pure" organic chemistry to agricultural chemistry. While his contributions to the first, including the investigation and analysis of different chemical compounds, were significant, it was his work in the latter that earned him a place among the most influential intellectual figures of the 19th century. Indeed, it was through his work in the applied field of agricultural chemistry that Liebig effectively pursued the position of "gatekeeper" between the industrializing world and the field of chemistry, a discipline he believed to be foundational to all of modern social, political, and economic life. While much of Liebig's success in this role should be attributed to the breadth of his professional activities, which I will explore later in this paper, the latter period of his career was marked by several key conceptual positions through which those activities and his influence more generally should be understood.

First, Liebig began both his scientific inquiries and his industrial interventions with the assumption that there was no meaningful difference between the constitutions of living and non-living matter. All material bodies could be productively reduced to a series of relationships between discrete chemical agents and interventions performed at the level of those chemicals. Further, these agents could translate uniformly between dramatically different contexts, building blocks in a world of circulating equivalents in which all matter was nominally equal to the sum of its parts. (Lipman 1967 177). While dominant thinking in this period retained a commitment to a fundamentally spiritual aspect of living organic processes- Romantic natural philosophy's so-called *vis vitalis* or vital force- Liebig's analysis aligned him with the materialists of the day in arguing that such forces were themselves the product of practically identifiable origins (Kirschke 2003). Liebig saw chemistry as an analytic *lingua franca* for connecting organic processes, concluding "'the only known ultimate cause of vital force, either in animals or in plants, is a chemical process'"(99). A chemical model of metabolism resolved the troubling distinction between living and non-living things. Moreover, once mechanisms of growth were identified as interactions between a limited number of chemical molecules, the possibility arose for systematic, informed interventions into that process.

Liebig's first public foray into the world of agricultural chemistry in 1840 brought those insights to bear on crop production in particular, weighing in against the prevailing "humus theory" of soil productivity with a new "minerality" model of plant sustenance. Laid out most

explicitly by Albrecht Thaër in *Principles of Rational Agriculture* (1809), the humus theory held that plants fed on organic material in the form of decaying plant and animal material, which transmitted fertility via the *vis vitalis.* While Thaër and others understood that plants could and did obtain carbon through atmospheric CO_2, they argued that, that source being unlimited, it was the presence of humus and its "nutritive juices" that was the limiting factor in plant growth. Thaër and his followers advocated for a program of soil management based on regulation of the humic balance through fallowing, manuring, and successive plantings of forage and cash crops. Rather than the universal applicability of minerals, they saw humus' connection to place-based of growth and decay as the primary source of its utility.

In contrast, Liebig saw soil fertility as a function of the presence or absence of the minerals required for plant growth, the source of which was irrelevant. Liebig used chemical analyses to determine the mineral content of dry plant matter. Drawing on these experiments and, to an often under-appreciated extent, the previous assays of Thaer's student Carl Sprengel (Jungk 2009), he arrived at a formula of elements necessary for growth. Dismissing humus as "mold," Liebig proposed a "mineralist" model of fertility management in which agriculturalists would focus on the addition of minerals according to the needs of particular plants. Soil, he argued, was best conceived as a "magazine of inorganic matters, which are prepared by the plant to suit the purposes for which they are destined in its nutrition" (Liebig 1843, 29-30). Plant metabolism in Liebig's model was resonant of the factory floor, with organic machines assembling a set number of standardized inputs on the steady march to harvest. While Liebig's limited understanding of phosphorus and potassium and misunderstanding of the actions of nitrogen and ammonia nullified many of the specifics of his theory (Manlay et al 2007, 222-3), its general outlines had a deep and lasting effect on conceptions of soil fertility.

These conclusions are directly related to the other concept for which Liebig is most commonly credited, the Law of the Minimum, which holds that the mineral available in the most limited quantity is the determining factor in plant growth, curtailing the capacity of a plant to make use of elements present in greater quantities and rendering those elements effectively inactive. Indeed, Liebig saw this principle as underlying the whole of his work in agricultural chemistry. Using mineral amendments beginning at the level of this "minimum" soil component, soil managers could effectively take control of fertility at a given site. While organic chemists Sprengel and Nicolas de Saussure had each articulated this general idea in earlier publications (Sprengler publicly posited a "Law of the Minimum" as early as 1828), it was Liebig's more explicit and simplified formulation of the concept in 1855 that brought it into common scientific parlance.[3]

[3] In his popular *Letters on Modern Agriculture*, Liebig described concept behind the law of the minimum as follows: "It hence follows, as a matter of course, that no single element of the food of plants…possesses superiority over another: they are all of *equal value* to the life of the plant. But to the agriculturist, who must provide a suitable supply of all these substances in his land to accomplish his particular object, they are, on the other hand, of *unequal value*. For should there be a deficiency of one of them, he can calculate on his crop only by supplying that one to the soil. The deficient or absent element then acquires a *superior value*, that is, in relation to the other matters (for example, lime in a lime soil), which the soil contains in greater quantity" (26-7).

Notably, in distilling plant growth to the mineral components of soil, Liebig's law of the minimum excluded conditions such as temperature, moisture, oxidation, soil density and texture, and qualities of the plant beyond its consumptive capacities. This was a departure from the earlier work of Sprengel, who emphasized soil nutrients in the context of conditioning environmental factors and who cautioned against the potential toxicity of excessive chemical fertilizers. The result of Liebig's simplified formulation, was a model of land management based on the addition of what Liebig termed "chemical fertilizers" (Browne, 1942b, 71-2). By identifying the specific chemical elements needed to bring a soil to maximum fertility and adding them accordingly, Liebig held, farmers could dispense with the inefficiencies of traditional crop-and-fallow systems and instead collect consecutive, maximized harvests from the same fields. While Liebig's supporters and contemporaries like Adolf Mayer and Ewald Wollny sought to amplify the Law of the Minimum in a way that accounted for other ecological factors, culminating in G. Liebischer's 1895 "Law of the Optimum" which explicitly broadened the category of "growth factors" to all conditions external and internal to the life processes of a plant, it was Liebig's initial articulation of the Law of the Minimum toward which practical and epistemological responses were pitched well into the twentieth century (Brock 1997; Browne 1942b; Thomas 1929).

These two assertions, simultaneously elegant and portable in their simplicity, served as the conceptual vehicles by which Liebig sought to extend the science of chemistry to the practice of modern life.

Theorizing Agricultural Science

While historians and sociologists of science have effectively demonstrated the ritual purification of scientific inquiry from the subjective mire of human politics and profit-seeking (Latour 1996; Shapin and Shaffer 1985), the field of agricultural science is self-consciously concerned with knowledge not simply for its own sake but rather to further productive enterprise. As such, the categorical impurity of agricultural science offers a particularly interesting opportunity to consider the relationship between the constitution of expert knowledge and politics at the intersection of political economy and science and technology studies. This cultural site might in fact be productively plumbed through a methodological frame that makes its own deliberate reach across discursive and materialist categories, specifically Antonio Gramsci's writings on the state, society, and the intellectual. While Science and Technology Studies (STS) scholars overall have been slow to engage Gramsci as a theorist of science and society, I argue that his work offers an important opportunity to link STS to political economic analyses of social change. Gramsci's analysis is particularly useful on two different fronts: his insistence on knowledge production as part of broader systems of material experience and his attention to the popular dissemination of professionalized knowledge as a means of cementing specific modes of production.

First, Gramsci himself does not substantively differentiate in his writings between scientific ideology and other kinds of ideological production and reproduction, all of which he understands as the historical manifestation of particular modes of social relations. For

Gramsci, because social organization is constituted through (though not confined to) material organization, all knowledge production is simultaneously occupied with both of social and material life. As such, his work takes pains to emphasize the ways that intellectual labor is intrinsically bound up in all forms of activity. Even the degraded mechanical labor of Frederick Taylor's so-called "trained gorillas" occurs under specific conditions that necessarily shape human consciousness.

For Gramsci, while particular iterations of intellectualism are the product of specific, concrete historical conditions, the category of intellectual activity itself is historically consistent as an essential source of labor linking an embodied experience of the world to other modes of social relations, including the artistic, religious, bureaucratic, and scientific. Further, men and women have experience and thus knowledge of the world that is in all cases in excess of formal employment. What Gramsci identifies as "traditional" intellectuals are not distinguished by their capacities for creative abstract labor, but rather by the professionalization of their work generating and disseminating modes of understanding amenable to the expansion of the classes they represent. In contrast, individuals engaged in formulating conceptions of the world based in but in excess of their professional labor are named by Gramsci as "organic" intellectuals.

Notably, while every class position represents the raw material of a system of ideological understanding, not every class is positioned to systematically reproduce that understanding throughout society. What is at stake, then, is not the existence of ideas in society but the ways in which certain conceptions of the world come to be held in common within heterogeneous social contexts. The work of so "traditional" intellectuals, ostensibly severed from on-the-ground material production and supported by the institutions of state and civil society, should be seen as part of an ongoing, active process of generating consent across all classes to a particular structure of social relations. However, Gramsci suggests, their very professionalization as intellectuals- the general category of which has survived in various manifestations as different classes have ascended to and ceded dominance- positions professional intellectuals in society in such a way as to mask this essential relation.

> Since these various categories of traditional intellectuals experience through an "*esprit de corps*" their uninterrupted historical continuity and their special qualification, they thus put themselves forward as autonomous and independent of the dominant social group. This self-assessment is not without consequences in the ideological and political field, consequences of wide-ranging import (7).

Indeed, a central consequence of the professed autonomy of traditional intellectuals is their capacity to intervene in society on behalf the interests of dominant classes while claiming a fundamental independence from those interests. Institutionally separated from contests over resources enacted through the social relations of material production, traditional intellectuals lay claim to a field of disinterested reality to which all other social groups may appeal for legitimacy. Thus, the social and political power of traditional intellectual production is specifically relational, deriving as much from its formal separation from other social spheres as from its capacity to forge deep channels for the articulation of interests and understandings

across that separation.

Gramsci's analysis of scientific expertise as the product of a collective- or class-experience is in many ways at odds with contemporary commonsensical characterizations of scientific developments. In the latter model, science modulates between moments of highly individualized subjective inspiration and processes of objective, practical affirmation using the authorized tools of the discipline. In her treatise on objectivity and authority in science, Helen Longino (1990) describes this process as follows:

> The context of discovery for a given hypothesis is constituted by the circumstances surrounding its initial formulation- its origin in dreams, guesses, and other aspects of the mental and emotional life of the individual scientist. Two things should be noted here. First, these non-empirical elements are understood to be features of an individual's psychology. They are treated as randomizing factors that promote novelty rather than as beliefs or attitudes that are systematically related to the culture, social structure, or socioeconomic interests of the context within which an individual scientist works. Secondly, in the context of justification these generative factors are disregarded, and the hypothesis is considered only in relation to its observable consequences, which determine its acceptability. (64-5)

Translated from his psyche to public consciousness through the unassailable language of chemical relations, Liebig's innovations on established agricultural knowledge are thus most frequently linked to the *extra*-social fact of his particular genius rather than the social facts of his ongoing engagement with a changing world.

However, as Longino's analysis and careful historical attention suggests, Liebig's inspiration to apply the logic and methods of bench chemistry to commercial agricultural practice cannot be separated from the political, spatial, and socio-economic transformations associated with the grown of urban industrial capitalism in the nineteenth century. Emphases on individual inspiration obscure the social conditions that give rise to and allow voice for new modes of perception; productive processes are negated by the hero-myth of discovery. When authorized knowledge is returned to society more broadly, the ensuing social changes are attributed to the progress of discovery rather than changing conditions of social reception. Thus purified of human politics and expressed in the universal language of science- in this case the language of chemical universalism- such knowledge can be productively translated between distinct social contexts, ostensibly bearing only the freight of nature's own truth. In this sense, Justus Liebig can be considered 'Father of Agricultural Science' not because he was the first to experiment with new modes of crop production but because he was the first to conduct those experiments within the authorized frame of 'pure' scientific discourse.

Liebig's own writings on scientific knowledge reveal a strikingly complex notion of the relationship between material experience, politics, and history. In an essay entitled "The Development of Ideas in Physical Science," delivered in 1866 to the Royal Academy of Sciences in Munich and included the next year in an edited volume entitled *The Culture Demanded by Modern Life: A Series of Addresses and Arguments on the Claims of Scientific Education*, Liebig

posited a theory of "physical inquiry" in which the physical experiences of labor itself served as evidence from which humans might generate hypotheses about the nature of the world and model technical innovations to replace the "force of man" with the "force of nature," the harnessing of which is the beginning of capitalist industry (361). Not unlike Gramsci's notion of the organic intellectual, Liebig's model of physical inquiry saw the conditions of material production, and specifically the relational moment between the human and non-human world, as the engine driving human intellectual activity. Further, this intellectual production was directly linked to the political economy of a nation.

For Liebig, the emergence of liberal capitalism represented the highest end of that activity. As much as the physical inquiry of organic intellectuals may have underwritten the technical innovations that enabled social and scientific progress (he uses the example of the invention of optical glass as the prerequisite for modern astronomy; the steam-engine for theories of heat; and photography for theories of light), it is only a dedicated intellectual class that can transform material innovation into socially available scientific truths, and such a class requires certain economic conditions.

> The development of science, the mother of which is culture, requires still other conditions; it depends on the formation of a class who shall devote their powers to the cultivation of the intellectual domain, exclusive of every other end. As the men who consecrate themselves to this labor produce no marketable commodities which they can exchange for the necessaries of life, such a class cannot arise until a certain surplus amount of riches has been accumulated, not needed by its possessors for the satisfaction of their material wants. Such accumulation once realized, men's spiritual wants presently assert their claims, and the wealthy class becomes ready to exchange a portion of its riches for the means of mental culture (358-9).

It is the work of science, then, to extract from the evidence of lived experience those abstract truths that constitute a society's mental culture. Here, as elsewhere in Liebig's text, intellectual labors are undertaken specifically to fulfill the spiritual desires of those who have accumulated the profit to support them. Further, these truths and the lived experiences that spawn them necessarily change over time, with changes in all forms of understanding following changes in material conditions in concert. Thus, "the conception of 'God' undergoes change and development with that of 'force'," as does "church" and "state" (357). Distinctions between knowledge about the material and the spiritual, therefore, mistake the fundamental relation of the two.

Tracing the development of scientific thought from ancient Greece through the 19th century, Liebig's analysis follows the relationship between social and political structures and the progress of intellectual and industrial innovations. Indeed, the narrative Liebig draws here posits industrial capitalism as the natural partner of intellectual productivity beginning in the earliest centuries of Western civilization. He equates the manufacturing output of Corinth with the "wares of Sheffield and Birmingham" and that of Athens with the woolens, tweeds, earthenware, and ship-building of Leeds, Staffordshire, and London, and describes the "counting-houses" along the Black Sea. The "men of science" were "burgher's sons, and

initiated in industrial pursuits." Socrates was a "stone-cutter," and Aristotle an "apothecary." It was exactly the intimacy of the scientific thinkers with the processes of manufacturing that enabled their intellectual output (360-361). This development, however, was ultimately retarded by the institution of slavery, in which slave-laborers themselves were precluded from offering intellectual innovations and the state colluded with landowners to support the institution of slavery. Liebig draws an explicit connection between organic and professional intellectual undertakings.

> It is evident that, with the invention of a machine which shall convert a given natural force (e.g., a falling weight of water) into an industrial force, performing the labor of twenty men, the inventor could grow rich and twenty slaves be set free; moreover, that the natural effect of the introduction of machines is an augmentation of the productive classes, whence a greater number of inventors and increased production. But, in a slave-state, the application of natural forces and the substitution of machine-labor for servile, is mainly impossible, for as, in such a state, the profits of the capitalist rest upon his slaves, he sees that the introduction of machines must imperil his resources, and when, as in Greece, the capitalists belong to the ruling class, the government and people will combine to perpetuate the existing system, i.e., slavery; - the government with the seemingly wise purpose of assuring subsistence to the laborers.

He goes on:

> Only the freedman, not the slave, has a disposition and interest to improve implements or to invent them; accordingly, in the devising of a complicated machine, the workmen employed upon it are generally co-inventors. The eccentric and the governor, most important parts of the steam-engine, were devised by laborers. The improvement of established industrial methods by slaves, themselves industrial machines, is out of the question.
>
> *Freedom*, that is, the absence of all restrictions which can prevent men from using to their advantage the powers which God has given them, is the weightiest of all the conditions of progress in civilization and culture (363).

Liebig's emphasis on freedom as the socially determined avenue through which society's material development might progress is a particularly interesting conflation of the individual and collective goods and stands in provocative contrast to other nineteenth century notions of liberty and equality.

In the medieval period, the institution of Latin among the scholastic and ecumenical classes, what Liebig terms "warfare against physical inquiry," cut them off from productive laborers and caused an overall paralysis of scientific progress (369). At the same time, Liebig likens the spatial and social restraints imposed by feudalism to "the old slave-condition, in which the pith and marrow of the people is poor and without susceptibility for intellectual and moral culture." Excluded from the processes of formal intellectual production, the burghers in this period started the first popular schools, promoting literacy and oral communication among the manufacturing classes. Civilization, for Liebig, rests in the innovative material

production of societies.

Moreover, it was the present moment in Europe, with the rise of the manufacturing classes and their intimate connection to the intellectual classes, that bore the most promise for the development of civilizations. This promise would be best realized in the context of modern states like Canada and the United States, poised, he says, to achieve "the highest point of culture and civilization attainable by men," that could most freely apply its laws and institutions to support the development of industrial capitalist enterprise. He explains:

> The effect of riches on the spirit of the productive classes is visible in the commercial states whose trade rests on industry. The sons of the opulent manufacturers and merchants abandon their father's business, which was the source of their wealth; being rich to superfluity, they transfer their ambition to the pursuit of rank and reputation, devoting themselves to science, to politics, to the army, or church, and in this wise the intellectual class grows out of the productive (363).

Further, this class and scientific knowledge will be constantly revitalized by the circulation of individuals across class, a process which he links indirectly to a social shift from hereditary to commercial wealth.

> In modern Europe, a manufacturer is not transmitted to the third generation; so, too, most commercial houses pass to other hands in the second. Hence, in a free country, the renewal of the producing class with each generation, and the constant resuscitation of industry. The industrials, grown rich, give place to energetic, inventive poor men, and thus a circulation is established in the state, through which its power and wealth increase continually (364).

Modern industrial capitalism, then, promises not only to facilitate the highest degree of civilization of which mankind is capable, it will do so by breaking down divisions between classes. As an emergent *lingua franca* of organic and inorganic mechanical processes, chemistry will further enable those transformations.

It would be a mistake, however, to mistake Liebig's interest in class mobility and emphasis on the value of laborers' "productive inquiry" for a wholesale commitment to the empowerment of the working classes. Rather, Liebig takes pains in his writing to distinguish between experience- the raw material of scientific labor- and truth, which is that labor's product. As such, if laborers provide the raw material for the intellectual development of nations, it is the exclusive provenance of scientists (and chemists, in particular) to transform that material into the refined matter of material progress.

Letters on Modern Agriculture, presumably directed to an audience that included agriculturalists, is full of examples of well-meaning practical professional agriculturalists whose zealous blundering in trade journals, popular publications, and general professional congress poses a grave threat to civilization itself. Bearing the appearance of science, with documented trials and reports and confident conclusions about manure, irrigation, and the

like, Liebig declared that such unschooled experimentation was in fact "*all sham: without a single law or a single truth…'*dressed in the livery of science like a monkey in regimentals, and understanding and appreciating the language they talk at second-hand, as much as the organ-grinder does the opera tune that his winch works threadabare'*"* (11-12). The problem, Liebig suggested, lay in practical agriculturalists' failure to discern the difference between the practical and the scientific:

> Agriculturalists had not yet acquired the faculty of distinguishing between mere opinions and correct facts. Every fact was acceptable; every opinion was received by them. *If science doubted the truth of one of their explanations, they imagined that she was disputing their facts*. If she asserted that a great progress would be made for substituting for stable manure its active constituents, they believed that in doing so she denied the efficacy of the former. About misunderstandings of this kind disputes then arose. The practical man did not yet understand the deductions of science. His dispute was with the bug-bear of his own false conceptions, not with science. He did not know that science also has a moral of her own, the foundation of which lies in the precepts of the school and their practice in education (17-18).

Though they might observe phenomena in their fields, these observations could in no way stand in for the perceptions of a trained scientist working in the regulated conditions of the laboratory. While agriculturalists were distracted by their emotions and the myriad of conflicting opinions reflected in their popular journals, scientists were educated to distinguish and understand different *categories* of knowledge. Thus, "Each day brings its own progress without strife; for each cultivator of these sciences knows what constitutes a fact, conclusion, rule, law, opinion, and explanation." Science, Liebig wrote, had "prepared a house" for modern agriculture using its unique capacities to organize experience into knowledge (1-2). Agriculturalists had only to acknowledge those capacities to step inside.

This apparent generosity of science and scientists can be linked to the special position science occupied in society, which was marked not only by formal training but also by its particular economy of knowledge rather than profit. Structurally separated from other kinds of practical production, scientific knowledge exceeded the quotidian capacities of capital to transform production at its root. He wrote: "Science confers *power*, not *money*; and power is the source of *riches* and of *poverty…*; it is expended by *use*, and renewed by *supply*"(7).[4] Consisting purely of use value, Liebig imagines a scientific knowledge outside of commerce but deeply embedded in the relational stakes of power and wealth represented by the commodity. Moreover, "Science should… be the common property of all; it should bestow aid on all who require and seek it, and should increase the intellectual store of rich and poor who

[4] Liebig's stated position here is not an accurate representation of his own profit-directed activities, though arguably the general failure of those might clear him of accusations of reaping riches from science. Despite their unprofitability, these efforts were caught up, often very publicly, with his scholarly production, creating a curiously transparent field of conflicting intellectual and fiscal investments. Liebig, in company with many friends, investors, and students, lost considerable funds on his various entrepreneurial efforts. Interestingly, Liebig's chief commercial success was achieved through a series of beer endorsements in 1852, the world's first infant formula, and his patented Liebig's Extract of Meat. (See Brock 1997)

are sincerely striving after truth" (xx). As such, it is a collective good (conferred through the patronage of the state and the bourgeoisie) with the power to ameliorate the ills of social inequality for those wise enough to make proper use of it. If scientific knowledge was the wealth that bequeathed social power, British and German agriculturalists who insisted on attending to one another rather than to the truths offered by Liebig and his supporters conducted their business in willful poverty.[5]

The social hierarchy implied by the conceptual hierarchy of theory to practice placed scientists, supported by the economic and political elite, ahead of the laboring public that they served. The tension represented by Liebig's early position characterizing the work of science as embedded in productive practice and his later writing extricating the former from the latter was absorbed by his students not as a contradiction but as a mandate to both fully engage the world and to occupy a place of superiority against it. Brock (1997) notes that "Liebig's British pupils absorbed both messages; the first wave of 'civic scientists' used the rhetoric of utility to justify their expectations of patronage; the later institutionalized 'academics' deployed the rhetoric of pure science as a necessary prior step before it bore fruit in application"(301-2). The power of ideas, rather than mere utility, would precede and enable the political and financial power of a modern, progressive society.

Liebig's conclusions on these points mirrored those of another British philosopher, one with whom Liebig cultivated a relationship of reciprocal public acknowledgement. The renowned British liberal John Stuart Mill (1806-73) cited Liebig's research in his volume *Logic* to support his call for a radical "utilitarian" social transformation based on the scientific method. Opposed to the notion of universal suffrage, Mill advocated for democratic rule by an intellectual elite, and Liebig's writings provided the conceptual justification for the stratified political structure Mill envisioned. Describing the key conditions requisite to good government, Mill wrote:

> ...that it be government by a select body, not by the people collectively: That political questions be not decided by an appeal, either direct or indirect, to the judgment or will of an uninstructed mass, whether of gentlemen or clowns; but by the deliberately-formed opinions of a comparatively few, specially educated for the task.

Further, this class would be drawn from the middle class, the very class Liebig saw as the engine for productive progress:

> No practical and judicious statesman could...take his stand anywhere but on the middle class...it does not follow, that he is obliged to take their policy; it follows only, that he

[5] While Liebig's passion on this point was clearly deeply felt, it may have been fueled in part by the profound indifference on the part of practical agriculturalists, particularly those in Britain, to his own patented commercial fertilizer as well as their enthusiasm for that of his commercial rival, the scientifically untrained British agriculturalist John Bennett Lawes. Many of Liebig's harshest criticisms of the British commercial fertilizer industry (such as his discussion of the "vampirism" of its international bone imports) was directed specifically toward Lawes' production methods, both experimental and extractive (Brock 1997, 124).

> must be able to make them take his... He cannot, therefore, attempt Universal Suffrage. To extend the suffrage to the whole middle class, to equalize its distribution among that class, to enable that class to exercise it freely, all this can be and ought to aim at (quoted in Munday 404).

Using the logical processes of science, this educated elite would craft a progressive revolution in business, politics, and social life.

Alerted to Mill's work (and his own citation in it), Liebig familiarized himself with the English edition and set about facilitating its translation for a German public. An 1847 letter to his friend, the German publisher Eduard Vieweg, reveals both Liebig's enthusiasm about Mill and his frustration with the contributions of German philosophy in this period:

> I have read and studied Mill's *System of Logic* with increasing satisfaction, and am of the view that this man knows more about chemistry, physics, medicine, political science, etc. than most German chemists, physicists, or physicians... Mill has done me the honor of taking up my method of research (on agricultural and animal chemistry) as a model in his book and, if you read what he says about it, you will not be able to resist publishing this book (413).

Clearly, the empirical bent of British philosophy which birthed Mill's utilitarianism was simultaneously a source of inspiration and frustration for Liebig. However, in Mill, he found an intellectual ally who both saw the political as appropriately structured through the material and understood the material as best organized by the mental labor of specially trained intellectual workers.

Liebig's own students, many of whom were involved in the March 1848 uprising that led to the formation of the German Parliament, translated and championed Mill's *Logic* for a German-speaking public. Jacob Schiel, who fled Germany under accusation of organizing a student democratic organization, wrote to his mentor Liebig:

> For heaven's sakes I ask you to be careful with your progress in agricultural chemistry! If bad luck wills it, and your ideas on soil cultivation and production gain a real foothold, then all the socio-political questions which the state deals with will draw the attention of the police to chemistry. I still do not understand why they are not keeping a vigilant eye on you and your wholly communist scientific direction. Oh! If I were the police chief! You would be the first among the demagogues (Munday 417).

Clearly, the political implications of Liebig's recommendations for agricultural and industrial practice were not so subtle as to escape the notice of the young chemists he was turning out into European society. For Schiel, and presumably, many of his peers trained in Liebig's laboratory, science and politics were one and the same.

The second way in which Gramsci's work is particularly useful for an analysis of agricultural science and Liebig's work specifically is his interest in the social dissemination of

intellectual production. Thus, his analysis allows us to capture the disciplinary vagaries of agricultural science without privileging the professionally specialized aspects of the field at the expense of the popular. What distinguishes Gramsci in this instance is his emphasis not on the consolidation of categories of expertise and intellectual production but rather on the porousness of those categories. Specifically, his central concern with the concrete practices by which such knowledge is articulated between ostensibly differentiated groups- infusing social life with particular assumptions and possibilities- makes his work extremely useful for an investigation of the movement of science through society.

For Gramsci, the key to this process is education, the organization and implementation of which is a key site for the reproduction or the transformation of society in general. Schooling, particularly in its institutionalized forms, serves not only to "specialize" individuals within and among classes but also to direct intellectual activities in accord with the material structures of existing social relations. The dominance of one class over another, in this context, is conditioned by the epistemological possibilities disseminated by the intellectuals of each class and the capacities of that class to extend particular understandings across society.

The process of ideological extension as a means to secure social consent is, for Gramsci, amplified by the marriage of the state and the bourgeois class under capitalism. He writes:

> The revolution which the bourgeois class has brought into the conception of law, and hence into the function of the State, consists especially in the will to conform (hence the ethicity of the law and of the State). The previous ruling classes were essentially conservative in the sense that they did not tend to construct an organic passage from the other classes into their own, i.e. to enlarge their class sphere "technically" and ideologically: their conception was that of a closed caste. The bourgeois class poses itself as an organism in continuous movement, capable of absorbing the entire society, assimilating it to its own cultural and economic level. The entire function of the State has been transformed; the State has become an "educator" (260).

This mode of continuous and concurrent material and ideological assimilation of society by the dominant bourgeois class can be seen to follow the movement of capitalism, the existence of which is premised on ongoing expansion through the appropriation of resources and the transformation of social relations in the interests of the same class. At the same time, in a key dynamic that distinguishes Gramsci's work from that of many other theorists of knowledge and society, this process of assimilation must also at all times account for the multiplicity of life experiences that are always generating context-specific consciousness distinguished by those factors of class, race, gender, and professional specialization through which power is organized in society. The slippage, then, between that knowledge emanating from traditional sites of intellectual production and that which emerges organically from life experience becomes the ground on which struggles for political enrollment are most actively staged.

As many historians of science have noted, the genius of Justus Liebig as an intellectual force lay less in the innovation than in the dissemination of knowledge, achieved both through his own writings and associations and through the work of students like Schiel and hundreds

of other young chemists working in Europe and the United States. The concepts for which he is most renowned, notably the mineralist model of soil fertility and plant metabolism, the law of the minimum, practical laboratory training, and even the technology for the laboratory condenser that bears his name, were already publicly circulating well before he introduced them to the world according to his particular rhetorical and practical strategies. In a 1942 essay commemorating the centennial of the publication of Liebig's *Organic Chemistry in its Applications to Agriculture and Physiology*, Rutgers soil scientist Selman Warman argued that Liebig's influence was a function of exceptional rhetorical gifts:

> Liebig's place in agricultural science is not that of a great experimenter and discoverer, but of a brilliant coordinator and popularizer, who clearly summarized the existing knowledge, and who pointed the way to new discoveries. His fine style of presentation, his logic, and his biting sarcasm enabled him to reach a far wider circle of readers than those scientists who merely discovered the various links in the chain of scientific elucidation of soil processes and plant nutrition (63).

Like the traditional intellectual Gramsci describes, Liebig situated himself at the institutional intersection of the state, civil society, and the general public in his efforts to apply epistemological pressure to processes of production.

Warman rightly points to the role of Liebig's many students in spreading his influence and ideas. Indeed, a large number of his students at Giessen's chemical laboratories, the first and most prestigious mid-nineteenth century training grounds for practical laboratory work, were preparing for professional careers in pharmacy and manufacturing. Having taken on the task of educating more chemists than had every been trained in laboratory techniques in a university setting, Liebig devised a system of instruction that enabled a high volume of potentially under-prepared students to produce and publish scientifically credible work. Further, the labor of the students at Giessen, assigned to execute the laborious extracting and measuring required to provide data for Liebig's own writing as well as to test the conclusions of his adversaries, afforded Liebig a rate of productivity that furthered his own reputation and that of the lab. Executed on a large scale, the result was a kind of international "knowledge factory" characterized by the "steady and systematic production of reliable experimental results by ordinary students whose scientific mediocrity had been converted into scientific competence by the acquisition and use of these very techniques" (Fruton 5). While not all research at Giessen can be characterized as mechanical repetition, this "knowledge factory" conveniently mirrored new industrial methods of systematized production and training, producing a model for the expansion of chemical investigation both within the academy and beyond.

In 1837, Liebig went so far as to uniformly condemn other professors of chemistry, particularly those employing outmoded methods of instruction, as "no real chemists" and unworthy of service to the science that was the mother of modern industry (Blondel-Mégrelis 47). This style of publicly and forcefully disparaging those with whom he disagreed (or who disagreed with him) marked much of Liebig's career, often generating heated exchanges that had the simultaneous and perhaps not unintended effect of generating curiosity about his own

ideas and publications. Students who left the lab to take positions in universities and in government, often at Liebig's recommendation, benefited from and enhanced the range of Liebig's influence while replicating many of his core theories and methods. These trade chemists carried Liebig's ideas with them into the factories, boardrooms, and laboratories of industry, including his emphasis on methodical replication and systematic quality control and his belief in the capacity of chemistry to address all problems of material production.[6] Historian Marika Blondel-Mégrelis explains: "In fact, Liebig wanted everybody to believe that chemistry commanded every phenomenon in living nature. "Alles ist Chemie." (Everything is chemistry.) Knowing the laws of chemistry, everyone would be able to understand and improve. The first task was to prioritize the teaching of chemistry, particularly the pure science he considered as the trunk of a tree (48)." In this sense, Liebig's choice to direct his chemical experiments toward agriculture can be seen as in direct service of his vision of installing the field of scientific chemistry at the core of social development.

In addition to using professional training as a way to embed his own thinking in the relatively new discipline of chemistry, Liebig also trafficked his work through academic journals such as the *Annalen der Chemie and Pharmacie* (later *Liebig's Annalen*), published, at Liebig's suggestion, in French, German, and English (46). Liebig instructed his publisher reserve 2-3000 copies of his key publications to be sent "to all the kingdoms of the world." At home, he also worked to place his work major newspapers in order to "make more noise about it, if possible" (Blondel-Mégrelis 48). As his intended fields of intervention extended from the laboratory toward the factory and the farm, he sought out an even broader audience for his work, adjusting his language and strategy accordingly for popular American and British magazines like *The Cultivator* and *Cornhill*. With the international publication of *Agricultural Chemistry* (1840) (originally *Organic Chemistry and Its Application to Agriculture and Physiology*), Liebig was in active pursuit of an audience that extended well beyond chemistry's scholarly community, and he took pains with typesetting, graphics, and high quality paper stock to appeal to the taste and sensibilities of a well-bred popular audience. His *Agricultural Chemistry* dispensed with chemical formulas and tables in favor of accessible language and familiar images to lessen popular distrust or fear of chemical analysis.

As Liebig's professional influence grew, the chemical model of soil fertility achieved increasing dominance on an international scale. Moreover, for agriculturalists seeking a reliable return on investment, chemically based agriculture promised to tame the vagaries of agricultural life. This was particularly the case in frontier environments, where growers were investing increasing amounts of capital in relatively unfamiliar landscapes. In the United States, Liebig's students went on to populate the bureaucratic desks of the nascent Department of Agriculture and its public and private laboratories. Charles Wetherill, received his training in Liebig's laboratory before he was appointed the first USDA scientist in 1862 (Browne 1942a, 8). Yale chemistry professor S. W. Johnson was Liebig's student in Munich. Deeply instrumental in formulating the policies of the Land Grant College movement, Johnson was a champion the agricultural experiment station, based on similar stations in Germany,

[6] One of Liebig's more famously successful students was Georg Merck (1825-73), son of a Darrmstadt apothecary who transformed his family business into one of the world's largest pharmaceutical companies (Brock 1997, 120).

and authored two books on agricultural science- *How Crops Grow* and *How Crops Feed*- that were widely read and highly influential throughout the United States (Bradfield 55).

As an essential site of both national production and reproduction, agriculture for Liebig represented the foundation of modern society. He wrote: "There is no profession which can be compared in importance with that of agriculture, for to it belongs the production of food for man and for animals; on it depends the welfare and development of the whole human species, the riches of states, and all industry, manufacturing and commercial" (Howe 46). At the same time, Liebig saw chemistry as important not just as a form of industrial innovation but as a structure of understanding that would revolutionize and optimize society itself. In the preface to his *Familiar Letters on Chemistry*, he explains that the book contains sketches:

> Written for the especial purpose of exciting the attention of governments, and an enlightened public, to the necessity of establishing Schools of Chemistry, and of promoting, by every means, the study of a science so intimately connected with the arts, pursuits, and social well-being of modern civilised nations. For my own part, I do not scruple to avow the conviction, that ere long, a knowledge of the principal truths of Chemistry will be expected in every educated man, and that it will be as necessary to the Statesman and Political Economist, and the Practical Agriculturist, as it is already indispensable to the Physician and the Manufacturer (5).

Here, as elsewhere, Liebig saw the education of the public in the "truths" and techniques of chemistry as essential to the productive development of the developing nation-state.

Conclusion

It is difficult to find an aspect of contemporary life in the developed world that has not been in some way influenced by Justus Liebig's early insistence on the capacity of chemistry wedded to capitalism to transform the world. Industrial agriculture, the mass production of pharmaceuticals, the pedagogical and practical centrality of laboratory training to the reproduction of scientific knowledge- all of these have had direct and indirect influences on the lives and livelihoods of human beings around the world. By embedding his particular formulation of social power within a scientific model of agricultural practice, Liebig promised a concert of human/non-human interactions timed to the engine of nineteenth century industrialism. Enabled by the state, and reproduced by the educating institutions of civil society, the productive possibilities Liebig envisioned brought the disciplinary tools of the laboratory- efficiency, standardization, and the conceptual disassembly of systems- to the land and those who labored on it.

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Chapter Two

Polar Bears, cactus, and natives: race, agrarian reform, and environmental determinism in Latin America (1920-1950)

To make a scientific study of man abstracted from the soil he cultivates, the landscape he travels, or the sea he sails is as impossible as understanding a polar bear or a desert cactus outside of their living mediums... The study of the Indian and the earth that sustains him can be found in a general ecological perspective, sounding the depths of past indigenous cultural developments and observing from this vantage point the American and the possibilities of his cultural future.

- Pío Jaramillo Alvarado (1946)

In 1911, Ellen Semple published *Influences of Geographic Environment*, a text that would anchor the emerging discipline of geography in the mainstream of global social science. A re-interpretation of the ideas of Friederich Ratzel, Semple's text became synonymous with a mode of analytical inquiry that saw human societies as the dynamic product of place-based environmental engagement over time. Known as environmentalism, this methodological lens appealed to both scholarly and popular audiences seeking to make sense of human difference in light of increasingly cosmopolitan social experience. The best of this work asked challenging questions about the effects of material constraints and opportunities on social and cultural development. The worst deployed notions of geographical difference to justify ongoing exploitation, subordination, and dispossession, arguing that environment was fundamentally determinative of a given people's political and economic development. On a global scale, the latter sought to naturalize colonialist relationships between far-flung social landscapes, contrasting, for example, the natural industry and acumen of northern peoples with the lassitude and intellectual torpor of the south.[i] More locally, it offered ostensibly scientific

legitimization for institutionalized discrimination between racially-differentiated persons inhabiting contiguous political space. In all cases, ethnicity became synonymous with geographical origin, offering a specifically spatial analysis of human social development. As such, environmentalism offered an analytic structure with which to make sense of social unevenness on both a global and local scale.

While environmentalism entered the world under many different conditions and realized diverse potentials accordingly, conventional wisdom among geographers and social scientists has ascribed to it 'a special explanatory quality which uniquely suited it to serve as a cover for a deeper imperialist *Weltanschauung*.'[ii] Geographers sensitive to the destructive impacts of environmentalist thought have sought to distance themselves from Semple's legacy even as that legacy has continued to represent a high-water mark in the history of geography's global intellectual influence. Variously indicted as enabling colonial exploitation and capitalist imperialism; legitimizing racist policy and culture; and subordinating human agency to the vagaries of nature, environmentalism came to stand as an uncomfortable testament to the power of science and geographical science in particular to justify global imperialism.[iii] By the 1960s, the very term 'environmentalism' had become an epithet among critical geographers seeking to distance the field from earlier collaborations with empire.

However, as important as the assignment of disciplinary responsibility for that collaboration has been, it has also held a particular cadre of Euro-American intellectuals at the generative center of scholarly production. The breadth of environmentalism's influence- extending beyond the field of geography to turn-of-the-twentieth-century intellectual life more broadly- makes clear that a critical accounting of its analytic power must be attuned to the complexity and diversity of its deployment. Attending to environmentalism's multiplicity not only resists the unwitting replication of a colonialist or imperialist frame, it also sheds light on the ways that globally circulating ideas are transformed in their travels. Further, while such concepts carry ideas and assumptions from elsewhere, their local realization is always resonant with the particular social and historical grounds of their reception.[iv] This paper asks how geographicall rooted environmentalist notions travelled beyond the Anglo-American world, and particularly how they worked in service of anti-imperialist as well as imperialist projects.

As Karin Rosemblatt has argued in her study of racial theory in the Americas: 'To understand the meaning and effects of comparison, and how audiences use ideas of similarity and difference for political ends, we need to pay attention to the specific contexts in which comparisons take place. We also need to examine the categories that structure comparisons and transnational exchange, including race.'[v] Recently, Innes Keighren has shown how contingencies of place generated a geographically uneven reception and incorporation of Semple's *Influences of Geographic Environment* among Anglo-American social scientists in the early twentieth century. Refuting the notion that reading is an abstracted intellectual process, Keighren follows contemporary literary theorists and other cultural geographers to argue that textual interpretation is an active process of meaning-making in which '*where*, *when* and by *whom* books are read matters.'[vi]

While Keighren's book-length study admirably tracks diverse engagements with Semple's work within the Anglo-American academic community, very little attention has been paid to environmentalism's manifold reverberations and manifestations beyond that context. In one of a very few examples of such an investigation, Mark Bassin's study of Russian revolutionary Georgii Plekhanov refutes commonly held assumptions that environmentalist perspectives were inherently reactionary or conservative. Rather, he argues that environmentalism was transformed in diverse contexts by the terms of particular intellectual engagements, winning adherents from across the political spectrum, including revolutionary anarchists such as Elisée Reclus and Lev Mechnikov and Marxist intellectuals like Karl Kautsky.[vii] Such investigations offer a deeper, more nuanced understanding of a formative moment in international social science history. They also present the possibility of critically recuperating aspects of environmentalism for social investigations in the present.

This paper contributes to such an accounting by tracking environmentalist thought in the politically contested post-colonial and settler-colonial spaces of Latin America in the decades before the Cold War. In contrast to the mainstream of Euro-American environmentalism, an important strand of environmentalist social theory in this context worked in support of *anti*-imperialist mobilizations, naturalizing historic connections between peoples and places to legitimate collective claims to land. While fundamentally invested in assimilationist modes of national governance, New World environmentalism offered an important challenge to universalist regimes of private property associated with imperialist and capitalist dispossession in the early twentieth century.

Further, unlike Russian leftists, who eschewed the racialist undertones of Anglo-American geography, Latin American anti-imperialist environmentalisms made explicit use of racial tropes to emphasize the generative nature of spatial difference within global economies. If race offered an opportunity to naturalize imperialist social hierarchies of the present, then race, and particularly indigeneity, could also allow *anti*-imperialists to *de*-naturalize those hierarchies. Their work linked the historically-rooted development of peoples in place to contemporary claims on territory and community sovereignty. New World environmentalists made strategic use of colonial-era racial categories to connect nationally-scaled political contests with global processes of appropriation, exploitation, and exclusion, evoking change over time and space to legitimate indigenous claims to territory and sovereignty.

In their analysis of Latin America's diverse intersections of race and nation-building, Applebaum, Macpherson and Rosemblatt constructively emphasize the distinction between race as a contingent, lived phenomenon and race as an analytic.[viii] As an example of the latter, Latin American environmentalism was simultaneously the product of the region's long-standing global entanglements as well as the particular local and regional dynamisms of the 1930s and 1940s. The highly abstracted nature of modern racial categories that made them so amenable to globally-scaled imperialist projects had the reciprocal effect of providing a ready-made frame around which to assemble an anti-imperialist movement of far-flung historical subjects whose diverse experiences of dispossession were united under a broad banner of racialized difference. As historian Thomas Holt points out, when W. E. B. Du Bois famously declared that 'the problem of the twentieth century is the problem of the color-line,- the

relation of the darker to the lighter races of men in Asia and Africa, in America and the islands of the sea,' he spoke of a battle not over scientific taxonomies but rather for the human spirit in the face of global monopoly capitalism and the racially-inflected structures of exploitation supporting that enterprise.[ix]

Not coincidentally, those struggles coincided with a parallel, globally-scaled shift in scientific race theories. As historical race scholars like Peter Wade and George Stocking have observed, the post-WWII period in science history marked a departure from the 'biologistic version' of scientific racism toward a more Boas-ian theory of cultural difference. Particularly in the United States and parts of Europe, social scientists moved away from genetics as the primary indicator of racial nature.[x] While that shift opened the door for new, more contingent and contextually attentive analyses of collective difference, the resulting analyses were also determinedly anti-materialist. For anti-imperialist Latin American intellectuals, environmentalism offered a third path, eschewing the genetic fixations underwriting national eugenics programs but retaining an attention to the ways human sociality is grounded in material engagements.

The possibility of this 'third way' was rooted in the region's distinct history of racial science. Much racial theory in United States, the United Kingdom, and Germany in the first half of the twentieth-century held closely to a sense of racial nature- both cultural and genetic- as innate, immutable, and most importantly, inherited. As Karin Rosemblatt has observed in her insightful study of linked studies of race and poverty in North and South America, the 'key concept of inheritance- with its cultural, biological/genetic, and economic registers; its conflation of biology and environment; and its insistence on the centrality of family to cultural and economic processes- helped scholars and policy makers to move from race to class and to cross national borders' in analyses of social groups.[xi] In Latin America, however, a preponderance of social scientists adhered to a more plastic notion of race, based in neo-Lamarckian rather than Mendelian genetics. To a much greater degree than their northern colleagues and for a significant period after the so-called 'cultural turn' among U.S. ethnographers, Latin American scientists considered individual racial expression to be a dynamic product of both inherited and environmental influences working in concert. In addition to geographical factors, environment included factors like education, nutrition, housing, language, and artistic and spiritual life.[xii]

As such, anti-imperialist environmentalists used racial categories to make materialist claims not just about who has a natural right to govern land but also about how national space should be produced. While fraught with many of the complications and contradictions of the social environments they described, including, in some cases, race-based essentialisms, this work nevertheless succeeded in producing a distinct, place-based analysis of collective rights in land that challenged conventional liberal notions of property and citizenship. These formulations drew on a long line of particularly Latin American racial thinking about indigeneity and imperialism, transforming independence-era anti-colonial representations of New World *mestizaje* or racial mixing to accommodate the conditions of late nineteenth and early twentieth century economic imperialism. Latin American environmentalists were cosmopolitan in their intellectual networks and analyses, but their work was grounded in

discrete, place-based political concerns. Widely-circulated texts like José Carlos Mariátegui's *Siete Ensayos de Interpretación de la Realidad Peruana* [*Seven Interpretative Essays on Peruvian Reality*] (1928) and Ferndano Ortiz's *Contrapunteo Cubano del Tabaco y el Azúcar* [*Cuban Counterpoint: Tobacco and Sugar*] (1940) linked distinct modes of agricultural production to imperialist exploitation on one hand and local self-determination on the other. *Indigenista* scholars like Pío Jaramillo Alvarado made similar arguments as they crafted research and community development programs for reformist governments and as part of the transnational intellectual network of the Inter-American *Indigenista* Institute.

This article proceeds according to two distinct but related analytic objectives. First, I argue that just as fixing racial natures in a given context has particular social consequences, so does fixing the nature of theoretical model similarly embed power in particular segments of society. In failing to attend to the diversity of environmentalism's expressions but focusing instead on its deployment at the hands of racist and colonialist programs, scholars have obscured an important chapter of global intellectual history. Such a collective oversight not only negates the work of anti-racist and anti-imperialist intellectuals, it also elides important connections between historical and contemporary anti-racist and anti-imperialist thought.

Second, I argue that environmentalism was attractive to this international cohort of thinkers because of its emphasis on spatial difference. By spatial in this case I indicate not simply geographic location but also the tri-partite engagement of environmental resources, labor, and social systems in place by which social space is continually produced and transformed over time. In a context in which leftist politics emphasized the rights of rural and indigenous peoples over the power of international capital to control national landscapes, environmentalism lent the weight of international scientific authority to struggles for agrarian reform, naturalizing collective land claims by asserting the deeply-rooted mutual constitution of particular peoples and landscapes. Moreover, by linking racial and cultural formation with specific lands and landscapes, these theories resisted the universalist claims of political subjects' commensurability (if not equivalence) that distinguishes both imperial enterprise and liberal capitalist nation-building.

By invoking an explicitly spatial ethnic difference, anti-imperialist thinkers used race to differentiate between modes of social production, be it José Carlos Mariátegui's Incan communism or Fernando Ortiz's locally-controlled smallholder tobacco production. While these formulations were resonant with European Marxist models of class formation, they amplified class analysis with an attention to spatial- and thus racial- difference. Environmentalism enabled leftist Latin American intellectuals to attend to the materiality of class formation alongside the lingering spatialities of colonial and neo-imperial struggle. Environmentalism's place-based particularities allowed anti-imperialist intellectuals to link national and regional sovereignty with authority over land as well as over the manner in which that land was worked. If, as Stuart Hall has argued 'race is the modality in which class is "lived,"'- albeit in ways which force us to understand the complexity of both affiliations-[xiii] these evocations of distinct socialities with pre-colonial roots raised the possibility of collective affinity *outside* of contemporary capitalist or imperialist class formation. Just as indigenous peoples or races were constitutive of post-colonial national identities, so were territorially-

rooted alternatives to imperialist modes of social production similarly constitutive of a modern Latin American present.

THEORIZING LATIN AMERICAN ENVIRONMENTALISM

By the 1930s the battles predicted by W.E.B. DuBois and other contemporary critics of imperialism had begun in earnest. The Mexican Revolution (1910-1920) and the 1917 Russian Revolution raised the possibility of radical national transformations, while the Spanish Civil War (1936-39) demonstrated the critical role that international solidarity could play in supporting (or thwarting) such transformations. International labor, anti-imperialist, and anti-capitalist movements gained momentum alongside heightened global capitalist investment and expansion. In 1927, anti-imperialist leaders from all seven continents convened the League Against Imperialism meeting in Brussels. Repudiating the paternalism of the 1919 League of Nations Conference, the assembly of Third World socialists, labor activists, and national independence leaders called for the right of colonized and previously colonized peoples to control their own lands and destinies. As important as the conference's formal resolutions was the development of a more deeply-informed solidarity as well as a new, shared vocabulary.[xiv]

In the American hemisphere, similar sentiments drove a series of local and regional movements. Latin American leftist leaders connected with working and colonized people from around the world through networks of literary, artistic, and political publications. Overseas travel by visitors to the Americas facilitated personal connections and educational opportunities. Such connections were also enabled by formative visits abroad by Mariátegui and others, including Colombian populist leader Jorge Eliécer Gaitán, Chilean communist and poet Pablo Neruda. and politically influential Mexican leftists like Diego Rivera and revolutionary anarchist Ricardo Flores Magón, who visited leftist communities around the Americas as well as in Italy, Russia, Spain, the United States, and elsewhere. These thinkers added contemporary perspectives to earlier critiques of writers like José Martí, Rubén Darío, and José Enrique Rodó in the post-independence period. Similarly, almost a century after formal independence from Spain, the decade-long Mexican Revolution asserted the rights of Mexican laborers over the neo-imperial incursions of European and United States investors. Their calls for national self-determination and 'land for those who work it' set a precedent for a new wave of national populist mobilizations in Latin America just as the French and Haitian revolutions had done a century and a half earlier for anti-colonial independence movements. In other contexts- most notably the South American Andes- marginalized communities and their allies rose up against the vestigial dispossessions of colonial occupation, including debt peonage, the termination of community land rights, and institutionalized racism against indigenous peoples. For much of the predominantly rural population of working class Latin Americans, access to land was at the center of those concerns; leftist rural political demands emphasized the de-consolidation and re-distribution of agricultural lands from elite and foreign ownership to community and worker control.

While conflicting claims between middle and upper-class elites were one key source of social negotiation in this period, perhaps even more important were growing demands lodged

by the laboring and agrarian classes long excluded from political power. In his study of modernity and *indigenismo* in the first half of the twentieth century, José Coronado contends that Latin America's post-independence incorporation in global economic and political systems galvanized new forms of social identification and, in turn, new avenues for social claims. 'This pressure from below,' he writes, 'is crucial to understanding the contours that modern societies assume in Latin America in general and the Andes more specifically.'[xv] Inspired by an accumulation of local experience as well as by new transnational and trans-regional connections, popular movements inserted themselves in new and powerful ways into national conversations, calling for property and labor reforms as well as increased government accountability to working people.

For many Latin Americans in this period, the region's distinctive *mestizaje* became the central metaphor with which to make sense of emerging political and cultural developments. Julie Skurski explains this phenomenon as a re-assertion of national authenticity as a discursive tool against imperial and elite capture of Latin American nation-building in chaotic decades following World War I:

> Claiming that the region could help revitalize world civilization through its fusion of disparate cultures, the discourse of authenticity defined a position from which ascending middle-class elites sought to reformulate the basis of national identity. Fashioned in response to both imperial and domestic pressures,...the broad appeal of the discourse of authenticity lay in its dual thrust: it criticized the mimetic upper-class elites for divorcing themselves from the *pueblo* (people), and it promoted the formation of a nationally grounded elite which could channel popular energies. From this perspective, the hybrid racial makeup of Latin America was both a source of creative energy and a threat to civilized order.[xvi]

As Trace Headrick contends in her study of 'mestizo modernism' in the early twentieth century, 'If the word *raza* (race) was not actually on everyone's lips [in this transformative period], it was to become an increasingly central concept for almost every Latin American intellectual, artist, politician, or other public figure by the 1920s and 1930s.'[xvii] Race-based assertions of nationalist authenticity had different resonance in different places. In Bolivia, rural activists demanding rights as both citizens and *indígenas* forged alliances with the populist military government to undermine rural elite power. As they leveraged that power to make their own claims on the state, their insistence on difference both undermined and transformed the populist military government's vision of *mestizo* nationhood.[xviii] Conversely, in El Salvador, violent repression of an indigenous-led leftist uprising in 1932 included the discursive erasure of Nahua peoples from national political life via assertions of Salvadoran *mestizaje*.[xix] Thus, race-based territorial claims in Latin America can be seen as the product of diverse global, national, and regional entanglements, wedding historical formulations of race and nation to contemporary struggles for land and self-determination in the context of the particular social dynamism of the 1930s and 1940s.

As in the first wave of Latin American anti-imperial struggle, race and formulations of racially-mixed *mestizo* and native *indígena* identity were an important part of early twentieth

century national populist movements. A century earlier, anti-colonial elites had asserted their right to rule through symbolic links between themselves and historic pre-conquest indigenous societies, notably the Aztec and Inca. This collective focus on pre-Columbian cultures had two discrete manifestations in elite Latin American society. The first was the formulation of a kind of 'creole patriotism' that helped drive republican independence movements, situating Euro-American conquerors as the natural heirs to long-disappeared empires. Such declarations of racially mixed national origins privileged the infusion of European bloodlines while simultaneously invoking *mestizo* or *criollo* racial mixtures to distinguish Latin American nationalist identity from its imperialist origins.[xx] With its simultaneous emphasis on the value of cultural and genetic mixing, José Vasconcelos' *The Cosmic Race/La Raza Cósmica* (1925) was an iconic and widely influential theorization of Latin American *mestizaje*.[xxi]

A related but distinct aspect of nationalist *mestizaje* was the settler-colonial construction known as *indigenismo*. Predominantly an engagement of Euro-descended or *mestizo* elites, *indigenismo* affirmed the value of indigenous culture, predominantly in the areas of artistic and spiritual life and often via a romanticized notion of 'authentic' Indian-ness. In some cases, *indigenistas* advocated for the social uplift and inclusion of indigenous communities; in others adherents worked toward capturing and preserving 'authentic' artifacts and traditions. In both cases, such advocacy effectively reified indigenous alterity at the same time that it has sought to embed strategically curated notions of indigeneity within *mestizo* national identity.[xxii]

In her exploration of *mestizo* nationalism, Estelle Tarica argues that *indigenismo* changed in the first half of the century according to the shifting popular and understandings of indigeneity and of the nation itself. In particular, Tarica shows how *indigenismo* emerged as an oppositional movement in the 1920s and 1930s only to be contained and co-opted by subsequent state programs seeking to contain the claims of indigenous peoples on the nation.[xxiii] Her analysis is echoed by Jorge Coronado's contention that *indigenismo* emerged 'first as an oppositional force, but then also as *both* an oppositional and an establishment set of practices,' a transition that followed the movement of previously marginal interests to the center of national governance projects with the widespread election of nominally populist governments in the region. As Coronado explains, 'this duality is fundamental to the 1920s and 1930s, when revolutionary groups flourished alongside official government offices dedicated to bettering the lot of the indigenous population.'[xxiv] Ironically, in the decades that followed, the success of Latin American pressure from below would have the long-term effect of containing many of its most powerful agents.

In the 1920s and 1930s, however, those pressures were making themselves felt across multiple social spheres, not the least of which was intellectual and academic production. As a project of primarily educated elites, *indigenismo* was an important forum for the diffusion of grassroots and populist demands into the more rarified intellectual and institutional fields. Its imbrication in state politics as well as in academic fields like archeology, anthropology, and ethnography testify to *indigenismo*'s ongoing challenges to and reliance on the status quo. Indeed, many leading intellectuals in this period were enlisted in newly elected reformist governments or were active in their advocacy of particular parties and policies. In post-

revolutionary Mexico, Ecuador, Colombia, Peru, and the United States, *indigenistas* harnessed the resources of the state to their cause. Other *indigenistas*, sometimes in the same national context as more state-oriented reformers, conceived their work as part of a broader mobilization for regime change. These intellectuals turned to the institutional resources of print journalism, academic publishing, and oppositional party and trade organizations to make their case to a national and transnational public.

By the 1920s, demands for land and territorial autonomy among rural, indigenous-descended people had changed the terms of mainstream discourse about race and nation-building. Organized agrarian reform movements in the Americas found many of their strongest advocates within indigenous communities, with some operating under the banner of indigenous affinity and others forging solidarities according to various combinations of class, race, region, and trade affiliations. In southern Chile, intensifying critiques of the hacienda system in the 1920s erupted in a swathe of violent uprisings by rural mestizo and indigenous Mapuche peasants in collaboration with the national Socialist and Communist Parties in the decade that followed.[xxv] In 1926, the newly-formed Ecuadoran Socialist Party responded to the efforts of influential indigenous delegates by incorporating indigenous issues into their founding platform.[xxvi] Similarly, the 1931 Peruvian presidential election and the 1934 Colombian presidential election saw indigenous leaders Eduardo Quispe Quispe and Eutiquio Timoté step forward as the presidential candidates of the national Communist parties.[xxvii] Similarly, Bolivia's 1952 revolution was the direct outgrowth of multi-ethnic movements for "communal land, local power, and rights" in the 1910s and 1920s and again in the 1940s.[xxviii]

Even, or perhaps especially, in instances where mobilization resulted in violent suppression rather than progressive transformation, peoples of indigenous descent in these instances must be understood as active agents in national political change, impacting both the practical and discursive terms by which power was negotiated. *Indigenismo*, in turn, directed its focus away from a prior occupation with literary and cultural production to attend to the more immediately pressing questions of control over land and resources.

LATIN AMERICAN INTELLECTUALS AND ENVIRONMENTALIST MATERIALISM

Environmentalism, both as an interpretation of Euro-American theories and as an organic product of Latin American theoretical work, was an analytic particularly well-suited to these conditions. Entwined formulations of people and place afforded *indigenistas* and other anti-imperialist social theorists in the Americas a model of social identity embedded in rather than abstracted from conditions of place and space, effectively entering contests over space and place-making into a broader politics of race and nation. While ethnic and cultural groups might also be united by linguistic, spiritual, or aesthetic practices, these became secondary to the primary affinity of place-based social production in the period of nationalist development.

Indigenismo and Territorial Politics

The *indigenista* turn toward land politics is evident as early as 1923 in the work of Manuel Gamio, the 'undisputed intellectual leader of Mexican *indigenismo.*' whose revolution-era *Forjando patria* [Forging a nation] (1916) was an internationally-heralded call for policy-oriented ethnographic research, particularly in the indo-*mestizo* nations of the Americas.[xxix] In his introduction to geographer George McBride's *Land Systems of Mexico*, the future director of the Inter-American *Indigenista* Institute signaled a new consideration of human-nature relations and particularly agricultural production as a central measure of Latin American social experience:

> Many factors contribute to explain the abnormal and deficient conditions of life which for several centuries have governed the development of almost all the Latin American countries... In a book published some time ago I commented, although somewhat superficially, upon the effect of these factors, selecting Mexico as a representative country for such an analysis. Unfortunately the interesting theme which the agrarian problem presents was treated in an incidental and secondary manner- *unfortunately, I say, because, in truth, the agrarian question has been the most powerful factor in the development, past and present, of the Mexican people* [emphasis added].[xxx]

While Gamio's changing anthropological conclusions no doubt had many influences, they were certainly informed in no small part by the revolutionary mobilizations of his rural compatriots during the period of McBride's research. Deferred by ongoing political conflicts at the federal and state level, the agrarian reforms of the Mexican revolutionary constitution would be realized a decade later under the leadership of President Lázaro Cárdenas. Though Mexican recognition of collective *ejido* lands prioritized national class-based development over any particular racial or ethnic affiliation, the ascent of Cárdenas' *Partido Revolucionario Institucional* (PRI) built on the foundational assistance of indigenous and mestizo people demanding the return of community land rights in Mexico's southern states. This period also coincided with an abrupt left turn in federal engagement with indigenous communities, shifting from a policy of assimilation to a heightened accommodation of locally-articulated demands, part of an expanded revolutionary hegemonic project to win broad popular consent.[xxxi]

Gamio's comments made explicit what would soon emerge as a trend among many left-leaning Latin American social scientists in the wake of widespread mobilizations for reforms of land and labor rights. In a study of *indigenista* Moises Saénz, a Mexican revolutionary bureaucrat who would go on to advise the Peruvian government, Cynthia Hewitt de Alcántara observes that Saénz's writing in the 1920s and early 1930s prefigured an emergent trend among *indigenistas* in which concerns 'with the material, or socio-economic [were greater] than with the cultural roots of livelihood problems in indigenous communities.'[xxxii]

As *indigenistas* joined other left-leaning intellectuals in the governments of the 1930s and 1940s, they brought relevant theoretical models to bear on reformist political programs, in particular through a Pan-American network of national *indigenista* institutes co-ordinated by the Mexico and U.S.-led Inter-American *Indigenista* Institute. Funded by the Smithsonian

Institute's Institute for Social Anthropology under the direction of Julian Steward, international teams of sociologists, anthropologists, and geographers turned from past fixations on 'pure' pre-contact Indians to compile contemporary portraits of indigenous practices. Such work was intended to inform place and culture-specific state development strategies, projecting indigeneity ahead into a national future rather than back toward a pre-modern past.

In Peru, *indigenista* and Director of the Institute of Andean Biology Carlos Monge Medrano formulated his research into the "Indian question" specifically in reaction to the racist environmentalist conclusions of European and U.S. colleagues that "all dwellers at high-altitude are persons of impaired physical and mental powers."[xxxiii] In 1927, Monge commenced a study of specifically *Andean* biology with the goal of disrupting universal standard of development based on sea-level dwellers. In public lectures around Europe and the Americas, Monge contended that their engagement with territory had made Andean people 'the race with the greatest physical performance in the world,' declaring to *Time* magazine: 'Where North American aviators ask for oxygen, Peruvians play soccer.'[xxxiv] Such developments were not genetic inheritance, but rather a constitutive adaptation of a people to place.

The prominent sociologist and Ecuadoran *Indigenista* Institute director Pío Jaramillo Alvarado similarly transformed environmentalist logic to his own ends, citing the 'magnificent' theoretical contributions of geographer Ellen Semple and intoning her oft-quoted maxim 'Man is the product of the surface of the earth' in the opening essay of a two-volume compilation *Cuestiones Indigenas del Ecuador* [*Indian Questions in Ecuador*] (1946).[xxxv] The Ecuadoran *Indigenista* Institute's '*Manifesta Indigenista*' retained a commitment to a social and historical category of an 'Indian race' but rejected fixations on genetic inheritance, focusing instead on legacies of land and landscape as a marker of racial identity:

> The Indian question is fundamentally economic and political and not relevant to biological investigations. For if the indigenous campesino obtains a fixed salary, their own parcel of fertile land, and unrestricted access to their own acculturation, the fact of being or not being a mestizo or a 'pure' Indian is no longer of importance... It is a thing of great pride to belong to the Indian race, the historical base of the Americas.[xxxvi]

The same publication featured a full-page photo of noted Ecuadoran indigenous and communist leader Dolores Cacuango, lauding her 'exceptional spirit of rebellion' and her impressive public oration in service of indigenous agrarian communities. In Colombia, where the recently-elected Liberal state promised constituencies a 'Revolution on the March,' government agents formulated new bureaucratic definitions of indigenous communities around collective land holding.[xxxvii] One of the first publications of the Colombian *Indigenista* Institute was a 200-page historical treatise by historian Juan Friede called 'The Indian and the Fight for Land' (1944).[xxxviii] Similarly, a 1943 letter from the *indigenista* social science team to Colombian President Alfonso López emphasized the importance of understanding cultural specificities of 'diet, agriculture, education, land tenure, income and inheritance' in formulating policies that would affect Colombian indigenous communities.[xxxix]

As in earlier strategic deployments of indigeneity by *mestizo* and Euro-descended elites, these characterizations frequently fell short of capturing the breadth and complexity of native experience and demands. In this sense, indigeneity remained an analytic more closely linked to shifting conceptions of the nation itself, even as new ideas about nationhood expanded to more fully encompass popular interests and experience. In some instances, prominent *indigenistas* framed indigeneity in contrast to domestic elites. In others, indigenous identity was called on to distinguish national interests against neo-colonial incursions of European and United States capital interests. In both cases, indigeneity marked a particular assemblage of material relations in place.

Land and the Intellectual Politics of Nation-Building

Indigenistas were not alone among intellectuals in turning their attention toward questions of land and production in response to changing social concerns. Indeed, these issues were central to contests over nativity on a national scale as critical thinkers lent scholarly weight to diverse claims on territory and modern citizenship. Colombian historian Jaime Jaramillo Uribe observed a concurrent shift among Latin American academics more broadly, as the offspring of the middle class brought their personal experiences to research and teaching positions formerly held by upper class elites. Around the region, work like Jacinto Oddone's *La burguesía terrateniente argentina* [The Argentine landholding bourgeoisie] (1936) and Colombian Orlando Fals Borda's *El hombre y la tierra en Boyaca* [Man and the earth in Boyacá] (1957) became foundational texts for a new generation of scholars. Similarly, journalistic work like *Amauta*, Mariátegui's journal of art and political writing; Benjamin Subercaseaux's *Chile o una loca geografía* [Chile or a mad geography] (1940); and Peruvian Aurelio Miró Quesada's classic text *Costa, sierra y montaña* [Coast, sierra, and mountain] (1947) centered questions of land and landscape within developing popular conversations about nation and society.

Following travels through South America in the early 1940s, Fernando de los Rios, New School for Social Research professor and exiled member of the Spanish Republican government, observed a shift in intellectual life from philosophical abstraction to place-based investigation, and particularly to investigations of the historical relationships of national societies to land. This trend, he argued, followed a broader attention to the materiality of national development in an era of heightening international conflict and connection.

> Since 1930 South America has been going through a period of unprecedented intellectual unrest. This condition has arisen from the depths of of the collective conscience, as a result of the social upheaval and spiritual depression that have accompanied the economic and political crisis of the past decade.
>
> In several South American countries intellectuals had for many years felt attracted by the concept of the abstract world, or at any rate one that is isolated from the surrounding reality. That period has now passed, and yesterday's minority of thinkers who were concerned with the immediate problems confronting their nation has become an overwhelming majority.

Describing Engenio Gómez's *Problemas Colombianos- la unidad politica* [Colombian problems- political unity] (1941), De los Rios observed 'in this book there emerges once more the same obsession that dominates so many thinkers of Ibero-America at the present time: *land and man.*'[emphasis added].[xl] Concerns of geopolitics were bound not only to conflicts over land but also to efforts to forge a more populist national identity. Questions of indigeneity- what it meant to be authentically native to and make legitimate claims on a place- were at the core of both issues.

Narrations of race, nation, and self-determination

Latin American environmentalist formulations were not limited to nationally scaled demands on the state but rather extended to internationally-scaled critiques of imperialist exploitation. Written by two internationally-influential intellectuals, José Carlos Mariátegui's *Seven Interpretative Essays in Peruvian Reality* and Fernando Ortiz's *Cuban Counterpoint* both rely to varying degrees on re-considerations of internationally-familiar environmentalist tropes to support arguments for national self-determination. Frequently romanticized, often essentializing, these constructions make class-based inequality explicit through racially-differentiated relationships to land and resources. In Fernando Ortiz's 1940 text on transculturation, racial natures were embodied in the literal products of those engagements, namely tobacco, sugar, and coffee. For José Carlos Mariátegui, the struggles of Peruvian indigenous peoples could only be overcome by the abolition of colonialist land tenure systems, a revolutionary national transformation that would free his country's indigenous majority to express their collective communistic nature. In contrast to environmentalist writing that naturalized inequalities, these texts made a case for collective action and redistribution, naturalizing collective claims by grounding ethnic affiliation in the land itself.

The son of a *mestiza* seamstress mother and an absent father, Mariátegui achieved only a primary education before he began work at the age of fourteen for a Lima newspaper. Like many Peruvian journalists of that era, Mariátegui addressed much of his early writing to questions of aesthetics in art and literature. By 1918, he had redirected his writing toward social critique, and particularly to the support of Peruvian socialism. In 1920, condemned by the new liberal reformist government of Augusto Leguía, Mariátegui fled Peru for Europe, where he spent three years meeting with like-minded intellectuals and political activists in Europe.[xli] In Italy, Mariátegui developed close ties to Italian trade unionists through Antonio Gramsci's publication *L'Ordine Nuovo*.[xlii] Upon his return to Lima, he began to offer lectures to primarily working-class audiences on the world crisis of capitalism and revolutionary alternatives.[xliii] Written during this period, *Seven Interpretative Essays* placed Peruvian 'problems' of the Indian and of the land in the context of global economic development.

While deeply informed by the European political economic tradition, Mariátegui's explication of capitalist imperialism departed from work by contemporaries like Lenin or Luxemburg in its emphasis on the ongoing relevance of race. Mariátegui described the Spanish

colonists as having arrived in a land where the inhabitants of the Incan Empire worked together in an 'agrarian communist' society that provided for over ten million human beings.[xliv] Mariátegui's analysis relied on a unitary category of Indian, a formulation that owed more to Latin American colonial history than a careful attention to Peru's diverse indigenous peoples. However, he was also explicit that the identity he presented was not biological, religious, or linguistic. Rather, Mariátegui described a group of people united by a shared history of collectivist production followed by colonialist exploitation and finally the imposition of liberal property law. In his view:

> Any treatment of the problem of the Indian- written or verbal- that fails or refuses to recognize it as a socio-economic problem is but a sterile, theoretical exercise destined to be completely discredited... The socialist critic exposes and defines the problem because he looks for its causes in the country's economy and not in its administrative, legal, or ecclesiastic machinery, its racial dualism or pluralism, or its cultural or moral conditions. The problem of the Indian is rooted in the land tenure system of the economy.

In the essay 'The Problem of the Indian,' he quotes the conclusions of Peruvian anthropologist José A. Encinas, who advocated for restriction of private property rights in favor of indigenous land tenure: '[The Indian's] economic strength and all his activity are found in the land. To take him away from the land is to alter profoundly and dangerously the ancestral tendency of his race. In no other place and in no other way can he find a better source of wealth than in the land.' Speaking on behalf of Peruvian indigenistas, Mariátegui proclaimed:

> We protest against the instinctive attempt of the *criollo* or *mestizo* to reduce [the Indian problem] to an exclusively administrative, pedagogical, ethnic, or moral problem in order to avoid at all cost recognizing the economic aspect... We are not satisfied to assert the Indian's right to education, progress, love, and heaven. We begin by categorically asserting his right to land.

For Mariátegui, the answer to this problem, which is also fundamentally the problem of the nation *writ large*, lies in land reform. Not, significantly, in the division of *latifundia* into smaller, privately held plots, but rather in land reform that returns agricultural land to the collective ownership of its workers. In this struggle, Mariátegui described the Indians of Peru as united with colonized and formerly colonized peoples around the world. He wrote:

> The soul of the Indian is not raised by the white man’s civilization or alphabet but by the myth, the idea, of the Socialist revolution. The hope of the Indian is absolutely revolutionary. That same myth, that same idea, are the decisive agents in the awakening of other ancient peoples or races in ruin: the Hindus, the Chinese, et cetera. Universal history today tends as never before to chart its course with a common quadrant. Why should the Inca people, who constructed the most highly-developed and harmonious communistic system, be the only ones unmoved by this worldwide emotion? The consanguinity of the Indian movement with world revolution currents is too evident to need documentation.

Even as Mariátegui rejected a Western imperial racialization of indigenous peoples, he was

himself unable to consider indigenous peoples outside of a romanticized mythology of Incan communism. Like its imperialist antecedent, his essentialized racial category was a strategic one; Mariátegui connected the communist nature of Peruvian indigenous peoples with the emergent revolutionary spirit of other colonized and sub-altern peoples, making a case for Peru's place within a rising global tide of socialist nationalism.

The Peruvian colonial mix of feudalism and capitalism, according to Mariátegui, birthed a weak capitalist spirit and a socialization of production that was more rural and agrarian than urban, and whose 'urban' center might indeed be read as the cities of Europe eager to import Peruvian agricultural commodities. His argument was a spatial one, describing the ways that European consumption of and investment in Peruvian raw materials severed the Peruvian countryside from the political and intellectual life of Peruvian cities. It is the specifically *criollo* or racially-mixed spatiality of this mode of national production, Mariátegui argued, that marks the distinction between imperialist relations and other networks of trade. Indian-ness and European-ness emerged together as a function of a dialectical relation between geographically distinct spaces. Flows of capital to the European metropole were vivified by the human and material resources of the commensurably impoverished Peruvian countryside.

Given the particular conditions of what Mariátegui called Peruvian reality, it was the Indian on whose life conditions the subsistence of the nation ultimately rested. Comprising four-fifths of the Peruvian population, Indians, 'by tradition farmers,' engaged in the socialized production of the goods on which the nation depended for its own, and not foreign capital's, reproduction. Further, he contended, the political subordination of indigenous people, or the 'problem of the Indian' lies not in racial uplift, as advocated by scientific race thinking, nor in cultural reform through education, notably, the program of the liberal government.

> The assumption that the Indian problem is ethnic is sustained by the most out-moded repertory of imperialist ideas. The concept of inferior races was useful to the white man's West for purposes of expansion and conquest. To expect that the Indian will be emancipated through a steady crossing of the aboriginal race with white immigrants is an anti-sociological naïveté that could only occur to the primitive mentality of an importer of merino sheep... the degeneration of the Peruvian Indian is a cheap innovation of sophists who serve feudal interests.[xlv]

The Indian problem, then, was not a question of racial mixing to improve the national condition, but rather a challenge to Peruvian people to shift the class relations that subordinated rural indigenous laborers to foreign capital interests.

Indeed, despite the prevalence of people of indigenous ancestry in Peru at this time living middle-class lives in towns and trades, Mariátegui insisted on a category of Indian as rural agriculturalist, a particularly spatial claim. It was specifically the possibility represented by the category of Indian, constructed as a function of imperial dispossession, which constituted its conceptual value for the dismantling of a modern imperial system. Elsewhere in the Americas, this construction would be taken up for similar purposes, both literally, within

the burgeoning *indigenista* movements of the Americas, and, as Cuban nationalist anthropologist Fernando Ortiz would use it, as a discursive tool for critiquing modes of production.

Ortiz's career can be read in many ways as a mirror of Cuba's own transformation of neo-imperial outpost to anti-imperialist revolutionary state. Following study in Italy and Spain, Ortiz won international acclaim for his work in positivist criminology, though unlike many of his contemporaries, Ortiz argued for rehabilitation rather than eugenic termination as a means to reduce national crime. Returning to his native Cuba, Ortiz entered government service. As the century progressed, however, Ortiz's political and intellectual life took a critical turn. In 1927, Ortiz ceased work on a planned criminology volume and resigned his seat in government, devoting his energies instead to unseating the regime of President Gerardo Machado.[xlvi] During this time, Ortiz organized a new *Institución Hispano-Cubana de Cultura*, an organization dedicated to developing Cuba in accordance with the nation's rich cultural and demographic history.

First published in 1940, Fernando Ortiz's *Cuban Counterpoint* is an allegory of the emergence of a society and a nation, told through the story of its central commodities- tobacco and sugar.[xlvii] The book begins with a 'counterpoint' between tobacco and sugar farming in Cuba followed by an exposition of the different cultural groups that have labored in their production. While the counterpoint is ostensibly a tale of two commodities, it is simultaneously the story of the people of Cuba- represented metaphorically and literally on the world stage by the products of two very different modes of human industry.

A long-standing member of the *Sociedade de Geographia de Rio de Janeiro* and active supporter of the *Instituto Inter-panamericano de Geografía e Historia*, Ortiz's work explicitly engaged the scientific race theories of his contemporaries, including environmentalism, the fundamental assumptions of which are the book's guiding premise. However, Ortiz turned Semple's environmentalism on its head, describing how seismic shifts in human social structures provoked distinct physical and temperamental qualities in the island's natural products. In so doing, he affirmed the constitutive links between social and natural production while unsettling scientific attempts to fix taxonomic significance to either outside of the particular contingencies of place and time. Indeed, Ortiz made a point of critiquing notions of race as immutable qualities of people. In 1940, he introduced a successful referendum at the Eighth Pan-American Congress stating Anthropology's refusal 'to lend any form of scientific support which might be used against any social, linguistic, religious, or political group, under the pretext that such a group is racially inferior' and similarly argued against the use of the category *raza* (race) among Latin American demographers. Acutely attuned to the specificities of racial experience, Ortiz insisted on scientific attention to race as a real but contingent product of social relations over time and in place.[xlviii]

As *Cuban Counterpoint* made clear, it is impossible to separate tobacco and sugar from the political, economic, and social constitution of the nation as it has developed over time. Following the arrival of the Spanish, whose appearance in the sixteenth century, according to Ortiz, caused the wholesale decimation of the native population, there arose, in the minds of

the colonists, the necessity to import 'a completely new population, both masters and servants,' to the island of Cuba. Like the story of Peru, the mix of peoples and practices that gave rise to the new nation of Cuba was constitutionally ill-suited for the replication of European feudalism imagined by aspiring overlords. Instead, a uniquely American set of dialectical relations emerged along with new relations of power in place.

The nature of those transformed social relations followed claims on the land, the means of production in an emerging agricultural economy. The social relation of race, then, emerged as the discursive site where such claims were mediated and justified. Ortiz, like Mariátegui, was critical of the notion of irreconcilable biological or cultural distinctions between groups of people. Rather, he took care to distinguish between phenotypical constitutions and the productive practices through which people are positioned in relation to one another:

> It must also be set down that the union between sugar and the Negro had nothing to do with the latter's pigmentation; it was due solely to the fact that for centuries Negroes were the most numerous, available, and strongest slaves, and cane was cultivated by them throughout America. When there were no Negroes, or even together with them, slaves of other races were to be found on the plantations- Berbers, Moors, mulattoes. The alliance was not between the canefield and the Negro, but the canefield and the slave.[xlix]

In another passage, he drew an ironic parallel between the sorting of shades of tobacco for market and racial taxonomies that sort humans within society. 'It is not to be wondered at,' he wrote, 'that there are tobaccologists as bold and self-seeking as certain proponents of racial theories today who, for the sake of their own countries, have created varieties, blends, names, and brands as absurd and artificial as the imaginary races invented by the race theorists of the present.'[l] Ortiz's narrative suggests that the sorting of humans has itself been a sorting for the market in labor and laborers that has enabled the development of Cuba and the capitalist export economy.

At the same time, *Cuban Counterpoint* drew for its central premise on specifically those notions of essential difference based on race and color. Ortiz was playful in his inversion of colonialist color bias, which he rejected without reverting to a 'color-blindness' that would deny the lived inheritance of colonial difference. While each commodity embodies the mixing of peoples that Ortiz referred to as 'transculturation,' tobacco is a product of the hybrid labors of the Indians and later 'Negroes' who first cultivated it first to satisfy their own desires, while sugar stands for the violent and exploitative marriage of blacks and whites working profit-driven plantations. Tobacco ranges from dark to mulatto, proudly carrying the color of its race. Refined cane, conversely, is a 'high yellow' social climber, allied with colonial values and seeking to pass itself as white.[li]

Contemporary Resonance

While the valence of racial difference served many different political programs, race

remained central to nationalist assertions throughout the twentieth century. In Mexico and Peru, where it had arguably the strongest national presence, *indigenismo* was institutionalized in ways that marginalized the most radical claims to collective power in place as national governments moved to the right in the mid-twentieth century. At the same time, these early forms of *indigenismo* maintained a scholarly and popular resonance that exceeded the bounds of assimilationist state projects, providing a conceptual framework for critical, place-based challenges to liberal notions of property and citizenship. In Peru, as Marisol de la Cadena has shown, indigenous communities from the 1950s through the 1970s drew on symbols of ethnic affinity to support widespread uprisings against the hacienda system, even as state agents sought to re-frame indigenous affinity in exclusively cultural terms or, worse, deployed the category "Indian" to deny basic civil and human rights.[lii] Farther north, while Julian Steward aided U.S. federal efforts to deny American Indian landclaims, his research assistants Sidney Mintz and Eric Wolf lodged important studies of race, place, and power with a focus on the global social relations of agrarian production.[liii] Similarly, Latin American scholars like Mexican anthropologists Maurilio Muñoz Basilio and Guillermo Bonfil Batalla, Guatemalan historian Severo Martínez Peláez and others carried forward notions of indigeneity as a practice of place-making.

More recently, ethnic identity remains a strategic leverage point in international struggles for land and resources, both in attempts to constrain civic dissent- as in what Charles Hale has called Guatemala's 'neo-liberal multiculturalism'- and in community-based resistance to territorial appropriations in places like Ecuador, Bolivia, and Colombia.[liv] Perhaps most striking, however, are the ways in which indigenous disruptions of liberal logics of property and citizenship have taken new forms in the national sphere. While media attention has focused on its charismatic leaders, a key aspect of Latin America's present leftward turn has been a wave of radical environmental legislations extending what Fernando Coronil called Latin America's "expansive democratizing project" to national ecological systems.[lv] These laws include Colombia's 1991 constitutional declaration of collective environmental rights, Ecuador's 2008 extension of civil rights to non-human occupants of its territory, and Bolivia's 2011 "Law of the Rights of Mother Earth." Such laws move beyond essentialist constructions of race to frame a more radical logic of modern political pluralism.

CONCLUSION

This paper argues that Latin American nationalists and *indigenistas* in the early twentieth century produced a model of environmentalist thought distinct from that of Euro-American theorists of the same period. Drawing on hemispheric histories of race and empire, these intellectuals posited environmentalist theories of modern political subjectivity based in the collective production of space. By insisting on the constitutive relationship between race and landscape, writers like Mariátegui, Jaramillo, and Ortiz lent the weight of scientific analysis to anti-imperialist claims on land. Notably, these claims were lodged in part in reaction to liberal state reforms of the nineteenth century that nullified collective territorial rights, rendering community lands fodder for national and international markets. Thus, if progressive social scientists in Europe and the United States sought to de-naturalize racial

difference to justify full inclusion in a liberal political project, progressive Latin American intellectuals insisted on ecologically-based difference to resist the losses of liberal assimilation. These anti-imperialist formulations extended not only to indigenous-identified peoples but also to Latin American national publics existing in neo-colonial relation with European and United States interests. Thus, even as many Latin American intellectuals sought reforms through the relatively conservative organs of the state, they relied on environmentalist articulations of local difference to advocate for new, more expansive categories of rights, including collective rights to land, community-governance, and national resources. Such expressions employed historical categories of imperial difference to project explicitly anti-imperialist futures. Similarly, they appealed to the universal form of the modern nation-state to assert new national identities rooted in the particularities of landscape. While the most radical forms of this logic disappeared from state programs during the second half of the twentieth century, such formulations retained discursive power for both oppositional and liberal assimilationist endeavors and continue to operate as a strategic political tool in the contemporary moment.

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Chapter Three

The Other Green Revolution: Land Epistemologies and the Mexican Revolutionary State

Introduction

Mexican agriculture in the twentieth century undoubtedly achieved its greatest renown as the fielding for the Rockefeller Foundation's Green Revolution project. Piloted in Mexico during the 1940s and subsequently exported to agrarian communities around the globe, the Green Revolution's production of a singular model of highly productive, capital-intensive farming paved the way for an international transformation of agrarian spaces commensurable with an emerging post-WWII political-economic world order as imagined by U.S. and Western European bankers, industrialists, and Cold Warriors (Donnenfeld 1992; Ekbladh 2010; Hewitt de Alcántara 1976; Perkins 1997).

While much attention has been paid to Mexico's seminal role in what would be an international Green Revolution, that elite-funded undertaking was preceded by an equally influential model of grassroots social transformation, the Mexican Revolution (1911-1920), an effort to return the means of national production to the Mexican people which reached its fullest expression in the 1930s following the election of President Lázaro Cárdenas (1934-1940). Such experiments generated their own agrarian imaginaries with distinct understandings of power, labor, and land. Some of these experiments were expressly allied with anti-capitalist or socialist sensibilities; others simply sought to recover key ecological processes from the realm of the commercial, prioritizing sustainable lives and livelihoods over financial accumulation.

Just as Green Revolution scientific technologies were not an inevitable global outcome, the global political and economic systems they supported were not the inevitable outcome of the collapse of nineteenth and early twentieth century international market capitalism. The 1929 New York Stock Market crash marked a profound crisis of that system and, simultaneously, a similarly profound opportunity for social reorganization. In the ensuing period of international transition,

destabilized local spaces did not simply revert to earlier forms; rather, decades of international entanglements shaped local responses to global developments. From the chaos of global market collapse emerged a new period of widespread pressure from the working classes in which engaged populaces actively advocated for reform of liberal governance underwriting the exploitation of both land and labor. In countries ranging from the United States to Haiti to Brazil, mobilized populations of working people pushed for progressive state reform, efforts which achieved momentary traction during the brief absence of global investment pressure on local resources. The result was a diverse body of practical, discursive, and organizational forms that, while indexed to specific historical and geographic conditions, also reflected a shared hemispheric experience.

With its call for 'Land to those who work it!', the Mexican Revolution (1911-1920) was a vanguard event of such sentiments, offering a model for rural people's deeply-felt ambitions to control the means of community subsistence after a nearly a century of elite-dominated post-colonial governance. As in many post-independence Latin American nations, Mexico's Liberal independence government had sought to link the Mexican territory and economy with international markets. This process rested on the widespread commodification of land and labor resources in a predominantly agrarian nation and peaked during the Liberal dictatorship of Porfirio Díaz from 1876 to 1911. Despite the critical role played by peasant insurrections in the winning of Mexican independence, the end of colonial rule saw formal political power pass into the hands of secular elites, who sought to curtail both the historic claims of indigenous villagers and the church in their efforts to consolidate territorial authority (Craib 2004).

It is no wonder, as one observer of Mexican politics in noted in 1911, that it was the agricultural classes who furnished the militant elements of the emerging political rebellion (Knight, 1986: 79). More than a decade after its nominal conclusion, however, many of the most progressive goals of the Revolution had yet to be achieved, particularly in the area of agrarian reform. The decades between 1920 and 1940 saw "an open, continuous- albeit generally local and disorganized-class war" waged through much of the Mexican countryside; indeed, the ongoing practical failure of the early revolutionary state to meet earlier demands had the effect of energizing a dissatisfied populace well after the ink had dried on the 1917 constitution (Knight 1985: 15). In addition, a significant aspect of rural poverty was due to lingering legacies of environmental exploitation, of which soil degradation was a significant aspect. Much land was badly degraded after decades of intensive use, while in other cases, local political instabilities and related internal migration meant that agricultural fields had been long abandoned, requiring rehabilitation before they could provide food for families. Harvests in the area surrounding the capital were so paltry that they could no longer cover the cost of seed for planting.

These forces allowed Cárdenas, populist governor from Michoacán, to depart from the vision of his political patron- former president Plutarco Elias Calles- and institute a series of widespread reforms. These included the distribution of over 14 million hectares of land to approximately one million people, a significant portion of which was allocated in the form of community lands to rural *ejidos*, an effort in part to rectify the widespread dispossession of common lands that had characterized the Porfirian dictatorship (Boyer 2003; Craib 2004). In the words of Alan Knight (1985), the revolutionary project "contained within it the genetic potential for a variety of offspring"(27). If, as Knight has argued, the cohort of centrist leaders beginning in 1940 should be seen as grandchildren of the Revolution with a more direct inheritance from the Cold War and the World Wars, Cardenismo was the direct spawn of the 1911 uprisings and the "last kick of the revolutionary

cause."

This relatively short but influential florescence of revolutionary populism can be attributed to a number of influential factors outside of the Cárdenas administration itself, not least of which was the global Great Depression. When global markets crashed in 1929, elite Mexican and foreign landholders invested in production for export were profoundly weakened, significantly shifting the balance of power toward the Mexican masses and clearing ground for major social and economic reforms (Tutino 1996). Empowered by an outspoken leftist populace, Cárdenas successfully challenged U.S. power by expropriating millions of acres of U.S.-owned agricultural land for land redistribution in the early 1930s; the U.S, in turn, begrudgingly accommodated Mexican policy, an accommodation that would be tested and affirmed with the nationalization of foreign-owned petroleum companies in 1938. While the oil conflict is often seen as the critical moment in Mexico's international assertion of economic sovereignty, Dwyer (2008) makes clear that that action was premised on the earlier, formative agrarian dispute. Further, as Boyer (2003) has argued, while not all Mexicans felt implicated in the early revolutionary politics of *agrarismo*, by the late 1920s a growing portion of the countryside had come to identify with campesino or rural working class identity, as well as the principle that "impoverished rural people had a moral right to possess the land they worked, that subsistence farmers should sustain a degree of political solidarity with each other, and that the promises of the revolution codified in the 1917 constitution redressed a long history of social injustice in the countryside"(5).

The resulting social reforms were enabled by an innovative body of ideas about the governance of people, resources, and territory. In the pages that follow, I detail the development of revolutionary "land epistemologies" to bring into relief the body of distinct but connected cultural, scientific, and technical understandings underlying the broader governmental project of the Cárdenas era. I invoke the term "epistemology" to reference a particular framework for making sense of the materials and encounters of human experience. This study looks specifically at the ways a new cohort of state agents conceived and sought to influence social practice in Revolutionary Mexico via three distinct state programs- state-sponsored soil conservation, public education as conceived by the Institute of Socialist Orientation, and popular media. This work draws on documents accessed over a 36-month period at Mexico's Archivo General de la Nacion (AGN) and Biblioteca Nacional, the Mexican Archivo del Agua, the former archive of the Secretaria de Educación Publica, the Rockefeller Archive Center, and the Bancroft Library as well as on state-sponsored murals and film.

Revolutionary land epistemologies took different forms among different actors in different contexts but shared a reconsideration of the social aspects of environmental resource use. Such ideas were not the product of a single imagination but rather emerged from what Raymond Williams (1978) has referred to as the "structures of feeling" that enliven the spirit of an age. As such, the revolutionary period saw a range of actors engaging and leveraging new forms of social recognition in pursuit of political goals.

State-sponsored land epistemologies must be understood as part of a comprehensive attempt to transform systems of social production more broadly. Long lauded for its relative progressivism, *Cardenismo* has also come under fire for its practical and ideological failures to achieve its early professed goals. Even so, especially in the area of agrarian reform, the degree to which those goals were achieved is reflective of active and ongoing claims made on the state by rural and working

peoples (Cotter 2003; Craib 2010). While conceding *Cardenismo*'s limitations, this article is concerned with the ways that popular demands succeeded- albeit with contingencies- in reshaping key expert understandings in periods of social transition. I contend that emergent ideas about human-environment engagements were deployed in each case to support a political commitment to long-term community self-determination. These formulations drew on past shared experiences of colonialism and culture to posit a unified narrative of national identity and future within a revolutionary space.

Theorizing agrarian expertise

As much as ideas of nature contain, in the words of Raymond Williams (1980), "an extraordinary amount of human history" (67), the epistemological *separation* of these two has played a foundational role in the development of liberal capitalism, most centrally through the abstraction of nature from human sociality via the modern commodity form (Polanyi 2001). By re-imagining land and resources as alienable from place-based social production, liberal actors also re-imagine human subjectivity as independent of ecological relationships. Such formulations naturalize the private property form and simultaneously recreate a political subject distinguished by an individualized capacity to engage in commerce with other private actors, including the sale and purchase not just of land and resources but also of labor. Moreover, political discourse and non-market-based values are constrained to the realm of human subjects, excluding the non-human natures from the nuanced contestations of public life. Indeed, we may see such a separation as a constitutive epistemology of modern liberal capitalist society; liberal society knows land and resources as sources of market value and we know modern persons as those equipped to realize that value (Strathern 1990).

To the degree that abstractions of nature from social life involve significant and strategic conceptual exclusions, liberal epistemologies of nature and society leave communities vulnerable to often violent destabilization by failing to account for important aspects of human and non-human experience. In the case of Mexico in the 1930s, those destabilizations included land exhaustion as well as popular unrest rooted in sustained social inequality. The practical and cultural centrality of agricultural production to national life, particularly in contrast to the Euro-inflected urbanism of the *Porfiriato*, made agrarian life a key point of intervention for newly appointed bureaucrats charged with incorporating a fragmented and contentious public within a coherent program of nation-building. While informed by international, research-based science, Mexican agricultural expertise was reframed for a national public as a commonsensical function of the politics, tradition, and affect that drove the revolutionary project as a whole.

To understand this effort, it is important to consider the development of new state expertise not only as an internal technical project but also as an appeal to the popular imagination more broadly. As Joseph and Nugent argue in *Everyday Forms of State Formation* (1994), states must be understood not as discrete objects of study but rather the evolving product of everyday negotiations of power in society, a "formation" with which a given political community's members are dynamically if sometimes contentiously engaged. Those formations involve not only the objects and institutions that sustain daily life but also the conceptual and cultural practices underlying common sensibilities. In post-Revolutionary Mexico, where regionally-distinct agrarian conflicts had long driven some of the nation's most impactful social destabilizations (Tutino 1996), agricultural

production was a key site for the institution of new social forms. If the strategic exclusions of institutional science achieved through specialized training, language, and affiliation had previously excised ecology from the execution of Mexican citizenship in the pre-revolutionary period, then the governmental pursuit of long-term, community-based subsistence required a different form of authorized knowledge.

As Craib (2010) has argued in the case of post-revolutionary village land claims, the "precarious legitimacy" of the post-revolutionary state drew in no small part on the cultivation of new modes of understanding contested resources. "The process of creating knowledge," he writes, "intersected with the process of creating the state and, conversely, the practices of rule intersected and shaped how knowledge was produced and used (417)." The resulting techniques of knowledge production were simultaneously practical and theoretical. This was particularly so in the context of agrarian reform, a process in which rural stakeholders had a deep investment and were, as a result, particularly engaged. Legitimized understandings were negotiated according to dynamic, place-based, and historically-inflected engagements between diverse actors. In the sense, the state was far from uni-vocal in its attempts to win hearts and minds. Indeed, Cotter (2003) shows how Ministry of Agriculture agronomists of various political persuasions sustained an institutional bias toward European technical regimes. In the case of the agencies described in this article and particularly the newly-formed Institute of Socialist Orientation and Division of Soil and Water Conservation, I suggest that their emergence at this key moment of national development allowed for conceptual innovations that might not have been possible in other institutional contexts.

Critical scholars of agrarian and conservation history have effectively demonstrated the ways that expert knowledge has undermined rural subsistence and furthered colonialist dispossession (see Blaikie 1985; Davis 2007), a process intimately linked to land dispossession and commodification, to the proletarianization of labor, and to rural-to-urban migrations (Kloppenburg 2005; Perkins 1997; Sayre 2008). This study deviates from that work by asking how efforts to support working peoples' resource access have relied on their own forms of knowledge, knowledge that has informed but is not limited to the scientific field. Indeed, as Sarah Phillips (2007) has argued in the context of Depression-era United States soil conservation efforts, science-based environmental policy is not always a tool of capitalist exploitation and dispossession. As Burke and Shear (2014) assert in a recent introduction to a special issue on non-capitalist political ecologies, economic and environmental crises are not merely disruptive; rather, "they destabilize socio-economic relations and cultural narratives in ways that can open up new symbolic and social possibilities" (129).

The subject of a rich body of scholarship addressing state formation and class politics, the Mexican Revolution has only begun to come under examination as an event with impacts beyond the human community. Recent works by Santiago (2009), Boyer (2012), Boyer and Wakild (2012), Wakild (2011), and Wolfe (2011) make an important contribution to this effort, arguing that Revolutionary values and rhetoric made themselves felt in environmental governance that ranged from oil nationalization, forest management, and state-sponsored irrigation. Coining the term "social landscaping" to describe these interventions, Boyer and Wakild contend that Cardenistas rejected a view of the environment as a "storehouse of natural wealth" in favor of a conception of Mexican ecological health as a critical component of progressive social change (2012: 74). In this sense, environmental issues were foundational to the Revolutionary project. Such efforts extended state control into the countryside but did so in a manner constrained and directed by "a popular class energized by years of social upheaval and assembled in institutions such as ejidos, unions,

cooperatives, and political organizations capable of making *claims* on the state and *challenging* the jurisdiction over natural resources"(2012: 77).

While Mexican Revolutionary agrarian expertise bore a much greater resemblance to indigenous Mexican conceptions of ecology and society than to either dictatorship-era state-sponsored agronomy or Green Revolution technologies (Cotter 2003; González 2001), social landscaping was nevertheless a resolutely top-down mode of nation-building, embedded in the institutions and values of a state struggling to secure both resources and legitimacy. Even as the Revolutionary state sought to empower local communities via a transfer of the means of production from capital to labor, it did so according to a particularly national model of social production; state attempts to return the means of agrarian production to rural communities required a reformulation of both land and citizenship. The result was a model of political subjectivity based in the dynamic and ongoing mutual constitution of national publics and national landscapes.

This paper builds on Boyer and Wakild's insights to make a different but related claim. Even as Revolutionary land *policies* were an important interruption to unsustainable commodity boom era practices, this paper argues that Revolutionary land *epistemologies* were an equally important innovation, offering new logics around which to craft state legislation and education. If Rockefeller-funded agricultural development efforts sought to radically reshape society to mirror the high modernist, industrialist visions of Cold War-era international capitalism, the "other," earlier green revolution to which this article refers was an attempt to refigure national agrarian resources within a new model of political community, one which re-imagined healthy soil, water, and forests not as sites for profit extraction but rather as vital components in the sustainable self-determination of rural and working peoples. I show that ideas about Mexican nature-society relations and agrarian practice in particular were not simply a mirror of changing cultural and political ideologies but rather were themselves fundamental to the formation of a nationally-scaled *campesino* consciousness as imagined by the Revolutionary state. Such a project was especially relevant given the fractured and in many cases fractious nature of Mexico's heterogenous publics. While certainly indigenous to a particular place and political projects, Mexican revolutionary land epistemologies were cosmopolitan as well as emergent.

Ecological dialectics and popular education

As Vaughan (1997) and others have shown, the Secretariat of Education was a key institution in the Revolutionary nation-building project. While important work has been done showing related institutional formulations of culture and race (see Dawson 2004; Vaughan 1997), much less attention has been paid torelated thinking on science and environment. In fact, the Secretariat of Education proposed a radical new conceptual foundation for national human-nature relations that should be seen as directly related to broader state commitments. At the core of Cárdenas-era Mexican conservation was a clearly-articulated ideological program based in what biologist and conservationist Enrique Beltrán called "ecological dialectics." Cárdenas tapped Beltrán, a committed Marxist and accomplished zoologist, along with anthropologist Manuel Gamio to address the so-called "agrarian problem" (Beltrán 1977; González 2003, 133-4). Given the widespread poverty and land degradation in the countryside, the stakes of this undertaking were high.

Nominally employed by the Department of Agriculture, Gamio and Beltrán made the

decision to route their vision through the Department of Education, and specifically through its new Institute of Socialist Orientation, which Beltrán would direct. Beltrán wrote: "At first glance, it seems as though there is little or no relation between conservation of natural resources and... literacy, mediums of communication, etc. In reality, they are of the greatest importance" (1949: 37). Through a concerted program of popular education, he asserted, "every man, woman and child of the world will become a champion of the noble cause of conservation" (1949: 90). Their choice of the Department of Education reflected a broader agenda of the revolutionary state. As Vaughan (1997) and others have shown, education was at the heart of the Mexican revolutionary program. To those charged with designing Cárdenas' 6-year plan, public education offered the promise of instilling a consistent constellation of values, reference points, and skills, making of the country's often contentious inhabitants a coherent citizenry.

In 1936, the Department of Education funded the translation of French zoologist Marcel Prénant's *Biology and Marxism*, to be published by Workers' University of Mexico. Prénant's theory of "ecological dialectics" pointed to a growing body of research on the generative relationality between all living organisms, including humans. Drawing on Karl Marx's "Theses on Feuerbach," his argument rejected nineteenth century materialism that reduced organisms to simply mechanistic impulses. In his introduction, Beltrán followed Prenant in arguing that Marx's theory of dialectics could and should be fruitfully applied to make sense of social production at the broadest scale possible, that of social ecology (1937: 2).

It is useful here to contrast the theories guiding Mexican conservation with the notion of "climax theory" that underwrote much mid-century conservation policy in the United States. In climax theory, nature on its own tends toward a fixed state of perfection or "balance;" as destructive foreign agents, human users press nature farther from perfection. In contrast, ecological dialectics conceived living beings as engaged in a continually dynamic process of ongoing mutual constitution. In a publicly circulated Department of Education pamphlet, Beltrán gave a Mexican response to the equilibrium theory, writing: "Nature, in the absence of man, is always in a state of unstable equilibrium. Relations between its diverse elements are altered in each moment and, in each moment, are won anew in a state of apparent equilibrium.... It is continually destroying and creating itself" (1949: 18).

Ecological relations were integrated not only into practical and vocational training of the revolutionary education department but also into philosophical instruction. Federal training for new teachers introduced an expanded notion of Jean-Jacques Rousseau's theory of rights, calling for appreciation of "all bodies of Nature and all trades of humans, for the sensitive relation between their utility, security, conservation, and well-being." A training program on the "Materialist Interpretation of Biology" considered the dialectical method in relation to the philosophy of science and historical materialism. Further, teacher training in the sciences emphasized the inherently political nature of science, considering, for example, the social implications of different interpretations of Darwin's evolutionary theory, the historic relationship between scientific theories and nationalism, and generative links between capitalism and scientific investigation.

Teachers were instructed to put administrative rhetoric into practice, though social and economic constraints meant that plans laid in Mexico City did not always successfully translate into action in the countryside. As a practical model and income source for school communities, school-based student agricultural cooperatives functioned as a practicum for classroom work and a model

for community-based *ejido* production. Federal teaching directives including grade-specific lesson plans emphasized the development of scientific sensibility based on first-hand experience of the natural world. National curriculum for the primary grades dictated that children actively observe plant and animal communities in rural, urban, and semi-urban areas, noting the impacts of sun, wind, soil and water. Students were to collect and plant seeds in school gardens according to the season, tracking growth and development based on local conditions.

Conservation education was not limited to the classroom. A 1946 Department of Education circular declared that trade unions, agricultural collectives, cultural groups, civic centers, and women's clubs should all be active sites of soil and water conservation activities with an eye toward investing all citizens in the long-term well-being of agricultural resources. In addition to local Soil Conservation districts, government agents helped organize Junior Conservation Clubs, enlisting young campesinos to the cause of rural conservation. Enrique Beltrán's book *The Natural Resources of Mexico and Their Conservation* was widely distributed through the Ministry of Education's Popular Encyclopedic Library series and boasted an introduction by US conservationist William Vogt (Beltrán 1946). Another publication printed by the government for sale to the public, written by Lorenzo Patiño- *The Conservation of Soil and Water*- went into multiple editions. *Soil Primer: The Story of Antonio Arango*, a government-published picture book for popular consumption, told the story of a campesino and his family who were saved from the catastrophe of soil exhaustion and erosion by terracing and intercropping strategies learned by the children in their rural school (Nannetti and Reyes 1950).

In addition to formal education, visual culture was another key pedagogical forum for the Revolutionary state. As the revolution moved from the battlefield to more quotidian spheres, politically-active Mexican artists applied their talents to embed the most radical spirit of the revolutionary movement within the nascent spaces and institutions of the emerging state, using mural work as well as sculpture, architecture, literature, photography, and film. Central to all these was the subject at the core of campesino uprising- Mexican land, its soils, crops, and the diverse lifestyles and cultures it supported. Mexican revolutionary artists like Diego Rivera, José Clemente Orozco, María Izquierdo, and Juan O'Gorman drew on connections with international intellectual and artistic networks, including both work abroad and the arrival of a new cohort of radical artists and philosophers like Italian Tina Modotti, US-born Pablo O'Higgins and sisters Marion and Grace Greenwood, and Russian filmmaker Sergei Eisenstein, whose enthusiasm for the Mexican revolutionary project was infused with ideas and experiences from their home countries.

In representing the emerging state to the people, Mexican revolutionary muralists, including the three most famous members of the cadre- Rivera, David Alfaro Siquieros, and José Clemente Orozco- also created the visual tropes by which the state would announce itself, a process of mutual recognition that relied heavily on depictions of landscape transformation as a metaphor for nation-making. Murals like Rivera's *Partition of the Land* (1923)- part of the large-scale *Ballad of the Agrarian Revolution* cycle painted for the federal Secretary of Education building- celebrated agrarian reform. Rivera's 1934 mural *Man, Controller of the Universe* contrasts a socialist with a capitalist techno-future, each based on a distinct agricultural foundation. On the side of socialism traditional subsistence crops like corn and beans spread their roots in rich black earth fed by an underground spring, while on the side of capitalism and imperialism cotton, wheat, and pineapples crowd one another over dry bedrock.

Public work like Marion Greenwood's *Landscape and Economy of Michoacán* (1933-4) and *The Industrialization of the Countryside* (1935) emphasized the relationship with landscape underlying the politics of rural life and culture. In Marion and Grace Greenwood's 1936 murals for the Abelardo public market in Mexico City, workers stay close to the earth, making tortillas, nurturing children, turning soil, hauling crops, and mining metals, all the while talking, working, organizing, and in some panels taking up arms, alongside working compatriots. At the top of the frame, corpulent capitalists count gold, two distinct and explicitly contrasted modes of social and material engagement (see Oles 2006). Taken as a whole, these images are a public celebration and exploration of the life processes rather than simply the commercial products of Mexican labor.

Perhaps the most impressive visual testaments to revolutionary ecology, however, are Diego Rivera's 1926 paintings at the *Universidad Nacional Autónoma de Chapingo* (National Autonomous University of Chapingo), the new university for agriculture and agronomy. Founded in 1920, the university occupied land expropriated from one of the most powerful hacienda owners of the *Porfiriato*. Of the former neo-feudal estate, a portion was allotted for a public university and the remainder was redistributed as *ejido* lands to local campesinos. Giving his panels names like *The Abundant Earth, The Earth Enslaved* and *The Blood of the Revolutionary Martyrs Fertilizing the Earth*, Rivera painted a narrative in which the oppression and release of the Mexican people through revolution paralleled that of the Mexican earth itself.

Rather than a straightforward agrarian romanticism, the work of Rivera and his colleagues should be understood as insisting on the ongoing ethical and political significance of human-nature engagement. These images linked social and ecological production in place, detailing the strength of political communities bound through their engagement with the diverse fruits of the soil.

Community-Based Conservation

In his survey of the countryside in post-revolutionary Mexico, geographer George McBride observed that soil exhaustion from intensive and extensive mono-cropping in this period had been amplified over the previous decades by widespread deforestation which exacerbated erosion and stream siltation in agricultural areas (1923: 39-40). The nation's 70% of national territory classified as mountainous was especially subject to erosion, but even in the flatlands soil exhaustion was a serious concern. Near the Villa de Ayala in the state of Morelos, agricultural lands had lost 30 cm of topsoil in a single ten-year period. Further north, in Chihuahua, ranchers and farmers faced regular flooding due to deforestation-related silting. Soils near the village of Tacambaro, Michoacán had diminished by 60 cm, and erosion in the zone of Ixmilquilpan in the state of Hidalgo had earned it the moniker "Valley of Misery" (*Proyecto de Ley de Conservation* 1945). While the poor may have felt these degradations first and most keenly, in time diminished crop yields, silt-choked rivers, and disappearing forests were felt by societies more broadly, undermining subsistence and social stability on a national and international scale.

In 1939, Mexican federal irrigation engineer Lorenzo Patiño declared soil erosion "one of the most serious problems that the Government of my country has to deal with." Formal transfer of title might have reversed some of the legal dispossessions of the past five decades, but would not on its own remediate material changes to lands and communities during the same period, in particular the soil exhaustion and erosion associated with intensified and extensified production of commodity

crops for export. While traditional indigenous terracing methods continued to successfully control erosion in some parts of the country, he reported, erosion overall had "become so menacing that it has obliged the rural inhabitants in some regions to abandon their fertile lands, converted today into sterile tracts." Further, he argued, the absence of a nationally-scaled soil assessment had confused land and credit markets and left farmers holding underwater mortgages on land that could no longer produce crops (Patiño, 1939).

The same year, President Cárdenas gave instructions to the Irrigation Department to begin soil surveys in irrigation districts to address erosion control ("Mexico Reports" 1944). At the beginning of his term, Cárdenas had initiated the Department of Forestry, Game, and Fish under the direction of veteran forest conservationist Miguel Angel de Quevedo, inaugurating his administration's emphasis on revolutionary land-management by building on the existing foundation of late-19th century forest conservation discourse that Quevedo himself had spearheaded in the *Porfiriato*. Trained in Europe (like many Mexican agricultural and scientific experts in this period) as well as in the French colonial forests of Algeria, Quevedo saw peasant activity as the central source of Mexican deforestation and argued for widespread conservation education as well as limits on land redistribution as a way to limit what he saw as the destructive impulses of *campesino* resource use (Cotter 2003; Simonian, 1995: 79).

A new generation of conservationists and bureaucrats would build on Quevedo's conservationist legacy but recast peasants as the solution to rather than the source of the nation's resource challenges, creating a *campesino*-centered program of forest administration. Around the country, state agents helped fund the development of cooperative small-scale enterprise based on sustainable use of forest resources (Boyer and Wakild 2012: 9). The earliest issues of *Protección a la Naturaleza*, the popular magazine published by the Department of Forestry, Fish and Wildlife, included soil erosion and conservation among its core concerns. A department official described the consequences of a historic frontier mentality and accompanying inattentive stewardship:

> Our country, due to its particular geographic constitution, is one of the countries most affected by [erosion]... Our neglect had been one of the principal causes of this real loss of territory, but never have we considered how to control the phenomenon in question. Our policies have been to constantly open new lands to cultivation, then to abandon them not long after, substituting virgin land that will undoubtably produce better harvests with little additional effort on the part of farmers. ... Those abandoned lands, where all manner of vegetation has been destroyed, have the greatest tendency, in general terms, to suffer from erosion.

The implied solution was as much social as technical. Rather than land use strategies designed to maximize profit, agrarian practice should accord to a broader social good, thinking both of a farmers' descendants as well as the nation as a whole. The federal program he suggested included cultivating awareness among all the country's campesinos; establishing soil conservation demonstration stations throughout the countryside; developing and distributing conservation-related films in rural areas; and planting given areas with cultivars appropriate to local soils ("Un Grave Problema Nacional" 1936).

In 1939, with erosion and soil exhaustion an undisputed concern for national subsistence, Cárdenas initiated a new federal soil conservation program under the direction of Lorenzo Patiño, which in 1942 would be incorporated as an independent Division of Soil and Water Conservation within the

Irrigation Commission.

If Mexican Revolutionary environmental politics were sensitive to the exploitative potential of international entanglements, they also reached beyond national borders for innovative responses to those exploitations. Relatively unheard of before the 1930s, soil conservation as a governance strategy gained international traction following the globally spectacular U.S. Dust Bowl and ensuing Soil Conservation Service (SCS). Authorized by the New Deal U.S. Congress in 1934, the SCS had a mandate to support sustainable local production, explicitly disavowing the *laissez-faire* bonanza strategies of the 19th century frontier (Phillips 2007). In 1941, Mexico sent a group of trainees north to train with the U.S. Soil Conservation Department, which was actively soliciting connections with Latin American neighbors as part of a World War II-era hemispheric solidarity program. Later, Patiño himself undertook a 3-month training with the US SCS. Mexico's new department enlisted the skills of the graduates of the US training program and translated parts of SCS Chief Hugh Bennett's seminal text on soil conservation for distribution among technical staff (*Levantimiento de Conservacion del Suelo* 1943). Patiño reported that his team relied particularly on the field methods of the SCS field experiment station in Tyler, Texas (Patiño 1941; "Soil Conservationist from Mexico" 1944).

Drawing on the SCS community-based administration model, Mexican officials established the nation's first soil conservation districts in the states of Tlaxcala and México in 1943. These sites were widely considered to be some of those most deeply effected by erosion, but around the nation erosion and soil exhaustion presented a clear and pressing problem. Mexico faced particular challenges in the 70% of national territory classified as mountainous, but even in the flatlands soil exhaustion was a serious concern. Harvests in the area surrounding the capital were so paltry that they could no longer cover the cost of seed for planting. Further north, in Chihuahua, ranchers and farmers faced regular flooding due to deforestation-related silting (*Proyecto de Ley de Conservacion de Suelos y Aguas* 1945).

The community-based research approach of Patiño's team was distinctive from previous state conservation efforts in that it sought to understand local land use and environments as a function of broader social and economic factors. A preliminary report on the new Tlaxcala district was indicative of the problems facing many rural communities (Patiño 1942). Conducted on 61,040 hectares of mountainous *ejidal* lands belonging to a total 8051 households, the survey included detailed descriptions of soils as well as of historic, economic, and social conditions of village life. An 1880 survey of village lands in Contla San Marcos had recorded 206 hectares of cultivated farm land, 193 hectares of forest land, and just under 10 hectares of gullies and ravines unsuitable for agricultural use, a total of approximately 410 hectares. In 1919, villagers petitioned for formal *ejido* status with the National Agricultural Commission. By that time, 193.49 hectares of forest had been felled since 1880 by impoverished villagers, compounding ongoing soil erosion; corn yields, the surveyor reported, were too low to even meet the costs of cultivation. A 1922 survey described a similar condition of ongoing degradation. Of the approximately 337 remaining community hectares, 47 were deeply gullied by erosion; 103 were rock-covered; 25 were "degraded" and uncultivable; the cultivated 144 hectares had extremely thin topsoil. Only 20 hectares of community forestland remained.

In their formal report, Patiño and his team joined Quevedo in linking land degradation to deforestation- in this case deforestation at the hands of villagers- but considered deforestation in a

broader context of household subsistence and land loss. In the first place, an 18% reduction in available land from the *Porfiriato* to the revolutionary period forced farmers to exploit common lands more intensively or seek out other forms of cash-based household subsistence. Patiño's analysis emphasized the linked impoverishment of the land and its inhabitants:

> Given the poverty of the terrain, the yields residents can obtain from the land are too low and in the end incomes of farmers in the majority of cases are insufficient to satisfy the most basic necessities of life. This results in a great poverty in the campesino population living in the foothills of the mountain, forcing the campesino to exploit natural resources at hand to provide subsistence. In bad years the exploitation of [these resources] is the only means of subsistence they possess, selling firewood, charcoal, or wood for construction. It thus becomes necessary to emigrate to other areas, but the campesinos from this region are attached to this province and care deeply for the land they possess, refusing to abandon agricultural work even when it does not even pay enough to live.

As in many other regions of the country, Tlaxacalans' options were limited by the sharp rise of staple commodity prices in the early twentieth century, particularly in relation to relatively flat salaries. As such, while some Tlaxcalans had the option of turning to waged labor in the textile factories, industrial wages were also inadequate to meeting household needs during this period. The suffering of villagers in relation to heightened commodity prices thus became the suffering of village land. As trees were removed from forests to close the gap between what households had and what they needed, unchecked wind and water carried topsoil down the mountain, further widening the subsistence gap.

While protections for forests (if not forest users) had been enacted in the decades previous, the soil conservation team saw these laws as working against a fundamental goal of community well-being:

> On occasion, forest service officials will confiscate [these small harvests of] wood or even their limited tools, aggravating the economic situation even further....Under the circumstances, it can be considered an injustice to impose legal restrictions on the exploitation of resources...[that serve] as the only means of subsistence without cultivating some other source of local wealth or moving the population to some other area with other options for subsistence (72).

Faced with a mutually reinforcing poverty of soils and people in the region, the task of Patiño's team was to interrupt a decades-long cycle of exploitation and desperation with new land use practices that could sustain rather than exhaust community resources.

Given the magnitude of local erosion and the high costs of initiating a conservation program, any improvement program would require the cooperation of both state and federal government alongside community members. The plan for Tlaxcala involved a significant investment of paid community labor and materials on the part of the state to re-forest, repair eroded fields, and provide infrastructure for more sustainable cultivation going forward. The resulting plan of work included stabilization and flood prevention on mountainsides; the planting of trees to protect all areas with thin soil cover; and the formation of reserved forest areas in completely eroded areas. In cultivation zones with slopes greater than 5%, workers for the Soil Commission would help install terraces. In all areas, crops should be alternated or planted in alternating zones on a contour. The Commission

would study the best system of crop rotation based on regional experience and habits and encourage the planting of high-value crops better suited to local soils as well as intensive cultivation of fruits and vegetables in kitchen gardens and the raising of domesticated birds and livestock. Commission personnel would teach more sustainable methods of harvesting wood and obtaining charcoal and establish nurseries for fruit trees well-suited to forest environments. In sandy areas, rather than burning soils clear, villagers would be encouraged to leave at least 30 cm remaining of stalks when they harvested soil in order to protect the ground from wind and preserve organic material and microflora. The Commission would procure and establish winter plantings of legumes to fix and improve soils and establish a tree nursery for common use, with villagers assisting in planting trees on denuded hillsides. Farmers would be encouraged to leave fields fallow when possible, a practice that had been common in the past but rendered nearly impossible by the exigencies of the past decades. Patiño estimated that such a project would require a team of 148 people with at least 100 of those laborers employed from the local community, at an overall cost for labor and materials of 395,033 pesos (Patiño 1942: 70-4).

By 1945, the Mexican Department of Soil Conservation had commenced community conservation programs in states where erosion had been designated particularly acute, namely México, Tlaxcala, Morelos, and Jalisco and conducted intensive studies of the particular geographic and social conditions in sixteen different states (*Proyecto de Ley de Conservacion de Suelos y Aguas* 1945). The 1946 Soil and Water Conservation Act cited the land reform provision of the 1917 constitution giving the state the right to regulate the exploitation of natural elements in order to ensure an equal distribution and conservation of public resources (*Diario de los Debates* 1945). However, just as conservation rhetoric began to settle into institutional legitimacy, changing institutional values prompted a redirection of state practice.

Cold War epistemologies and the advent of the Green Revolution

As international post-war investment and political pressures shifted, Mexican "social landscaping" to strengthen rural campesino communities would give way to a new mode of environmental governance by a shifting, more centrist cohort of PRI leaders with markedly different social commitments. Describing President Manuel Ávila Comacho's agricultural reforms (1940-46), Angus Wright has described those policies as moving from agriculture as a means of achieving social equity to agriculture as the "foundation of 'industrial greatness.'" As in many developing nations in this period, nationalist tropes of productivity seized on industrial independence, for which natural resources and national labor could provide valuable inputs (Wright 2012: 33).

If agricultural planners retained commitments to conservation through this shift, they did so according to changing epistemologies about land and society. Despite significant innovations in conservation strategies and the institution of conservation-minded legislation, new programs continued to suffer from lack of funding adequate to effectively scale strategies to a national level, stalling the social change imagined by bureaucratic innovators a decade earlier. Further, agricultural reform efforts over the past decade had not succeeded in bringing agricultural production to levels sufficient to meet the demands of an industrializing nation, and key export crops like bananas suffered from seemingly uncontrollable disease outbreaks (Cotter 2003: 125-6). At the same time, national and international resources poured into other innovations in resource management- specifically Green Revolution programs for agricultural industrialization- facilitated a very different

constellation of changes in the countryside (Cotter 2003). International market demands for forest products during the Second World War spurred a reframing of forests as repositories of valuable raw materials, prompting the creation of a new industrial forest exploitation unit that placed rhetorical emphasis on reforestation and sustainable but with an end objective of guaranteeing a steady stream of industrial inputs rather than assuring community access to resources (Simonian 1995, 122).

Prompted by advisers and resources from the Rockefeller Foundation and the U.S. Department of Agriculture's Office of Foreign Agricultural Relations, Mexican agricultural development emphasized extensive plantings of new, high-yield varieties dependent on intensive irrigation and the application of commercial fertilizers, herbicides, and pesticides to achieve optimal yields. As a result, the Mexican government invested in a new wave of large-scale hydraulic engineering modeled on the U.S. Tennessee Valley Authority (Tortajada and Contreras-Moreno 2007). Conservation values were seconded to productivity, with expensive inputs and encumbent credit obligations putting increased pressure on profit margins over resource sustainability. Rather than rehabilitate existing agricultural soils, emphasis was placed on bringing new soils into large-scale production. Small farmers without capital to invest in new inputs could not compete with low prices for high yield varieties and were pressed into waged industrial or agricultural labor to support their households. In areas where new inputs did come into widespread use, rural communities had to contend with the impacts of agricultural chemicals on local health and ecology (Wright 2012).

The election of President Miguel Alemán Valdés (1946-52) cemented the shift of Mexico's national resource policies, despite sustained support for social landscaping from many researchers and local officials. A detailed program of conservation submitted by Beltrán to the new Alemán administration went unanswered (Beltrán 1977: 306) and soil and water conservation programs begun in the early part of the decade were slowly defunded (Blanco and Ramirez 1966). In response, the frustrated Beltrán moved his efforts outside of government to a new Mexican Institute of Renewable Natural Resources or IMENAR. Formed with the financial support of the U.S.-based Charles Lathrop Forestry Foundation alongside Mexican business and civic groups, IMENAR would pursue field research and public education about natural resources in the face of growing government disinvestment. Gonzalo Blanco Macías, a soil conservationist who trained in the Pan-American Union's Division of Agriculture and Conservation, similarly instituted *Amigos de la Tierra* (Friends of the Earth) to galvanize community-based conservation as government resources were directed elsewhere (Blanco 1950).

Beltrán's institutional re-orientation coincided with a new focus on the purported dangers of overpopulation to resource conservation (Simonian1995: 136). This move aligned him more closely with an emerging faction of North American conservationists who warned that the real threat to natural resources wasn't capitalist exploitation but a dangerous excess of rural resource users. Disseminated by books like Fairfield Osborn's *Our Plundered Planet* (1948) and William Vogt's *Road to Survival* (1948), this message was especially resonant with international elites concerned with resource degradation but suspicious of redistributions to rural workers advocated by an earlier generation of conservation advocates (Harvey 1974; Iyer 2013). In 1948, for example, the Rockefeller Foundation purchased nearly 100 copies of Vogt's book to be distributed by their field officers traveling abroad. Both within and outside of government, resource streams directed conservation energies away from sustainable campesino self-determination and towards more industrialized efficiencies.

Conclusion

This article describes the role of innovative land epistemologies as part of a broad program of social reform in revolutionary Mexico. Governmental attention to popular consciousness in the form of education and cultural life was a constitutive and not merely coincidental aspect of revolutionary agrarian reform. Rather than focus exclusively on conventional categories like science or agronomy, I examine diverse forms of public discourse simultaneously to demonstrate how changes in resource access required transformations of understanding that spanned political, cultural, and technical experience. These changes reflected an effort to reverse commodification's conceptual excision of the natural world from social and political life. An emphasis on mass consciousness in relation to land use should be seen as evocative of a new regime of rural governance and, simultaneously, a new conception of national subjects as ecological subjects. In part, the decision to invest citizens with responsibility for land management can be seen as a function of limited budgets and technical capacities. At the same time, state efforts to engage rather than ignore the ecological aspects of community life in a period of limited resources indicate a meaningful (if temporary) reorientation of political life in relation to land and resources.

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Chapter Four

The Blood of Heroes: Nationalist Bodies, National Soils, and the Scientific Conservation of the Federation of Colombian Coffee-Growers (1927-1946)

This earth that you cultivate, to which you are bound by need and by love- like an infant at its mother's breast- is tired; it is exhausted; it is dying in your hands, victim of an unrelenting enemy called erosion. And you aren't alone in depending on this land; we all depend on it. The soil is the most precious material resource of the nation, and you, *amigo campesino*, are its steward and guardian. The subsistence of you and your family depends on the fertility of the soil you cultivate, as does the prosperity of your country and the security of the nation.

In this simple manual…you will find suggestions to defend, conserve, and improve the fertility of your soil. But they are no more than suggestions. You, *amigo campesino*, with your virile spirit, with your power and your constancy, must transform them into fecund reality… Once again you will be the defender of the Country. You have the blood of heroes.

-Carlos Vargas Vanegas, *We Defend Our Soils*

1. Introduction

In 1940, Juan Pablo Duque, Technical Department Director for the National Federation of Colombian Coffee Growers (*Federación Nacional de Cafeteros Colombianos* or FedeCafé, the national growers' cooperative organization) prepared a detailed presentation for the Commission on Plant Sanitation in the Department of Caldas. Through the previous decade, local planters had been plagued by *la gotera*, or American Leaf Spot. In response, the 1938 *Cafetero* Congress voted to initiate a series of research-oriented campaigns focused on plant health. Two years on, Duque announced that those research campaigns as well as the Federation itself were to be reoriented from plant canopies to the condition of roots and soils. Based on the results of FedeCafé's technical research, Duque argued, soil erosion, rather than insects or disease, would henceforth be understood as the central ecological injury from which all other coffee ailments sprung. Describing in detail

eroded soils in coffee-growing regions- the "original sin" spawning a "veritable chain of maladies," Duque blamed nineteenth-century cultivation practices, citing techniques developed during a time when Colombians were still opening "virgin terrains," when nature was "wild and abundant" and land and labor were cheap (Duque, 1940b: 2615).

Now, in the 1930s, the largely poor, small-holding community of coffee-growers had neither the opportunity nor the resources to open new terrain when soils grew tired. Colombian *cafeteros* would need to develop practices directed toward the long-term viability of established *fincas*. Such an undertaking required an ongoing program of long-term experiment as well as structural improvements and grower education. Duque assured his audience that, all *cafeteros*, regardless of the size of their operations, would have access to the technical and education work of the Federation and, even more importantly, to financial credit to support long-term investment in soil health.

Their plan was framed around the unique physical and social relationship between coffee production and the country itself. Their conflation of national with industry interest was not merely grandstanding. Coffee's growing importance in the post-independence era meant not only a high portion of national capital bound to the industry; it also meant increasing hectares of national territory and growing numbers of workers occupied with the growth, harvest, transport, and processing of Colombian coffee products. Given that profits from the other dominant export sectors of gold, bananas and oil were destined for foreign coffers, the significance of Colombian coffee exports to the national economy was even greater (Palacios, 1980). As an industry controlled by domestic producers, coffee represented Colombian self-determination within a world market long tilted toward European and North American interests, producing a nationalist space that was, simultaneously, *cafetero* space. Coffee did not release from the contingencies of the world market; rather it offered an alternative form for those global market relations from one of mere resource extraction.

Birthed in 1927 and funded by coffee export taxes, the Federation emerged as an ambitious force that promised to stabilize and strengthen the nation against destructive international and domestic influences. Those forces included international investors, markets, and processors as well as the often violent party and class conflicts that had unsettled Colombian society over the past several decades (Koffman, 1969). To justify and help realize its ambitions, FedeCafé promulgated a new body of specifically national expertise linking the body of the land with the body of the nation more broadly. In an era of nationalist development around Latin America, FedeCafé assumed a pivotal governmental role in coffee-growing communities. The result was a kind of *cafetero* hegemony in the absence of strong state intervention (Palacios, 1980). Sustained materially by coffee's centrality to the Colombian export sector and allowed by an accommodationist state, *cafetero* hegemony was driven by FedeCafé's grower-controlled institutional apparatus and supported by popular and intellectual sentiment. While it took many forms, including credit institutions, collective processing and distribution infrastructure, and national trade policy, the production of new forms of expert and popular knowledge was central to FedeCafé's broad influence. This expertise was distinguished by its emphasis on the entwined well-being of social and ecological systems centered on national coffee harvests and the soils that produced them. If individuals in liberal society are affirmed through a private right to buy and sell property, Colombians in the early twentieth century entered *cafetero* society by virtue of a different kind of culturally-prescribed material relationship- the cultivation, care, and harvest of a singular crop.

One of FedeCafé's inaugural priorities was to apply resources to what Mariano Ospina Perez called "a complete science of our coffee industry" drawing on botany, soil science, and entomology alongside economics, ethnography, and hygiene to encompass café and *cafeteros* within a singular technical program (FNC, 1932: vi). Simultaneously legitimated and shaped by concerns of the primarily small-holder coffee-growing population, *cafetero* science from this period reveals the ways that transformations in social production provoke new conceptions of the world. Moreover, as I will argue here, such changes call for re-imaginings of both the human and non-human subjects transformed by new mixtures of land and labor.

In the text that follows, I show how new ideas about human and ecological natures were an essential component of FedeCafé hegemony, conceptually embedding the vitality of Colombian nationhood and citizenship in coffee country's ecological systems. Further, I argue that this conceptual re-embedding of society in ecological processes was itself the result of concerted challenges to new forms of land and labor exploitation that accompanied the global capitalist commodity booms of the late nineteenth and early twentieth centuries. McCook (2002) has argued that developments in Latin American agricultural science during the liberal period (1890-1930) sustained the interests of elite landowners; I show that subsequent efforts to serve small-scale and peasant farmers forged their own forms of hybridized scientific knowledge. Such intellectual innovations were foundational to transformations in productive practice, supporting Gramsci's contention that the emergence of a hegemonic apparatus "is never just a physical act; it is intellectual as well. Indeed, it is always intellectual before it becomes physical" (2000: 44). The example of early FedeCafé scientific programs elucidate the ways that sustainable resource management and class-based social justice can and have been mobilized simultaneously as part of a broadly-scaled effort toward social change.

FedeCafé's production of new social and environmental knowledge was instrumental not only in bringing into focus a particular form of national subject- the cosmopolitan, democratic *cafetero*- but also in reshaping the literal ground of Colombian coffee country. To better understand this phenomena, I turn to FedeCafé's treatment of agricultural soils, a subject of heightened international concern in the decades following the Great Depression. While the ensuing era of agricultural soil management is notable for the emergence and international dissemination of new U.S. soil conservation techniques, U.S. developments were far from the only innovations in this field, nor were they well-suited to all geographic and agronomic contexts. However, while U.S. and Colombian soil management shared a commitment to sustainable resource use as a foundation of popular well-being, FedeCafé knowledge production departed from U.S. expertise by prioritizing *cafetero* production over a more universal applicability. Thus, while U.S. strategies were abstracted to support a diversity of crops and landscapes, FedeCafé programs in the 1930s focused on the tri-partite engagement of coffee trees, Andean soils, and small-holder production.

This research is based on twenty-four months of archival research in the United States, Mexico, and Colombia as part of a larger project investigating the development of soil conservation practices in the Americas in the decade following the Great Depression. I investigate several classes of primary documents includinge industry publications for producers; newspapers and popular journals; state-sponsored publications and internal state documents; scientific conference proceedings; and publications by scientists for non-scientists to draw connections between new forms of expertise, popular discourse, and changing land management practice. Section 2 of this paper details the broader theoretical questions underlying this investigation, while Section 3

establishes the empirical foundations of coffee's centrality to national development in the early twentieth century. Sections 4 and 5 explore the emergence of new scientific thinking on race and ecology, respectively, that naturalized the constitutive links between the Colombian countryside and smallholder coffee production in a highly international context. In section 6, I show how these two distinctive features of FedeCafé epistemology were eroded by new incursions of U.S. economic and political interests during the subsequent Cold War era.

2. Theorizing Science and Global Exchange

Historians and sociologists of science have demonstrated how the global expansion of European and North American market interests drove new bodies of technical expertise, creating epistemological commensurabilities between far-flung environmental contexts via new universalized taxonomies and systems of measure (Scott 1999). Similarly, Strathern (1990) and Latour (1993) have effectively demonstrated that conceptual divisions between biological and political life are critical to the reproduction of liberal sociality, stabilizing oppositional relations between property and property holders while excising the non-human world from the realm of political debate. Relatively unexplored, however, are the ways that such conceptual divisions are unsettled by efforts to realign power and property relations within given social contexts.

This paper takes up that question, asking how new forms of empirical knowledge resonated within Colombian and cafetero society as part of a conversation about social life more broadly. Such resonance simultaneously reflected changes in the political realm and directed material practice in a way that reinforced those dynamics. These questions are especially salient in the realm of agrarian production. As Franklin (2007) and Stassart and Whatmore (2003) have argued, agriculture breaks down key ontological distinctions between human and non-human bodies, connecting societies to environments in ways that are simultaneously political, discursive, and metabolic. FedeCafé science embraced such connections, linking human, soil, and plant natures to a distinctly national mode of social production. This emerging sense of national subjectivity was specifically linked to *inter*national flows of capital, goods, and ideas. As such, the emergence of FedeCafé expertise reveals the ways that cosmopolitan science is not of necessity universalist science.

The example of FedeCafé also points to the heterogeneity of territorial and governmental forms within national development processes. I follow Larner and Walters' (2004) contention that processes of globalization are also forces of governmentality, generating new forms of governance, expertise, and subjectivity that are in all cases conditioned by place-based particularities of politics, history, and geography. The result is what they term "situated re-territorialization", generating new epistemologies and ontologies alongside new, place-based subject forms. Sparke (2005) has called into question conventional conflations of the nation with the state, arguing that territories and homelands are subject to the exercise of institutionalized power at multiple scales. In the absence of a strong national government, FedeCafé leveraged coffee's social and economic primacy to assume social authority in *cafetero* country, forging a discursive and practical mechanism that united growers of diverse class backgrounds in a singular program of rule. While the bulk of FedeCafé's activities were geographically centered in the coffee frontier zones, coffee's long-standing position as Colombia's most significant domestically-controlled export linked FedeCafé authority to the productive heart of the nation itself. Thus, despite the fact that coffee farming and the coffee frontiers represented only a portion of Colombia's productive activity in this period, the industry's

privileged position in relation to Colombian economic self-determination fed both popular and scientific conflations of *cafetero* and national identity.

Marxist political economy suggests that commodities in liberal capitalist society must be conceptually and literally severed from the social and ecologic relations of their production in preparation for market exchange (Marx 1976:165-177), what Polanyi (2001) has termed a "dis-embedding." Given that, Colombian coffee in this period offers an intriguing example of market-based sociality that is consciously embedded in rather than abstracted from its material conditions of production. Coffee implicated *cafeteros* in dynamic ecological and social systems, the particularity of which was affirmed by the national institutions, popular knowledge, and biological and social sciences orbiting Colombia's central export industry. Though *cafetero* nationalism was itself a function of global market relations, FedeCafé's nationalist agrarian science was made possible by the temporary retreat of international capital interests during the years of the Great Depression andthe Second World War, a moment of economic sovereignty that birthed in turn an intellectual sovereignty.

3. Global Depression, Class Struggle, and the Emergence of FedeCafé

Between 1923 and 1928, as much as 198 million pesos in foreign capital were invested in the Colombian economy (Fluharty, 1957: 82). In all, 214 million dollars in loans were contracted during the 1920sin what became known as the Dance of the Millions Safford and Palacios, 2002: 275). Thousands of people moved from the countryside to the cities to work on bank-financed urban development projects, creating a new class of urban laborers. However, despite this infusion of cash and the growing wealth of national elites, per capita income in Colombia remained very low-approximately US $100 per year between 1925 and 1928. In the coffee sector, large plantation owners faced with widespread defection of agricultural workers tightened restrictions on rural laborers in order to tie them more securely to the *fincas*, accelerating class conflict in the countryside (Vanela and Romero, 2007). Changing labor conditions spurred many discontented coffee workers to relocate from the older eastern coffee zones, either to urban areas to work in the burgeoning public works sector or to the western coffee frontiers of Antioquia, Caldas, and the Cauca Valley (Safford and Palacios: 276).

In the face of escalating tensions between growers and laborers, innovative forms of rural organization emerged. Chafing from increased pressures from the older, semi-feudal hacienda structures and new forms of exploitation from an emerging capitalist free labor system, tenant farmers and sharecroppers as well as indigenous peasants and waged agricultural laborers found common cause against elite property-owning elites (Rivera Cusicanqui, 1987). In the words of historian Hermes Tovar (1975), Colombia's global market integration of the 1920s converted rural laborers into a *campesino* proletariat. During this period, exponential growth in coffee exports also helped spur the national economy. Coffee exports tripled from one million to three million bags annually between 1913 and 1930, representing nearly 66% of the total value of the nation's exports (Posada, 1976: 114). Further, the push to expand production created new conflicts over land in the frontier zones as well as in existing agricultural areas, tensions that exacerbated both class and race-based antagonisms. In the words of regional officials, the coffee *haciendas* of Cundinamarca served as the "'nerve center of the agrarian problem'" (LeGrand, 1986: 110-12).

In 1929, the crash in North American investment markets brought the Dance of the Millions to a halt, compounding tensions in the countryside as unemployed workers returned from the cities to the rural frontier zones in search of subsistence, with the greatest demographic movement between Bogotá and the nation's coffee frontiers (Tovar, 1975). As internationally-funded economic sectors went into a tailspin, domestically-driven coffee production served as a powerful ballast preventing full-scale chaos.

In 1934, Colombians elected self-styled radical Liberal candidate Alfonso López Pumarejo to the Presidency, followed by a modest program of state-led reforms known as the *Revolución en Marcha*, or the Revolution on the March. Between 1933 and 1940, the Colombian government purchased 240 large estates to redistribute for sale among11,000 workers. Many of those would-be landowners, as Catherine LeGrand (1986) notes, had participated in mass mobilizations to gain title to their lands in the early 1930s. The number of coffee farms in Cundinamarca and Tolima would more than double as a result of plantation liquidations, with the majority of those divisions occurring between 1932 and 1940 (Hirschman, 1963: 103). A state newly sympathetic to laborers and widespread worker mobilization successfully eroded longstanding legal prohibitions against peons' commercial participation via sale of coffee grown on home plots, further altering the character of production in the coffee sector. Moving forward, FedeCafé's efforts to remediate social and environmental instabilities in coffee country for this burgeoning class of small-scale growers would supercede those of Colombia's relatively weak national government.

Palacios (1980), Bergquist (1986) and others have characterized FedeCafé in the mid-twentieth century as a monolithic organization led by, and implicitly in service to, an elite coffee-growing class. Certainly, the observation that FedeCafé leadership pulled largely from affluent *cafetero* families is accurate, and the organization's relatively low membership in its early years drew most heavily from historic planting regions in which large haciendas were still the norm (Koffman 1969: 85). However, by the 1930s an active membership drive in the frontier zones coupled with new national laws supporting peasant farmers established another kind of producer at the ostensible forefront of the organization's mission- the small producer. This demographic turn also reflected a shift in geographic focus toward the predominantly small-holding coffee frontier zones. FedeCafé *gerente* Mariano Ospina Perez (1934a) proclaimed the organization's exceptionalism in the history of national agrarian relations, stating that, prior to FedeCafé "no entity or institution has been constituted in Colombia on behalf of the small scale cultivator, for whom the National Federation of Coffeegrowers was and continues to be made" (1803). A professed commitment to *el pequeño productor* resonated with the national mythos of the egalitarian nature of the coffee-growing frontiers as well as with the demographic realities of coffee production. Promotional materials and internal organizational documents emphasized how Colombia's mountain slopes "naturally divided" into small plots. Governed by the countryside's own proclivities, Colombian coffee-growers had no need for state intervention to assure equitable distribution of the means of production.

Such commitments were secured by an active, outspoken contingent of small-scale growers. In FedeCafé's early years, top leadership sided with the large growers of Cundinamarca, overriding internal opposition in order to direct their limited budget toward international marketing rather than farmworker aid (Koffman 1969: 170). Their reluctance sparked fierce internal conflict from the small-scale growers of the western coffee frontiers, specifically from the increasingly influential department of Caldas, where small proprietors threatened to dissolve the Federation if it didn't enact policies to meet all growers' needs. *Caldenses* railed against what they saw as the domination

of the Federation by large growers, proposing new, more democratic internal governance structures and more equitable distribution of resources. Colombian President Olaya pressed Federation *gerente* Mariano Ospina (1930-34) to negotiate a compromise between the two factions (Koffman 1969: 190-1).

Throughout this period, rural mobilization by coffee workers and aspiring small-holders continued to exert pressure in and beyond the coffee zones. Leftist activism in coffee country including *hacienda* occupations in the older coffee zones of Tolima and Cundinamarca had put the nation on notice that poor and laboring class interests should occupy a central position in new policy and resource allocation. Following the surge of organized populist energy accompanying the *Revolución en Marcha,* Colombian President Alfonso López selected Dr. Alejandro López (no relation) (1935-37) as the new executive leader of FedeCafé.

López was well-acquainted with the complexities of foreign markets, having recently completed a fifteen year stint representing Colombian interests in Europe. An engineer and prolific writer with a following among young left Liberals, the new *gerente* had argued publicly for equal opportunity, public education, and state intervention in the economy. Even closer to his heart was a commitment to ending the "semi-feudal" relations in the Colombian countryside through the subdivision and redistribution of Colombian land (López, 1983: 412). At FedeCafé his most outspoken positions were for solidarity among American coffee producers, price stabilization, and defense of small coffee-growers, all important factors in economic security and autonomy of FedeCafé's core membership. This selection followed a series of tense negotiations at the coffee congress, in which the government tried and failed to incorporate the Federation into its ministries. By the next decade, the Federation would have grown in political influence, securing along the way the right to pick its own leaders by internal vote (Koffman 1967: 173).

Federation leaders like López responded to conflicts between competing class factions by emphasizing the multi-classed nature of their collective enterprise. Affinity as *cafeteros*, the membership was repeatedly reminded, came before any class or party alliance. Founded for and by *cafeteros,* FedeCafé was not a union of employees, but rather a cooperative of all producers with membership ranging from those who have hundreds of thousands of trees growing in their department or *hacienda* "to the smallest cultivator who harvests a few dozen pounds of coffee on the outskirts of his shack" (Dupuy, 1933). Elite leaders imagined that the work of the Federation in service of "those men who work the earth beneath the rays of the sun, of *those men who are burnt by the sun"* could and should diffuse other, more radical forms of organizing by selectively incorporating the needs of the rural masses (Ospina Perez, 1934b).

This attention to the needs of small growers also reflected the demographic realities of the coffee-growing regions. In 1932, the Federation organized an exhaustive survey of all the nation's coffee-growers, revealing that three-quarters of the nation's coffee harvest came from 146,000 peasant farms, representing 98% of the coffee-growing population. Two-fifths of these households supplemented coffee income through the sale of additional crops or paid labor away from the family farm (Safford and Palacios, 2001: 276). The impact of the first-ever coffee census was powerful and two-fold. First, it effectively delineated what the organization saw as its field of institutional responsibility, a field which included all growers, large and small, as well as the land they worked and the crops they harvested. Second, it brought into sharp relief the profound and complex struggles within coffee-growing communities.

Marginal conditions among *cafeteros* revealed by the coffee census were compounded by the global crisis of coffee prices in the 1930s. In the past, the Colombian coffee industry had weathered such international crises by relying on intensified production among self-exploiting small-holders, raising production to offset declining prices per kilo. Declining yields on established plantations were evidence that such a policy on its own was insufficient to guarantee *cafetero* welfare into the future. Further, given the fifteen-year lifespan of the coffee tree, frontier zone *fincas* planted during 1920s faced an additional impending crisis of yields. Further, widespread poverty among *cafeteros* in the 1930s coupled with the relative unavailability of chemical inputs meant that the community's capacity to invest in chemical inputs and technical innovation was limited. Practically, FedeCafé would need to devise biological management systems that did not rely on significant or ongoing capital outlay. Formulated in response to coffee country's demographic and practical realities, this new expertise would complement another growing body of national knowledge, one that cast the small-scale coffee grower as the embodiment of a modern, democratic national subject.

4. Race, Coffee, and the Production of Colombian National Identity

FedeCafé policy and discourse emphasized the centrality of coffee to national self-determination. However, organizational rhetoric was in many ways an amplification of notions already at large among the Colombian public, notions that upheld the Colombian coffee industry as torchbearer for the modern national development project. Prominent Colombian intellectuals linked human social and biological natures, including race and gender, to coffee country ecology. The designation of 'la Raza Antioqueña,' - that is the "race" of inhabitants of the coffee-growing frontiers of the state of Antioquia as well as Caldas, northern Tolima and Valle- was a nationally-familiar truism (Parsons, 1948). At the turn of the century, racially-mixed or *mestizo* laborers in the older coffee zones were widely perceived as "Indian" by hacendados, while coffee workers in the frontier regions- also by and large *mestizo*- were considered to be "white;" labor practices were similarly spatially bifurcated, with "Indian" workers in Cundinamarca-Tolima embroiled in a pre-capitalist relationship of obligatory labor in exchange for limited land access and "white" workers in the frontier receiving monetary payment alongside land access in exchange for work (Safford and Palacios: 264). As the twentieth century progressed, Colombian politicians, intellectuals, and social activists refined and developed these notions of nationally-specific race and productive labor within a global society. While some of these reflected long-held biases against native peoples, others embraced a new notion of "indigenous" that contrasted imperialist exploitation with local mixtures of peoples and lands (see Marchesi, 2014).

In 1934, historian Luis López de Mesa published the influential *De cómo se ha formado la nación colombiana* citing the geography of coffee-growing regions as the key formative agent of the Colombian "race," which partnered indigenous, African, and European bloodlines with the fertile soils, ample water supply, and temperate climate of country's mountainous areas. The intrepid colonizers of the Colombian coffee-zones, he explained, mixed the biological potential of their own bodies and the land itself to clear forests and begin a new society of entrepreneurial small-holders who would drive a new, democratic, republican society (Bergquist, 1986).

Prominent socialist historian Luis Eduardo Nieto Arteta (1958) made a similar claim at mid-century in his assessment of the nation's economic development since independence, describing the

different human types that had emerged in Colombia alongside different forms of agricultural production, assigning to the Colombian coffee producer those qualities that would lead the nation toward a modern, profitable, future:

> The Antioqueños are decisive, clear-headed, realistic, enterprising. Coffee is Antioquia. It was the inhabitants of this department that colonized Caldas, Valle de Cauca, and the *cafetero* sector of Tolima. There is a sharp difference between the coffee-growing regions and the rest of the nation in terms of their lifestyles. In [coffee regions] existence is high pressured and dynamic. Life flows toward the exterior... It is an existence that coincides with a great spatial stability: coffee is not only a product of late yields, nor a tree with various harvests. Its vital cycle does not conclude with the first harvest. The producer of coffee is deeply-rooted to the land. He is never nomadic. It is understandable that in the coffee regions families are of the stable, patriarchal type.

In contrast to the (market-based) revolutionary figure of the coffee grower, producers of other crops were dull and parochial, not only because the simplistic nature of their crops' growth cycles but also by the limited geography of their commodities' circulation. "There is [the man] of yuca, corn, and cotton... He is tranquil, slightly apathetic. With the exception of cotton, he consumes all that he produces, selling only a little of his other two crops in local markets. He is *mestizo* or mulatto... There is the man of wheat. He is sad, secretive, solitary. He produces for internal markets."

Bound to new systems of international transport, communication, and commercial representation, coffee was by its very nature cosmopolitan. The labors of the man of coffee, "predominantly of the white race," had transformed and globalized the nation from an exploited colonial backwater to a sovereign nation among nations:

> The colonial tirade has ended. The favorable juncture for the development of coffee cultivation is developing new tendencies in the Colombian man. He will have a fundamental concern with economics. Profit will be his objective. He will be bold, not retreating before risk, always dynamic. He will not tire. He will not know idleness, the idleness of the colonial era. He will have a love of the new. From purely agricultural activity- the patriarchal era of life in Antioquia and northern Caldas- will come both commerce and industry (88-90).

Cafeteros in far-flung corners of the nation tracked foreign tastes, exchange rates, and trade policies in addition to local soil, precipitation, and processing work.

At a 1933 FedeCafé conference in Cali, *gerente* and future Colombian president (1946-1950) Mariano Ospina Pérez (RCC 1933) made a similar argument linking the natural proclivities of the Colombian people to the physical qualities of its landscapes, describing the mountainous terrain of the coffee zones as the area that best embodied the character of the nation, provoking those qualities most closely linked with national excellence. A close study of Colombia's colonial history, he explained, revealed that the indigenous peoples living on the hillsides demonstrated energy, drive, and levels of activity superior to tribes from the flatlands. Indigenous people from Colombia's mountainous areas, he claimed, were more advanced intellectually and culturally, as evinced by their pottery and metalwork. Twentieth-century occupants of the Colombian hillsides (who represented more than 80% of Colombians and the vast majority of *cafeteros*), were the present-day inheritors of that natural legacy by virtue of their own acculturation to that rugged countryside.

Such traits became even more pronounced as the work of coffee-growing developed and refined the natural dynamism of mountain living. Schooled by the earth itself in conjunction with international markets, *cafeteros* were the best hope for the nation's ongoing and future excellence. In the course of their regular activities, *cafeteros* employed geometry, mechanics, and biology. *Cafeteros* did book-keeping for their small operations, negotiated rates, understood international markets, exchange rates and trade policy. "In contrast," Ospina lamented, "we can think of the monotony of labor and reduced mental horizons of a child or a laborer employed on a ranching hacienda or in the planting and cultivation of potatoes or other root vegetables, of corn, or of wheat." Moreover, coffee-growing instilled in participants a unique cosmopolitanism: "The small coffee empresario has certain notions of commerce and contact with certain phenomenon that oblige him to think beyond the boundaries of his country." Even growers on a modest scale must be attuned to consumption patterns in the United States and Europe as well as international exchange rates, New York financial markets, and coffee harvests in competitor nations. "All this affirms for me that our coffee industry constitutes the 'great people's university' of Colombia," he declared.

In these formulations, the landscape itself was evidence of the constitutive alliance between national and *cafetero* development. The country's uneven, mountainous topography, observers argued, naturally suited it to the coffee industry's small-scale production. While areas like Tolima and Cundinamarca retained some large haciendas, Ospina cited FedeCafé census data showing that the great majority of Colombia's coffee production was the work of small-holders. In this, Colombia distinguished itself from other coffee-producing nations like Brazil or Guatemala, where large haciendas were the norm. "In this era when the democratization of property constitutes one of the world's great objectives," he argued, Colombia's natural adaptation of coffee production to the constraints of small-holder operations was not only practically relevant, but represented the nation's innate sociological and political progressivism (RCC 1933). Land and labor, the nation's two indigenous inputs, were the fulcrum of this progress.

5. FedeCafé and Colombian soil science

Just as coffee-growers exemplified the best of the modern nation, a 1937 FedeCafé study of crop diversification concluded that no single commodity crop was as well-matched to the natural capacities of Colombian soil as the coffee plant, which allowed for both long-term forest cover and diverse inter-plantings: "We can state unequivocally that our mountain hillsides are exclusively suited for nothing but our particular cultivation and method of using soil resources reasonably and with patriotic foresight" (RCC, 1937a). FedeCafé rallied member support for conservation by publicly distinguishing *cafetero* production from the profligate resource exploitation in other sectors.

FedeCafé's central challenge was to support its membership of predominantly small-scale, poor farmers in sustainably maximizing yields without significant capital outlay. They turned in this pursuit to the resources already widely-available to small-scale *cafeteros*: the inherent capacities of the land and its diverse living inhabitants. Soil and subterranean ecologies more broadly were central to this project. FedeCafé's concerns were both biological and structural. In the former case, industry leaders were anxious to avoid outbreaks of diseases that had crippled the industry in the past. In the case of the latter, frontier colonization had involved the swidden plantation of subsistence crops for settlers and their families. The ensuing loss of forest cover on steep hillsides

meant that coffee production frequently began in areas with diminished shade cover and accelerated erosion (Guhl, 2004: 126-7). While subsequent coffee plantings would slow soil loss, farmers faced significant challenges early on in farm ecology and soil health.

While rooted in local concerns, FedeCafé's burgeoning research program also reflected a growing international attention to soil health. High prices for commodity crops coupled in many cases with increased farmer indebtedness had led to unsustainable planting practices- and subsequent soil exhaustion and erosion- in agricultural regions around the world. The work of the U.S. Soil Conservation Service (SCS)- the first federal department of its kind in the world- emerged as an international formulation for systematically addressing soil sustainability as a function of rural community well-being. Under this program, farmer-led soil conservation districts under the advisement of trained SCS technicians were encouraged to survey local agricultural lands and employ a recommended suite of conservation practices in areas suitable for crop production. Around Latin America, these prescriptions were disseminated by the U.S. State Department's Office of Inter-American Affairs program via the translation and widespread circulation of SCS training and survey manuals; specialized SCS field schools for international trainees; and soil conservation "missions" conducted internationally by U.S. field agents (Phillips, 2007: 249-50).

Centered on the coffee tree, FedeCafé research deviated from the U.S. model in both its temporal and its biological focus. As Showers (2006) has argued, U.S. soil conservation practices were shaped by the challenges of farming annual crops on fragile frontier grasslands. As such, U.S. soil management centered on soil particle stability over other aspects of soil health. Moreover, while Bennett argued for the application of different techniques under different soil and topographic techniques, the diversity and annual nature of U.S. commodity crops meant that standard technical prescriptions did not consider soil in relation to particular plants but rather as a potential (if critical) medium for many different plants. In contrast, FedeCafé technicians considered soil particles specifically in relation to established coffee plantings, one aspect of a diverse living pedosphere, including micro-organisms and the root structures of coffee trees. Humans, animals, and cultural and economic practices all played important roles in shaping this assemblage.

Community commitment to one crop meant a similarly long-term commitment to the specific ecological conditions that would best support it. The high-quality, shade-grown coffee plants that distinguished the Colombian industry in this period from its competitors yielded smaller annual harvests but had longer lifetimes than those grown in the absence of shade trees, reaching a peak of productivity in its second decade of growth (Guhl, 2008). Under these conditions, the time scale of FedeCafé ecological management extended to decades, significantly longer than other cultivators for whom changing crops presented less of a burden. Investment in a coffee crop required that *cafeteros* care for particular organisms over many years, an intimate and sustained attention.

As such, the long-term success of the coffee industry also depended on a local set of dynamic connections: the relationships between coffee trees, soils, microbes, plants, and growers in the coffee zones. In Federation discourse, the generative relationship between all of those elements formed the living warp and weft of *cafetero* society more generally. FedeCafé agents took a two-pronged approach to facilitating those connections. First, the organization funded an active field research program to be conducted by a new National Center for Coffee Research (*Centro Nacional de Investigaciones de Café* or Cenicafé), establishing training centers in the departments of Caldas and Tolima with the purpose of studying and protecting coffee-growing soils (Lopez 1933a). Though

Cenicafé conducted research in each of the three coffee-growing zones, its headquarters and primary research program were centralized in the predominantly small-holding department of Caldas. Second, the Federation established diverse mechanisms for the dissemination of research among growers, including collaborations with farmers, public presentations, and the circulation of printed materials. As early as 1934, FedeCafé committed funds to support more than fifty "expert *cafeteros*" to provide instruction in coffee production, processing, and marketing as well as in farm accounting, sanitation, disease prevention, and household nutrition "to maintain the health and vigor of the *cafetero* body and avoid the degeneration of the race" (RCC 1934).

In 1933, Clemente Lopez Lozano, director of FedeCafé's new Central Experiment Station argued that the health of the soil was prior in importance to any technical advances not only for the coffee industry but for the nation:

> The defense of the soil is the defense of the economic base of the nation. We want to produce and increase production, improve agriculturally, but to achieve that goal [Colombians] believe that the base of industrial agricultural improvement that everyone so desires must be initiated by seed selection and hybrids, with genetics; we believe that the next step is the perfection of our work methods, sanitation, machinery, and then markets, etc. *But before all of this there is something even more essential, of greater importance, and that is the soil, whose defense and improvement are indispensable* (emphasis added) (Lopez 1933b).

The *Cafetero* Congress in December 1935 listed soil erosion as the industry's most pressing problem, followed by planting improvement; pest and disease control; improvement of coffee processing methods; and the problem of monoculture (RCC 1938). *Revista Cafetera* admonished growers to "have the patriotic foresight not to bequeath to our children impoverished lands." Readers had only to glance at the journal's back cover in 1937 to learn that "THE WASHING AWAY OF SOILS IS THE GREATEST PROBLEM OF THE COLOMBIAN COFFEE INDUSTRY" (RCC 1937b). For *cafetero* leaders, the future of the nation- its country and its people- rested on their capacity to protect and improve its soils. The science developed within that undertaking would also be the science of nation-building, even as that science bound Colombia more tightly within its international networks.

By 1945, the Technical Committee of the 15th National Congress of *Cafeteros* laid the institutional foundations for a nationally-scaled "Campaign for Soil Defense and Restoration." With a three-fold mission of education, research, and extension, the Campaign extended to all twelve of Colombia's coffee-growing departments. The Federation based its Campaign in part on the work of the United States Soil Conservation Service (SCS), contracting with two United States-trained Puerto Rican soil conservation technicians to guide its technical and organizational aspects. In 1946, after nearly five years of preparation, twenty trained FedeCafé soil conservation technicians, seventy field assistants, and an even greater number of trained laborers dispersed throughout coffee country (Ministerio de Agricultura de Colombia 1953: 1-2).

FedeCafé researchers departed from their North American colleagues, however, in their assessment that the most important aspect of both soil fertility and stability was not chemistry or engineering but biology and interactions between living parts. The introduction to a special soils issue of the FedeCafé journal was especially sanguine about soil biology relevance to a host of national problems:

> We would like to draw special attention to our investigations on soil biology, as our country is situated in a part of the world where the living section of the soil ...offers nearly unlimited perspective, sufficient that a small human effort can provoke maximum activity on the part of the infinitely small universe of living beings, invisible collaborators of immense power in humanity's fight for new fields for sustaining its population.
>
> In the course of a few years, research in the field of soil biology has yielded huge surprises and immeasurable benefits which may well hold the key to to solve our great problems caused by deforestation, diminishing waterways, climate change and all the negative effects that follow the erratic and wasteful methods of natural resource use employed until now the man of the tropics (RCC 1940).

A 1940 Cenicafe assessment gave similar primacy to soil ecology, placing healthy communities of microorganisms ahead of chemical amendments for encouraging plant growth. While fertilizers could be used to enhance the fertility of already healthy soil, they concluded, chemical fertilizers could not substitute for biological action. FedeCafé's director of research cautioned that "before using [commercial fertilizers] it is necessary that soil have achieved its maximum natural fertility... The basis for achieving the best returns from a soil is the exploitation of its natural fertility" (Schaufelberger 1940). These conclusions were based not just on formal field research but also on the past experience of hacienda owners on the older plantations of the central regions. In the 1920s in Viotá, Cundinamarca, for example, soil exhaustion and diminishing yields had prompted local landowners to invest heavily in chemical fertilizers. While such efforts succeeded in raising yields from 0.75 to 1.7 pounds per bush, *cafeteros* of southwestern Cundinamarca subsequently found themselves facing an expensive battle with repeated outbreaks of coffee rust disease (Jimenez 1989: 199). Though FedeCafé in this period did not object in principle (or in practice) to chemical amendments, those inputs on their own could not stand in for healthy soil biology.

FedeCafé researchers similarly argued that erosion control could not be based solely on structural intervention but rather required healthy soil biology. While most international anti-erosion work emphasized structural elements like terracing, embankments, and leguminous field barriers as the foremost anti-erosion practices, Duque's team of researchers expanded their scope of intervention to include microorganisms, arguing that the subterranean biota provided a fundamental structural integrity that preceded the macro-level supports of terraces and wind-breaks. "Paradoxically," Duque told the assembled growers, "man can most actively provoke plant response by operating on invisible rather than visible parts" (Duque 1940b: 2620). In contrast, while recommending similar interventions, US soil conservationists saw biology as secondary to mechanics in anti-erosion work. For example, the USDA Yearbook also advocated the introduction of cover crops but explained their utility in terms of the physical protection they afforded soil particles against wind and water (Pieters and McKee, 1938).

FedeCafé also emphasized the importance of biological diversity on the macro scale. Educational materials advocated the cultivation of shade trees in the denuded frontier zones for the dual purpose of protecting coffee plants as well as national soils in the coffee zones (RCC 1937a) and readers of the *Revista Cafetera* were frequently warned against the economic and ecological dangers of mono-cropping. If such an injunction coming from a national cooperative devoted to a single crop seemed paradoxical on its face, FedeCafé's position reinforced the realities of production on most Colombian coffee *fincas*. Historically, peasant farmers grew coffee trees as a source of cash alongside subsistence and off-season commodity crops (Reinhardt, 1988). FedeCafé recommendations upheld

ongoing peasant practice as ecologically superior; the natural habits of smallholders formed the basis for healthy farm ecology and economy, while large plantations only avoided the dangers of mono-cropping via the subsistence garden plots of laborers and sharecroppers.

6. Cold War international development and the erosion of domestic expertise

Though the Federation would retain its democratic structure and commitment to collective representation in the decades that followed, the changing political and economic landscape of the Cold War era drove yet another reconceptualization of human and ecological subjects in coffee country. In 1946, FedeCafé President and third generation coffee *hacendado* Mariano Ospina Pérez was elected to the Colombian Presidency. While his political ascent confirmed the national power of the coffee industry, it also coincided with a broader shift in hemispheric relations. During the 1930s and early 1940s, coffee-growing elites had contained the demands of peasant farmers through policies that attended to the needs of small and medium-sized growers. As the Second World War drew to a close, changing international forces tipped the scale of influence away from the masses and toward a resurgent international capitalist elite (Jiménez 1995).

National-level action and discussion about national soils during the 1940s reflected complex and often conflicting forces at work within Colombian society more broadly. At the close of the Second World War, the Colombian national government hosted a year-long mission from the United States "toward development of agricultural resources, particularly the production of crops that are complementary to those of the United States" (*Agriculture in the Americas* 1944a; see also Offner 2012).

Influenced in part by the increased traffic of United States technical resources, the interests of FedeCafé's technical department shifted during this period from on-farm ecology to a focus on soil's chemical and mechanical aspects. In 1947, FedeCafé joined forces with the Colombian Geographical Military Institute and University of California soil scientist Earl Storie to begin a comprehensive technical soil and mapping survey of the nation's agricultural lands (RCC 1947). Surveys were designed to determine where the nation might most productively undertake industrialized agricultural development, dividing soils between the categories of "totally mechanizable" and "impossible to mechanize or largely eroded" (*Agriculture in the Americas* 1944b; Ruiz and Garcia 1951).

Among the leadership of FedeCafé, also, earlier commitments to sustainable smallholder production were eclipsed by a new emphasis on expansion and productivity supported by increased chemical inputs and a move away from shade-grown coffee. This shift was prompted both by desires to maximize productivity and to prevent the possible spread of Coffee Leaf Rust in the relatively humid shade-grown environments. Over the next decade, the introduction of higher-yield coffee varieties brought significant benefits to larger-scaled growers who could afford upgrade and input costs but left small-scale growers significantly disadvantaged. While new varietals increased wealth for many growers, they also intensified erosion in the coffee zones (Havens and Flinn, 1973) and drove many of the poorest farmers from the ranks of independent producers.

A study of sixty-five *cafetero* families in Tamesis, Antioquía found that less than a third of growers were able to adopt these new technologies; eight years later, the per acre yield was 1,642

pesos and 632 pesos for adopters and non-adopters, respectively. These changes intensified a class divide among local growers and concentrated land ownership, with adopters increasing farm size from 18.86 to 33.13 acres and non-adopters decreasing average holdings from 7.97 to 6.42 acres (Havens and Flinn, 1973).

At the same time, institutional rhetoric began to shift from a celebration of democratic smallholders. A mid-1950s census emphasized the problems with smallholder farming, including low yields and unviably small production units. According to Safford and Palacios (2001), during this period "the heroic small farmer now became the villain. Now the federation began to glorify the farmer who was able to break old routines and assume the risks of technological changes... This ideology justified the rise of an entrepreneurial, decidedly capitalist, coffee-grower and the displacement of many small cultivators, who became day laborers" (278). Indeed, nearly a quarter (23%) of non-adopters who were owners or renters of land in Tamesis had become day laborers within the eight year survey period.

7. Conclusion:

The development of scientific knowledge alongside global market expansion is often associated with the erasure of locally-specific interests and practices. Such expertise has also been frequently deployed as part of a broader conceptual dis-embedding of land from society as part of the expansion of liberal capitalist sociality. In the case of the Colombian coffee industry in the 1930s and 1940s, the mutual dependence of coffee crops, small-scale coffee growers, and national economic sovereignty birthed a distinct body of knowledge linking the development of all three to the body of the land itself.

This body of knowledge was an essential element of what this article has termed FedeCafé hegemony in Colombia's coffe-growing regions, a project that was simultaneously solicitous of and defensive against transnational capital flows. If FedeCafé authority was amplified by the absence of a strong central state in this period, the exit of foreign investment capital following the 1929 crash evacuated another powerful source of social influence, clearing space for new assertions of national sovereignty through productive independence. Via developments in social and ecological science, FedeCafé posited Colombian coffee-growing and coffee-growers as both a material and a cultural anchor for a destabilized nation. The ensuing transformations wrought by FedeCafé's territorial project leveled an epistemological and practical challenge to the forces that had left Colombians and the Colombian countryside vulnerable to the exploitative investments and the vagaries of global commodity markets in early decades of the twentieth century.

The distinctive scientific knowledge production associated with FedeCafé governance in this period is notable for its challenge to universalist models of modern cosmopolitan science. At the same time, the seismic economic and political shifts that ennabled that project also rendered it unstable in the face of subsequent transformations of the international landscape. During the Cold War era that followed, the nationalist bent of Depression-era FedeCafé science, and particularly its two-fold advocacy of smallholder production and soil ecology, gave way to a new commitment to modernization and industry-wide yield maximization. As such, this example is also instructive as to the vulnerability of such place-specific projects to the transnational forces to which they are a response.

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Conclusion

This dissertation is an exploration of a particular chapter in human history. It is also a study conducted very much in relation to our collective future. I file this document in a moment when humans are becoming fully conscious of the pending implications of the planetary warming, a moment of broadly-scaled social and environmental crisis that in many ways parallels events of the early twentieth century even as it dwarfs those events in scale and intensity. The possibilities created and actions taken in this moment will have profound consequences for decades and centuries hence. Just this week, in December of 2015, world political leaders in Paris approved an unprecedented agreement to unilaterally reduce carbon emissions in an effort to stave off what we now understand is an inevitable transformation of global environments. While that agreement falls far short of promising change that would meaningfully ameliorate projected global warming, it reflects a significant transition in mainstream political thought. Conventional discourse and human conventions must now contend no longer with *if* but rather with *how* we will inhabit a transformed global landscape.

Moreover, we must dispense with the belief that we are either entirely in control or, conversely, out of control of environmental processes. Rather, humans must come to the grips with the fact that social life unfolds in a field that contains dynamic forces far in excess of ourselves. How we adapt to accommodate our ecological fellow travelers will have everything to do with the kind of landing we'll face. While conceptual practices are only one part of that adaption, new ways of understanding the world around us are a critical first step to re-imagining our collective practice. To revisit the words of Raymond Williams in Chapter Three, we need new ideas because we need new relationships. Indeed, new relationships between and among humans and the non-human world are already upon us. We find ourselves now with a responsibility to make sense of those relationships in light of the path we took to get here. The preceding essays are an attempt to better illuminate that path.