

Ecological Imperialism and the Global Metabolic Rift Unequal Exchange and the Guano/Nitrates Trade

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Abstract

Transfers in economic values are shadowed in complex ways by real material-ecological flows that transform ecological relations between city and country, and between the core and periphery. Directing material flows is a vital part of intercapitalist competition. Ecological imperialism creates asymmetries in the exploitation of the environment, unequal exchange, and a global metabolic rift. The 19th-century guano/nitrates trade illustrates the emergence of a global metabolic rift, as guano and nitrates were transferred from Peru and Chile to enrich the soils of Britain and other imperial countries. This global metabolic rift entailed the decline of soil fertility in Britain, importation of Chinese labor to Peru, mass export of natural fertilizer, degradation of the Peruvian/Chilean environment, war over possession of nitrates, and creation of debt-laden economies. It allowed Britain and other imperial countries to maintain an 'environmental overdraft' in their own countries, imperialistically drawing on the natural resources of the periphery. The social metabolic order of capitalism is inseparable from such ecological imperialism, which is as basic to the system as the search for profits itself.

Key words: environment • guano/nitrates • imperialism • Karl Marx • metabolic rift

The concept of ecological imperialism is seemingly unavoidable in our time. Obvious cases are all around us. One is the invasion and occupation of Iraq, which is at least partly over oil. Instances of ecological imperialism do not, however, stop with Iraq. Whether it is the renewed scramble for Africa, the flooding of the global commons with carbon dioxide, or biopiracy aimed at Third World germplasm, ecological imperialism is operating within a global economy predicated on accumulation. While the appropriation of resources from distant lands has taken place throughout human history, the origins and ongoing growth of

capitalism are dependent upon further ecological exploitation and ecological unequal exchange. It takes different forms, depending upon the historical context and the demands of economic production, but it continues to operate in order to funnel resources – land, raw materials, and/or labor – into the process of capital accumulation.

The concept of ecological imperialism has scarcely been visible, unlike notions of economic, political, and cultural imperialism (Crosby, 1986; Foster and Clark, 2003). Most historic studies of imperialism, although appreciating the importance that the imperial countries placed on control of Third World resources, have tended to analyze this primarily in terms of its effects on the flows of economic surplus, rather than in terms of ecological damage wrought by the robbing of Third World countries of their resources and the destruction of their environments. Although the latter effects have often been recognized they have been treated as geopolitical problems or as factors affecting economic development and not in terms of ecological imperialism *per se*, which would require that systematic asymmetries in the exploitation of the environment be acknowledged.

Although Marxist theory cannot be said to have approached the issue of ecological imperialism systematically in the past, Marx's own analysis provided the analytical basis for such a treatment, due to his simultaneous concern with economic expansion, imperialism, and ecological exploitation. Nonetheless, ecological problems are complex, especially as they emerge under capitalism.¹ Ecological degradation is influenced by the structure and dynamics of the world capitalist system, arising from the fact that a single world economy is divided into numerous nation-states, competing with each other both directly and via their corporations. The global economy is divided hierarchically, with nations occupying fundamentally different positions in the international division of labor and in a world-system of dominance and dependency (Frank, 1967; Wallerstein, 1974). To further complicate matters, the extraction, processing, and consumption of raw materials – an inevitable part of any mode of production – entails constant interactions with dynamic, integrated natural processes and cycles (Bunker and Ciccantell, 2005). In this, earthly conditions are transformed, potentially creating various forms of ecological degradation. The exact ramifications, of course, will be determined by the particulars of any situation.

Transfers in economic values are shadowed in complex ways by real material-ecological flows that transform ecological relations between town and country, and between nations, especially the core and periphery (Bunker, 1984; Burkett, 1999; Hornborg, 2003).² Control of such economic and material flows is central to the forces of competition and the accumulation of capital, and generates social and environmental inequalities throughout the global economy – both within and between nations. Stephen Bunker (1984, 1985) highlighted how the extraction and export of natural resources from peripheral countries involved the vertical flow of not only economic value, but also value in terms of energy and matter,

to more developed countries. These trade arrangements, influenced by the dynamics of the global economy and positions within the world-system, negatively affected and undermined the socio-ecological conditions in the extractive countries. Recent scholarship on ‘ecologically unequal exchange’ has drawn on Bunker’s seminal work, as well as the theory of unequal exchange (Emmanuel, 1972), in order to demonstrate the disproportionate (and undercompensated) transfer of matter and energy from the periphery to the core, and the exploitation of environmental space within the periphery for intensive production and waste disposal (Frey, 1994; Hornborg, 2003; Rice, 2007). The environmental footprint of economically advanced nations involves appropriation of land, resources, and labor in lesser-developed countries, increasing the environmental degradation in the latter for the benefit of the former (Hornborg, 1998, 2001; Jorgenson, 2006).

Here we consider how ecological imperialism, which entails control over natural resources, creates asymmetries in the exploitation of the environment and unequal exchange. In particular, the international guano trade in the 19th century highlights the emergence of a global metabolic rift, as guano and nitrates were transferred from Peru and Chile to Britain (and other nations) in order to enrich their diminished soils. This global metabolic rift involved the decline of soil fertility in Britain, the transfer of Chinese labor to Peru to work the guano islands, the export of natural fertilizer to core nations, the degradation of the Peruvian/Chilean environment, the creation of debt-laden economies, and the War of the Pacific as Chile (backed covertly by Britain) and Peru fought against each other to control resources desired by Britain. It also allowed Britain and other core powers to carry out an ‘environmental overdraft’ within their own countries by drawing imperialistically on natural resources from abroad (Elvin, 2004: 470).

However, before turning attention to the international guano trade and its ecological relations, it is necessary to address how the rise of the capitalist world economy itself was synonymous with the emergence of a hierarchical division of nations through the appropriation of distant lands, labor, and resources. Ecologically, capitalism operates globally as a particular social metabolic order that generates rifts in underlying metabolic relations between humanity and the Earth and within nature itself.

THE SOCIAL METABOLIC ORDER OF CAPITAL: ACCUMULATION AND RIFTS

Humans depend on functioning ecosystems to sustain themselves. Marx noted that there is a necessary ‘metabolic interaction’ between humans and the earth, and labor serves as ‘a process between man and nature, a process by which man, through his own actions, mediates, regulates and controls the metabolism between himself and nature’ (Marx, 1976: 283, 637–8). A metabolic relationship involves regulatory processes that govern the interchange of materials. Natural systems, such as the nutrient cycle, have their own metabolism, which operate

independently of and in relation to human society, allowing for their regeneration and/or continuance. For Marx, the concept of social metabolism captured the complex interchange of matter and energy between human beings and nature (Foster, 2000). Each mode of production generates a particular social metabolic order that influences the society–nature relationship, regulating the ongoing reproduction of society and the demands placed on ecosystems (Mészáros, 1995).

The transition from feudalism to capitalism ushered in a new social metabolic order that shaped the interpenetration of society and nature. As Marxist philosopher István Mészáros (1995: 44, 170–1) has explained, the ‘innermost determination [of] the capital system is *expansion-oriented* and *accumulation-driven*’, which pushes it to subsume the entire world to its logic of accumulation. In this, it attempts to impose a “‘*totalizing*” framework of control’ where everything must prove its ‘productive viability’ and its ability to generate profit within a desired timeframe in order to be seen as useful. Spurred on by competition and constant growth, capitalism is not capable of ‘self-sufficiency’. It must be constantly renewed, replenished, but on a larger scale. It cannot be stationary, thus it is ‘fundamentally unrestrainable’ and cannot ‘recognize boundaries’, whether social or natural, regardless of ‘how devastating the consequences’. As a result, it creates an ‘*uncontrollable mode of social metabolic control*’ focused on acquisition of profit that runs roughshod over the regulatory processes that govern the complex relationships of interchange within natural systems and cycles (Mészáros, 1995: 41–5). The internal dynamics of this social metabolic order produces various global inequalities and ecological contradictions.

A new division of both labor and nature took shape with the development of capitalism as a world system. The bounty of the land was ‘pumped out of one ecosystem in the periphery and transferred to another in the core. In essence, the land was progressively mined until its relative exhaustion fettered profitability’ (Moore, 2000: 124). The process of primitive accumulation established divisions between core and periphery nations, as the wealth of distant lands was appropriated through various mechanisms. As Marx (1976: 915) famously observed:

The discovery of gold and silver in America, the extirpation, enslavement and entombment in mines of the indigenous population of that continent, the beginnings of the conquest and plunder of India, and the conversion of Africa into a preserve for the commercial hunting of blackskins, are all things which characterize the dawn of the era of capitalist production. These idyllic proceedings are the chief moments of primitive accumulation.

Capital constantly seeks to overcome whatever social and natural limits it confronts, ‘tearing down all the barriers which hem in the development of the forces of production, the expansion of needs, the all-sided development of production, and the exploitation and exchange of natural and mental forces’ (Marx, 1993: 409–10). Distant lands and ecosystems became mere appendages to the growth requirements of the advanced capitalist center.

Nothing so illustrated this ecological unequal exchange in the 19th century as the global guano trade that arose to compensate for the ‘environmental overdraft’ that characterized industrial agriculture in Europe and the United States. In the 1840s, Germany’s leading chemist, Justus von Liebig, along with other agricultural chemists and agronomists, sounded the alarm with respect to the loss of soil nutrients – such as nitrogen, phosphorus and potassium – through the transfer of food and fiber to the cities. Rather than being returned to the soil to replenish it, as in traditional agricultural production, these essential nutrients were shipped hundreds, even thousands, of miles and ended up as waste polluting the cities (Foster, 2000).

John Chalmers Morton (1859), who studied the application of mechanical power in agriculture, noted that agricultural improvements increased the uniformity of land, making it easier to increase the scale of operations and to employ industrial power to agricultural operations. Marx was a devoted student of Liebig’s work and studied Morton when writing *Capital* (Marx, 1976).³ He incorporated a metabolic analysis into his critique of political economy and saw capitalism as generating a form of industrialized agriculture that industrially divided nature at the same time that it industrially divided labor. He determined that an economic system premised on the accumulation of capital led to intensive agricultural practices to increase the yield of food and fiber for markets. Marx (1991: 950) lamented how capitalism degraded labor and nature under these conditions:

Large-scale industry and industrially pursued large-scale agriculture have the same effect. If they are originally distinguished by the fact that the former lays waste and ruins labour-power and thus the natural power of man, whereas the latter does the same to the natural power of the soil, they link up in the later course of development, since the industrial system applied to agriculture also enervates the workers there, while industry and trade for their part provide agriculture with the means of exhausting the soil.

The transfer of nutrients was tied to the accumulation process and increasingly took place on national and international levels. As a result, this type of production, along with the division between town and country:

disturbs the metabolic interaction between man and the earth, i.e. it prevents the return to the soil of its constituent elements consumed by man in the form of food and clothing; hence it hinders the operation of the eternal natural condition for the lasting fertility of the soil. (Marx, 1976: 637)

In other words, it created a metabolic rift in the nutrient cycle, squandering the riches of the soil. Horrified by scale of soil degradation, Liebig (1859: 130–1) exclaimed, ‘Truly, if this soil could cry out like a cow or a horse which was tormented to give the maximum quantity of milk or work with the smallest expenditure of fodder, the earth would become to these agriculturalists more intolerable than Dante’s infernal regions.’

According to Liebig, British high farming (early industrialized agriculture) looted the soil of its nutrients and then sought to compensate for this by robbing other countries of the means needed to replenish their own soil. ‘Great Britain’, he wrote,

deprives all countries of the conditions of their fertility. It has raked up the battle-fields of Leipsic, Waterloo, and the Crimea; it has consumed the bones of many generations accumulated in the catacombs of Sicily . . . Like a vampire it hangs on the breast of Europe, and even the world, sucking its lifeblood without any real necessity or permanent gain for itself. (as quoted in Mårald, 2002: 74)

Marx too referred to the imperialist exploitation of the soil nutrients of whole countries – developing out of the rift in the metabolism between human beings and the earth. ‘England’, he observed, ‘has indirectly exported the soil of Ireland, without even allowing the cultivators the means for replacing the constituents of the exhausted soil’ (Marx, 1976: 860). As capitalism expanded, increasingly importing food and fiber from abroad, so did the metabolic rift. Marx (1976: 579–80) indicated that capitalist growth serves the interests of the ‘main industrial countries, as it converts one part of the globe into a chiefly agricultural field of production for supplying the other part, which remains a pre-eminently industrial field’. In this, the abuse and ‘misuse’ of ‘certain portions of the globe . . . depends entirely on economic conditions’ (Marx, 1991: 753). August Bebel, a close friend, mainly by correspondence, of Marx and Engels, and ‘the outstanding founder and leader of the German socialist movement’ (Draper, 1986: 15), captured the ecological transfer and contradictions of the global economic system, stating:

All those countries which principally export produce of the soil, but receive no materials for manuring in return, are being gradually but inevitably ruined, Hungary, Russia, the Danubian Principalities, and America. It is true, artificial manure, especially guano, replaces that of men and cattle, but few farmers are able to buy it in sufficient quantities on account of its price, and in any case it is reversing the natural order of things to import manure from a distance of many thousand miles, whilst that which one has close at hand is wasted. (Bebel, 1988: 208)

Ecologically, a key fact was the capacity of the core capitalist states to compensate for the degradation of their own environments through the even more rapacious exploitation of the natural resources of periphery economies. As Mark Elvin (2004: 470) noted, in *Retreat of the Elephants: An Environmental History of China*, core capital in Europe (as opposed to China) possessed ‘imperial overseas resources . . . that could be drawn on like an environmental overdraft without any need for further [ecological] restoration’.

THE TALE OF GUANO AND NITRATE IMPERIALISM

In the 19th century, the guano/nitrates trade united China, Peru, Chile, Britain, and the United States in a global metabolic rift. Guano was deemed a precious

commodity that would help replenish lost soil nutrients in advanced countries. Capitalist farming practices, and the division between town and country, confronted the natural limits of the soil, while constantly trying to increase agricultural yields for short-term economic gain. The tale of guano and nitrates, which is rooted in soil depletion, involves the advance of soil science, transformation of landscapes, transfer of human populations, exploitation of nature and peripheral nations, and integration of the global economy. This case helps illustrate the workings of ecological imperialism and the emergence of a global metabolic rift that involved environmental degradation and ecologically unequal exchange. It helps us understand the environmental overdraft that contributed to European prosperity while hiding the extent of the ecological degradation of industrial capitalism.

The existence and use of guano as fertilizer had been known for centuries in Europe, but its importance to European and US agriculture was not immediate, given the particular economic conditions and the state of agricultural science. In 1604, an English translation of Father Joseph de Acosta's book, *The Natural and Moral History of the Indies*, was published. De Acosta (1880) described how heaps of bird dung covered Peruvian islands as if it were snow, and how indigenous peoples mined this powerful material to fertilize their lands. In the 17th century, fascination surrounded the use of guano for agriculture. However, an international trade in guano was not established. Nor is it certain that such a trade was possible at this point in time. Furthermore, the advances in the science of soil chemistry, specifically the nutrient relationship between soil and plants, did not occur until the 19th century.

At the beginning of the 19th century, the German explorer, Baron Alexander Humboldt, observed how Peruvian farmers used guano to enrich their dry farm lands (Skaggs, 1994). He took samples of guano back to Europe in 1803, but there was no drive then to study this particular substance. However, as soil depletion increased, so did the need for fertilizers, stimulating business interests in the application of guano as a fertilizer. In the 1820s, tests were conducted to assess the chemical composition of guano in comparison to the requirements of plants and the nutrients loss through crop production. Guano contained high concentrations of phosphate and nitrogen. In 1835, a few cases of guano were imported to Great Britain to test the dung on crops. Guano proved to be a powerful fertilizer. The possibility of high returns seemed promising, given that the high yields surpassed what was calculated as the likely costs of guano importation.

Advances in soil science furthered interest in guano. In 1840, Liebig detailed how modern farming practices and the division between town and country contributed to the loss of soil nutrients (Foster, 2000). In the same year, Alexandre Cochet, a French scientist, discovered that valuable quantities of nitrate of soda could be extracted from guano and nitrates (saltpeter) both of which were abundant in Peru, helping stimulate the rush for guano (Skaggs, 1994). Guano

was soluble, so it was fast-acting, and provided an immediate influence on the growth of plants.

In the 1850s and 1860s, Liebig (1859) described the intensive agricultural methods of Britain as a system of robbery, opposed to rational agriculture. Numerous social and ecological problems were created given these methods. The soil required specific nutrients to produce crops; however, food and fiber (which took up nutrients) were shipped from the countryside, over long distances, to cities (Liebig, 1859). Increasingly, the material-ecological transfer took place both on the national and international level:

In the large towns of England the produce both of English and foreign agriculture is largely consumed; elements of the soil indispensable to plants do not return to the fields, – contrivances resulting from the manners and customs of the English people, and peculiar to them, render it difficult, perhaps impossible, to collect the enormous quantity of phosphates which are daily, as solid and liquid excrements, carried into the river. (Liebig, 1851: 473)

The riches of the soil were squandered. As a result, the soil was depleted of its necessary nutrients.

The degradation of the soil hastened the concentration of agriculture among a smaller number of proprietors who adopted even more intensive methods of production, including the mass importation of manures and eventually the application of artificial fertilizers. Marx indicated that capitalist agriculture, and by extension capitalism in general, generated an antagonism between human beings and nature, creating an ‘irreparable rift’ in their ‘metabolic interaction’ (Marx, 1991: 949; Foster, 1999). The expansion of capitalist operations had international implications, as the British circumnavigated the globe to furnish ‘raw materials in bulk to the mother country in the centre’ (Fay, 1940: 395).

Soil degradation in Britain and the United States sparked the international guano rush, as agriculturists sought the precious fertilizer to compensate for the soil nutrients that they were losing (Dennis, 1931; Farcau, 2000). Peru had the largest deposits of high-quality guano. The mining of this product involved the importation of Chinese ‘coolies’. Shifts in fertilizer ushered in a war between South American nations, while Britain maintained access to the supply of nitrate fertilizer. As Eduardo Galeano (1973: 72–3) noted in relation to guano and nitrates, the resource curse has long plagued the periphery: ‘The more a product is desired by the world market, the greater the misery it brings to the . . . peoples whose sacrifice creates it.’

The Guano Rush

Peru had the largest deposits of high-quality guano and an abundant supply of nitrates. Its guano contained the highest concentration of nutrients that were useful to crops. It rarely rained on the coast of Peru. As a result, the nitrogen in the guano was not washed away, like it was on other islands and coasts throughout

the world. The mountains of guano that de Acosta described were on the Chincha Islands off the coast of Peru. These islands served as habitat to numerous species of sea birds. The ocean currents surrounding these islands created an up flow of decayed matter, sustaining a massive population of anchovies, which the birds ate and deposited as waste on the rocks. The anchovy diet greatly enriched the usefulness of the dung produced by the birds. The guano deposits, hundreds of feet deep, had accumulated over thousands of years (Peck, 1854).

In the 1840s, Peru was still in debt to Britain for monies borrowed during the fight for independence from Spain. Guano offered an avenue for Peru to meet its debt payments and gain foreign exchange through the sale of guano contracts. Lima was at the time the richest city in South America. Although there were a number of contracts between the Peruvian government, acting on behalf of the Lima oligarchy, and European businesses (primarily British, but also French) during the duration of the guano trade, which thrived for 40 years, the dominant trade agreement was between Lima and the British firm Anthony Gibbs & Sons. The company holding the contract with the government had exclusive rights over the sale of guano on the global market. As a result Britain dominated the global guano trade.

The government of Peru claimed ownership of the guano (Mathew, 1972, 1977, 1981). Peruvian subcontractors, who were granted contracts from the government, were placed in charge of the digging and loading process. Lima repeatedly renegotiated the Peruvian guano contracts, trying to get a better deal. In addition to receiving a specified amount of money per ton of guano shipped, the government borrowed money against the contracts. Much of the money made in the sale of guano was directed toward paying off the existing and accumulating debt taken out by the Lima oligarchy, in a classic case of imperial dependency.

In 1841, the first full cargo of guano arrived in Britain. The manure was quickly sold on the market, stimulating a drive to secure more guano. An extensive advertising campaign was conducted to promote the use of guano. Gibbs & Sons (1843) published *Guano: Its Analysis and Effects*, detailing the various techniques of guano application, praising the powers of guano to make plants grow taller, stronger, and more productive. While this book served as a marketing ploy, its conclusion was clear: increased yields using a 'cheap' fertilizer. Other publications tested guano against other fertilizers, employing Liebig's work on the loss of soil nutrients (Sheppard, 1844; Smith, 1843; Solly, 1843; Trimmer, 1843). These tests heralded the triumphs of guano as far as its ability to meet the nutrient needs of crops. Guano became an obsession, seeming to offer an escape from the ecological contradiction that had been created.

Marx (1976: 348) noted that the 'blind desire for profit' had 'exhausted the soil' of England, forcing 'the manuring of English fields with guano' imported from Peru. Industrialized capitalist agriculture had fundamentally changed the nutrient cycle. Agriculture was no longer 'self-sustaining' as it 'no longer

finds the natural conditions of its own production within itself, naturally, arisen, spontaneous, and ready to hand' (Marx, 1993: 527). Britain was not the only country confronting severe losses in soil nutrients. Farms in upstate New York and plantations in the Southeastern United States were in desperate need of powerful fertilizers (Genovese, 1967). Thus both merchants and agriculturalists from Britain and the United States sought the fertilizer to compensate for the soil nutrients that they were losing (Skaggs, 1994).

Given the British trade monopoly on Peruvian guano supplies, the United States pursued imperial annexation of any islands thought to contain guano deposits. In 1856, Congress passed the Guano Islands Act, allowing capitalists to seize 94 islands, rocks, and keys around the globe between 1856 and 1903 (Skaggs, 1994). 'In the last ten years', Liebig observed in 1862, 'Britain and American ships have searched through all Seas, and there is no small island, no coast, which has escaped their enquiries after guano.' But, in the end, the deposits on the islands of Peru were the best, given the ideal natural conditions to preserve the nutrients.

For 40 years, Peru remained the most important country for meeting European and North American fertilizer needs. During this period, millions of tons of guano were dug, loaded, and shipped from Peru. In 1850, Britain imported over 95,000 tons of guano (Mathew, 1968). The following year, almost 200,000 tons were imported; by 1858, over 302,000 tons. From 1863 to 1871, the imports per year ranged from 109,000 tons to 243,000 tons. As noted above, guano was not only exported to Britain; from 1866 to 1877, Peru exported from 310,000 to 575,000 tons a year to the world as a whole (de Secada, 1985).

The Chincha Islands, which had deposits hundreds of feet deep in places, were a site of constant activity. In the early 1850s a British officer reported witnessing the simultaneous loading of guano on a hundred ships, representing 11 different countries (44 United States, 40 English, five French, two Dutch, one Italian, one Belgian, one Norwegian, one Swedish, one Russian, one Armenian, and three Peruvian), from a single island off the coast of Peru (Dennis, 1931; Farcau, 2000). Additionally, hundreds of other large ships would be waiting at sea for a turn to be loaded (Nash, 1857; *New York Observer and Chronicle*, 1856).

Despite the millions of tons of guano that were exported from Peru, international demand could not be met. Inferior guano deposits on islands throughout the world were mined and sold on the market. Off of the African coast, an island with substantial guano deposits had 460 ships on one day, simply waiting to fill their ships with the cargo. In a short period of time, the 'island [was] reduced to nothing but a plateau of bare rock' (Craig, 1964: 35-7). The guano trade suffered setbacks, as inferior guano was packaged and sold with false labels, claiming that it was Peruvian guano. Farmers became leery of guano on the market, but the necessity for fertilizer remained, given the metabolic rift in the nutrient cycle.

The guano trade transformed Peru in a number of ways. In the early 1800s, silver was the primary export of Peru. After Peru's independence, Britain

quickly forged trade relations, importing wool and cotton. While Peru desired trade protection, Britain worked to reduce tariffs and duties, desiring free trade. Once the guano trade was established, this resource became the primary export commodity. Guano supplied five percent of state revenue in 1846–7. In 1869 and 1875, 80 percent of state revenues came from the guano trade (Bonilla, 1987). The terms of trade continued to decline, as Peru was forced into accepting liberal policies which favored metropolitan capital in the imperial states (Hunt, 1973). The export economy failed to help the domestic economy. The Lima oligarchy spent money on luxury items, rather than social development, and on paying interest on loans. Much of the infrastructure, such as its irrigation systems and roads, fell into disarray (Duffield, 1877). The country was dependent on foreign nations for general commodities.

During this period, Peru remained the most important country for meeting British and North American fertilizer needs. At the same time, the country remained in debt to bondholders. The Peruvian ruling class profited heavily from the guano trade. Some of the money was used to help rich landowners enlarge their sugar and cotton operations. In particular, Domingo Elías, who handled contracts related to the extraction of guano, purchased more land and extended his plantation operations. He helped transform the agricultural sector into a producer of cash crops (such as cotton and cochineal) for export to Europe and the United States, transferring the riches of the soil to more developed nations (Blanchard, 1996; Gorman, 1979). Liebig and Marx noted that through incorporation into the global capitalist market and long-distance trade, the earth was robbed of its richness, the soil was depleted of its nutrients, and the separation between town and country increasingly became international. These conditions and consequences were only exacerbated through the exportation of guano and the production of cash crops, increasing the global metabolic rift. In spite of this trade, Peru remained a country in debt and one with vanishing resources (Gootenberg, 1993).

The guano trade transformed the natural landscape of Peru, especially the islands where guano was mined. In *Peru in the Guano Age*, A.J. Duffield (1877: 89), who took measurements to estimate the remaining guano deposits, describes the changes that had taken place:

On my return from the south [part of Peru] we passed close to the Chincha islands. When I first saw them twenty years ago, they were bold, brown heads, tall, and erect, standing out of the sea like living things, reflecting the light of heaven, or forming soft and tender shadows of the tropical sun on a blue sea. Now these same islands looked like creatures whose heads had been cut off, or like vast sarcophagi, like anything in short that reminds one of death and the grave.

The guano deposits that took thousands of years to accumulate were being depleted. Boussingault (1845: 290), a French soil scientist, noted that since guano had become ‘a subject of the commercial enterprise of mankind’ its reserves were quickly disappearing. The rate of extraction was faster than the rate of natural

accumulation. To make matters worse, the prospect for additional excrement was questionable, given that the extraction of guano was executed without regard to the needs of the birds, which were driven away and/or slaughtered in some cases (Murphy, 1925). The natural fertilizer that had been used for hundreds of years in Peru was being exported and diminished, as the social metabolic order of the capitalist world system expanded.

‘Worse Than Slave Labor’: Chinese Coolies and Guano Extraction

The guano trade not only involved the shipping industry and the distribution of manure on fields, it necessitated a labor regime to extract the materials from the islands. In the pursuit of profit, both Peru and Britain contributed to the global movement and exploitation of labor. In the 1840s Peru had a labor shortage for its plantations and mines. The government passed ‘an immigration law subsidising the importation of contract labourers’ (Gonzales, 1955: 390–1). Anyone who imported ‘at least fifty workers between the ages of 10 and 40’ was paid 30 pesos per head. Exploiting the decades of social disruption, due to the Opium Wars and the Taiping Rebellion, in China, European merchants began the systematic importation of Chinese laborers to Cuba and Peru (Hu-DeHart, 1989, 2002). Through coercion, deceit, and even kidnapping – often by the same individuals and companies who had engaged in the slave trade – tens of thousands of Chinese ‘coolies’ were contracted for through Macao and Hong Kong (Clayton, 1980; Hu-Dehart, 1989). The voyage to Peru took approximately five months. During this passage, the Chinese coolies were provided with a meager ration of rice. The mortality rate during the first 15 years of the trade was between 25 and 30 percent. To escape the horrible conditions, some Chinese in passage ‘jumped overboard [if and when allowed on deck] to put an end to their sufferings’ (Wingfield, 1873: 4). Marx and Engels characterized the labor of ‘Indian and Chinese coolies’ as ‘disguised slavery’, and they reveled in stories of ‘the very coolies’ on ships destined for the Americas and elsewhere rising ‘in mutiny’, as happened a number of times during passage (Marx, 1963: 112; Marx and Engels, 1972: 123).

The first Chinese coolies or indentured manual laborers arrived in Peru in 1849. Between 1849 and 1874, over 90,000 Chinese coolies were shipped to Peru. Around 9700 died during passage (Gonzales, 1955). The majority of coolies were forced to work on the sugar plantations and to build the railroads. However, many were forced to work on the guano islands. Of the three realms of employment, the guano islands had the worst labor conditions. For many years, Domingo Elías, a plantation owner, held the contract for operating the extraction of guano. He employed coolies, but also used convicts, army deserters, and slaves to work the guano islands. The work force on these islands varied through the years, but often involved between 200 and 800 individuals.

The extraction of guano required digging into mounds of excrement that covered rocky islands. The capital outlay for extraction was minimal. The most

expensive items were the bags into which guano was loaded. Using picks and shovels, coolies were required to dig through the layers of guano, filling sacks and barrows. Each worker had to load between 80 to 100 barrows, close to five tons, each day. Once the barrows were filled, the workers hauled the guano to a chute to transfer it to the ships. If the workers failed to move five tons during the day, they were physically punished. On occasion over 20,000 tons were said to be extracted from the islands in a day (*Friends' Intelligencer*, 1855; Mathew, 1977; Nash, 1857).

George W. Peck (1854: 207) visited the islands and noted that the Chinese were 'over-worked beasts of burden', forced to 'live and feed like dogs'. Their emaciated bodies struggled to carry sacks of guano and to push the barrows. Acrid dust penetrated the eyes, the nose, the mouth of a worker, and the stench was appalling. Duffield (1877: 77–8) noted:

No hell has ever been conceived by the Hebrew, the Irish, the Italian, or even the Scotch mind for appeasing the anger and satisfying the vengeance of their awful gods, that can be equalled in the fierceness of [the] its heat, the horror of its stink, and the damnation of those compelled to labour there, to a deposit of Peruvian guano when being shovelled into ships.

Infractions by workers were met by severe punishment, such as flogging, whipping, or being suspended for hours in the sun. In some cases, workers were tied to buoys in the sea. Prison sentences would have meant substantial losses in regards to lost labor, so physical punishment was preferred. Suffering from an inadequate diet, physical cruelty, and the inability to escape from the stench of the guano, many Chinese committed suicide by jumping off the cliffs and into the ocean. Peruvian employers attempted to stymie revolt by working with the British to import opium to pacify Chinese workers (Clayton, 1980; *Friends' Intelligencer*, 1854; Hu-Dehart, 1989).

Although coolies were not legally slaves, they lived in de facto slavery or worse. As prisoners, unable to leave the islands, they received minimal monetary returns. In an account of the Chincha Islands, Alanson Nash (1857) noted, 'Once on the islands a Chinamen seldom gets off, but remains a slave, to die there'. The cruelty imposed upon the Chinese laborers was inseparable from reports regarding the guano trade. The coolies were driven as expendable beasts: 'as fast as death thins them out, the number is increased by new importations', of 'Chinamen' who are thus 'sold into absolute slavery – sold by Englishmen into slavery – the worst and most cruel perhaps in the world' (*Friends' Intelligencer*, 1854). Working under the whip, the cruelties were 'scarcely believable, and very few, if any, of the Chinese survived more than a few months'. 'Those Chinese who did not commit suicide by some means or other speedily succumbed to overwork, breathing the guano dust, and a want of sufficient food' (Lubbock, 1955: 35).

The connection between the fertilized fields of Britain and the exploitation of Chinese workers did not escape the British consciousness. Writing in the

Nautical Magazine in 1856, a correspondent noted that the powers of guano as a fertilizer were well known, ‘but few probably are aware that the acquisition of this deposit, which enriches our lands and fills the purses of our traders, entails an amount of misery and suffering on a portion of our fellow creatures, the relation of which, if not respectably attested, would be treated as fiction’ (*Nautical Magazine and Naval Chronicle*, 1856). The *Morning Chronicle* wrote that the conditions of labor on the guano islands ‘seems to realise a state of torment which we could hardly have conceived it possible for man to enact against his fellow man’ (Mathew, 1977: 44). The *Christian Review* ran a story about the Chinese coolie trade, noting that ‘the subtle dust and pungent odor of the new-found fertilizer were not favorable to inordinate longevity’, creating a constant demand for more workers, given that guano labor involved ‘the infernal art of using up human life to the very last inch’ (*The Christian Review*, 1862). For Marx, writing in the *New York Daily Tribune* on 10 April 1857, Chinese coolies were being ‘sold to worse than slavery on the coast of Peru’ as a result of British imperialism. Even some shipmasters, upon delivering their cargo of coolies, in 1854, were ‘horrified at the cruelties they saw inflicted on the Chinese, whose dead bodies they described as floating round the islands’ (Wingfield, 1873: 5).

Despite British outrage regarding the treatment of the Chinese coolies on the guano islands and British attempts to end the coolie trade, British merchants continued to transport ‘hundreds of thousands of Indian indentured servants to British colonies’ around the world (Gonzales, 1955: 391). Ironically, in Peru, the success of the guano trade and the cheapness of importing Chinese coolies as workers made it possible for slavery to be abolished in the 1850s. Coolies were simply brought in to replace the slaves. Slaveholders, such as Domingo Elías, were compensated for the loss of the slaves that were now free. At the same time, Elías and other businessmen profited off of the importation of coolies.

The labor process on the guano islands was quite simple, depending primarily on human labor to make the guano useful. In order to sustain the large profits and control over the workers, the process was not modernized. Despite the millions of tons of guano that were being exported from Peru, international demand could not be met. The asymmetrical movement of natural resources, the unequal exchange of resources, to meet imperial interests was intimately connected to the exploitation of human labor under inhuman conditions.

The War of the Pacific: Control of Nitrate Fields

In 1821, in the Tarapacá desert province of Peru, Mariano de Rivero discovered immense deposits of nitrate, which could be used as fertilizer. At this point, Peru had massive quantities of two resources that soon became the most important fertilizers in the world. In 1830, Peru exported over 8000 tons of nitrates. The importance of nitrate only increased. In 1853 a process for efficiently mining the nitrate fields in Tarapacá was discovered, and soon after rich deposits were

also found in the adjacent Bolivian province of Atacama. As a result of the great guano rush, the availability of guano had started to decline. Plus, ‘in 1857, Dupont secured a patent for blasting powder made from nitrate’ (Coker, 1969: 118; de Secada, 1985). These nitrate fields began to displace guano as a source of fertilizer by the late 1860s, and became important for the production of TNT and other explosives, crucial to the expanding war industries of the industrial-capitalist states (Farcau, 2000). By 1875, British investments, primarily in the nitrate industry, in Peru totaled £1,000,000.

The Peruvian ruling class became very wealthy as a result of the guano and nitrates trade. This wealth did not, however, lead to economic development to any significant extent, apart from the building of railways. Instead, Peru became heavily indebted primarily to British investors, with its guano exports mortgaged well into the future.

From 1864 to 1866 the Peruvian guano trade was interrupted by what is sometimes known as the Chincha Islands War (also the War of the Quadruple Alliance) between Spain and the quadruple alliance of Peru, Chile, Ecuador, and Bolivia, following Spain’s seizure of the guano-rich Chincha Islands, which provided between two-thirds and three-quarters of Peru’s annual income. An important factor in obstructing Spain’s repeated attempts to come out of the war with control of the Chincha Islands was the position of the United States. US Secretary of State Seward adamantly declared that Washington would not remain neutral if Spain attempted to expropriate the islands permanently. The Chincha Islands War undoubtedly contributed to Peru’s growing dependence on Britain (Davis, 1950).

Following the war with Spain, Peru returned to a guano-induced prosperity that seemed to grow by leaps and bounds. ‘The country’, as Galeano (1973: 155) observed, ‘felt rich . . . and the state carelessly used up its credit, living prodigiously and mortgaging its future to British high finance’. As guano exports waned and the emphasis shifted to nitrates, Peru in 1875 attempted to get out of its growing debt trap by imposing a state monopoly in its nitrate zones in Tarapacá, expropriating the holdings of private investors (many of whom were foreign, particularly British) and offering them government certificates of payment. Subsequently, the Peruvian government sought to regulate the output of guano and nitrates so that they would not compete against each other. These actions angered foreign creditors who relied on a high level of guano exports and owned a substantial portion of the nitrate industry.

To further complicate matters, in 1879, Bolivia attempted to raise taxes on nitrate exports from its Atacama province. Together these changes in nitrate extraction led to the War of the Pacific (sometimes called the Nitrate War), four years after the Peruvian expropriation of the nitrate industry. ‘The Antofagasta Nitrate and Railroad Company, a Chilean concern fully controlled by English capital and counting among its shareholders the Gibb banking and trading house [the same commercial house that dominated the guano trade in Peru]’, operated

out of the Atacama Desert, and used the port of Valparaiso in Chile for exports and Chilean merchants as intermediaries in the nitrate trade (de Secada, 1985: 609; Farcau, 2000). Thus, Chile, backed by British investors, declared war on Bolivia together with Peru, with which Bolivia was allied. The two main goals of the Chilean army were to gain control over nitrate and guano deposits and to undermine Peru's economic ability to prevent occupation of these areas. With its more modern, British-built navy and French-trained army, Chile was soon able to seize Bolivia's Atacama province and Peru's Tarapacá – never to leave. Armaments dealers from the North sold weapons and used the War of the Pacific as a testing ground for new weapons such as torpedoes. In 1881, José Manuel Balmaceda, then Minister of Foreign Affairs of Chile, expressed that 'the real and direct causes of war' were 'the nitrate bearing territories of Antofagasta and Tarapacá' (Herrera, 1924: Appendix 2). Before the war Chile had almost no nitrate fields and no guano deposits. By the end of the war in 1883 it had seized all of the nitrate zones in Bolivia and Peru and much of Peru's guano territory (Alzamora, n.d.; Blakemore, 1974; Bonilla, 1978; Dennis, 1931; Evans, 1927; Farcau, 2000; Montéon, 1982; Sater, 1986). Capturing these resources served as a means to address the mounting foreign debt and other political and economic problems (Ortega, 1984).

During the war British speculators bought up the government certificates issued by the Peruvian government during its expropriation of the nitrate industry – certificates that were then selling at fire sale prices. As Galeano (1973: 156–7) wrote,

While Chileans, Peruvians, and Bolivians exchanged bullets on the field of battle, the English bought up the bonds, thanks to credits graciously afforded them by the Bank of Valparaiso and other Chilean banks. The soldiers were fighting for them without knowing it.

Immediately after the war the Chilean government at the urging of British investors decided that ownership of the nitrate operations in Tarapacá properly belonged to those owning the government certificates. Before the war British controlled 13 percent of the Tarapacá nitrate industry, immediately after the war this rose to 34 percent, and by 1890 to 70 percent (Mayo, 1987).

Former US Secretary of State James G. Blaine, who had been involved while in office in peace negotiations regarding the War of the Pacific, testified in April 1882 to a congressional committee investigating the US diplomatic role during the war. According to Blaine, the War of the Pacific had been a case of British-instigated and Chilean-executed aggression against Peru and Bolivia with the sole object of seizing the guano and nitrate territories. For some time before the war, he contended, Peru had been prevented from buying armaments from Britain. He declared, the war was about:

the guano and the nitrates . . . nothing else. It was to get possession of it . . . The iron-clads that destroyed the Peruvian navy were furnished by England, and the Peruvian

agent came to this country to see whether they could find a good ship to go out there in anticipation of this war, when they knew it was coming. They said they didn't dare to apply in England to get it, and we were not able to furnish it. I do not speak of the government; I mean the manufacturers of this country . . . It is an English war on Peru, with Chili as the instrument . . . Chili would never have gone into this war one inch but for her backing by English capital, and there was never anything played out so boldly in the world as when they came to divide the loot and the spoils. (US House of Representatives, 1882: 217–18; Belmont, 1941: 255–62)

Blaine noted that the Chilean capitalists were so compliant with the British desire to divide up and loot the guano and nitrate territories of Peru and Bolivia that:

The Chilean Government has put up by advertisement 1,000,000 tons of guano, which I suppose is worth \$60,000,000 in Liverpool, and they pledge themselves in the advertisement to pay one-half of it into the Bank of England for the benefit of the English bondholders who put up the job of this war on Peru . . . It [England] had not as much excuse in this as Hastings and Clive had in what they did in India. The war on Peru has been made in the same interest that Clive and Hastings had in India, and England sweeps it all in.

Blaine's contention that the British government would have refused to provide armaments and naval vessels to Peru was no mere speculative claim, since during the war Chile's own Minister of Public Works referred explicitly to an armaments blockade against Peru organized by foreign creditors (Dennis, 1931). Nor were such actions beyond the pale for British imperialism, which at that time was fighting expansionist wars in Afghanistan and Zululand, and was soon to invade Egypt. Blaine himself was speaking as one of the chief architects of US imperialism in the late 19th century. As he made clear in an interview for the *New York Tribune*, his issue with British capitalists was not so much what they did in the War of the Pacific, as the fact that they were intruding on an imperial domain in the Americas that properly belonged to the United States (Crapol, 2000).

Having lost its two principal resources for export, the Peruvian economy collapsed after the war. As Peruvian Marxist José Carlos Mariátegui explained, defeat in the War of the Pacific increased Peruvian dependence on British capital.

Very soon [after the war] the capitalist group that had formed during the period of guano and nitrates resumed its activity and returned to power . . . The Grace Contract [which they negotiated] ratified British domination in Peru by delivering the state railways to the English bankers who until then had financed the republic and its extravagances. (Mariátegui, 1971: 9–13)

The Peruvian government no longer had access to guano and nitrates to exploit, so it had no way to pay off the foreign debts with which it was still encumbered, except by handing its railroads over to British investors who had themselves clandestinely backed Chile in its seizing of much of Peru's territory and its most valuable natural resources. Bruce Farcau (2000: 14) explained that

the guano and nitrate deposits in Peru turned out ‘like the Midas touch’, to be ‘a curse disguised as a blessing’, first in the creation of a debt-laden economy, then in a war and a loss of these resources, and finally in the further loss of control over the Peruvian economy.

In this case, the metabolic rift in the nutrient cycle in Britain created a demand for fertilizers that were abundant in Peru. Through ecological imperialism, including various forms of unequal exchange, the bounty of the latter country was usurped, while contributing to the global metabolic rift and environmental degradation. Mariátegui (1971: 12) explained that with:

the loss of these resources came the tragic realization of the danger of an economic prosperity supported or held together almost solely by the possession of natural wealth at the mercy of the greed or aggression of foreign imperialism or vulnerable to the continual changes in industrial needs arising from scientific invention.

In fact, in the end, Peru was left ‘bleeding and mutilated, the country suffered from a terrible anemia’ (p. 13). The export economy encouraged by the expansion of the global economy appropriated Peru of its resources and exploited its people. At the same time, the country became entangled in the debt trap, which deepened the bleeding of the country.

Chile and the Curse of Nitrates

The War of the Pacific allowed Chile to seize control of the nitrate territories. In the decades that followed, the curse of the nitrates followed, as it was Chile’s turn to bleed due to the ecological imperialism of the core nations. Europe still needed guano and nitrates in vast quantities to maintain its agricultural productivity. Plus as nitrates become crucial to the manufacture of explosives, Britain sought to control this trade for the benefit of its own capitalists, exploiting these ecological resources to their zenith while siphoning off the bulk of the economic wealth generated through the extraction of nitrates.

Chile was one of the poorest countries in South America, carrying lots of foreign debt, before the war; however gaining control of the nitrate fields brought foreign investment, providing needed capital, and created an economic boom for this struggling nation. In 1880, Chile exported 275,000 tons of nitrate; in 1890, one million tons were exported (Miller, 1976; Ortega, 1984). But British capital had almost complete control over nitrate operations (Brown, 1963; Stone, 1968). In 1888 Chilean President José Manuel Balmaceda, who had carried out modernization reforms in that country, including extensive state spending on public works and support of education, announced that the nitrate areas of Chile would have to be nationalized through the formation of Chilean enterprises, and he blocked the sale of state-owned nitrate fields to the British. Attempts by the state to control the extraction and distribution, as well as the wealth, of nitrates angered foreign capitalists. Three years later a civil war broke out within Chile with British capital and other foreign investors supporting the

opponents of Balmaceda with money and armaments. John Thomas North, the British 'nitrate king', was said (according to an 1891 report from the US Ambassador to the US Secretary of State) to have contributed a 100,000 pounds to the anti-Balmaceda forces in the Chilean Congress.

The press in London characterized Balmaceda as a 'butcher' and a 'dictator of the worst stripe'. The London *Times* referred to Chile under Balmaceda as 'a communist government'. British warships blockaded the Chilean coast. When the defeated Balmaceda committed suicide in 1891, the British ambassador wrote to the Foreign Office: 'The British community makes no secret of its satisfaction over the fall of Balmaceda, whose victory, it is thought, would have implied serious harm to British commercial interests.' State control of industries and economic infrastructure in Chile quickly receded after the war, as the British extended their investments (Frank, 1969; Galeano, 1973; McNeill, 2000).⁴

Demand for nitrate fertilizer remained of utmost importance to Britain, while at same time, the depletion of these resources was a grave concern. As German socialist August Bebel (1971: 79) explained in the early 20th century:

Chile salt-petre deposits, as also the guano deposits, are being quickly exhausted, while the demand for nitrogenous compounds is constantly growing in Germany, France and England, and in the past ten years in the U.S.A. as well. The English chemist William Crookes brought up this question as far back as 1899, and referred to it as a matter of much greater importance than the possibility of an imminent exhaustion of the British coal mines.

Britain siphoned whatever monetary and material wealth it could from Chile. By the early 1890s, as a result, Chile was delivering three-quarters of its exports to Britain while obtaining half of its imports from that same country, creating a direct trade dependence on Britain greater than that of India at that time. When the First World War broke out in Europe two-thirds of Chile's national income was derived from nitrate exports primarily to Britain and Germany. The British monopoly of the nitrate trade through its control of the Chilean economy had put Germany at a serious disadvantage in its competition with Britain, since nitrates were necessary for explosives as well as fertilizer. Germany in the opening decade of the 20th century accounted for a third of Chilean nitrate exports. Like Britain, Germany had worked to have Balmaceda ousted. But Chile remained largely under British control, creating a huge geopolitical problem for Germany. Just prior to the First World War the German chemist and nationalist Fritz Haber devised a process for producing nitrates by fixing nitrogen from the air. The result within a few years was to destroy almost completely the value of Chilean nitrates, creating a severe crisis for the Chilean economy.

CONCLUSION

The economic development of capitalism has always carried with it social and ecological degradation – an ecological curse. Moreover, ecological imperialism

has meant that the worst forms of ecological destruction, in terms of pillage of resources and the disruption of sustainable relations to the earth, fall on the periphery rather than the center. Ecological imperialism allows imperial countries to carry out an ‘environmental overdraft’ that draws on the natural resources of periphery countries. As the material conditions of development are destroyed, Third World countries are more and more caught in the debt trap that characterizes extractive economies. The principles of conservation that were imposed partly by business in the developed countries, in order to rationalize their resource use up to a point, were never applied to the same extent in the Third World, where imperialism nakedly imposed an ‘after me the deluge’ philosophy. The guano and nitrates trade during the mid to late 19th century highlights the unequal exchange and degradation associated with the ecological contradictions of Britain and other dominant countries in the global economy. In fact, it is rather misleading to dignify with the word ‘trade’ what was clearly robbery of ecological and economic resources on a very high order, rooted in one of the most exploitative labor processes in history and backed up by war and imperialism. The result for Peru and Chile (and also Bolivia which lost its nitrates in the War of the Pacific) was not development, but rather, as explained by critics from Mariátegui in the 1920s to Frank in the 1960s, constituted the ‘development of underdevelopment’ (Frank, 1967; Mariátegui, 1971).

All of this, following Marx, needs to be understood in terms of the larger theory of global metabolic rift, which captures the underlying nature of the capitalist relation to the environment. In the case of the guano trade, the development of ecological imperialism necessitated not only an enormous net flow of ecological resources from South to North, but also gave added impetus to the importation of foreign labor, particularly coolie labor from China, under conditions that, as Marx said, were ‘worse than slavery’. Within the world system of capital, the robbing of the soil in Europe thus necessitated the importation of guano from Peru, and in the process fed into the robbing of human labor on a truly global scale. This might even be referred to as the ‘triangle trade’ of mid-19th century ecological imperialism.

Ironically, in recent years the exploitation of guano in Peru is raising the question once again of the complete exhaustion of this natural resource with the price in export markets in the United States, Europe, and Israel between 2007 and 2008 doubling to \$500 a ton (as opposed to the \$250 a ton that it sells for in Peru). Peruvian guano is now highly prized as an organic fertilizer for organic farms around the world. But this new global demand, which has increased the rate of guano extraction, is pointing to ‘the end of guano’ with supplies likely to run out in a decade or two, negating decades of successful sustainable development of this resource. In the Chincha Islands, where 60 million seabirds once deposited guano at the height of the 19th-century guano boom, there are now about four million birds. The guano deposits, which were once 150 feet high, now on some islands, such as Isla de Asia, south of Lima, reach ‘less than

a foot or so'. The once abundant anchoveta (of the anchovy family) that once constituted the main food for the seabirds has been depleted by commercial fishing, since it is sold globally as fish meal for poultry and other animals. Where Chinese laborers once dug guano, it is now worked by impoverished Quechua-speaking native laborers from the Peruvian highlands. In all respects this shows the absolute devastation that constitutes the natural end state of ecological imperialism (Romero, 2008).

Indeed, the nature of ecological imperialism is continually to worsen ecological conditions globally. Capital in the late 20th and early 21st century is running up against ecological barriers at a biospheric level; ones that cannot be so easily displaced, as was the case previously, through the spatial fix of geographical expansion and global labor and resource exploitation. Ecological imperialism – the growth of the center of the system at unsustainable rates, through the more thoroughgoing ecological degradation of the periphery – is now generating a planetary-scale set of ecological contradictions, imperiling the entire biosphere as we know it. Only a social solution that addresses the rift in ecological relations on a planetary scale and their relation to global structures of imperialism and inequality offers any genuine hope that these contradictions can be transcended. More than ever the world needs what the early socialist thinkers, including Marx, called for: the rational organization of the human metabolism with nature by a society (or societies) of freely associated producers, in order to establish a social metabolic order not predicated on capital accumulation and the degradation of the earth.

NOTES

- 1 Ecological degradation and environmental problems are not limited to the capitalist economic system. Ecological contradictions are present in all societies, as noted in numerous environmental histories (Diamond, 2005; Foster, 1994; Ponting, 1993).
- 2 See Burkett (1999) for a detailed analysis of the relationship between material-ecological flows (usually expressed in terms of use values) and value flows in Marx's analysis.
- 3 Morton's *Cyclopedia of Agriculture, Practical and Scientific*, with which Marx was closely familiar, contained detailed scientific articles on 'Guano', 'Manure', 'Sewage Manure', as well as articles on 'Labour' and agricultural technology. The article on guano dealt with Peru's guano islands (Morton, 1855).
- 4 During the events leading up to the civil war in Chile, US foreign policy, headed by Blaine, who was again Secretary of State, was sympathetic toward Balmaceda, whose nationalism was seen as a curb on British power.

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