

‘Amsterdam is Standing on Norway’

World Accumulation, Dutch Hegemony, & the Environmental History of the Capitalist North Atlantic, 1545-1789

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In history up to the present it is certainly an empirical fact that separate individuals have, with the broadening of their activity into world-historical activity, become more and more enslaved under a power alien to them..., a power which has become more and more enormous and, in the last instance, turns out to be the world market... [Thus,] the transformation of history into world history is not indeed a mere abstract act on the part of the ‘self-consciousness,’ ... or of any other metaphysical spectre, but a quite material, empirically verifiable act, an act the proof of which every individual furnishes as he comes and goes, eats, drinks, and clothes himself.

– Karl Marx and Friedrich Engels,
The German Ideology (1846: 55, 58)

It is said that one cannot be in two places at once. It is a truism. But is it true? “Amsterdam is standing on Norway” – a popular saying in the Dutch Republic of the seventeenth century. A curious expression but one that ably captures the essential point. Amsterdam, the crown jewel of seventeenth century capitalism, was built atop a veritable underwater forest of Norwegian origin (Sögner, 2004: 47).² To set foot on an Amsterdam wharf was, in a quite tangible way, to stand on Norway. But there was more to it than

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² Sögner (2004) credits the saying to Holger Jacobaeus (1650-1701), a Dane who lived in Leiden and later became rector of the University of Copenhagen.

this. The proverb spoke to the geographical juxtaposition of two places, it is true. Perhaps less immediately evident is the way that it speaks to the emergence of a new kind of place altogether. The place of the capitalist world-economy.

As Marx and Engels suggest, amongst the peculiarities of place in the modern world is the awkward interdigitation of the places of daily life and the place of world accumulation. (That there have always been other places – states and empires, cities, regions, *inter alia* – warrants mention, but their reconfiguration in the early modern era turned on creative responses to the particularities of world accumulation.) Many places occupied the same plot of earth, one on top of the other.

And so we might ask, Could the early modern Castilian merchant or *hidalgo* be in two places at once? Yes and no. To be sure, one could hardly walk down the streets of Potosí and Sevilla on the same morning. And yet over the course of the long sixteenth century it was increasingly the case that whether one happened to be frequenting the markets or prowling the bawdy houses of Potosí or Sevilla, one inhabited different places and the very same place, *all at the same time*. This was the place of Braudel's "vast but weak" capitalist world-economy. (Not to mention, in this case, the global empire of Philip II.) Which was at the same time a capitalist world-*ecology*, that is to say a patterned and expansionary matrix of nature-society relations that responded in decisive ways to the gravitational pull of accumulation (Moore, 2003c; Braudel, 1972).

Here was a place to be reckoned with. A big place for sure, and a place full of many other places without a doubt, but is this not true even of small towns and neighborhoods?³

³ "Place has to be one of the most multi-layered and multi-purpose words in our language" (Harvey, 1993: 4). Although my angle of vision differs from Harvey's, he is quite correct in steering for the middle ground between unyielding universalism and particularity, "that opaque world of supposedly unfathomable differences in which geographers have for so long wallowed" (1993: 5). I would suggest, however, that Harvey has yet to comprehend the modern world-system as a place with its distinctive set of particularities; preferring instead the invocation of systemic-level tendencies (absent their historical development) and

Perhaps not fully modern (what is?), but unquestionably a place that was *increasingly* modern in a powerfully geographical sense. Namely, one in which local history is transformed into world history. After 1492, developments on either side of the Atlantic were ever more crucial to those on the other. They were, in the language of climatology, “teleconnected” (Bjerknes, 1969). The teleconnections might be strong and immediate; operate subtly, so as to obscure their full significance; or become weaker or more forceful over time, depending on regional location and global shifts. They were, however, at all turns operative. *This* is amongst the irreducible geographical facts of the modern world.

The Great Frontier & Commodity Frontiers: European Expansion or Capitalist Advance?

How this curious sort of place, the capitalist world-economy, came to be is a matter of some debate. My position can be stated simply (Moore, 2002a; 2007b: Chapter One). Capitalism, if by this we mean a historical system premised on endless accumulation, emerged out of the global conquests of the long sixteenth century (1450-1640) (Braudel, 1953). It was, in other words, inseparable from Webb’s “Great Frontier,” something that

Webb that thought limited to the New World but which in fact extended to northern

thence finding particular instances of these general tendencies. This is a method of explanation with a very long history – and a useful one too – and also one that tends to posit the relation between actors (bourgeois and proletariat) theoretically in the absence of constructing these categories historically, that is as they have emerged through time and space in the actually existing capitalist system (on the latter approach, see Hopkins, 1978: 209; McMichael, 1990). As Peter J. Taylor puts it, “place can exist at different scales. This is not always the way that place is interpreted. There is a widespread tendency to equate place with local... There is good reason why places are often viewed as local: ‘humanizing’ space is most easily accomplished through micro face-to-face contacts. But there is no need to limit place-creation to this one process, especially in political studies where the imagined community of the nation [e.g. Anderson, 1983: JWM] with its homeland place is central to so much research... Providing place with the same multiple-scale property [relations as space] means that relations between place and space can be explored beyond the local up to and including the geographical limit of the whole Earth as both place and space” (1999: 98-99 and esp. 95-108 *passim*). From a much different geographical perspective, but making the same argument about place as irreducibly multi-form and also multi-scale, see Yi-Fu Tuan’s *Place and Space* (1977: esp. 194-260).

Europe as well (1964). The point can hardly be overemphasized. Capitalism did not form within Europe and then expand, although the overseas expansion of Europe's empires did figure prominently in the process. Nor was this a case of the capitalist impulse merely waiting for its day in the sun, hidden all along in the structures of European feudalism. Rather, Europe's ruling strata turned towards a strategy of endless global conquest – with the strategy of the commodity frontier at the center – only as the option of last resort.

The long fourteenth century crisis (c. 1290-1450) had not only eviscerated the apparatus of feudal domination by removing the demographic surplus that was its foundation. The crisis had also worked powerfully to change the balance of class forces in the western European countryside. These now favored peasant, not lord. The states and seigneurs strove mightily to reimpose serfdom, but to no avail. This contracted the surplus available to the states and seigneurs, who responded by trying to win in battle what they had lost in the class struggle, inaugurating a long century of endless warfare (North and Thomas, 1973: 80-81; Strayer, 1970; Wallerstein, 1992). It was a struggle with epochal implications. For the geography of “parcellized sovereignty” overlaid the increasingly capital-intensive nature of warring to call forth rising demand for ready cash (Anderson, 1974; McNeill, 1982; Parker, 1996; Arrighi, 1994). The states sought to win in battle against each other what they had lost in the class struggle. The massive borrowing that ensued was a central moment of primitive accumulation – the creation of public debts an important and under recognized moment of Marx's account of this process (1977: Part VIII). Urban capital, which had been hit hard by the fourteenth century crisis, had retained some of its economic muscle through the fourteenth century depression, muscle it was now able to leverage vis-à-vis the states to change the rules of the game. It

was a movement that empowered the accumulators of capitalist power and weakened the accumulators of territorial power. Thus were laid the conditions for a new and uneasy dialectic of territorial and capitalist power.

As a general rule, European expansion would thenceforth privilege commodity relations. Whether or not the systemic process of global expansion is best characterized as European is debatable. The long sixteenth was an era of decisive rupture with the longstanding civilizational dynamics of something we might call “Europe.” It is any event quite certain that by the fifteenth century, the economic recovery from the long medieval crisis had set new dynamics in motion. The extension of the geographical arena for commodity production and exchange was now in the vanguard. This was the road to surplus accumulation at the dawn of the modern world. How could it have been otherwise in western Europe, where empowered peasantries fought the states and seigneurs to a standstill?

This new road to accumulation – the endless accumulation of capital – was blazed by the commodity frontier. Above all in silver and sugar, but as we shall see presently also in forest products, cereals, fisheries, and other metals, here was an ingenious strategy of advancing the commodity system. States, merchants, planters, shippers, peasants, seigneurs, and many others pioneered (often in spite of themselves) new regional commodity complexes that were premised on the rapid exploitation of ecological wealth.

Pivoting on the commodity frontier strategy, the uneasy fusion of merchant-finance capital, commodity production, seigneurial power, and military conflict that accompanied and indeed enabled the first tentative advances towards the capitalist mode of production after 1450 effected two world-historical ruptures of signal importance. In the first

instance, ecological wealth – from forests, fields, mines, and communities (qua labor power) – would be extracted in the quickest way possible. (Extracted, we should note, from these agrarian spaces and conveyed into urban-centered production and accumulation.⁴) Waste was of little concern so long as it failed to enter into the register of profitability.⁵ The rapid movement of ecological overdraft tended to undermine the socio-ecological conditions of production and therefore eventually the conditions of profitability – typically within 50-75 years in any given region. Once the extraction of this regionally-delimited ecological wealth faltered – perhaps from the scarcities resulting proximately from commodity production, but more likely scarcities differentially created by social resistances intertwined with ecological shifts and market flux – this modern instantiation of the metabolic rift compelled the search for new commodity frontiers (Foster, 1999; Moore, 2000a, 2000b, 2007b).

This was and was not at the same time about the escalating *scale* of demand. The environmental history of the rise of capitalism turned decisively on *economies of geographical concentration and “economies of speed.”*⁶ While economic growth was sustained through geographical expansion and therefore the era’s ecological regime rightly called *extensive*, the uneven synergies of generally rising demand translated to agro-extractive strategies of hit-and-run – hit where the ecological wealth was most accessible (cheapest), extract it as fast as possible, and then move as quickly as possible once declining ecological returns registered a significant contraction of profitability. In commodity frontiers as ecologically diverse and geographically distant as North Sea

⁴ To state the basic tendency. Agrarian manufactures – so-called proto-industrialization – were of course an important part of the story (Scott, 2002a, 2002b).

⁵ A conservative objection to ecological waste in the spread of capitalist production, such as trees cut down and left to rot because they did not meet specific economic requirements, would remain an enduring feature of the modern world well into the late nineteenth century (e.g. White, 1980).

⁶ To borrow a phrase from Chandler (1977).

fisheries, Norwegian timber, Brazilian sugar, Peruvian silver, and Polish cereals, we see regional commodity regimes ascend to strategic primacy in world accumulation over the course of 50-75 years, only to meet with relative decline just as rapidly. (Production therefore did not stop absolutely; rather regional sugar, or timber, or silver complexes became, at best, second-tier producers.) Thus Antwerp's and then Amsterdam's successively more expansive metabolic rifts during the long sixteenth century, and the commodity frontiers they entrained, cannot be comprehended solely in quantitative terms of, say, demand for raw materials and grain.

The full import of these regional transformations can only be assessed in light of an ecohistorical matrix that compelled ceaseless efforts to reduce turnover time in concert with maximal resource-extraction, accelerating the rise and demise of raw material zones beyond anything known in previous modes of production. The upshot was a succession of commodity frontiers in many basic sectors of the European economy – from forest products to grain to metals to whaling. As a consequence, the primary expression of local environmental pressures at a systemwide level was not (*could not be*) rising prices but rather *the geographical expansion of the world capitalist system*. This lies at the heart of modernity's *first* metabolic rift – several have followed – and thence at the heart of early capitalism's rapacious global ecological fix strategy. Once greenfields turned brown, the search began anew.

This was the basis a thoroughly modern ecological regime predicated on the spatial fix of endless conquest. By-passing the empowered peasantries of the West, commodity-centered production in the Americas and in northern Europe satisfied capitalists, nobles, and Crowns, although never all equally. Moreover, feudalism's eco-demographic

tendency⁷ towards a declining rate of seigneurial levy⁸ was at first greatly attenuated by commodity-centered expansion, and over time, largely displaced. Global expansion enabled a way out of premodern cycles of boom and bust whereby commercial efflorescence invariably gave way to demographic-ecological crises (Goldstone, 2002). These latter Europe's early modern imperialism would consistently export by extending its hegemony through the endless commodification of nature. By 1492, it seems, Europe's ruling strata had discovered not just America, but a new and radically transformative political ecology of expansion.

Put schematically, the argument runs as follows. Ecological contradictions mobilized by the expansion of commodity production and exchange implied and indeed necessitated regional ecological crises. These were resolved, recurrently, through renewed geographical expansion, often but not always outside of Europe. Such expansion did not spring forth from a fully formed capitalist order but rather was a condition of its very birth. The Americas and northern Europe were not incorporated into an already existing capitalist world-economy; the capitalist world-economy emerged from their articulation.

This expansion was fundamental to the consolidation of the system within Europe, no less than outside it. Thus early capitalism as a whole developed so rapidly *because* it generated successive local ecological crises, not in spite of them. These contradictions developed most rapidly and most extensively in those regions entirely new to commodity production (such as the New World), or in those places where the "natural economy" was historically predominant (such as northern Europe). In these zones, the implantation of commodity production latched onto indigenous ecological wealth (including local

⁷ And indeed the broad spectrum of civilizations organized around politically-enforced tribute.

⁸ A phrase I have borrowed from Bois (1978).

supplies of labor power), drawn into the circulation of capital as a “free gifts” (Marx). The ensuing rapid commodification of land and labor pushed these regional ensembles of “fictitious commodities” (Polanyi) to the breaking point. The stage was set for the rapid exhaustion of land and labor, establishing a remarkably consistent cyclical phenomenon of boom and bust. Thence the search for new frontiers began anew, and with it the cycle of expansion, crisis, and expansion.

Here was an epochal transformation of time and space indeed, some three centuries before the Industrial Revolution.

Reworking the Origins of Modernity: Place, Region, and the Globalizing Production of Nature

It turns out that this sort of claim has been easy to advance and difficult to realize.⁹ In what follows, we shall follow American silver from its arrival in Sevilla. My intent is to track the emergence of the capitalist world-economy *within* Europe, by tracing the “diaspora of silver,” flowing by 1545 from its latest vein in the Andes (Stein & Stein, 2000: 40). The story here is, then, only superficially one of the impacts of monetary circulation on the environments of western and northern Europe. It is rather an accounting of the dialectic of place in the capitalist world-ecology that begins and ends with the transformation of production, and therefore one that begins and ends with the production of nature in a thoroughly modern sense – above all the tendency to treat nature as a “free gift,”¹⁰ through which ecological wealth is extracted in unsustainable

⁹ For one promising effort, see Pred and Watts (1992).

¹⁰ The phrase, often credited to Marx, is more precisely that of the English translator of the edition of *Capital*, Vol. III, published by Charles H. Kerr & Co. (1909) and subsequently reissued by International Publishers (1967, III). (The translator, curiously, is unidentified in the International Publishers edition.) In discussing the tendency of capitalist agriculture to exhaust the soil (“the decreasing productiveness of the

fashion, giving rise to successive moments of geographical expansion. Elsewhere I have discussed in some detail the ecological holocaust of Spanish colonialism in the Andes. Spanish Peru after 1545 was reshaped to serve Castile's imperial ambitions, and the faceless logic of accumulation for accumulation's sake (Moore, 2003a, 2007a, 2007b: Chapter Three). It is story of capitalist dynamism attended by all manner of human and ecological devastations – widespread deforestation, the destruction of indigenous agriculture, catastrophic flooding, the spread of famine and the imposition of structural food insecurity, not to the mention the wholesale resettlement of more than a million souls into Spanish-style towns, perhaps the first of modernity's strategic hamlets.

And this is where the discussion of American silver often ends. But the transformation of the Andes was part and parcel of the transformation of Europe. Potosí is then better considered a point of departure rather than a point of closure. It is not just that the rise of capitalism made possible the rise of Potosí, although this is certainly true. It is equally certain that the rise of Potosí made possible the expansion of capitalism *within* Europe. Once again, this has proved much easier to say than to show. In one sense we are now moving from one region to many, from Potosí and Spanish Peru to a succession of regions within Europe – Castile and Aragon, the United Provinces, Norway, Poland, and Russia. (And many others). In another sense, however, I am tracing the rise of a distinctive, *singular* world region (place) upon which the history of capitalism would pivot for the next three centuries.

soil”), Marx observes that “natural elements entering as agents into production, and which cost nothing, no matter what role they play in production, do not enter as component of capital, but as a free gift of Nature to capital, that is as a free gift of Nature’s productive power to labour, which, however, appears as the productiveness of capital, as all other productivity under the capitalist mode of production” (1967: III: 745, Chapter 44). David Fernbach’s useful translation phrases this language of free gift somewhat differently. Here, Marx is translated as referring to such free gifts, instead, appearing as “free natural power of capital” (1981: 878-879).

While the “Atlantic economy” often gets the good press (e.g. Davis, 1973), and rightly so, this may be too much of a good thing. For the Atlantic economy was not one but many regions. Indeed, the decisive regional economy of early capitalism – stretching well into the nineteenth century – was not the Atlantic at all, but rather an extended North Atlantic zone. This capitalist North Atlantic was home to the most effective accumulators of capital in the centuries after 1492 (first the Dutch, then the British) precisely because capitalism demands the incessant reworking of nature, and it was the social natures of the North Atlantic that provided the very raw materials indispensable to consolidation of capitalism – timber, naval stores, metals, cereals, whales. Starting from a nucleus that comprised the British Isles, France, the Low Countries, and parts of Scandinavia, the capitalist North Atlantic would emerge through successive commodity frontier movements – at various turns limited and propelled by geopolitical struggles – that would by the late eighteenth century incorporate Finland, the greater Vistula Basin, the present-day Baltic states, Russia, and North America. It would of course become progressively intertwined with the plantation economies of Wallerstein’s “extended Caribbean” (1980: 175) and Braudel’s “global Mediterranean” (1972).

As a consequence, this part of the story offers a distinctive geographical perspective from that of the Americas, from Bahía or Potosí or Bridgetown. The methodological premise is a shifting unit of analysis approach that treats successive geographical units (places) as vantage points from which to view the emergence of patterned interactions – always provisionally, uneasily stabilized and subject to violent change – over long historical time, and within the globalizing “place” of the world-economy, and the capitalist North Atlantic in particular (see esp. Moore, 2002b).

Regional environmental history and its interweaving with capitalist transition tell us an indispensable part of the story. Indispensable, but nevertheless partial. So long as capitalist transition is handled as a bundled of abstract and place-less tendencies, the inevitable “context” to the real stuff of local and regional history, it is impossible to construct a holistic account of modernity’s socio-ecological contradictions and creations over the long run. It is, for starters, quite evident that the motive forces of change surveyed in Spanish Peru could not be squarely located within Spanish Peru, or even Spanish Latin America. Nor would it be reasonable to impute all agency to the steamroller of a frequently-caricatured world-system.¹¹ The task is to identify the strategic relations of territorial and capitalist power at multiple scales and across multiple regions from the standpoint of modernity’s globalizing movements of uneven development. For a world-historical interpretation finds inspiration in the interweaving of scalar narratives and the rejection at every turn of a scalar reductionism or place-centrism. Insofar as our perspective is world-historical, scalar reductionism is impermissible. The world-scale included!

The Modernity of Spanish Imperialism and the Limits of Medieval Political Ecology

¹¹ See especially Stern’s critique of Wallerstein’s world-historical studies (1988a, 1988b). This is the most widely-cited critique of the world-systems perspective within the American historical profession. This is a critique premised on the assumption that “world market” and “world-system” are synonymous in Wallerstein’s narrative. Just how Stern managed to draw this conclusion is, however, not clear. Wallerstein, who began his career as a political sociologist of African decolonization, premised his conception of the modern world-system on competition within the interstate system – this is what distinguishes world-economy from world-empire. But the political interpretation goes still further. Much of the first volume of *The Modern World-System* is taken up with the political sociology of state formation in the European world-economy (Wallerstein, 1974: esp. chapters three and five). The regional-scale dialectic of class conflict and state formation is central to the story of the emergence and reproduction of the world market. A line of argument that Stern makes for Latin America, emphasizing the agency of regional-scale actors such as political elites and regional bourgeoisies. Stern has, therefore, given us a Hobson’s Choice between region and world-scale that would best be jettisoned in favor of an approach that emphasizes relations between the parts.

All of which is meant to foreground an immodest proposition. Imperial Spain, through “the deadly alchemy of permanent war, capitalist accumulation, and the new enclosures” (Retort, 2005: 43), transformed Peru’s forest-equivalents into silver and thence back again into forest-equivalents. Here I use the language of forest-equivalents as a useful metaphor, albeit one with evident material implications – one could neither move capital nor project military power without access to gigantic volumes of forest products.

Talk of forest equivalents may seem shamelessly anachronistic. But in fact the notion of forest equivalents dates from, at the *latest*, the seventeenth century. Addressing the 1669 Forest Ordinance in France, Brown puts the issue squarely before the bar: “In order to secure the full benefit of the device it was found necessary [by the French Crown] to divide the... forest, not into *equal*, but into *equivalent* portions – subdivisions, not of equal area, but of equivalent produce” (1883: 45, emphases in original). Indeed the Ordinance itself reads as a spectacularly modern text in certain respects. The Ordinance mandated “trigonometrically [*sic*] measured lots” and provided guidelines to inspectors to render these lots “more regular” within a five percent range of error (Anonymous, 1669: 103-155, Chapter XV). My point is not to suggest that these measures were generalized across Europe (they were not) but rather to identify such measures as expressive of an emergent, underlying logic premised on the radical abstraction of the law of value, then in formation,

Put schematically, the deforestation of Peru enabled the Empire to pursue its territorialist ambitions on a grand scale, but at the ecological cost of deforestation on an extended scale within Europe, and thence (back again) within the Americas. Thus deforestation emerges as not merely a sad story of modernity, but as constitutive of

multiple reorderings of its systemwide division of labor. The transformation of forests into forest-equivalents was itself a novel development. It found expression in multiple forms, from state forestry initiatives, to the homogenizing impetus of the commodity form in its world market manifestation, to the abstract metric of the long sixteenth century's "quantitative revolution" (Fernow, 1911; Crosby, 1997).

"Whenever West Europeans reached the huge forests of Norway, Poland and the New World," Braudel observes, "such forests, if they were accessible by sea or river that is, immediately joined the category of capital goods" (1982: 241-242). This was an unusual turn of events indeed. These forests were subsequently fed into the vast but weak leviathan of expanded accumulation, either directly, indirectly, or both. Forests were now first and foremost "capital goods" *in addition to* their status as resources.¹² Herein lies the hidden secret of European expansion, the commodity frontier. It was this commodity-centered strategy that enabled (and then reinforced) the ongoing displacement of landed wealth by monetary capital that gained traction during the long fourteenth century's feudal crisis (see Moore, 2002a; Moore, 2007b: Chapter One).

So let us turn from American to European political ecologies, and thence to the relations between them. This will allow us to take a step back to consider the bigger picture of capitalism not purely as world-economy, but also as world-*ecology* – that is, the material life of the world-economy (Moore, 2003c). Deforestation certainly occurred in Spanish Peru. And deforestation, along with all manner of other environmental transformations, was linked to with rising costs in the mining sector, a situation the

¹² Here is not the place for extended critique but let us note for the moment that for Braudel, capital means resources that are struggled over by capitalist and non-capitalist strata. In Braudel's view, capital is a thing and not a relation. Its political-ecological corollary is an essentially passive rather than active view of the production of nature, although Braudel is astute enough to recognize, empirically if not conceptually, the latter (see Moore, 2003c).

colonial state sought to attenuate through the progressive extension of the town-country division of labor (Moore, 2003a, 2003b, 2007a, 2007b: Chapter Three).

But this dynamic was hardly unique to the colonial world. While the theory of “sequential overexploitation” is one readily applied to the extra-European world – where overexploitation and relative exhaustion in one region gives rise to a frontier movement that promises relatively free supplies of land and labor (Gadgil & Guha, 1992) – it is clear that the same logic was at work *within* Europe, and *between* Europe and the colonial world. Silver nourished the arteries of territorialist power, feeding Spain’s imperial ambitions, which in turn fed the appetites of capital accumulation. Spain’s imperial project presupposed the capacity to transmute silver into military power, and this entrained widespread material transformations. This was the logic of forest equivalents as symbolic (and in time practical) deforestation. The violence of abstraction inscribed in the logic of this new (modern) imperialism made it possible to think of forests as forest equivalents.

The ensuing material transformations were not only geographically expansive, but *expansionary*. The endless accumulation of capital is the endless conquest of nature. The failure of Charles V to transform the European world-economy into a world-empire had by 1559 given birth to a *de facto* balance-of-power stalemate that would be codified at Westphalia in 1648. With silver shipments made into a steady flow of ready cash thanks to the magic of Genoese finance, Spain after 1571 had become at once more powerful than, and less able to dominate, its European rivals.

The twists and turns of Europe’s geopolitics turned crucially on the cascading and geographically uneven transformations of local and distant environments. Silver is one

optic through which to bring these uneven transformations into focus. The material-ecological implications ran this way. Spain was powerful militarily but its economic base was weak. That is to say, its aggregate productivity was low, in agriculture but also in manufactures. This meant that its cost of waging war was higher than its rivals, the Dutch above all. This was bad enough in any era. In the era of the “military revolution,” it was nothing short of disastrous. The cost of war was skyrocketing, and this favored states that were able to pursue a capital-intensive rather than coercion-intensive strategy of statemaking (McNeill, 1982; Parker, 1996; Tilly, 1990). The balance-of-power meant that small military-territorial gains were won at great expense. And rising expense signified rising material throughput, and therefore escalating pressure on local political ecologies across Europe. Consider, for starters, the escalating concern over forest management in England (Albion, 1926), France (Bamford, 1956), Sweden (Heckscher, 1954), Germany (Fernow, 1911), and Spain (Goodman, 1997, 1998) during the sixteenth and seventeenth centuries. There was in every case inexorable (if cyclical) pressure for renewed geographical expansion in response to local overexploitation. Such expansion unfolded differentially – sometimes within the territorial state, sometimes through colonial expansion, sometimes through the world market. (The most successful states, such as Britain, were able to take advantage of all three, which explains something of the origins of the Industrial Revolution.) But, and here’s the punchline, such expansion ultimately depended on the capacity of the states (and not only the states) to fork over the dough. And *this* depended in great measure, between 1559 and 1648, on access to American silver, itself won through a colonial political ecology that insistently pushed outward the commodity-centered divisions of labor in Latin America.

The military revolution meant, among a great many other things, a geometric expansion of shipbuilding. Over the course of the long sixteenth century, Europe's shipping grew fivefold.¹³ Perhaps more (Maddison, 2002: 59; Ozveren, 2000; van Zanden and Horlings, 1999: 36; Unger, 1992). The relationship between deforestation and shipbuilding should not be overstated in its formal dimensions. The crucial point concerns shipbuilding's specific timber demands, especially but only for masts, and the ecological regimes that mediated access to the timber. Such regimes encompassed juridical frameworks, class relations, and business organization no less than the infrastructure, tools, financing, and labor power implicated in cutting and moving timber (of whatever sort) from the forest to the point of consumption. Nevertheless, the very selectivity of shipbuilding timber demands, in concert with the urgency of those demands, meant that shipbuilding played a role in the enclosure of European forests (and the frontier movements associated with it) out of all proportion to its absolute material throughput. There was, then, unrelenting pressure to extract as much as quickly as possible, and then to move towards greener pastures whenever relative overexploitation created problems. To say shipbuilding timber was to say commodity frontier.

For Spain, the big obstacle in the way of a vibrant shipbuilding sector was its essentially medieval political ecology. There was no dearth of forests in Castile and Aragon. In this respect Spain was certainly better off than the ascendant Dutch (McNeill, 2004: 397; also Albion, 1926: 169). But Spanish Absolutism had all manner of local custom and rights to contend with. And the Dutch had two things the Spanish did not:

¹³ It bears noting that there was considerable overlap during this era between merchant shipping and warships.

peat, and the capitalist North Atlantic. The first was geographical good fortune. The second, geographical good fortune combined with bourgeois ingenuity.

Let us begin with Spain. There were, even from the late fifteenth century, pressures coming from all directions that drove up the cost of shipbuilding timber. One source was Spain's agro-ecological crisis, which began in earnest during the 1580s and would not relent for nearly a century. Exhausted land was abandoned, and new lands cultivated. Not infrequently these lands were cleared from forest. Indeed, it seems likely that the arrival of Spain's agro-ecological crisis, which hit home with a vengeance in the 1570s (da Silva, 1964), had been delayed by carving out new arable land from the forests earlier in the century. It was, in Hamilton's words, a century of "rapid deforestation" on the peninsula (1938: 177). In 1520, wood was so scarce around Medina del Campo the chronicler and Court historiographer Antonio de Guevara complained that "the firewood cost us as much as the stew in the pot" (Guevara, 1520: 93). By the 1590s, "the supply of firewood and charcoal was running short in much of Castile" (Sella, 1974: 393).¹⁴ By 1612, in the northwestern province of Galicia, home to strategic timber reserves, a Crown official:

Identified one of the principal causes of forest depletion to be 'the practice in this kingdom [Galicia] of making clearings in the oaks in order to burn them and sow wheat. And at times it happens that in burning the cleared section a league or more of the forest is burned.' Seeking to rectify this, he approached the peasant farmers. They said that 'unless they make the

¹⁴ By the 1670s, there was serious talk in Madrid about moving the Court elsewhere. The supply of woodfuel, drawn from a twenty-league radius around the city, had reached a critical situation (Goodman, 1997: 69-70). Even a conservative estimate of a league (2.4 miles), this meant that firewood was scarce within a zone that comprised nearly 23,000 square miles!

clearings they will have no ground for sowing, and they will perish’
(quoted Goodman, 1997: 83).

The situation was much the same in Guipuzcoa as early as 1580 (Goodman, 1997: 94).

Shipbuilding also had to face down competing industries. Vizcaya, home to the shipyards of Bilbao, was dominated by “the most important” ironmakers in Spain (Goodman, 1997: 91). Already by 1547, Philip, acting as regent in the absence of Charles V, issued new regulations mandating tree planting around the shipbuilding centers in Vizcaya. The preamble to the 1547 decree expressed concern over what it saw as mounting timber scarcity driven by the region’s shipbuilding industry (Goodman, 1998: 90). Was this mere alarmism? This is possible, although it seems insufficient as an explanation. Philip’s legislation occurs on the eve of a prolonged “state of crisis” in Spanish shipbuilding, beginning in the 1560s (1986: 22). In the 1610s, a Crown forest inspector complained that Vizcaya’s ironworks consumed so much charcoal that “this [situation] had to be watched because it could cause shortages *for everything*” (quoted in Goodman, 1997: 91, emphasis added). As if this were not bad enough, Spain’s iron sector found itself undercut by the forest-rich Swedes at this very moment (1620s) (Davis, 1973: 153) – financed, we may recall, by the Dutch (Barbour, 1950: 36-37, see Chapter Two). And from the 1620s, we see a rising number of conflicts between the Castilian state, seeking to protect shipbuilding timber, and the metallurgical sector, the charcoal burners and owners of forges above all (Goodman, 1997: 82, 88, 92)

Around Barcelona, the problem was not iron but glass. A quite modest glassworks operation could strip the surrounding forests in no time at all. The Catalonian situation

reminds us that it was not *necessarily* the absolute shortage of timber at play. Rather, the chief difficulty was the political economy of this ramshackle thing we call “Spain” – an idea rather than an established territorial fact, Kamen reminds us (1994). In Catalonia, where Philip’s galleys issued from the Barcelona shipyards, “the forests were being consumed to supply fuel for furnaces for glass manufacture” (Goodman, 1998: 92). Here was the Castilian replay of Central Europe’s “battle for wood” a century earlier (Westermann, 1996; Moore, 2007b: Chapter Two). Barcelona’s municipal council called for shutting down the glassworks, with only modest results. The crux of the matter was this. Philip II simply could not act on his own, for the hold of Spanish absolutism was far from absolute, throughout the peninsula, and especially beyond Castile. “The complex of medieval ‘liberties’ presented a singularly intractable prospect to the construction of a centralized Absolutism” in early modern Spain (Anderson, 1974: 65).

It was the very persistence of these medieval liberties that resulted in a critical mass of “grants of privileges... to monasteries and individuals,” such that the Crown could no longer easily harvest the timbered lands surrounding Barcelona. Instead, shipbuilding timber was trucked in from thirteen leagues distant (in Montseny and Arbucias), “bringing great increases in transport costs” (Goodman, 1998: 93). This distance, about thirty miles, represents an upper limit to overland transport before the nineteenth century; it must have been costly indeed. By 1586 the fiscal crunch was so severe that shipbuilding timber, including precious masts, was rotting in the Montseny forests as workmen awaited the royal paymaster. The scenario would repeat itself in 1589. Nor would the Crown’s woes diminish thereafter. “Later [in the early seventeenth century] when the sources of pine masts at Arbucias seem to have been exhausted, searches

further afield reached out to the extensive pine forests of the Pyrenees” (Goodman, 1998: 93). Predictably, this meant still higher transportation costs (ibid: 93). The masts “reached Barcelona with difficulty” (ibid: 95).

Spain was, then, faced with multiple episodes of relative deforestation that throttled domestic industry. Crucially from our point of view, this forest clearance was sufficient to provoke a “sharp rise in the prices of forest products in the first half of the seventeenth century” (Hamilton, 1938: 177). The general situation was bad enough. A more serious threat to Spain’s imperial ambitions was the rising cost of *shipbuilding* timber. Around Bilbao, “the long timbers needed for masts and spars had been used up by the *early* sixteenth century” (Phillips, 1986: 23, emphasis added; also 49, 80). Goodman thinks there was never an absolute shortage of masts, even if they were not quite up to par with Baltic supplies (1998: 89). But these local supplies were difficult (and costly) to reach. And wasn’t this the crucial variable? Rising local costs meant that by the early sixteenth century, a growing volume of masts and naval stores were imported from Baltic (Phillips, 1986: 23, 49, 80). Castile was importing lumber from Flanders — probably of Baltic or at least German origin — by 1534 (Klein, 1919: 321). By 1575, the commander Escalante de Mendoza observed that “most of the materials used in construction were of native production, *with the conspicuous exception* of masts and spars which were... imported from Prussia by way of Flanders” (quoted in Usher, 1932: 203). In the later sixteenth century, Braudel reports on “marked deforestation in the western and central Mediterranean... notably in Sicily and Naples[:] the very place where one of the great shipbuilding efforts for Philip II’s navy was centred” (1972: 142). Having decimated his Neapolitan supplies, Philip went global. In the 1580s Philip “tried to buy, or at any rate

marked for felling, trees in Poland” (Braudel, 1972: 143). Ozveren believes the Barcelona shipyards had in any event entered a period of “irreversible decline” by the 1590s (2000: 22). Was this not principally a symptom of rising timber costs? By 1630, the situation had gone from bad to worse: “The Spanish yards were [by] then dependent upon [Baltic] imports for tar and pitch, for masts, for hemp” (Usher, 1932: 203). This was a disastrous situation for the material basis of Spanish power. Spanish shipping in the century after 1570 entered absolute and not merely relative decline. Iberian and Italian fleets shrunk 17 percent while the British and Dutch fleets expanded nearly threefold (Maddison, 2002: 59). The decline of Iberian *shipbuilding* was even greater than these figures suggest. Castile, for once both wisely and quickly, externalized production to Havana, which became by the mid-seventeenth century “the busiest site of shipbuilding in the Spanish empire” (Ozveren, 2000: 30). By the 1640s, American-built vessels constituted “at least” 40 percent of the Spanish fleet, 75 percent of which were built in Havana (Ozveren, 2000: 35). Another third was foreign-built, probably of Dutch origin (Parry, 1966: 249).

Spain’s shipbuilding crisis was but one expression of a bigger problem. Silver allowed Philip to pursue a two-front war, buying ships, guns and men even as the Castilian ecological formation withered in its capacity to supply these. It is clear that Castile was deindustrializing. If not in absolute terms (although this was often the case, as in shipbuilding), then certainly in relative terms – and isn’t this the decisive variable at the end of the day? The political ecology of such deindustrialization is much less apparent. When Perry Anderson (1974: 71) cogently opines that it was American silver which allowed Spanish Absolutism “to dispense with the slow fiscal and administrative unification which was a precondition of Absolutism elsewhere,” that “the colonies, in

other words, could act as a structural substitute for provinces,” would it be imprudent to say much the same about the Empire’s ecological regime? That the colonial reordering of Andean political ecology enabled Castile’s agro-industrial complexes to reproduce an essentially medieval mode of ecological production, the ecological complement to those enduring “autarchic patrimonies” such as Barcelona?

The Political Ecology of World Hegemony:

Dutch Capitalism & the Rise of the Capitalist North Atlantic, 1450-1750

Spain’s deindustrialization was hardly self-contained. One man’s loss would be another man’s gain. The Low Countries, whose mercantile and manufacturing centers had developed in the century since 1450 as pivotal nodes in the integration of northern and southern, eastern and western, Europe, emerged from the great depression of the 1550s as a leading contender for world economic primacy. Spain lay inbetween one world region (the Mediterranean) that was in decline, and another, the extended Caribbean, that was moving through an unprecedented commodity revolution in sugar by the 1650s. The Dutch, for their part, lay inbetween the commodity frontiers of the extended Caribbean and the increasingly capitalist North Atlantic. The Spanish had neither the capital, guns, money, or food to make a go of it. The Dutch did.

The two economic zones, Spain and the Low Countries, were closely intertwined. The Low Countries had been an important part of Charles V’s dynastic patrimony. Upon his abdication in 1556, Philip retained formal political control. (At least for a time.) Whatever modest differences in economic development existed in the fifteenth century, the gap widened considerably over the “first” sixteenth century (1450-1557) (Braudel,

1953). From the standpoint of world trade, Spain began to look more and more like a colonial exporter, sending wool (but increasingly fewer *woolens*) and bullion northward to the Netherlands in exchange for textiles, metal goods, grain, and as we have just seen, naval stores (Boxer, 1965: 24; Anderson, 1974: 75).

Of course, the Dutch were not *producers* of this exported grain and naval stores. They were, rather, the producers of the means of production – that is to say, ships – that enabled Baltic grain and timber to materialize in Castile. For shipbuilding, along with textile and iron manufacture, was the era’s leading value-added sector (Bunker and Ciccantell, 2003b: 15-18). For good measure the Dutch also produced half the Baltic’s textile imports and a growing volume of Spain’s (Wilson, 1957: 41). Flemish and Dutch capital could therefore pursue a high productivity strategy in shipping and shipbuilding, and consequently dominate the carrying trade between northern and southern Europe, a key source of hard currency surplus for the Dutch (Barbour, 1950: 52). The Low Countries accounted for nearly 85 percent of this trade in the mid-sixteenth century (Braudel, 1984: 207).

The chief point of difference between the Mediterranean trade and the decidedly semi-colonial Baltic trade was that Spain had Potosí and the Poles did not. Braudel calls the Baltic “a sort of America on Europe’s doorstep” (1984: 207). During the ensuing Dutch revolt – the Eighty Years’ War (c. 1566-1648) – there would be no de-linking with Iberia (Boxer, 1965: 23-24). Spain and the Netherlands “were neither willing nor able to break off relations” (Braudel, 1984: 208). Spain could not do without naval stores and grain; the Dutch, without Portuguese salt (Israel, 1982: 210-211, 413). The grain situation became increasingly dire as the “second” sixteenth century wore on (1557-1648)

(Braudel, 1953). Spain “was at the mercy of foreign grain, hardly any of which, by the end of the sixteenth century, came from the Mediterranean” (Braudel, 1984: 208; also Israel, 1982: 52-53).

There was, then, a conspicuous gap between the military capacities of Spanish Absolutism and its economic basis. Philip II’s imperial project foundered on the effort to subordinate the eminently modern Low Countries – “home to the most advanced centres of urban industry in Europe” (Mandel, 1963: 5) – to the centralizing imperatives of Spanish Absolutism. But in terms of capitalist production and business organization, the Dutch had gone far – and the Spanish had not – over the course of the first sixteenth century. The fiscal demands of Habsburg imperialism, even before Philip, consequently had “gravely strained the traditional loyalty of the Netherlands” (Anderson, 1974: 70). Charles V’s conflict with France drew heavily on the Dutch economy but did so by “assign[ing] a larger and larger role to the States in the collection and management of finance” rather than by “increasing Habsburg control” (Darby, 2001: 15). Philip was therefore already on shaky ground when he moved “to make the Netherlands a net contributor to imperial finances” in the 1550s (de Vries and van der Woude, 1997: 371). This was an explosive situation to be sure. Even if we do not wish to go so far as Mandel and Anderson in characterizing the Dutch revolt as the modern world’s first “bourgeois revolution” (Mandel, 1963: 5; Anderson, 1974: 75), it is nevertheless evident that the stage was set for a clash pitting the precociously modern military apparatus of Spanish Absolutism against the precociously modern capitalist organization of the northern Netherlands. And much to the detriment of Spain, the former fed the latter. Fielding an

army of 60,000 soldiers – Spain’s “Army of Flanders” (Parker, 1972) – required a gigantic stream of specie to flow from Seville to Antwerp:

These payments buoyed the otherwise depressed economy of [Flanders]..., but they buoyed the Republic even more, for much of the specie arriving in the Spanish Netherlands flowed directly to the North to balance the South’s massive trade deficit (de Vries and van der Woude, 1997: 371).¹⁵

The connection with developments in Potosí can now be viewed more clearly. Spain exerted relentless pressure in the colonies to sustain and maximize production (Moore, 2007a, 2007b: Chapter Three). This was effective so long as Spain was able to deploy its greatest asset, military power, against relatively weak adversaries. Under these conditions, the primitive accumulation of silver was as effective as “modern,” productivity-maximizing production. Within Europe, however, Spain’s greatest strength turned to weakness. The Spanish-Habsburg regime sought to deploy its military capacities, bolstered by American silver far beyond the strength of any single contemporary power in aggregate terms, against a regional-scale territorialist-capitalist alliance in the Low Countries. And Dutch economic prowess, as it turned out, could be translated into military power much more readily than Spain’s military prowess could be transmuted into capitalist power. Thus, the Dutch were able to hold the Spanish at bay, reproducing a long-term situation – over the course of the second sixteenth century – in which European geopolitics at once reinforced the primitive accumulation of capital in the colonies (and the semi-colonial North Atlantic), *and* pushed forward the expanded

¹⁵ And let us add the massive outmigration from Antwerp following its sacking in 1585. Between 1585 and 1622 Amsterdam grew from a city of 30,000 to 105,000, one-third of which “were immigrants or their first-generation descendants” (Boxer, 1965: 21).

reproduction of capital in the northern Netherlands. Locked in struggle through to Westphalia in 1648, the political economy of world power would therefore propel Europe's powers ever outward in search of mass commodities and the capital they generated. (Was not the Dutch conquest of the Spice Islands propelled by Portugal's efforts to keep them out of the Indian Ocean?)

All of which suggests an elementary but rarely analyzed dimension to this world-historical geography. Not only were the economies of Peru, Spain, the northern Netherlands, and the Baltic intertwined, *so were their ecologies*. If Amsterdam was central to the emergent world-economy – Europe's "greatest commercial entrepot" even in the sixteenth century (Boxer, 1965: 20) – this had everything to do with the environmental history of the northern Netherlands as it emerged from late medieval crisis. The Low Countries had suffered little from the ravages of the Black Death relative to the rest of central and western Europe. Coupled with much weaker structures of seigneurial power, in *socio*-historical perspective we would expect a return to the seigneurial *status quo ante*. But this is not what happened. The crisis that emerged in the maritime Low Countries at the end of the fourteenth century was a crisis not of men but of soil. It was at this point that

what turned out to be a very large – and rapidly growing – part of the rural population suddenly found itself, *due to profound ecological disruptions*, unable to make a living by arable farming and compelled to find productive activities in which they could successfully compete on the market. *Unlike anywhere else in Europe*, the subjection of the agricultural population to dependence on the market and the rise of a large market-

dependent population involved in trade and industry in the town occurred to a very great extent as part of *a single process of agrarian transformation*. The emergence, on the one hand, of Dutch clothmaking, brewing, shipping, shipbuilding and peat digging – much of which was oriented to export – and, on the other, of Dutch dairy and cattle raising, were thus two sides of the same extraordinary process of ecologically driven separation of the direct producers from their means of subsistence leading to the transition to capitalism, and they must be understood together (Brenner, 2001: 206, emphases added).

Herein lie the origins of the “Dutch road,” and its distinctive response to the specificities of feudal crisis. “Ecological processes” acted in a manner “strikingly analogous to ‘the so-called primitive accumulation’ that deprived agricultural producers of their land in England” (Brenner, 2001: 208). Here the social basis of modern economic growth is revealed as not social at all, but rather as irreducibly *socio-ecological!*

The full story of the Dutch “economic miracle” has been told elsewhere and need not detain us here (de Vries and van der Woude, 1997; Wallerstein, 1980: 36-71; Arrighi, 1994: 127-158; Israel, 1989). The political ecology of this miracle remains however largely invisible. Two ecohistorical strands deserve further attention.

In the first instance, there is the relationship with the Baltic and its grain and timber. The rising productivity of Dutch agriculture and industry, driven by their intertwined market dependence that found its source in the ecological crisis of the long fourteenth century, enabled the maritime Low Countries to move from strength to strength in the global expansion on the first sixteenth century. Here was a virtuous circle indeed. Dutch

primacy in the Baltic trade reinforced its domestic agricultural revolution. Dutch farmers, freed from the imperative to cultivate cereals (a low-profit line), shifted to dairying and other high-profit pursuits.

Cheap grain in turn underwrote the rapid growth of the non-agricultural workforce over the course of sixteenth and seventeenth centuries. The population of the northern Netherlands more than doubled over this period, while the rural population increased by just one-third (de Vries and van der Woude, 1997: 208). Somewhere between 30 and 60 percent lived in cities, three-quarters of them in “large” cities with 10,000 or more people (Wallerstein, 1980: 45; Berry, 1990: 103; DuPlessis, 1997: 72). Amsterdam, with just 11,000 residents in the early sixteenth century (de Vries and van der Woude, 1997: 358), tripled in size by the 1580s, and reached 200,000 by 1650 (Davis, 1973: 180; Wallerstein, 1980: 45) – a nearly twenty-fold increase in just a century! Already by 1560, Baltic grain met 15-23 percent of Dutch needs (de Vries and van der Woude, 1997: 198; Elliot, 1968: 48). By the turn of the century, probably half the population of the most urbanized, and therefore most commercialized, provinces (Holland, Utrecht, Friesland, and Groningen) relied on grain imports for their daily bread (de Vries, 1974: 172).

But why *Baltic* grain? The explanation turns on some combination of environmental history and political economy. In the first place, when we say Baltic grain what we really mean is *Polish* grain. And this had everything to do with the geography of the situation. Poland was, to put it crudely, a frontier zone. It had been so since the great colonizing movements of the eleventh century, but now the frontier meant something entirely different. With relatively abundant land and a balance of class forces favorable to the forcible extraction of surplus, Poland was the only cereal zone in Europe from which

significant surpluses could be won. Sicily had come online in the early sixteenth century, but was showing signs of exhaustion, along with the rest of the Mediterranean, by the end of the century. It was in any event under the hegemony of Spain. Poland, in contrast, was relatively free for the taking, and it retained plentiful supplies of fresh soil.

Our second point concerns the political economy of the situation. By the later sixteenth century, the Dutch innovation in the Baltic was to capitalize on the favorable conjuncture provided by huge silver flows on the one hand, and “booming western demand for Baltic grain” on the other (Davis, 1973: 180). Dutch manufacturing prowess was significant but insufficient on its own to forge a neo-colonial relation with the Baltic.¹⁶ Dutch trade with the Baltic may have been semi-colonial, but it was a strange sort of colonialism, one in which the *Dutch*, not the Poles, ran a persistent trade deficit. Ready cash was therefore the decisive intervening variable (Braudel, 1984: 209).¹⁷ Ready cash meant silver – Attman puts the volume at some 50 tons *annually* during the seventeenth century (1983a: 10-12)¹⁸ – and silver could be got most readily from the Spaniards. (Hence the importance of Dutch surpluses with the Mediterranean and the New World.) “There is little doubt that the Baltic was the drain down which disappeared much of the American silver which Spain mortgaged to Amsterdam for Dutch imports. The ultimate destination of much of the contents of the Silver Fleets was the [Danish] Sound” (Wilson, 1949: 153-164; 1951: 235). An overstatement, no doubt – we have learned so much about the Manila Galleons and the flow of silver to the Far East in recent decades (Flynn and Giraldez, 2002; Frank, 1998) – but it is nevertheless quite clear that

¹⁶ The language of semi-colonialism is, without a doubt, deeply anachronistic. Nevertheless, the flavor of the relationship is aptly conveyed. Like post-colonial societies of the later twentieth century, in Poland and elsewhere, formal independence overlapped with new inequalities of economic power.

¹⁷ Among other things, it reduced the price of credit relative to English merchants (Lambe, 1657: 9-10).

¹⁸ Attman (1983a: 10-12) takes pains to emphasize that this is an enormously conservative estimate, one that omits overland transport of specie, and relies heavily on registered exports from European ports.

large volumes of American silver were flowing into the Baltic by way of Amsterdam (Attman, 1983a: 31-37, 103; Barbour, 1950: 52). And nowhere in Europe did American silver “cause the price of agricultural products to soar” more than in Poland (de Maddalena, 1974: 308).

Just how much American silver flowing into Spain wound up in Dutch hands? Barbour thinks 15-25 percent, but cites higher estimates too (1950: 50; also Attman, 1983b: 29-31). Whatever the precise figures, the acquisition of American silver was sufficient to transform the economic geography of northern Europe. At least sufficient, that is, once integrated into the political economy of Dutch world power. There is no call for bullion fetishism here. But silver served ably as a socially-recognized medium of exchange in an era when confidence in the world market was shaky at best (Moore, 2007b: Chapter Two). Quickly recognizing the power of ready cash, the Dutch capitalized on the situation by pursuing what Wallerstein calls a system of “international debt peonage” (1974: 121-122; also Malowist, 1959). Superior access to mobile capital allowed Dutch merchants (through Gdansk/Danzig intermediaries who bore much of the risk) to make advance payments to Polish landowners:

This prevented sale on an open market. It allowed the merchants rather than producers to decide the optimum moment for world resale. And since the money lent tended to be expended by the time of delivery of the goods, if not overspent, the producer was always tempted to perpetuate the arrangement... [Dutch] merchants could thereby take the profits of the price revolution and multiply them (Wallerstein, 1974: 122; also Braudel, 1982: 419-420; Malowist, 1958, 1959, 1960).

What I would like to stress about Poland's deepening financial dependence on the West – which a long list of historians have characterized as colonial in essence if not form (e.g. Elliot, 1968; Malowist, 1959; Stavrianos, 1981) – is how such financial mechanisms called forth a thoroughly modern political ecology. While Poland's (under)development owed something to the peculiarities of settlement expansion in the medieval period (Brenner, 1985), the *consolidation* of a cash-crop monocultural regime in rye and wheat, worked by serf labor, owed much to the Dutch organization of credit and trade. By absorbing Polish agricultural surpluses into its North Atlantic town-country division of labor, the Dutch were able simultaneously to facilitate their movement into high-profit lines (both agricultural and industrial) *and* block the incipient development of mercantile and manufacturing activities in eastern European cities. In Poland, no less than in the Americas, economic power and financial innovation – seemingly limited to the social-financial sphere – were closely intertwined with the commodity-centered production of nature. (We shall have opportunity to return to the question of Baltic cereals presently.)

Was this “merchant” capitalism? In part, yes. But mercantile activity takes the explanation only so far. This was far more than buying cheap and selling dear, although, then as now, this was one aspect of the situation. To begin a more compelling explanation, we might observe that shipping and shipbuilding were in themselves only tangentially about buying cheap and selling dear. Beyond this, the fruits of merchant capital accumulated through the Baltic trade were fed into urban manufacturing, for instance sugar refining and textile manufactures. We might recall as well that this “external” moment of Dutch agro-ecological innovation was complemented by an

“internal” agricultural revolution. Dutch agriculture was the Continent’s most advanced (DuPlessis, 1997; Wallerstein, 1980; Davis, 1973; Grigg, 1973; Slicher van Bath, 1964). At a time when grain yields stagnated or rose only slightly throughout Europe, Dutch agriculture surged forward in the sixteenth and seventeenth centuries (Davis, 1973: 110, 116; de Maddalena, 1974: 312). Grain and milk yield ratios were “double or triple those achieved... outside the Netherlands” around 1600 (DuPlessis, 1997: 73). Some rye and wheat continued to be cultivated – indeed Dutch yields were the highest in Europe in the later sixteenth century (van Houtte and van Bruten, 1977: 85). But this was only part of the story. The “invasion” of cheap Baltic grain reinforced the effects of the ecological disruptions identified by Brenner to drive Dutch farmers towards cattle and dairy production, as well as industrial and garden crops (de Vries and van der Woude, 1997: 195-234). “Numerous villages that had reported extensive arable land devoted to grain in the fifteenth century had none in the seventeenth” (DuPlessis, 1997: 72-73; de Vries and van der Woude, 1997: 200; van Houtte and van Bruten, 1977: 85).

From the Forest a Mighty Empire Takes Shape: The Timber Commodity Frontier and Dutch World Power

Very little of the Dutch-led economic revolution – which was also an ecological revolution – was possible without timber and forest products, or without fresh land carved out of the forests. Everything turned on the forests. In this respect the Dutch occupied an even weaker geographical position than did Castile. Peat compensated for the lack of forests to some degree, and could be used for industrial and domestic heating.

To this extent, urban pressure on the forests for charcoal and firewood was correspondingly reduced.¹⁹

But ships could not be built from peat. “Of all the European powers, the Dutch had the most unfavorable ratio of domestic forests to overseas ambitions” (McNeill, 2004: 397; also Albion, 1926: 169). Indeed the *immediate* hinterlands of Dutch shipbuilding centers offered less good timber than even Venice, perhaps the most widely cited case of early modern timber scarcity (Braudel, 1982; Perlin, 1989; Appuhn, 2000). And yet, if the Dutch had such little timber in their hinterlands, why do we find, in 1653, Sir Walter Raleigh lamenting England’s backwardness to the Dutch? The United Provinces’ access to the “exceeding Groves of Wood in the East Kingdomes” yielded “huge piles of Clapboard, Firdeale, Masts and Timber... in the Low Countreyes, where none groweth” (Raleigh, 1653: 26). Over the next few pages, we will trace the commodity-centered conversions of American silver into shipbuilding timber and Baltic cereals, which were of course transported in those floating forests, the merchant marines of northwestern Europe.

Wherever Dutch capital set ashore, they set in motion new commodity frontiers in grain and timber. And this meant strong if uneven pressure on those forests within the orbit of Dutch power. There is no need to postulate a continental forest crisis to make the argument that these commodity-centered environmental transformations were implicated in recurrent waves of geographical expansion and relocation within northern Europe.²⁰

¹⁹ Peat gave the Dutch a cheap source of energy for a range of manufacturing activities that would otherwise have been quite limited in the thinly-forested Low Countries. It was not inexhaustible however, and by the later seventeenth century peat extraction was characterized by the same logic of rising costs and frontier movement that we’ve identified for the forest products sector, among others (see de Zeeuw, 1978).

²⁰ The debate over forest crises in early modern Europe dates back to Sombart (1921) and surely even earlier. It has revived in recent years with the resurgence of environmental history (see Malanima, 2006; Warde, 2006; Williams, 2003).

These transformations owed much to the remaking of New World political ecologies, in turn reinforcing a systemwide dialectic of sequential overexploitation and geographical expansion. (The devastations of the sugar commodity frontier in Brazil and then in the Caribbean were of a piece with Europe's great merchant fleets.) Thus American silver intersected with the Dutch agricultural revolution and its attendant competitive edge in manufacturing to drive forward a series of cascading environmental transformations, effecting the widening and deepening of the specifically capitalist economic geography of northern Europe.

We may begin with shipbuilding timber. Over the course of the early modern era, Dutch capital would cast "an ever-growing net over the timber-producing capacities of Norway, Poland, and the Baltic states alike" (Jacks, 2000: 23). But this was less *one* net – the fishing metaphor seems especially relevant for the Dutch – than a *succession* of nets. Nets as webs of entrapment and as networks of power, this succession of commodity frontiers constituted the geographical law of motion underpinning the "national" triumphs of the Dutch-, and then British-led North Atlantic. It was the skill with which these nets were cast, and the quality of the nets themselves, that would give Dutch shipping (and therefore Dutch power) a decisive competitive edge over its competitors through at least the mid-seventeenth century, driving down shipbuilding costs to one-half to one-third those of the English (Albion, 1926: 156; Barbour, 1930: 267; Wallerstein, 1982: 109).

The first of these nets would be cast upon Norway's southwestern coast. If "the economic life of the Scandinavian countries was honeycombed by Dutch enterprise," as Violet Barbour observes (1950: 118), in Norway, Dutch capital was the Queen Bee. The dramatic expansion of Dutch shipbuilding – whose tonnage increased *ten times* between

1500 and 1700 (Sella, 1972; Unger, 1992: 260-261) – corresponded to the movement of Dutch capital into southern Norway. Norway (formally incorporated into the Kingdom of Denmark) emerged as Holland’s principal timber colony after 1550. Sawmills spread like wildfires as the Dutch advanced; nowhere to be found less than a century before, there were over 500 mills by the end of the sixteenth century. Sögner sees “large scale” timber purchases by Dutch merchants from 1580 (2004: 45), but Lunden puts the decisive shift between 1528 and 1560, when the number of ships exporting timber increased more than sixfold (2004: 201). What ensued was one of modernity’s first great logging booms (Sevetdal and Grimstad, 2003: 14).²¹ So important was Norwegian timber that the advance of Dutch capital across the North Sea and the introduction of the greatest technological innovation of Dutch world primacy – the *fluitschip* (or “flyboat” as it is sometimes translated) – coincide almost perfectly. The Dutch timber trade with Norway took off in the 1580s; the first *fluitschips* appeared in 1595, manufactured, yes, from Norwegian pine (de Vries, 1976: 117-118; Derry, 1979: 142).

The semi-colonial strategy employed by the Dutch in the Polish grain trade found its sylvan counterpart in the Norway timber trade. Dutch merchants “fetched the timber in their own ships, trading with the peasants on very cheap terms and leaving scarcely any profit” (Kiaer, 1893: 332). Norway’s role as a colonial zone becomes sharper in contrast to the Swedes – the chief distinction between Norwegian and Swedish timber exports, at least up to the 1660s, was the former’s role as an exporter of largely unfinished timber (Heckscher, 1954). It was Norway’s double subordination, to the Dutch economically and

²¹ Representing a geographical shift from the more-distant Baltic (Malowist, 1958).

to the Danish politically *and* economically (through the unequal extraction of tax revenues), then that goes far to explaining its poverty during the “Norwegian night.”²²

As in the Baltic, the Dutch strategy in coastal Norway deployed the power of ready cash on a massive scale to buy when prices were lowest and to sidestep the middleman (Barbour, 1930: 273). So successful was this strategy that Dutch shipbuilders obtained masts and shipbuilding timber at prices *below* those of their Norwegian competitors (Barbour, 1930: 273)! No wonder, then, that Norwegian and Baltic timber displaced Rhine Valley sources in the early seventeenth century (Unger, 1997: IV, 9).²³ Moreover, the North Sea was by definition a free trade zone relative to Europe’s heavily regulated river networks:

Rivers... were encumbered with man-made obstacles: mills, fish-weirs, and, above all, tolls. *The Rhine was probably the most heavily encumbered*, probably because there was more to tax than elsewhere... Further impediments, most burdensome on the Rhine, were the ‘staple’ and ‘transshipment’ rights exercised by some riverine cities. *So obstructive were they that they were at this time hastening the decline of*

²² “It is a problem,” Lunden reflects, “how the population of Norway could remain so poor through all of this period 1500-1814 [roughly the period of the ‘Norwegian Night’], and above all how the native economy could remain so under developed [I would say *underdeveloped*], the degree of urbanization remaining so low. This is a problem, regarding the 200-year head start of Norway in export of timber to Western Europe, and regarding the rather gigantic dimensions of the trade, relative to the size of the population. *This seems a major problem*, not only of Norwegian agrarian history, but of general Norwegian history as well. Nevertheless, the problem has as yet recovered little attention from historians. It seems reasonable that a clue to solving the problem is the inclusion of Norway in the Oldenburg state, implying that 66-50 percent of the Norwegian-accounted state revenues were shipped off to Copenhagen” (2004: 203, emphasis added). But did not Dutch primacy in the timber trade siphon wealth as effectively (more so?) as Danish taxation?

²³ Rhenish and Elbian sources would become important suppliers after Westphalia (1648), which coincides with Dutch decline (Barbour, 1950: 91). German sources were available, but on balance these were not frontier sources, and therefore posed all manner of social and ecological barriers to treating nature as a free gift.

the land route between Italy and northwestern Europe in favor of that by sea (Pounds, 1990: 244, emphases added; also Bamford, 1956: 35).

While it would be unwise to speak of generalized deforestation, there were indicators of scarcity in shipbuilding timber and naval stores by the 1660s (Davis, 1973: 190).²⁴ By this point, the Dutch were importing 300,000 m³ of timber annually from Norway (Sipkens, 1996: 36) – de Vries and van der Woude (1997) put this figure closer to 375,000 m³ – or the natural increment of 150-190,000 hectares. The Danish Crown began selling its forest holdings in Norway to pay its war debts at this time (Sevetdal and Grimstad, 2003: 14). Undoubtedly construction timber fetched a good price in the aftermath of London’s 1666 fire. Together, the century-long expansion of *both* forest products sectors (shipbuilding timber and naval stores) and the iron-sector combined to “inflict [wood] shortage, and *in some places devastation of the forests*” (Sevetdal and Grimstad, 2003: 10, italics added; also Berg, 1997). Kiaer observes a noticeable “thinning of the forests situated along the coasts” by mid-century (1893: 332), inducing a shift towards eastern Norway’s timber zones by the later seventeenth century (Sögner, 2004: 45).²⁵ Increasingly it became a “necessity” to “float timber from the interior” to sustain exports (Kiaer, 1893: 332; also Sögner, op. cit.). Smout and his colleagues identify the

²⁴ Kirby and Hinkkanen are however sceptical (2000: 98-99). “The growing preference of shipbuilders for composite rather than single masts from the seventeenth century onwards might be seen as a sign that the Norwegian forests were no longer able to supply the stick timber required, but it might also have been brought about by other factors, such as cheapness or ease of construction” (2000: 98). But was not “cheapness” one of the fundamental expressions of timber abundance or scarcity? Moreover, composite masts were clearly second-rate masts, especially from the standpoint of strategic interests. Addressing the supply problems of the French navy in the seventeenth and eighteenth centuries, “the French navy was therefore obliged to use ‘assembly masts’ made of piece of jointed wood ringed with iron, *but they lacked flexibility and broke if overloaded with sail*. Compared with the English [who had access to northeastern Baltic supplies by the eighteenth century], French ships could never show an extra turn of speed” (Braudel, 1981: 363, emphasis added; also Bamford, 1956; Albion, 1926: esp. 170-171).

²⁵ A century later, in the 1790s, the Dutch sailor Cornelius de Jong observed the “depletion of the wood lands due to the intensively cutting of trees. The government ought to intervene and to consider limits to the deforestation, he thought” (Bruijn, 2004: 98).

same trend in their analysis of Ryfyllke, an important timber region in southwestern Norway. By the middle of the seventeenth century, “the best timber was cut out and the smaller, remaining trees proved less saleable” (Smout, McDonald, and Watson, 2005: 125). Only timber “in smaller dimensions” remained a major export item in the southwest (Sögner, 2004: 45). Lillehammer puts it more baldly (1986). Observing a 75 percent decline in the production (rather than export) of boards in Ryfyllke between the 1660s and 1680s, he argues that “what... seems to have happened was that further deforestation in the easily accessible woods” in the region drove the crisis (Lillehammer, 1986: 108). “The boom,” Smout and his colleagues observe in surely deadpan fashion, “had not produced sustainable forestry” (Smout, McDonald, and Watson, 2005: 125). By one reckoning, in the century after 1650, Dutch timber imports from Norway declined from 130,000 *lasts*, approximating 260,000 tons, to just 38,000 *lasts* (Sicking, de Bles, and des Bouvrie, 2004: 7).

The collapse of Norway’s timber exports was surely influenced by factors other than forest depletion pure and simple. Denmark sought to mobilize Norway’s resources in classical mercantilist fashion. The Danish Crown barred the export of masts and “other big stocks” in 1640 “under the pretext of Norway running out of timber” (Tossavainen, 1994: 74; also Lunden, 2004: 202). Pretext? Or was it perhaps that relative depletion now threatened Danish power? Would not the pressure to apply mercantilist measures have been even stronger under conditions of escalating relative scarcity? Norwegian masts “were described as the worst in Europe as early as 1637” (Bamford, 1956: 137). No doubt an exaggeration (the source is English), but surely one with more than a kernel of truth. Norway

had supplied masts and timber to the Hanseats for centuries, and more recently [, between 1550 and 1650,] the Spanish, Dutch and English demands had drastically reduced the available supplies. The metallurgical industries and the enormous demands of the Norwegian lumbering industries, unrestrained by forest legislation or effective conservation measures, did much to ruin what remained of the forests, and to destroy the mast traffic in the last three decades of the seventeenth century (Bamford, 1956: 136-137).

By the later seventeenth century, escalating “supply problems in Norway” led the Dutch to resume the long march of the timber frontier. This time towards first the southern, then the northeastern, Baltic. Dutch ships would reach as far north as Archangel (Tossavainen, 1994; Kotilaine, 2003: 311). The Baltic timber trade quadrupled in volume between 1661 and the 1690s. In the 1660s, 1.5 million “pieces” of timber passed through the Sound. Nearly that many (1.3 million) were shipped in 1689 alone (Unger, 1959: 215). In Russia, the fur trade was quickly eclipsed by naval stores – these latter “the most rapidly growing categories of Russian exports” by the 1690s (Kotilaine, 2003: 306) – in exchange for Dutch metalwares and munitions.²⁶ Indeed, Dutch capital moved into coastal Russia to establish the first sawmills much as they had done a century before in Norway (Ozveren, 2000), and just as they had poured into Sweden a century earlier to establish a modern iron and copper industry (Barbour, 1950: 119). Meanwhile, Finland saw a “particularly striking” rise in timber exports by 1700 (Unger, 1959: 215; Åström, 1975, 1978).

²⁶ All of which was implicated in the transition to a “new era in Russian economic history” characterized by its integration into the world capitalist system (Kotilaine, 2003: 311; Wallerstein, 1989).

Albion sees a succession of Baltic supply zones in the century or so after 1670, organized around Danzig, Memel, and Riga in their respective turns (1926; also Smout, McDonald, and Watson, 2005: 124-131; Kirby, 1990: 229-232). The frontier would roll onwards well into the nineteenth century. By the 1880s around Königsberg, timber supplies from its 27,000 square miles of once-thickly forest terrain, were “gradually becoming scarce and dear. The distance to haul [was] increasing” (Brown, 1885: 247). This frontier movement was driven by the very intersection of endless accumulation and rising material throughput that lay behind the expansion of the silver commodity frontier to the New World. The “Baltic timber trade,” Albion reminds us,

was not a matter which affected Dantzic, Riga, Longsund, and other timber *ports* alone. Extending even into Bohemia, Galicia, and the Ukraine, it afforded employment to men living hundreds of miles in the interior... [As] the old sources of supply grew inadequate [because of overcutting, it] became *necessary to go farther and farther up the rivers and deeper into the woods away from the rivers in order to find suitable tress, which naturally increased the price of timber...* Even the rivers grew shallower as a result (Albion, 1926: 143, 145, second emphasis added; also Richards, 1990: 168).

The shipbuilding timber frontier was expansionary out of all proportion to its material demands. Even in the late eighteenth century shipbuilding timber made for perhaps one percent of European consumption (Warde, 2006: 40-41). The sector’s disproportionate demands stemmed from two mutually reinforcing reasons. First, shipbuilding timber was highly selective and dependent upon slow-growing, “old growth” trees such as oak.

Shipbuilders, because they needed “grand and ‘outsized’ timbers,... vociferously feared scarcity. This was in part because the curved ‘compass timbers’ required for ships’ parts *were not generally found conveniently amassed*” (Warde, 2006: 40, emphasis added.) Most shipbuilding timber was simply out of reach. High transport costs precluded moving timbers more than a few kilometers. Just how far this timber could be hauled overland is uncertain. Estimates vary. Albion thinks the limit was twenty miles from the rivers (1926: 145). This is almost surely too generous.²⁷ Looking at the early *nineteenth* century, Pollard sees twelve miles as the “farthest possible distance [overland] for transporting timber or grain” (1974: 38; also Braudel, 1981: 365; *pace* Berg, 1997). In the mid-nineteenth century U.S., timber was rarely hauled for more than two miles, although heavy snows might allow sledding for some distance farther (White, 1980).

Baltic cereals were the second major vector of sequential exploitation nourished by the silver trade. Combined with “agricultural expansion... together [timbering and agricultural clearing] degraded the forests of the Vistula basin and more generally those of southern and central Poland” (Richards, 1990: 169). Szczygielski sees a century-long advance into the forest after 1550, predicated on the extraction of masts, naval stores, potash production and other forest products (1967). There was, as Szczygielski puts it, a movement of “exhaustive cultivation” in full flower by the second sixteenth century (1967: 97).

Tossavainen (1994) accounts for this ecological overdraft not simply in terms cumulating pressures, but in the competition between forest sectors predicated on the rate

²⁷ Although Brown (1885: 241) thinks overland haulage of trees as far as 30-40 miles was “by no means unusual” in late nineteenth century Poland. This would have been possible only at very high prices (which, Brown argues, was indeed the case) and very low wages, which Brown does not mention, but which is certainly possible in a region where timber haulage would have served as a by-employment for peasant cultivators.

of profit. Two sectors stand out, tar and pitch suitable for protecting ships from water damage, and potash, crucial for bleaching fabrics preparatory to manufacture. Both were devastating. They were perhaps the only activities in the European world-economy – aside from agricultural clearing pure and simple – that came close to realizing total deforestation. Deploying the same power of ready-cash that we saw in the cereal trade (in fact the two were functionally related), beginning in the sixteenth century, Dutch merchants “encouraged Baltic peasants to convert from a traditional forest economy to agriculture based on wheat and flax for export.” The result was a series of short-lived regional booms in tar and pitch extraction that decimated the forests and drove down the price of tar (for the Dutch) below that of western European competitors (Loewen, 2005: 239-240).

Potash was no less important, and equally voracious of the forest. Potash production relied on the oak stands as much as shipbuilding timber:²⁸

[A]shes and potash were commodities which gave to a middleman especially high profit compared to the export of timber. For instance, in the middle of the seventeenth century the middleman in a loading port had a profit from 40 to 90 per cent in the trade with potash, while in the timber trade the most important single type of timber, clapboard gave only 16 per cent profit... Danzig merchants were using either subcontractors who felled the timber and burned the ordinary ashes needed in the refining process of potash, or the local magnate got an advance payment of a

²⁸ The situation with potash was no simple expression of merchant capitalism, of buying cheap and selling dear. Potash was so profitable because it was a strategic use-value. It was central to the high value-added strategy of Dutch capitalism: “Where did the biggest profit margins lie in textile manufactures? Not in spinning or weaving or growing wool but in the refined technology of dyeing and dressing the cloth which provided the key to the control of the markets” (Wilson, 1968: 31).

certain quantity of potash delivered to Danzig. *The subcontractors and landowners did not care about the future of the forests.* They felled large areas totally empty of hard wood such as oak and beech, best suited for potash production. *When the forest was cleared, the subcontractor simply made an agreement with another landowner who still had suitable types of timber. This was especially disastrous to the oak, because it takes decades before oak is big enough to be used for waynscot*²⁹... The short-sighted clear-cutting of forests together with the internal and external factors already mentioned were enough to cause a disaster in Danzig's timber trade (Tossavainen, 1994: 73-74, emphasis added).

Such was the deforestation around Danzig – “the unreasoning greed of man [had] destroyed these trees” – that sand dunes invaded (Wessely, 1873: 221-222 quoted in Brown, 1884: 96-97).³⁰ By the early eighteenth century the dunes had advanced not only over nearby “meadows and fields,... [but also had] completely buried” two nearby villages (ibid). By the close of the century, the problem had advanced such that only state intervention averted its “growing danger... [to the] commerce of Danzig” (Wessely, 1873 quoted in Brown, 1884: 120-121). In the 1870s, Bebel would attribute frequent and severe flooding on the Vistula to the “devastation of forest,” which he called a “mad sacrifice... for the sake of ‘profit’” (1879 [1988]: 204). No wonder that in “Poland we meet with only very few forests capable of giving an idea of the ancient forest state of the country,” Brown observed in the 1880s (1885: 21).³¹

²⁹ Waynscot or wainscot was a type of high-quality planking, made from oak, used in shipbuilding.

³⁰ This had happened earlier on the Baltic coast, during the Thirty Years War (1618-1648), when “the Swedes, who needed money, cut down vast areas of forest in Pomerania with the result that many regions were afterwards invaded by sand-dunes” (Braudel, 1981: 365).

³¹ Much better off was Poland's southern neighbor, Hungary, which Brown characterized as considerably “less devastated than Poland” (1885: 22).

The dramatic expansion of Baltic cereal exports began in the 1550s, reaching four times the volume of a half-century earlier (Malowist, 1959; Tielhof, 2002: 43). About half these shipments originated in Poland, and about sixty percent were carried in Dutch bottoms until the mid-seventeenth century (Bogucka, 1978: 14; Glamann, 1974: 461).³² Poland itself, at least the “Poland” shaped by the expansive region comprised of the Vistula and its tributaries,³³ became a vast monocultural zone. By the end of the sixteenth century, grain would constitute 70 percent of exports; by the early seventeenth century, 80 percent (Bogucka, 1978: 14). Hoffmann puts the figure closer to 90 percent as early as 1550 (2001: 136). No wonder that Glamann (1974: 459) sees in the sixteenth century Poland the “lopsided development of agriculture and forestry under the massive pressure of western demand”! While the Dutch were urbanizing rapidly – the urban population nearly tripled between 1500 and 1600 – Poland was rapidly and structurally de-urbanized. The number of people living in cities fell by almost *one-third* over the seventeenth century, even as aggregate population increased 20 percent. Of major European countries, only Spain suffered a meaningful drop in urban population, and this by just five percent (calculated from Allen, 2000: 8-9). The ecological moment of this double reconfiguration of town and country is easily missed but simply stated. Towns consumed forest products at a ferocious pace – above all timber for construction and

³² Three-fourths of the Baltic grain arriving in Amsterdam was re-exported in the seventeenth century (Glamann, 1974: 461).

³³ “The river system [of the Vistula] seems to have contained a larger volume of water than in our day, since the water-table was higher, thanks to the extensive forests. The Polish lowlands placed few obstacles in the way of river traffic, which operated along a whole network of rivers with the Vistula as the main artery. This means that the Vistula carried grain and timber belonging geographically to other regions... The supplying districts associated with the Vistula trade were thus in the sixteenth and seventeenth centuries substantially bigger than the ‘hinterland’ drained by that river alone – *which is itself bigger than that of the Rhine*” (Glamann, 1974: 458, emphasis added). Indeed Wazny’s (2002) dendrochronological studies indicate that timber was drawn from the far south of Poland, close to the Czech and Slovakian border.

charcoal for manufacturing. All things being equal, less urbanization in seventeenth century Poland meant more resources for the United Provinces.

What Marx once observed for the relationship between England and Ireland in the early nineteenth century might just as well be applied to the relation between the northern Netherlands and Poland: “Ireland is at present merely an agricultural district of England which happens to be divided by a wide stretch of water” (1977: 860). But if the political economy of uneven development seems rather straightforward, the question still remains: Was there a significant *political ecology* of uneven development in the long sixteenth century? There is ample evidence by this point to indicate that environmental devastations ranged far and wide in the conquest of the Americas, from the canefields of Bahia and Barbados, to the mining centers of Potosí and Zacatecas. But were these ecohistorical moments of a New World exceptionalism, perhaps the straightforward outcome of a rapacious European colonialism? Or were they, perhaps, moments in a world-historical pattern that extended to the Vistula, to Stavanger, to Viborg? What we have seen suggests that this was more than a replay of premodern empire-building; that empires were in play, but they no longer were the independent variable.

Other questions present themselves. Was there a political ecology of underdevelopment for the North Atlantic as well as the New World, one that reinforced and sustained the political ecology of uneven development on a world-scale? Were there, in others words, a multilayered and overlapping series of “metabolic rifts” between Amsterdam and Poland, between Amsterdam and Spain, Seville and Peru, Potosí and Peru? Does Marx’s concept of metabolic rift – the creation of an “an irreparable rift in the interdependent process of social metabolism” between town and country (1981: 949) –

hold for the era of manufacture and the rise of the world market as well as for the era of large-scale industry?

Our evidence suggests an affirmative answer to these questions. The emergence of Poland as a vast cereal export zone was predicated on an equally vast movement of forest clearance. Williams (2003: 176) and Richards (1990: 169, 177) sees the rapid and large-scale transformation of Baltic forest into arable land. Between 500,000 and 700,000 hectares of forest were sacrificed to feed the Dutch, English, Iberian, and Mediterranean socio-ecological formations. Just how much of this was concentrated in Poland remains unclear. But even if we take the low end of the Richards' estimate, 500,000 hectares, this translates to a scale and speed of deforestation unknown before in human history, *except for the deforestation ongoing at the very same time (1550-1750) in northeastern Brazil* (see Dean, 1995; and for an upward revision of Dean's estimates, see Moore, 2007b: Chapter Six).

How much grain was flowing from Vistula breadbasket? Richards figures an annual average of 60,000 tons of cereal passing through the Sound during the sixteenth century. This may be too conservative. Malowist (1958) reports 10,000 lasts – one last amounting roughly to two tons – exported from the Baltic to western Europe at the end of the fifteenth century, and then a significant jump to 40,000 lasts (80,000 tons) by the 1540s. Shipments rose to around 100,000 tons by the late 1590s and to 120,000 tons a year by the 1618 (Tielhof, 2002: 43). Of course it is difficult to factor in the tremendous oscillations of the trade, generated by climate and war, but the Richards-Williams estimate on deforestation appears sound. Even “today [1979] the view of the land on an

aeroplane journey from Warsaw to Cracow still shows the way in which the long fields thrust into the forests” (Braudel, 1981: 364).

The fate of the forest and the fate of the soil were therefore dialectically bound. Perhaps Poland’s high yields in 1550s – just barely above the European average – owed something to reclaiming arable land from the forests? If so, this would explain at least part of the subsequent downward revision of yield ratios, evident even before cereals prices declined in the early seventeenth century. Szygielski (1967) sees the two movements, forest clearance and declining yield ratios, closely linked in Poland. There were, he points out, two principal strategies for sustaining a grain surplus, even in the face of a medium-run tendency towards soil exhaustion. One was sustaining output “by deviating from the fundamental principles of rotation in tilling the soil” (Szygielski, 1967: 97, 94). The second strategy was necessitated by the first. Exhausted land was abandoned, and new arable carved from the forest. Thus were soil exhaustion and deforestation closely intertwined. It is quite certain that the process cannot be explained solely in terms of the extension of the modern world market. We can be equally confident that the expansionary cycle of forest clearance and soil exhaustion was not the unmediated outcome of a peasant-seigneurial cycle, as we witnessed during the long medieval expansion. World market forces were strong, but not *that* strong; the peasant economy was expansionary, but not *that* expansionary. It was rather a situation in which the two forces combined in unstable and dynamic tension, preserving in crucial respects a set of pre-capitalist arrangements, even as these latter were entrained within the gravitational pull of Dutch-led capitalism. It was a combination, in other words, that was more than the sum of its peasant and Smithian parts.

We have seen that cereal exports crested sometime in the first quarter of the seventeenth century. Poland had sustained a strong demographic expansion in the sixteenth century, which meant primarily an expansion of the peasant economy (McEvedy and Jones, 1978: 73-77). This accounts for one moment of the drive into the forest. Meanwhile, the threefold expansion in cereal exports between the 1540s and the early seventeenth century constituted another, linked but relatively autonomous driver. What emerges is the more-or-less typical pattern of commodity frontier development within early modern Europe. Poland in the second half of the sixteenth century remained, as it had been for medieval Europe, an open frontier, for the peasant economy and market-oriented seigneurs alike. During this half-century, “there still seems to have been enough... virgin land to satisfy seigneurial ambitions for demesne expansion, so that land held by peasants was only occasionally absorbed” (Blum, 1957: 829). After 1600,³⁴ however, the seigneurs moved strongly against the peasantry:

The expropriation of peasant holdings became much more general, so that an ever-increasing number of peasant holdings were reduced to cottars, left without any land at all, or had the size of their holdings much reduced (Blum, 1957: 829).

Whether or not this is synonymous with a market-driven “second serfdom” is another question. The point I wish to underline is that the drive towards the expropriation of peasant holdings, as Blum puts it, and the drive into the forest, were dialectically joined. They were movements of a singular socio-ecological process expressive of the commodity frontier. While the socio-spatial moment is crucial, so is the matter of timing.

³⁴ It was precisely at this moment, the early decades of the seventeenth century, that land scarcity began to materialize in the sugar frontier zone of Brazil’s Reconcavo (Moore, 2007b: Chapter Six).

For the cereal and timber commodity frontiers (or was it perhaps a singular frontier?) produced not space alone, but also time. We see, once again, a 50-75 year cycle of expansion and ascent, followed by decline – an especially dramatic decline in the case of seventeenth century Poland.

It is therefore not terrifically surprising that we see an agro-ecological crisis within Polish cereal zones by the middle of the seventeenth century. Tielhof identifies soil exhaustion as a serious problem from the 1660s (2002: 54), at which point Szczygielski begins to speak of a “catastrophic” decline of agricultural productivity (1967: 86). Moreover, the ramping up of corvee labor by the market-oriented nobility deprived poor peasants of animals, thereby undermining a key source of soil fertility (Wallerstein, 1980: 132). That yields were declining is widely agreed, from 5:1 in the mid-sixteenth century to 3:1 (or lower) in the mid-seventeenth century (DuPlessis, 1997: 82; de Maddalena, 1974; Topolsky, 1962). As if that wasn’t bad enough, widespread deforestation led to mounting soil erosion problems as early as the seventeenth century, likely intensified by the cold, wet winters of the Little Ice Age (Klimowicz and Uziak, 2001).

Was this crisis the outcome of the market-orientation of Polish agriculture, or perhaps the resurgence of a seigneurial-agrarian dynamic? The late seventeenth century was an era of “severe agricultural depression” across the Continent, which in certain respects replayed the crisis of the long fourteenth century (Abel, 1980: 182; Seccombe, 1992). The question is one of relative causal weight. Abel provides one clue, suggesting that the depression was “less pronounced” in Scandinavia “because subsistence agriculture *still played a larger part* in the management of farms and estates than in the neighboring countries,” above all “east Germany and Poland” (1980: 178-179, emphasis added). The

expansion of the peasant economy, it would seem, insulated regional economies from the seventeenth century downturn. This was the diametric opposite of the logic of the fourteenth century's crisis. Danzig's grain exports fell some 90 percent between the late sixteenth century and the early eighteenth. It was, then, not the weakness of capitalist advance in the Vistula that drove the crisis; it was rather a crisis that emerged out of more than a century of capitalist restructuring.

Poland was by the late seventeenth century undercut decisively by English grain. Surely we can explain this in terms of rising English agricultural productivity and the capitalist relations that enabled it (Brenner, 1985). But wasn't this higher productivity achieved in part by what Overton (1996: 117) describes as the "cashing in on reserves of nitrogen under permanent pasture for short-term gain," gains that would turn to stagnation after 1750? And wasn't Danzig also undercut from the other direction by "a shift towards the eastern Baltic" in the world grain trade by the eighteenth century (Glamann, 1974: 462)? This shift would in turn reproduce on an extended scale the deforestation that characterized the earlier phase of the cereal commodity frontier – creating, for instance, widespread deforestation in Estonia and elsewhere in Baltic Russia towards the end of the eighteenth century (Veski, Koppel, and Poska, 2005: 1384; French, 1983: 30-41). It was, Wallerstein wryly observes, a "self-consuming method" (1980: 133). But self-consuming for whom? For the peasantry, certainly. For the seigneurs, probably. But thanks to the magic of the commodity frontier, a self-expanding method it surely was for the accumulators of capital.

Fishing the Commodity Frontier

If world environmental history is to become more than a succession of regional case studies, our most pressing task is to identify synchronicities, and then relational movements (teleconnections), between these regions. The teleconnections between the Low Countries and the extended Baltic zone do not end with the metabolic rifts instantiated in the grain/timber/silver nexus. Among the more surprising synchronicities is the near-simultaneous decline of herring fisheries and Poland's agricultural crisis. Dutch herring exports traveled far, in the first half of the seventeenth century between one and two thousand *tons* of the salted fish were consumed in Warsaw, and on average 15,000 tons a year for the Baltic as a whole (Unger, 1980: 263). By 1640, the Dutch were hauling in 40,000 metric tons of fish annually, about 80 percent of which was exported (de Vries and van der Woude, 1997: 251).

Apparently this was too much. Especially when reinforced by Danish and German competitors, "who responded to growing Dutch [harvests] by increasing their own catch" and in the process "destroying their own fishing grounds" (Munro, 2006: 18). (Did this lay behind the "final collapse" of the Scania fishery in the 1620s [Unger, 1980: 272]?) By 1650, the North Sea's herring fisheries were in trouble. Richards sees a "long, slow decline" (2003: 51). But was the crisis perhaps more pronounced, a bellwether of Dutch hegemonic crisis? (Recall that Norwegian timber imports had faltered and Polish agriculture was in crisis at this very moment.) De Vries and van der Woude see a "precipitous decline in the herring catches after the 1650s" (1997: 419; see esp. 25-251). This was no small matter for an economy in which one-fifth of the population depended on the fisheries, directly or indirectly, for their daily bread – the value of the 200 million herring caught in the 1650s exceeded that of English woolens (Munro, 2006: 19). It is in

any event clear that herring yields per boat were declining, a difficult state of affairs for a sector characterized by very low labor productivity and a “structurally low level of profitability” (van Bochove and van Zanden, 2006: 568). Yields declined and with it the rate of profit, which fell by more than half between 1640 and 1700 (van Bochove and van Zanden, n.d.: 8).³⁵ The same historical-geographical pattern was at play in Dutch whaling grounds as well. These began to show “quite certain” evidence of declining yields at the same time as herring (ibid: 9). The Dutch economy could not do without either – the herring trade kept the shipyards in business (with nearly 500 *busses* in the water during the 1640s) and whales provided the raw material for such crucial industrial products as bone (for textiles), soap, lubricants, and lamp oil (Munro, 2006: 19; Richards, 2003: 609-610; Wallerstein, 1982: 96).

The solution was of course an old one by the mid-seventeenth century – extend the frontier. Build a bigger net. (Or harpoon, as the case may be.) Thus the period between 1640 and 1670 marks the decisive turning point in northwestern Europe’s fisheries and whaling grounds. Fleets rapidly moved north and west into Arctic zones. Commenting on whaling, Richards ably captures the grim logic of these aquatic commodity frontiers:

No allowance was made for any sort of conservation or sustainable use of stocks. The Arctic bowhead herds became an open-access resource without any discernible management or restraint on the part of the users. From the early sixteenth century to the mid-nineteenth, as bowheads were killed off, *the whalers shifted to more and more distant, difficult and dangerous regions....* Over the entire period, *and in each phase of the*

³⁵ Here I cite the unpublished version of van Bochove and van Zanden paper, which does a better job of highlighting the declining profitability of the herring industry than the published paper.

hunt, there was a slow reduction in productivity as the number of size of whales caught declined. For example, in the 1670s each Dutch whaling ship took an average each year of 6.4 whales... [I]n the 1770s, the annual average catch was down to 2.2 animals (Richards, 2003: 610, emphases added).

For whaling the movement was strongly outward. Herring declined in relative importance to the world-economy after the seventeenth century – the catch was no larger in 1800 than it was in 1600 (Poulsen, 2006: 3). By the eighteenth century, herring would give way to cod. As so often was the case, a new frontier entailed a changing of the guards – Dutch *busses* gave way to the aggressively expansionary English- and French-cod fleets. Nevertheless, the geographical restlessness of the herring commodity frontier persisted within the limits of low profitability. The eighteenth century witnessed a succession of local fishery booms on the coasts of Scotland, Norway, and Sweden, none of which “flourished for more than 50-60 years at a time” (Poulsen, 2006: 2 and *passim*). (A by-now familiar temporal cycle.) Already in relative decline, the Dutch were boxed out of these resurgent fisheries, which explains the industry’s failure to revive profitability. Meanwhile cod rose to prominence and outstripped herring production several times over; but the Netherlanders’ moment in the sun had passed and the English now led the way. By the 1780s, the world cod harvest approached 400,000 tons.

This was, then, an early instance of the product cycle taking hold and reshaping “local” geographies in such a way as to necessitate continued expansion. If the outward movement of the herring frontier was articulated with the Baltic grain frontier – both showing signs of exhaustion by the mid-seventeenth century – the global extension of the

cod frontier was metabolically linked to the sugar commodity frontier's movement into the Caribbean, at the very moment when the North Atlantic nexus of grain, silver, and herring was coming unraveled. Here was a definite rupture with premodern patterns. The North Sea fisheries had been overexploited in the seventeenth century. Three centuries prior, these fisheries had also shown definite signs of stress in the wake of the long medieval expansion (Hoffmann, 2005). But in the long fourteenth century, the ecological crisis of the sea and the ecological crisis of the land led to the crisis of the feudal order as a whole (Moore, 2002a, 2007b: Chapter One). In the seventeenth century, the ecological crises of the herring and whaling sectors led not to the crisis of capitalism as a mode of production, but to the unraveling of Dutch world power. The globalization of the North Atlantic fisheries, then, carried out by French and especially English fleets, was one moment of global expansion and restructuring that was the *sine qua non* of early capitalism. On the cod frontier no less than in whaling and herring, "fishing pressure diffused over [an ever] wider area and bore upon new cod stocks... In response to local scarcities, cod fishers moved to new, unexploited coastal regions" (Richards, 2003: 567-568). It was a frontier movement that fed, and was in turn nourished by, the depredations of Caribbean's sugar commodity frontier (Moore, 2000b, 20003a, 2003b). The sugar plantations ravaged the soils of the West Indies through their mobilization of African slaves fed on cheap salted fish – whose cheapness rested upon the cod frontier's capacity to treat the North Atlantic as a free gift to capital, in turn a particular expression of early capitalism's extensive ecological fix strategy. So inexpensive was the imported fish that

Caribbean planters in the 1650s found it cheaper to buy fish from New Englanders than to allow slaves to fish for themselves (Ligon, 1657: 35).³⁶

There is a startling synchronicity to the patterns here. While all commodity frontiers went through boom and bust cycles that were regionally specific, combined they created a roughly connected world-time. This is the 50-75 year cycle.³⁷ I have used the metaphor of teleconnection to convey,³⁸ albeit in rough and ready fashion (but then, was not this the reality of early capitalism?), the proliferation and intensification of “large, statistically significant signals” in one region and “equally large signals” in another (Bjerknes, 1969). Of course the task of the historian in this context is rendered all the more challenging by the unrelenting reality of a polycentric system that was still in formation and still expanding. Early capitalism was no closed system. (Is it today?)

Wallerstein (1980: 133) sees a 50-60 year cycle of new agricultural exploitation and thence soil exhaustion for eastern Europe in the early modern era. Was this not remarkably similar to the Central European (1460-1530) and Potosí silver cycles (1573-1630)? And to the high point of the Dutch-led whaling commodity frontier, c. 1661-1719 (Richards, 2003: 600)? To the Dutch-led boom in Norwegian timber (1580-1630)? And also to the sugar commodity frontier in successive movements across the Atlantic, from Madeira (1470-1520), to Sao Tome (1530-1580), to Pernambuco (1570-1620) and Bahia (1620-1670) in Brazil, and thence towards the Caribbean by the mid-seventeenth century? All of which suggests that these commodity frontiers were increasingly

³⁶ “[T]he planters are so good husbands, and tend their profits so much, as they will not spare a Negro’s absence so long, as to go to the *Bridge* and fetch it [the fish]” (Ligon, 1657: 35).

³⁷ It is not, as near as I can tell, directly bound to Kondratieff waves, although it is possible that such price movements are in dialogue with ecological contradictions of the commodity frontier.

³⁸ Borrowed from meteorology (Bjerknes, 1969) and deployed by Davis, although without reference to the global socio-ecological developments he traces, to examine the late nineteenth century El Niño cycles (2001: esp. 240-245).

occupying the same “place” of the world-economy, even as this place quite evidently transformed (and was in turn shaped by) distinctive socio-ecological conditions and specific regional contexts. The patterns of boom and bust were still loosely, and yet increasingly, teleconnected through the circuits of capital and the machinery of empire.

And now we can connect the world-historical dots of forest clearance, which we have talked about in terms of “forest-equivalents.” The dramatic expansion of the Baltic grain trade over the course of the sixteenth century was, among many other things, a period of rapid forest clearance. Not just because of arable’s expansion at the expense of forest, although this was important. Grain of course moved on ships, and shipbuilding was aggressive in pushing the division of labor ever outward. Petty estimated Dutch shipping at 900,000 tons in 1676 (1690: 5) Spotting these ships a generous life span, of say ten years, this meant 90,000 tons of shipbuilding annually, which would have depended upon 126,000 m³ of timber.³⁹ (And this for the Dutch alone.) Using Warde’s ratios, this would have translated into about 1708.5 acres annually (2006: 50). But here the figure is surely misleading. Not just any timber would do, as Warde notes. His yield figures, presuming 73.75 m³ of timber per acre, may be reasonable for certain kinds of shipbuilding timber (planking for instance) but it strikes me as rather too optimistic for the most strategic materials, hulls and above everything, masts. There is evidence that suggests a much lower yield for shipbuilding timber. Perlin, citing a 1593 source, finds that 1,740 “mature oaks” made for 2,000 tons of shipbuilding timber (1989: 175). If so, we may build from Naish’s observation that 2,000 such oaks (1,740 tons) could be extracted from about 50

³⁹ My calculations derive from Warde’s estimates of 210,000 tons of shipping requiring 295,000 cubic meters of wood, for the British navy in 1812 (2006: 50). Bamford (1956) reports that ships could last up to three decades, but this is an exceptional upper limit, and refers to well-maintained ships-of-the-line rather than merchant vessels.

acres (1957: 493).⁴⁰ Combined with standard weight-to-volume conversions for hardwoods,⁴¹ this produces a yield of 39.4 m³/acre for shipbuilding timber (97.24 m³/ha). This would explain why southern Norway in the 1650s was running low on shipbuilding timber – not from lack of forests but from the “cherry picking” characteristic of the shipbuilding timber trade.

“Everything conspired against the forest,” Braudel once observed (1981). The Andean mining frontier consumed forests (or their functional equivalents such as Peru’s Icho grass), its silver precipitations flowed to Castile in massive convoys built of wood, who upon arrival disgorged their treasure into private and public coffers, fueling among other things Spain’s imperial ambitions. Such ambitions enabled substantial shipbuilding and ironmaking within Spain, which consumed the forests and therefore undermined the Empire’s capacity to make its own iron and launch its own vessels. Even these activities depended upon imports of quality timber (such as masts) and especially grain from northern Europe. In the same breath, the enormous silver inflows allowed Castile’s ruling strata to dispense with the kind of internal restructuring, within the administrative apparatus broadly conceived, and (more corrosively over the long run) within the agro-ecological and industrial spheres. Thus the “crisis of the seventeenth century” hit earliest in Spain; its essentially medieval agriculture reproducing the ecological crises of the seigneurial-agrarian cycle in a manner strikingly reminiscent of the fourteenth century crisis. Within Spain, only the southern frontier zone of Guadalquivir escaped this fate, precisely because it was a frontier zone (de Maddalena, 1974: 300). But this was no

⁴⁰ Or forty trees an acre, a figure that is about ten percent higher than Warde’s guesstimate of 35.3 trees an acre (2006b: 50), and just below what Smout and his colleagues find for seventeenth century Scotland, at 42.9 “mature” oaks/acre (Smout, MacDonald, and Watson, 2005: 97).

⁴¹ Assuming 6400 lbs for a standard hardwood cord (3.62 meters) (State of South Carolina, 1999). This is a high estimate, in favor of forest productivity. For more detailed technical discussions, see Moore (2007b: Chapter Two).

feudal crisis. Things were now quite different. Spain's "agricultural revolution in reverse" (Braudel, 1972) was neither isolated nor universal. Spain agro-ecological woes were teleconnected with the colonial ecological revolution in Peru (and not just Peru), to the agricultural revolution in the Low Countries of the first sixteenth century, and thence to the "economic regression" and ecological crisis of Poland in the mid-seventeenth century. From the standpoint of *modern* environmental history, what differed in this seventeenth century "crisis" – a crisis in but not of the system – was the *uneven articulation of capitalist and medieval political ecologies*. As such articulations go, it was creative. It was destructive. It was globalizing. How little things have changed.

The Rise of Capitalism and the Origins of Ecological Crisis

We live in the midst of an ecological crisis unprecedented in the history of the modern world, and indeed in the history of humanity. From whence this crisis has issued remains a topic of some debate, although perhaps not nearly enough debate. There has been (alas!) a studied reluctance within geography, environmental history, and environmental studies more broadly to grasp the nettle of the origins of ecological crisis. It is a little like tracking the progress of a disease without searching for its cause.

The origin of today's crisis finds its taproot in the transition to capitalism and Europe's overseas expansion during the "long" sixteenth century (c. 1450-1640). The scale and speed of the environmental transformations that ensued was entirely without precedent – relative to medieval Europe in its heyday, relative to all previous "golden ages" enjoyed by those mighty civilizations fortunate to get face-time in our textbooks, the Greeks, Rome, Persia, China. It is a simple answer, and some say will say deceptively

so. And surely there is much to the story of modernity's environmental history that must be left on the editing room floor. It is always a matter of one's priorities, of the argument one wishes to make, and the theoretical and methodological challenges inscribed in the nature of the problem itself.

In historical-geographical perspective, there are three main ways to approach the questions posed by these crisis tendencies: 1) regional transformation; 2) the cumulative development of crisis tendencies over the lifespan of the historical system; and 3) the cyclical development of these cumulative tendencies, as phases of development. In the foregoing, my concern has been the relationship between regional transformation (as crisis-producing) and renewed geographical expansion (as crisis-resolving). In such abstract terms, this logic applies to the history of capitalism as a whole (Moore, 2000a).

What distinguishes the ecological regime of early capitalism from the long wave of British-led accumulation that followed was this. Early modern capitalism's ecological regime was one premised on a highly effective combination of military conquest, the vigorous geographical extension of commodity production directly (as in the plantation system) and indirectly (as in Poland's "second serfdom"), the creation of financial structures that radically accelerated turnover time and sustained economic interdependence on a globalizing basis, and the maximization of technological development oriented towards geographical expansion.⁴² Early capitalism was based on a globalizing ecological strategy that emphasized the radical expansion of the arena for commodity production and market exchange. It was above all a *commodity-widening* strategy. Hence the centrality of the commodity *frontier*. This we have seen with timber, naval stores, cereals, and fisheries in the North Atlantic. We could follow similar stories

⁴² Including not merely innovations in shipbuilding but also, for instance, in cartographic techniques.

regarding silver mining, stockraising, sugar planting, tobacco cultivation, fur trapping, and other commodity frontiers across the geographical breadth of early modern capitalism. There were, in the Low Countries and then England, important moves towards rising agricultural productivity, as we've seen in the relation between Dutch and Polish agriculture. This is the story of "agricultural revolutions," and these were clearly moments of *commodity-deepening*. The dialectic of plunder and productivity is immanent to capitalist development. (It is not for nothing that resurgent academic interest in Marx's concept of primitive accumulation has materialized at precisely the moment when the last significant frontiers been enclosed.) On balance, between 1450 and 1750, there was clearly more widening than there was deepening in the European world-economy. Europe's geographical hegemony more than doubled over this period (Chaunu, 1959: 148). By the later eighteenth century, however, British-led industrialization was beginning to reverse the earlier state of affairs. The arena of commodity-deepening had shifted by this time from agriculture to industry. The problem was, by the 1750s neither English agriculture nor Dutch farming was revolutionary. The sustained productivity increases of the seventeenth century had given way to relative stagnation. This was expressive of two big developments. First, it points to the systemwide exhaustion of the early modern ecological regime. It was sufficiently capitalist in breadth, but by the middle of the eighteenth century, it was no longer sufficiently capitalist in depth. And second, it indicated a looming agro-ecological bottleneck that threatened the middle-run prospects of British-led industrialization.

I can do no more than allude to this eighteenth century crisis of the early modern ecological regime, which at I would call a *developmental crisis* – an ecological crisis

implicated in the transition from one phase of systemwide development to the next. This paper carries to the reader to the doorstep of developmental crisis, but not beyond it. Schematically, we can say that early capitalism's ecological regime was one predicated on the *extensive expansion* of commodity production and exchange, born out of the multivariate movements of the economic recovery beginning in the 1450s. Insofar as it was extensive, European expansion differed little from contemporary expansions in China, South Asia, and elsewhere (Pomeranz, 2000; Richards, 2003). Insofar as its mode of expansion was *globalizing* and theoretically endless – tendencies that (re)materialized landscapes through the generalization of the commodity form – Europe's expansionary moment was a world-historical rupture of epochal significance. Such expansion was only nominally European in a civilizational sense; its endless thirst for land and labor rendered it paradigmatically capitalist. This early modern ecological regime was stunning in its speed, scope, and scale: encompassing successive waves of expansion in sugar planting (the Atlantic islands, Brazil, the Caribbean), silver mining (central Europe, Peru, New Spain), cereal cultivation (the Baltic, England), iron and copper mining and metallurgy (central Europe, Sweden, England), timber extraction (the Baltic, Norway, Finland, Russia, and eventually North America). To name just a few.

These waves of expansion were successful, and therefore they were ultimately self-limiting. By the eighteenth century, the ecological regime was issuing stagnant or declining returns. Europe's iron output had been stagnant relative to population growth for the better part of a century, despite relocations to greenfield zones, in Sweden above all. Even more problematic, the agricultural revolutions of the previous three centuries had run out of gas. In England most notably, but all across Europe (Kjaergaard, 1994),

the land-extensive demands of capitalism's early modern ecological regime had reached definite limits:

[P]er-acre and total yields from arable land remained flat and the threat of decline constant, until Britain began mining, importing, and later synthesizing fertilizer mostly after 1850.... [A]lthough the English studied continental practices, classical agricultural manuals, and their own experiments very intently, much of what they learned about how best to maintain soil fertility while increasing yields was not actually applied in England, because it involved highly labor-intensive methods and English capitalist farmers... were intent on labor-cost minimization and profit maximization. The methods they adopted instead, which raised labor productivity, represented a *fundamental break with much of the literature on best farming practices and actually interfered with preserving soil fertility in many cases*; it was in part because of these strategies that increasing amounts of off-farm phosphates and nitrates were needed in the nineteenth century just to keep yields from declining. In other words, without the new industrial [*sic*] inputs that came to its rescue, England might have had a hard time even maintaining its yields without putting far more labor into the soil (2000: 216-217, emphasis added).⁴³

⁴³ Berg agrees: “[A]gricultural improvement was labour-using rather than labor-saving” (1986: 101). On the centrality of labor-intensification as the chief means of increasing Euro-American agricultural productivity prior to 1850, see Clark, 1987. Pomeranz's thesis is well-supported by the experience of Belgium, among Europe's fastest industrializers in the 19th century. Belgium's land productivity continued to increase over the period 1750-1830 (Dejongh, 1999), in contrast to the English situation. But it seems likely that Belgium's rising land productivity, as Pomeranz's thesis would suggest, was effected by means of labor intensification. While Belgium's manufacturing output trebles over this period, Britain's increased by a factor of *seven* (Bairoch, 1982: 290, 292); meanwhile despite (or because of?) the former's emergence as a grain exporter (Dejongh, 1999), its population just doubles over the period 1750-1850, relative to a threefold rise for England (McEvedy & Jones, 1978: 43, 63).

The problem with putting it this way is that the debate has been so dominated by Malthusians and quasi-Malthusian economic historians, such that the limits to systemwide accumulation have been viewed ecologically-posed rather than created by the contradictions of early modern capitalism itself (e.g. Pomeranz, 2000). The Marxist tradition has largely ceded the terrain of ecohistorical crisis theory to the Malthusians, a legacy that has stymied efforts from the left to account for the crises in a way that would inform our understanding of global ecological crisis today. So let it be said from the outset, that ecological contradictions have played a variable role, sometimes pivotal, but certainly not decisive at *every* juncture. *Contra* the neo-Malthusian tradition, socio-ecological limits are not given but produced, albeit not under circumstances of one's choosing. Benton drives the point home: What constitutes a limit in one mode of production (or phase of capitalism) "may *not* constitute a limit for another" mode of production (or phase of capitalism) (1989: 79; also Moore, 2000a).

The Industrial Revolution retains its hold on the popular imagination as the historical and geographical locus of today's environmental crisis. A view that coexists, sometimes more easily than at others, with a profound faith in technological progress. I would suggest that a perspective on the Industrial Revolution as the *resolution* of an early moment of modern ecological crisis, *and* as the detonator of another, more expansive and more intensive reconstruction of global nature, offers a more historical – and therefore more hopeful and democratic – means of thinking through the problem of ecological crisis in the modern world. While the technological marvels of the past two centuries are routinely celebrated, it had become clear to Stanley Jevons as early as the 1860s that all advances in resource efficiency promised *more* (not less) aggregate resource

consumption. *This* is how the modern world market functions, towards profligacy not conservation. The technological marvels of the industrial era have rested on geographical expansion neither more nor less than they did in the formative centuries of capitalist development. Not only has the pressure to enclose vast new areas of the planet, and penetrate ever-deeper niches of social and ecological life, continued unrelented. (Witness the revival of interest in the so-called “new” enclosures.) All of this has been reinforced, in the same manner, by a radical plunge into the depths of the earth, to extract coal, oil, and all manner of strategic resources. It is an ecological regime that has reached, or will soon reach its limits. Whatever the geological veracity of the “peak oil” argument, it is clear that the American-led ecological regime that promised – and for half a century delivered – cheap oil is now done for. (An issue that of course has to do with much more than oil alone.)

It is from the standpoint that an accounting of earlier crises may help us discern the contours of the present global ecological crisis. At a minimum, it seems safe to say that historical capitalism’s preference for spatial fixes to its recurrent waves of crisis would seem to present a major problem on a world with very definite geographical limits. As long as fresh land and labor existed beyond the reach of capital (but still within capital’s reach), the system’s socio-ecological contradictions could be attenuated. The possibilities for external colonization foreclosed by the twentieth century, capital has been compelled to pursue strategies of “internal” colonization, among which we might include the explosive growth of genetically modified plants and animals since the 1970s; drilling ever-deeper and in ever more distant locales for oil and water; and perhaps most ominously, converting human bodies — especially those belonging to women, people of

color, workers and farmers — into toxic waste dumps for a wide range of carcinogenic and otherwise lethal substances (Davis, 2007).

These developments are new and not new at the same time, and this dialectic of continuity and rupture is precisely what so many observers of the present conjuncture have missed. There is of course no shortage of analysis when it comes to the proximate factors of contemporary environmental degradation — government policies, multinational corporations, international trade organizations and agreements, and so forth. But there is insufficient care given over to the task of situating these factors systemically, much less historically. Which means that we are left with abstractions rather than concrete totalities, “as if the task were the dialectical balancing of concepts, and not the grasping of real relations!” (Marx, 1973: 90).

There is a certain urgency to all this. There is by now widespread agreement that the world-economy has driven to the limits, and in some cases beyond, a whole range of ecological thresholds. The global ecological crisis is not impending. *It is here.* Ecologically-oriented social scientists and environmental historians would do well to take to heart the chief methodological insight of the historical perspective on globalization — namely that the most effective means of distinguishing the new from the old in the present socio-ecological conjuncture is to situate contemporary dynamics world-historically (esp. Arrighi and Silver, 1999). By locating today’s ecological transformations within long-run and large-scale patterns of recurrence and evolution in the modern world, we might begin to illuminate the distinctiveness of the impending ecological crunch. This means, as an initial step, situating ecological relations *internal* to political economy of capitalism — not merely placing concepts of ecological

transformation and governance *alongside* those of political economy, but reworking the fundamental categories of historical political economy from the standpoint of the actually existing dialectic of nature and society.

Once ecological relations of production are put into the mix, one of the chief things that comes into view is the production of socio-ecological regimes, on regional and world-scales both, that initially liberate the accumulation of capital. Over time, these regimes generate self-limiting contradictions that culminate in renewed ecological “bottlenecks” to continued accumulation. Whereupon the cycle starts anew, and historically speaking this has entailed progressively more expansive and intensive relations between capital, labor, and external nature. Although the point is certainly arguable, the moment of global expansion seems to have been central over the long run and it is not at all clear that capitalism can survive on the basis of the internal fix (*pace* Harvey, 2003). Among other things, this historical approach get us closer to a more useful formulation of “ecological crisis,” and the idea of multiple forms of ecological crisis in the modern world, past, present, and future.

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