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Nature–Culture Relations: Early Globalization, Climate Changes, and System Crisis

Sing C. Chew [1,*] and Daniel Sarabia [2]

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[1] Department of Urban and Environmental Sociology, Helmholtz Centre for Environmental Research—UFZ, Leipzig 04105 Germany
[2] Department of Sociology, Roanoke College, 221 College Lane, Salem, VA 24153, USA; sarabia@roanoke.edu
* Correspondence: sing.chew@humboldt.edu; Tel.: +49-341-235-1746; Fax: +49-341-235-1836

Abstract: Globalization has been on everyone's lips in light of the contemporary conditions. It has been viewed mostly as a stage reached as a result of long-term societal changes over the course of world history. For us, globalization has been an ongoing process for at least the last 5000 years. Little attention has been paid to the socioeconomic and natural processes that led to the current transformation. With the exception of historical sociologists, there is less interest in examining the long-term past as it is often assumed that the past has nothing to teach us, and it is the future that we have to turn our intellectual gaze. This paper will argue the opposite. We believe a long-term tracing of the socioeconomic and political processes of the making of the modern world will allow us to have a more incisive understanding of the current trajectory of world development and transformations. To plead our case, we outline the emergence of the *first* Eurasian World Economy linking seven regions (Europe, the Arabian Peninsula, East Africa, the Persian Gulf, Central Asia, South Asia, Ceylon, Southeast Asia, and China) of the world, with the exception of the Americas, starting as early as 200 BC, and the sequence of structural crises and transformations (trading networks and commodities) that has circumscribed the structures and trends of the current global system. Such consideration in our view is limited if we do not also include the relations between social systems and Nature, and the rhythms of the climate. For the latter, an awareness of the natural rhythms of the climate as well as human induced changes or climate forcing have triggered system-wide level collapses during certain early historical periods.

Keywords: social system crisis; social change; globalization

1. Introduction

Materialistically, world history has always been a history of the relationship between Culture and Nature. For at least the last five thousand years, this relationship has been an enduring one, whereby human communities from the least transformed in terms of complexity to the most advanced postmodern social systems have required Nature to meet their basic needs of survival and reproduction. If such is the case, then for the discipline of sociology this, therefore, should be *the overall dimension* that sociology should expend its overall efforts in understanding and explaining the processes and structures that reproduces this relationship. A relationship described by Marx [1] in his early writings as "the humanization of nature" and "the naturalization of man". Unfortunately, the history of sociological scholarship does not reflect this interest nor accept it as *the* dimension that should be its focus. With the global concern now focusing on global warming with environmental changes affecting social, political and economic processes, notwithstanding the "fashionability" of studying environmental changes these days, sociologists have over the last decade or so come around to

addressing this dimensional relationship with much fervor. Rather than using a broad brush to paint the absence and neglect of sociological scholarship in examining Nature and Culture relations, we wish to note of the early scholarship of Catton and Dunlap [2], O'Connor [3,4] and Schnaiberg [5] that did try to explore this Nature–culture dimension in depth, and especially Catton and Dunlap's call for an end to the human exemptionalist paradigm that has been underlining sociological scholarship. The outcome of this early intervention did not result in sociological scholarship focusing on biophysical factors as causal and dependent/independent variables and dealing with Nature as the phenomenon all to be examined *holistically and in a dialectical fashion*; instead what resulted was to treat such calls as *a* dimension of study (environmental sociology) in sociology like the various dimensions that sociologists were already focused on (sociology of the military, economic sociology, political sociology, *etc.*).

Our endeavor in this exercise is not to revisit every direction that sociological scholarship has taken in the area of the environment since the call of Catton and Dunlap [2], but rather to review only briefly the sociological scholarship focusing on political economy and system crisis that is the focus of our paper dealing with Nature–culture relations. The latter scholarship we are referring to are those theoretical analyses that utilize political economy models (for example, see Foster [6,7] and Moore [8] that have their anchors dropped in Karl Marx's ocean in their attempts to account for the social, political and economic processes in the reproduction of "capitalist mode of production" systems of the last 500 years. In doing this, we suggest that these Marxian political economy studies have not gone far enough in their frameworks ontologically and theoretically, for they have refrained from putting Nature front and center in their analytical calculations. Instead, these analyses treat Nature as a benign substrate as the base by which capital and its various modalities of modes of production utilize and desecrates in telling their versions of Marxist inspired history. We believe, they continue to treat Nature still within the human exemptionalist paradigm, and in certain cases Nature is viewed as a social construction, or in our view anthropocentrically, instead of seeing Nature and other natural processes as having independent and causal dimensions that have impacted on the reproduction of human societies over world history, thus, generating system crisis that these political economy analyses have endeavored to explain.

Our response to the aforementioned paragraph, without relying on theoretical or ontological rationalizations, will be through a historical materialistic exercise, propose our *ecocentric* framework through our articulation of world history whereby we combine "theoretically informed history and historically informed theory" to explain system crisis over *la longue durée*. Our *la longue durée* is not the 500-year time span starting from supposedly capitalist Western Europe that some like Foster [7] and Moore [8] present, but one that stretches over 5000 years of world history. Historically, in this context, we like to focus specifically on globalization as a phenomenon that has also gained wide currency and popularity these days, and specify the evolution of this global process in relation to the occurrence of natural phenomenon such as climate changes resulting in social system crisis over world history. We assert that Nature can be both an independent and dependent variable in determining the evolution of human societies. We suggest that Nature can be the "agent" in long-term social change (see for example, [9–12]). In this context, perhaps it is not "capitalist" socioeconomic relation that is the determinant in the last instance that shapes the trends and tendencies of world history over *la longue durée* like the Marxian political economists have asserted [13] (p. 9).

2. The Attempt to Green Marx

Among the Neo-Marxists, James O'Connor's [3,4] contribution was the first major reinterpretation of Marx's political economy with his insertion of Nature into the overall equation of understanding the contradiction of the process of capital accumulation in late industrial social formations. With the first contradiction of capital between labor and the owners of production ultimately leading to system crisis, O'Connor's insisted that there was a second contradiction of capital as well that has to be added and considered. This being the expansionism of capital tends to cause environmental problems that will ultimately lead to crisis in the reproduction of capital. The significance of O'Connor's writings is

his infusion and highlighting of Nature as the substrate for the reproduction of capital accumulation and that there is the tendency to cause social system crises with the exploitative use of Nature as a consequence of capital's inherent expansionism and incessant drive for increasing accumulation. Unlike other Neo-Marxists who at that time (1970s–1980s) were still preoccupied towards addressing system crisis via the process of accumulation and the social relations of production along with the role of the Capitalist state in this process, the insertion of Nature by O'Connor's stress on the second contradiction of capital shifted attention to the conditions of the times then. For that his intervention has to be applauded.

We can see that O'Connor's work influenced numerous Neo-Marxists leading to the development of a number of Neo-Marxist frameworks today. Instead of commenting on these developed frameworks *in toto* which will take up too much space, we propose to examine one that has garnered Neo-Marxist support in terms of publication and citations in sociology that we feel is pertinent to our article's proposals and objective. Here we are referring to the Metabolic Rift framework of Foster's [6,7] and extended by Moore [8,14].

In this model, Foster [6,7,15] proceeded by mining the seams of Marx's mother lode, especially *Das Kapital*, even to the level of footnotes to support Foster's attribution that Marx had always paid attention to Nature in his writings. In response to numerous critics of Marx who have stated that Marx did not in any systematic, exhaustive way address issues such as "the exploitation of Nature, Nature's role in the creation of value, the existence of distinct natural limits, Nature's changing character and the impact of this on human society, the role of technology in environmental degradation, and the inability of mere economic abundance to solve environmental problems" [7] (p. 168); Foster [7] argued that the ecological blinders are not present in Marx's thought, and that each of the aforementioned criticisms was addressed in his theory of metabolic rift. Delivering in his analyses coverage of environmental issues of salience during his time period, Marx addressed the problem of agriculture under capitalism and in particular made observations regarding the soil, while also turning his attention to deforestation, pollution in urban centers, and overpopulation [13] (p. 168). Through this particular lens, Marx came to understand sustainability and the tensions brought about by a rural urban divide, a nexus of relations some analysts conclude Marx captured in his model of social ecological metabolism [8].

Foster shows that in Marx's *Das Kapital* there is a critique of capitalist arrangements linked to the depletion of soil [13]. Marx, according to Foster [13], presented an explanation of "how large scale-industry and large-scale agriculture combined to impoverish the soil and the worker" (pp. 174–175). Foster [13] contends that both Marx's retort of Darwinian evolutionary theory and his formulation of social and ecological metabolism significantly explains the dialectic of capital accumulation and the exploitation of Nature and its various consequences while at the same time considering the relations of production.

In more recent publications, Foster [13] in keeping with the times updated his diagnosis and prognosis of late capitalist systems by alerting us to the supra level that we should be concerned with of the dangers that have now evolved to the level of the world system and the *planetary rift* that we are experiencing, and will face in the future. Foster [13] (pp. 213, 229) however true to his Marxian roots, continues to maintain that we should focus on the relations of production that is undermining ecological sustainability, and that "long-term prospects demand truly revolutionary change, especially a rupture with the accumulation/growth imperative of capitalism". Clearly one can see that Foster's metabolic rift is still placing its emphasis on the paramount status of Culture, with Nature being the substrate that provides value formation for capitalist social relations that are extended to other social structures such as urban and rural areas spanning geo-spatial boundaries on a planetary scale. By Culture's actions (capitalist social relations) Nature is impacted and degraded. This model just follows O'Connor's second contradiction of Capitalism type of argument nothing more nothing less theoretically. Anthropocentric in orientation, it is simply following the basic Marxian argument of the theory of value and crisis dressed up with specific references to natural elements and environmental sustainability.

Moore [8,16–24] satisfied with the Neo-Marxian ecological foundations that Foster had carefully constructed and legitimated via the publication of Foster's seminal piece in the *American Journal of Sociology* in 1999, proceeded to utilize this theoretical model to fashion a defense of Wallerstein's world system perspective accused of being neglectful of Nature [25–28]. Keeping within the dogmas of leftist understanding of the emergence Capitalism in Western Europe over a certain time period from either the 16th century to the late 18th century, Moore [16] undertook an exercise to "naturalize" the work of Wallerstein's analysis. By then, Wallerstein [29,30] himself had started to include Nature as a factor in his continuing analysis of the evolution of the modern world-system.

In trying to extend a Marxian analysis of Nature–culture relations, Moore's [8,17] recent attempt is to criticize the metabolic rift theory of Foster's by suggesting that Foster's model is dualistic, based on a Cartesian binary that puts "biophysical (nature) crises in one box and accumulation (culture/socioeconomic) crises in another" [8] (p. 2). For Moore, this leads to the conclusion that biophysical problems are outcomes of capitalist accumulation "but not constitutive of capitalism as a historical system" as he puts it [8] (p. 2). What this means is that Capitalism "develops through nature-society relations" and does not act on Nature. By fiat, Moore [8] (p. 2) declares capitalism is an "ecological regime"! Our reply to this is so is everything else! By such a theoretical move, Moore has flattened and collapsed society and nature into one with no distinguishing features, and not as young Marx [1] and Habermas [31] had distinguished of the different objectifications: that of the natural world and that of social/individual worlds, and in praxis, nature is socialized and the human is naturalized. This attribution of Moore's that Capitalism as World Ecology advances Capitalism—which is a theoretical concept—into a concretized entity having nature-like properties and rhythms. Therefore, Nature to Moore is a *social construction* devoid of its natural properties, and instead Capitalism is the living, breathing organism oozing the sweat of labor. Again, instead of giving *equal* weight to the dimension of Nature and the dimension of Culture, and acknowledging the distinct characteristics of Nature as subject/object, Moore's model remains within the framework of awarding paramount status to Culture, in this case for Moore, Capitalism; and hence anthropocentric. To further this notion of Capitalism as an ecological regime, the theory of value of Marx was imported by Moore to furnish the scaffolding for his model of Capitalism as World Ecology. Distinguishing distinctions in Marx's theory of value under conditions of overproduction and underproduction, Moore proceeds to sketch out the different historical periods that can be explained according to the different types of the logics of capital accumulation in order not to flatten the historical epochs nor generalize the logic of capital accumulation. Such a theoretical stance is then used to turn the different logics of capital accumulation to account for the history of capitalism or historical capitalism.

We have several reservations concerning Moore's model: Firstly, inspite of Moore's persistent reference to *the dialectic*, we do not see any dialectical process in Moore's model. With his constant resort to *the dialectic* to explain the logic of the model he is proposing, one wonders *what is the interplay between the "particular" and "universal" or of the "moment" and totality for him?* By in the "moment", we mean a phase or aspect of a cumulative dialectical process; and not just a period in time. Moore for wanting to be dialectical chose in referring to the logic of capital accumulation process from *Das Kapital* as his methodological reference point instead of Marx's *Grundrisse*. *We are confused as to what is the particular in relation to the totality for Moore.* For him, we think, Capitalism is his totality and everything else gets subsumed. It is rather difficult for us to accept ontologically that Capital is considered the totality and everything else are particulars. But if one wants to employ the dialectical process, the universal or totality and the particular proceed through history in a constant interplay resulting in a transcendence (*Aufhebung*) with no end (no complete identity). For Moore the culture/nature relation is Historical Capitalism, therefore the totality and particular are one, or as he [8] (p. 34) puts it: "Capitalism does not have an ecological regime; it is an ecological regime." Collapsing the "universal" and the "particular" is by no means dialectical nor transcending, it annihilates the course of history (*Auflösung*); hence no freedom and no history! We are puzzled that Moore would subscribe to this philosophy of history for he is undertaking a Marxist dialectical analysis or at least that is his intention.

Secondly, Moore [8] (p. 17) suggests that his project moves "from the analysis of what *makes* capital to what capital makes, from the logic of capital to the history of capitalism". This means a rigorous inspection of historical events of accumulation on a world ecological basis. Despite Moore's enthusiasm [8,16–24] for the work of Marx and the Neo-Marxists and their analyses of Capitalism, Moore seems to be unaware of the vigorous debate on the nature of "capitalism", its time emergence and its duration that have taken place in world-systems analyses. Moore's fervent attempt to theorize Capitalism as historical capitalism with its long cycles never grapples with the numerous works that have been produced over the last two decades under the umbrella term of world system history whereby there are concentrated discussions on what is "capitalism", the duration of the world system, and the various dynamics underlining such a system from hegemonic rivalry, core-periphery relations, the global accumulation process and long waves (see for example, [9,10,32–41]). Following Wallerstein [42] for Moore, the emergence of capitalism and the capitalist mode of production, its duration and nature all began in the 15th century in Western Europe. World history for Moore starts then, and there was no history before then. Moore's historical capitalism began then and evolved, anything else before this watershed moment were ignored or considered unnecessary to our understanding of culture/nature relations over world history. Moore's historical analysis therefore is limited and this reservation on our part can also be applied to Foster's work [7]. The adherence to the 15th century for the rise of the "capitalist" mode of production in Western Europe, Moore's model suffers from the same accusation of being Eurocentric that the late Frank [36] had leveled at the world-system history of Wallerstein [42].

3. Historical Globalization and System Crisis

For the Left, in trying to explain globalization there are basically two narratives. The first argues that globalization is the *stage* reached with the process of accumulation starting at the nation-state level followed with the export of capital in the form of imperialism, and over time the accumulation of capital covers the globe. The other states that globalization is a process that has occurred through world history, and that it is not a stage reached but one that started at different time periods. For Wallerstein [42], it was the 15th century, whereas for Frank [36] and others [9,10,37,40,41] the process started at least 5000 years ago.

If it is not a stage reached but an evolving process, we can make the assumption of the evolution of a structure that we can categorize as a world economy/system. We use the term world economy instead of world-economy as the latter has been utilized by world-systems specialists for a historical structure that has a certain set of socioeconomic and political attributes and trends "capitalistic" in nature that do not necessarily cover a wide geographic space. To world-system specialists, this historical structure of a world-economy is a world in itself, hence the hyphenation between world and economy [43]. In our case, a world economy is not distinguished necessarily by a mode of production but that it covers a *global geographic* space with multiple cores/regions linked at a minimum by a trading system. *It is an evolving global economy "of the world"*. Depending on the temporal sequence, an economy of the world encompassing different chiefdoms, kingdoms, civilizations, empires, and states in a global division of labor, technology, and knowledge circumscribed by different cultural patterns.

Regardless of time or geographic space, this historical globalization process is punctuated with system crisis that impacts on the regions of the world. The spread of such crisis conditions and what it covers is determined by the systemic connections of this world economic structure that continues to evolve and transform to overcome these systemic crisis phases. These systemic crisis phases termed as Dark Ages are not only distinguished by downturns in socioeconomic conditions and political rivalry but are also characterized by climate changes and natural environmental degradations [9–11]. These crisis phases—occurring in the past and more to come in the future—were by no means continuously exhibiting increasing ecological degradation. These periods also led to lesser ecological degradative practices because of the socioeconomic decline [10]. Climate changes should also be considered as a major factor in the precipitation of system crisis [11].

If we examine world history in terms of trade connections, we can trace the contours of a "regional" world economy encompassing the Eurasian region of Mesopotamia, the Arabian Peninsula, Levant, Anatolia, Iran, the Indus Valley, and Egypt by 3000 BC [9,10]. Beaujard [44–46] has identified three possible regional world systems from 1000 BC onwards. For him, there was the Western world system, the Eastern world system, and the Indian world system during the Iron Age with growing interactions between these systems from 350 BC onwards. Regardless of whether it is a single world system that started in the Fertile Crescent and over time encompassing other regions of the world as postulated by Frank and Gills [33] or Beaujard's [46] three regional world systems coalescing into one world system, what is clear is that by *the turn of the first century of the current era* we find a world system encompassing Europe, East Africa, and Asia (South, Southeast and East) [9,10,46]. In world history, we can conceive of it as the *first Eurasian* world economy as the only major region that has not been connected at this point in world history is the Americas.

Conceptually, the factors and processes that trigger system crises or Dark Ages over the last five thousand years of recorded human history have not been fully understood. Their identifications have relied on analyses of the political economy of the world system in the 1970s and 1980s, and on the whole, based on Marxian crisis theory. The outcome of this is that several interrelated and intrinsic factors have been distinguished providing conditions for the generation of barriers to system reproduction: overproduction/under consumption, crisis of state authority and competition, social exploitation and polarization leading to antisystemic social movements, and crisis of sustainability. Clearly, the first three factors relate to the dynamics occurring at the social (world) system level with the fourth focusing on the interaction between the social (world) system and the natural system. With the first three factors being anthropogenic in origin, system crisis and transformations are considered to have socioeconomic and political roots.

Notwithstanding such a declaration of economy as being determinant in "the last instance" in terms of system reproduction, others for example, such as O'Connor [3,4], Chew [25,26], and Roberts and Grimes [27] have declared the need to treat Nature as part of the equation towards understanding system dynamics. As we have identified in the previous section, O'Connor [3] has stated that besides the widely accepted capital/labor relation contradiction, there is also a second basic contradiction of capitalism: the capitalist system's insatiable consumption of natural resources leading to crisis conditions. If the latter is the case, on several occasions, one of us (see for example Chew [9,25]) has suggested that based on a materialist conception of history we should reintroduce Nature back into social analysis, and perhaps it is "ecology in command" in *the last instance* that induces system crisis conditions. The rationale for this is based simply on the material fact that the social system requires the natural system to reproduce itself. Along this vein, some historians have also recently raised the issue of Nature's historical agency in conditioning the transformation of human societies [12,47]. Besides Nature's agency, we would like to assert that in the long run, perhaps climate is an important driver of social system structural crisis. This we will attempt to show in this paper.

Besides the above considerations, it is also clear the duration of these world system crisis phases have not been worked out clearly. Different duration for each crisis phase has been proposed according to the different views of world system development [9,33,36,38,41,42,48]. Time-wise, the duration stretches from 50 years to a thousand year in length. Such differences are based on a number of factors and conditions such as the span of historical epochs, empirical verification of economic stagnation, sociopolitical trends, and natural system indicators such as the rate of deforestation.

What the Marxists and other world-system theorists have suggested to date for the past system crises have been recurring and contingent factors of an anthropogenic nature that condition system crises. What about those of ecological and natural origins? Ecologically stressed conditions (deforestation, soil erosion, desiccation, *etc.*), climate changes, and tectonic shifts/volcanicity have been proposed as factors that can precipitate system crises [9,25,26]. How can we be more precise in demarcating these ecological factors? We believe our precision can be enhanced by materialistically identifying system crises with recurring Dark Ages that have occurred in human world history. For it

is during these Dark Ages that system transformations occur. Not only do we witness socioeconomic and political declines, but also, ecological degradation, climatological shifts, and natural disturbances. Climatological changes and natural disturbances (tectonic shifts) recalibrate our understanding of the evolution of the world system by adding natural system factors to the already declared anthropogenic ones for our understanding of system transformation.

Given the above parameters, we can abstract historically the several processes and factors that depict a Dark Age period in order to have a clearer understanding of the various factors that precipitate a system crisis and transformation. Such an abstraction starts by delineating the connections between the natural system and social system in the reproduction of the world (social) system.

Barriers to the reproduction of the world system are formed when humans induced changes to the ecology and climate. The degradative aspects of human activity are conditioned by social organizational factors (urbanization, accumulation, wars, technological innovations, and population) that impact on system reproduction. Natural disturbances such as earthquakes and volcanic eruptions also condition the reproduction and evolution of the world system, and thus work independently. Climate as well can affect precipitate and affect the crisis independently and also dependently. For the latter, human actions can cause climate changes, for example, global warming, and thus causing the crisis. We need, therefore, to consider the degree of weight these factors have in precipitating a system crisis.

Through the course of human history, system crises have appeared in the "concrete" in the form of Dark Ages. Over world history, these historical phases are rare. Between 3000 BC and AD 1000, there have been indications of only two such identified phases (2200 BC, 1700 BC and 1200 BC–700 BC (considered as one phase in terms of the crisis of the Bronze Age) and AD 400–AD 800/900) occurring in the world system from Northwestern India, West Asia, the Mediterranean, and Europe. Several scholars such as Desborough [49], Snodgrass [50–52], and Braudel [53–58] have discussed the conditions of life during past Dark Ages highlighting the economic, political and social disorder with population losses, deurbanization, *etc.* Furthermore, historical records and archaeological evidence indicate a flattening of the social hierarchy, and devolution away from a complex form of sociopolitical organization and lifestyles that existed prior to the onset of Dark Ages. The trends and patterns of Dark Ages therefore show developmental reversals: fall in population levels, decline or loss in certain material skills, deurbanization and migration, decay in cultural aspects of life, fall in living standards and thus wealth and trading contacts.

If Dark Ages are prolonged ecological crisis periods, crisis provides opportunities. In other words, crisis conditions provide the opportunities for the resolution of contradictions that have developed to such a state that inhibits the reproduction of the world system. It leads to pathways and processes that would mean system reorganization and transition. If reorganization does not occur, system collapse usually follows. This has been seen historically (see for example [9,25,26,59–61]). If this is the case, ecological limits become also the limits of the socioeconomic processes of the world system, and the interplay between ecological limits and the dynamics of the social system define the historical tendencies of the human enterprise [9,11,60].

To this extent, Dark Ages or system crises also offer opportunities for Nature. Dark Ages should be appreciated as periods for the restoration of the ecological balance that has been disrupted by centuries of intensive human exploitation of the natural system. The downscaling of socioeconomic processes during Dark Ages provides the opportunity for Nature to recover.

4. The Bronze Age Crisis

The Ancient World System

The ancient world of the Near East and Northwestern Indian subcontinent during the third millennium was characterized by a system of overlapping core regions (for example, Egypt, Mesopotamia, and Harappan Civilization of Northwestern India) (see for example [9,33,62]). Within

such a political economic matrix, each core interacted with its immediate hinterland and with each other leading to certain core regions attempting to manipulate its adjacent hinterland, and at times trying to control it [9]. Given such political incursions and trading initiatives, systemic connections were established, and during moments of systemic crisis, crisis-like conditions reverberated throughout the system providing opportunities and constraints depending on the circumstances.

In the Far East, there were no systemic connections with the Near East at this point in time. It was to come later around 200 BC. System-wise, we have two subsystems in place at the start of the Bronze Age crisis. In the Near East we have a subsystem encompassing Southern Mesopotamia, Northwestern India, the Eastern Mediterranean including Egypt, and Central Europe. In the Far East, there was a subsystem with geographic coverage enclosing China and other parts of East Asia.

The accumulation of surplus, urbanization, and population growth are the prime drivers of the processes of the social (world) system, which in turn, define the social (world) system's interactions with the natural system [9]. The interacting relationships among urbanization, population and production/trade mean that resources from the natural system are utilized for the reproduction of the social systems. Thus social collapse and/or crisis of the natural world can be attributed to the excessiveness of the dynamics—accumulation of surplus, urbanization and population growth—of the social world. This is just one side of the equation. We contend that the other side of the equation that encompasses Nature–culture relations (leading to natural resource scarcities and landscape degradation) and *climate* are also key factors affecting socioeconomic and political collapse.

By the late third millennium, sailors from the Aegean were able to sail to the Syro-Palestinian coast thus linking the Aegean and Central Europe by sea with the Near East. Such types of connections foster the beginnings of a "global" division of labor from Northwestern India to the Eastern Mediterranean, and of long-distance trade articulated within a single interacting whole: the Bronze Age World System. We thus have the beginnings of a globalization process, and the emergence of the world system that started five thousand years ago.

Viewed from the perspective of Nature, such world historical processes (urbanization and accumulation) induced a continuous and degradative transformation of the landscape. Trees were removed for agriculture, and to meet the energy and material needs of urbanizing communities. The valleys were excavated for canals to provide irrigation for crops, and for the transportation of people and goods. Other lands were dug up for their natural resources and building materials. Such wide-scale human activities such as deforestation led to soil erosion in the mountains and hills, and the continuous impact of human activities further heightened the process. Rivers were dammed. In all, socioeconomic activities along with wars were transforming the landscape with scars revealing the scale of such acts.

In *World Ecological Degradation*, the level and scale of resource use by the core centers from near and afar in the third millennium BC was traced [9]. This history started on an intense trajectory from the fourth millennium onwards, and by the third millennium BC, after one millennium of drawdown of the natural capital, the natural system and social system was exhibiting signs of crisis type conditions. They emerged stretching over very long duration. Accompanying these long phases of ecological crisis were climate shifts and eruptions of natural processes that impacted on the social, political, and economic landscapes. Economic downturns followed with social-political unrest. The combination of all these conditions induces a *systemic* crisis of the world system. One such *systemic* crisis or Dark Age began around 2200 BC impacting initially Northwestern India, the Gulf, Mesopotamia, Egypt, and West Asia and had repercussions for the urbanized core areas such as Mesopotamia, Indus, and Egypt [9,63–66]. Following this phase of the crisis ending around 1700 BC, new power centers emerged in the Near East, Northern Mesopotamia, and the Eastern Mediterranean. This systemic crisis reemerged around 1200 BC at the social system level and continued until 700 BC, impacting the main areas of West Asia, Egypt, Eastern Mediterranean, and central Europe (from 800 BC onwards).

5. The Early Phase of the Near East System Crisis (2200 BC–1700 BC)

Natural System Changes

If as we have argued in the previous pages that world system crisis is also an ecological crisis accompanied with climate changes and natural disturbances (tectonic shifts, *etc.*), we should be able to find trends that reflect the ecological injuries that Nature suffered as a consequence of social (world) system dynamics of accumulation, urbanization, and population increases. The level of deforestation is a good proxy to indicate the state of the natural environment and we do find indicators of severe deforestation during the Bronze Age crisis period starting from 2200 BC onwards.

Over world history from at least 3000 BC onwards, the available forests have been intensively exploited to meet the needs of an evolving world system, starting from the core centers such as Egypt, Mesopotamia, and Harappa [9,67,68]. In the Mesopotamian case, high quality timber were sought for either through military expeditions or trade in the Zagros and Taurus mountains, the Caspian Sea area, the Eastern Mediterranean, and in Punjab [69,70]. In the Harappan case, NorthEastern Punjab (on the Siwaliks and the foothills), and the Western Ghats were the immediate areas of deforestation. Teak came from the Gir forests or from the Panch Mahals, Surat and the Dangs [71]. Timber was also sought as far as the Himalayas. The Egyptians sought their wood in neighboring areas of Lebanon and parts of the Syrian coast. For Northwestern Europe, from as early as the third millennium BC, there was extreme deforestation caused by extensive land use and animal husbandry [60] (pp. 281–292).

From an empirical analysis of the trend lines of arboreal pollen covering four geographic regions of the world: Western Europe, Central and Eastern Europe including Russia, Northern Europe and the Mediterranean, we note of severe deforestation phases [10].

The first phase of deforestation started from 3854 BC–2400 BC, and there were three/four subsequent phases of deforestation followed by reforestation that occurred towards the latter period of the course of a Dark Age. Deforestation periods are the most pertinent time points for our discussion of the ecological degradation of the early Bronze Age crisis. With one deforestation period starting around approximately 2400 BC, this dating also corresponds with Barbara Bell's [65] identification of the first Dark Age of the Ancient World. In Western Europe, arboreal pollen from areas in Belgium, Germany, and France exhibit the deforestation period starting around 2200 BC–2000 BC. In Central and Eastern Europe, trend lines of arboreal pollen show deforestation levels in areas of Hungary and Ukraine. In Northern Europe, the trend line of arboreal pollen in an area in Finland also supports this deforestation pattern. Finally, in the Mediterranean, we find areas of Greece, Spain, and Turkey exhibiting such trends. The latter area of Turkey is most pertinent for present discussion for it is where the Southern Mesopotamians sought their natural resources.

Agriculture and other anthropogenic induced changes naturally lead to forest fragmentation and deforestation, and the rise in the pollen record of indicator plants and ground weeds such as *Plantago lanceolata* [72] (p. 224); [68] (pp. 12–25). Time phases of the *rise* in the number of *Plantago* pollen when there was a *decline* in the number of arboreal pollen, supports the thesis of anthropogenic induced deforestation over five thousand years of world history.

Climate-wise, there is evidence of temperature changes (higher temperatures) and increasing drought-like conditions persisting in the Eastern Mediterranean, Egypt, West Asia, Mesopotamia, Northwestern India, Central Asia, Africa and parts of the New World starting from 2200 BC onwards during the onset of the Dark Age of the third millennium [9,73–78].

According to Fagan [77] who has argued on the impact of climate change on civilizations, this start of a warming trend again was a global event. Affected areas covered Egypt, Northern Africa, Greece, Indus, the Fertile Crescent, Crete, Russia, West Asia, and Palestine [9,65,74,77,78]. Between 2710 BC and 2345 BC, Anatolia and the Northern Crescent had arid conditions, however the Nile floodings continue to be high [79]. However, by 2205 BC, the starting time point initializing the start of the Bronze Age crisis, the Nile floods had weakened. From 2205 BC–650 BC, a period that covered the Bronze Age

crisis, there was widespread aridity in Anatolia and the Northern part of the Fertile Crescent including Northern Africa [79].

For social systems with agricultural practices that are reliant on irrigation waters or from annual floods, this loss of moisture would place tremendous stress on the agricultural systems and hence, the economy and social-political stability [73]. Such was the case for the core centers of Mesopotamia, Egypt, and the Harappan civilization. Each responded differently to such stressed conditions depending on what they were facing.

The climate changes were also accompanied with the occurrences of tectonic shifts that added further strain to the social system. Tectonic shifts by themselves would not immediately impact on the reproduction of the social system unless they are in the immediate proximity of human communities or they reshape the contours of the landscape by shifting river courses. The latter is what happened in the second millennium BC By diverting watercourses, the diversions transformed some rivers into dry waterbeds that further exacerbated the already existing aridity, thus impacting on social system.

For this time period, in Northwestern India, Agrawal and Sood [80] noted of tectonic shifts that diverted the course of the Satluz and the easterly rivers away from the Ghaggar, which over time transformed into a lake-like depression during this period. The Ghaggar or Sarasvati which feeds into the Indus River was alive until the late Harappan Period (1800 BC) but was dead by the time of the Painted Grey Ware period (1000 BC). Possehl [81,82] has also confirmed this drying up of the Sarasvati and its implications for the Harappan urban complexes located on its riverbank.

Beyond the above core centers of Mesopotamia, Egypt, and the Harappan Civilization of Northwestern India, temperature changes also impacted on other ecological landscapes. In Western Asia, the introduction of Zebu cattle, which can withstand aridity, occurred during the two arid periods (2200 BC and 1200 BC) of the Bronze Age [83,84]. In central Eurasia, preliminary data also confirmed marked changes in vegetation, beginning around 2200 BC and lasting until 1700 BC [85,86]. Pollen cores indicate a sharp decrease in arboreal pollen and an increase in steppe pollen. From 2200 BC to 2000 BC, there was a severe drop in forest cover and an increase in steppification, leading to an expansion in steppe landscape from 1800 BC to 1700 BC. The pollen profiles for the region discussed in the previous section also confirmed the deforestation process. Arid conditions also affected arable land, which caused severe pressure on animal husbandry of the steppe population. The lush feather grass steppe growing on the landscape near Kalmykia for example, from 2500 BC–2200 BC gave way to dry scrubby vegetation—wormwood steppe—and even desertification by 2200 BC–1700 BC. This changed ecological landscape led to outmigration of the sedentary population from river valleys with time, and exploitation of the steppes for animal feed.

6. Socioeconomic and Political Transformations 2200 BC–1700 BC

Socioeconomic and political trends during Dark Ages are reversals of what occur during periods of expansionary growth.

6.1. Deurbanization and Migration

Tracking the reversals in socioeconomic trends during Dark Ages or over the very long-term requires considerable effort, especially when the quantitative data are sparse. Some recent attempts such as that of Modelski [37] and Thompson [40] on urbanization and economic expansion have provided us with some broad contours on these processes. In terms of urbanization, by 3500 BC for the "heartland of cities" such as Southern Mesopotamia, urban growth had progressed to such an extent that it had three cities with population at or over 10,000 [37].

By 2500 BC, during the period of Early Dynastic III, the rise of Sumer exhibited the largest urban conglomeration at 60,000 persons. Uruk by this time had been reduced to a population of 40,000 in comparison to 80,000 in 2800 BC [37] (p. 28). However, the total urban population of Mesopotamia at 2500 BC had reached 290,000 [40]. Outside of the "heartland of cities", we find Ebla located in Northern Syria with a population of about 40,000 and Mari in Northern Mesopotamia with a similar

population size. Elsewhere, we have Memphis in Egypt at 30,000 persons, Mohenjo-daro and Harappa in Northwestern India at 20,000 and 15,000, respectively.

By 2200 BC, the Akkadian period and the start of the Dark Age Phase 2, the total urban population of Mesopotamia had been reduced to 210,000. This shift is also reflected in the proportion of declining urban settlement sizes. During the Early Dynastic Period II/III (2800 BC–2300 BC) the percentage of urban settlements with more than 40 hectares was about 78.4%, by the Akkadian Period (2200 BC) it had been reduced to 63.5%. Further deurbanization continued that in the Ur III and Isin-Larsa periods (2100 BC–1900 BC), and the percentage dropped further to 55.1%. This slippage continued to the Old Babylonian period, reducing further to 50.2% (1600 BC). Conversely, non-urban settlement sizes (10 hectares or less) increased. During the early Dynastic II/III period, it was about 10%, almost doubling by the Akkadian period. With the arrival of the Ur III and Isin-Larsa periods, the percentage had risen to 25%, and almost tripled to about 29.6% by the Old Babylonian period in comparison to the Early Dynastic period. This deurbanization process and migration to rural communities are also supported by the population decreases in Mesopotamian cities. From 210,000 during the Akkadian period (2200 BC), the population in Mesopotamian cities was reduced to 190,000 by the Isin-Larsa period (1900 BC). This was a loss of 10%. The population level was reduced further to 70,000 by the Old Babylonian Period (1600 BC). Overall therefore, between the start of Dark Age Phase 2 (Akkadian Period) and its end around 1700 BC (Isin-Larsa and Old Babylonian periods) we see a loss of over 66% of the urban population in Mesopotamia.

Deurbanization and population losses were also repeated in Northwestern India. According to Possehl [81,82], by the late third millennium BC there was evidence of abandonment of important buildings in the highly urbanized setting such as Mohenjo-daro where we find the Great Bath and the Granary devoid of human use. Concurrently, the Sindh region and the Baluchi Highlands also witnessed depletion and deterioration. By the early second millennium BC, Baluchistan was uninhabited. Cholistan, in Northwestern India, experienced a drop in size in terms of settled areas from an average of 6.5 hectares in 3800 BC–3200 BC to 5.1 hectares by 1900 BC–1700 BC, and finally to almost 50% less (2.6 hectares) by 1000 BC [81]. In the Sarasvati region, the shifting and drying up of the river system saw the abandonment of settlements in the inland delta of Fort Derawar. The latter area was the breadbasket of the Mature Harappan civilization.

Elsewhere for the time period of 2200 BC, similar signs of deteriorating conditions were also encounters in Anatolia, with abandonment of urban centers such as Troy II to Troy III–IV [48,87] (p. 139–152). Consequently, depopulation also resulted. Sedentary population settlements on the Anatolian plateau were also abandoned. To the west of Anatolia, Palestine also suffered such crisis conditions [88]. Walled towns were replaced by unwalled villages. There were signs of cave occupation and migratory movements. In some areas, settlements completely disappeared, and remaining settlement sites were reduced by more than half of what existed before 2200 BC [89] (pp. 1–38). Across the Mediterranean from Palestine, the Aegean experienced distress, though to a lesser extent. Between 2300 BC and 1900 BC there was a loss of sedentary population. Such losses were experienced both on mainland Greece and even Crete [90,91].

For central Eurasia similar stress conditions also prevailed. The changed ecological landscape led to out outmigration of the sedentary population from river valleys over time, and exploitation of the steppes for animal feed. Denucleation occurred with the establishment of smaller communities near oases. This spread occurred in Central Asia at Korezm (south of the Aral Sea) and Margiana (Murghab Delta) in Turkmenistan, Bactria, and Western China. This process prompted by ecological degradation and environmental changes, also occurred in Syria and Jordan. Migration out of urban centers located on the coast to the interior, and the establishment of smaller village type-settlements resulted [92] (pp. 267–273).

6.2. Political and Social Changes

If we examine the Dark Age of 2200 BC–1700 BC, political instability is one feature that highlights the political economic events. Climate changes as identified above led to famines that in turn generated political upheavals and the dissipation of central authority in Egypt. Drought conditions and lowered Nile flooding impacted on the farmers' ability to pay taxes because of lower harvest yields. This resulted in local administrators and governors, who collected taxes, having to delay their transfers to the Royal House. In turn, the King's revenues plummeted, and thus impaired his ability to pay for an army or to deal effectively with drought and famine. As a result, the stability of the political regime was affected. The sum effects of this in terms of political stability, as Bell [65] has concluded, were short reigns.

Besides political instability in Egypt during the third millennium Dark Age of 2200 BC, other reversals also occurred such as artistic degeneration and the downsizing of monumental buildings as a result of diminishing resources. The size and elaborateness of the pharaonic tombs were reduced; by this time, the tombs of kings were one-chambered affairs with less ambitious layouts [93] (pp. 316–319). Boundaries of provinces were also closed to prevent mass migration out of famine stricken areas. All these initiatives proved fruitless at times as riots broke out along with the ransacking of granaries.

In other parts of the system such as Southern Mesopotamia and Northwestern India, structural political, economic and social reversals were also occurring. These transformations were extremely impactful in view of the trading relations of the region among Southern Mesopotamia, the Gulf, and Northwestern India, and led to the demise of social systems in place with repercussions system-wide. By the third millennium BC, Southern Mesopotamia, the Gulf region and Northwestern India were linked in a trading network of commodity exchanges. Therefore, a crisis in one part of the system would also mean a translation of this stress to other parts of the system. Therefore, an ecological stress in Southern Mesopotamia would mean a lowering of agricultural output or production, and hence a drop in imports and demand. Reductions of demand in Southern Mesopotamia would impact on other regions such as Dilmun in the Gulf and the Harappan civilization through a diminished demand for their material and goods. What this type of dynamics further suggests is that supply and demand might not necessarily be a consequence of the state of the economy or based on consumer tastes and needs. But rather, supply demand dynamics are inextricably linked to the connections between the natural system and social system. Thus, anthropocentric explanations provided for systems demise have ecological roots.

Southern Mesopotamia by 2200 BC was experiencing salinization problems leading to lowered agricultural productivity and this became acute by 1700 BC. It never recovered from the disastrous decline in agricultural yields that accompanied the salinity issue. Deurbanization was the order of the day as we have indicated previously. Urban life and culture continued on a declining scale with the population concentrating only in major towns [94]. The Harappan civilization not only had to face ecological stress, climate changes with temperature increases and arid conditions like Southern Mesopotamia, it also had to undergo tectonic shifts. As the urbanized communities of the Harappan civilization were linked to the overarching Gulf trade and beyond, its infrastructure and surrounding hinterlands had therefore developed and specialized in the manufacture of products and natural resources for export. Thus, when its exports to the Gulf and beyond disappeared, it could no longer reproduce the accumulation process that had sustained its urban growth. This led to migration to the rural areas of the North and south.

7. The Final Phase of the Near East Bronze Age Crisis (1200 BC–700 BC)

The demise of Southern Mesopotamia and Northwestern India coupled with the socioeconomic and political upheavals in Egypt and their associated hinterlands from 2200 BC to 1700 BC initiated a significant system crisis of the Bronze Age. With the socioeconomic collapse of Southern Mesopotamia and Northwestern India, the demise of these economies meant also the breakdown of the Gulf trade.

After 1700 BC, at the social system level, despite the fact that ecological stress (at the natural system level) continued as reflected in the arboreal profiles listed in [10] (p. 49–53), economic recovery resumed. With recovery, other parts of the Bronze Age system such as the Eastern Mediterranean littoral (centered around Crete and mainland Greece) along with central Europe and Anatolia increasingly began to take advantage of the vacuum generated by the collapse of the Southern portion (the Gulf Trade) of the Bronze Age system. Egypt, Syria-Levant (such as Ugarit, Mari, Byblos, Ras Shamra), Crete, Cyprus and mainland Greece expanded their trading volumes utilizing the peripheral areas such as Central and Eastern Europe, and Nubia for their resource needs [9,95]. With the loss of trading dominance of Southern Mesopotamia, Mesopotamian trade shifted Northwards, thus making Anatolia an important Eastern node of this Bronze Age trading network [9]. In sum, the Eastern Mediterranean littoral became the prime axis where economic activity of the Bronze Age system concentrated during this period.

The social system adaptation and resolution of the crisis of the Bronze Age that started at 2200 BC and ending around 1700 BC was only *temporary*, for over *la longue durée*, because of the continued ecological stress and degradation including climate changes, social (world) system crisis would only appear again in 1200 BC The system crisis of 1200 BC repeated what occurred in 2200 BC except that when it finally dissipated we have system transformation with the arrival of the Iron Age.

The collapse of the Southern portion of the Bronze Age world system led to the reconfiguration of the trading networks. Shifting away from the Gulf region, the trading networks range from Crete, the Cyclades, and the Greek mainland on one side of the Aegean Sea with Troy, Cyprus, and Anatolia located across from it. Included in this configuration were the communities of Syria and Palestine, and the kingdom of Egypt. This network of socioeconomic exchanges of the Eastern Mediterranean region was also linked to communities of Western, central, and Eastern Europe, and Central Asia [61]. It was a globalized system of trade and sociopolitical exchanges.

Within this trading network, intermediary centers such as Crete increasingly played a part in the Eastern Mediterranean. The Minoan command-palace economy was involved not only in the export of surplus agricultural produce such as grains and oil, but also in the export of textiles, metal works, pottery, wood work, *etc.* [9,61]. Initially, such a diversified economic structure provided it with a competitive advantage over other regions of the Bronze Age system such as mainland Greece, the Cyclades, and Europe to the North.

Later in the millennium, the rise of Mycenaean Greece in this era increasingly eclipsed the role Crete played in the Easternmost region of the Bronze Age world economy [9]. On this trading backbone, Mycenaean Greece began to establish its economic dominance within the Aegean. Similar to the Cretan economy, Mycenaean Greece exported wine, olive oil, grains and manufactured products to Eastern and Northern Europe, and the Eastern part of the Mediterranean, and in turn, received needed natural resources such as copper, tin, and horses. To the East of this globalized Bronze Age trading system was the kingdom of Hatti with metallic resources such gold and silver whereby these precious metals were exchanged for textiles, lapis lazuli, olive oil, grain, horses, tin, *etc.* Trade contacts were established with Babylon, Mittani, Assyria, Syro-Palestine, Egypt, and Crete.

The globalizing trajectory was extended starting as early as 2000 BC onwards when these cores in the Near East as Kristiansen and Larsson [61] (p. 99) put it "turned their interest towards the barbarian peripheries in Central and Western Europe" for their natural resources and livestock such as horses. In the Caucasus, the mines supplied the copper, and there was the development of a Circum-Pontic metallurgical province that included Anatolia [61,96–98]. With such development, the central and Western European metallurgical centers were "increasingly drawn into trade relations with the palace cultures and city states of the Eastern Mediterranean and Anatolia, which reached a new flourishing after 2000 BC when the Minoan palaces were built" [61] (p. 104).

It should not be assumed that these trading networks were stable structures over time. It was a globalized system of interconnected regions and polities—a world system. Their vitality and concentration changed over time, and were conditioned by the pulsations of ecological and climate

changes, notwithstanding political and economic ones. Thus, when the Dark Age returned in 1200 BC, the collapse was system-wide due to the level of connectivity.

7.1. The End of the Bronze Age in The Near East

If 2200 BC was the start of system crisis at both the natural and social systems levels, and with the natural system in continuous crisis throughout the late Bronze Age, 1200 BC signaled the beginning of social system transformation leading to the end of the Bronze Age. Starting from about 1200 BC, socioeconomic and political collapses during this period ranged from Mycenae through Egypt, the Levant, and Northern Mesopotamia to Anatolia. With the exception of parts of the periphery, the core centers of the Bronze Age system at this point in time were in crisis.

The collapse of the Bronze Age world has been explained rooted on a variety of factors. On the whole, they have been rationalized and based on anthropocentric ones such as barbarian invasions, unceasing consumption and cultural decadence, power rivalries and state competition, vagaries of development, overcentralization of authority, military and weapon innovations, and famines and diseases (see for example, [52,63,99,100]). Without a doubt, these factors at the social system level are ones to consider. However, what is lacking is a consideration of the *linkage* between the social system and the natural system, and how a disruption of this connection would ultimately induce crisis conditions, for the former (the social system) depends on the latter (natural system) for its continued reproduction. It is to underscore again the viewpoint that in the last instance it is perhaps Nature that has the final say!

For Crete, the intensive exploitation of resources for economic transactions impacted on the landscape. Deforestation generated soil erosion and flash flooding; the latter impacted on the manufacturing processes of Crete. Wood scarcity forced changes in production locations or resulted in the closure of facilities. It has even been suggested that such land deterioration contributed to the demise of Minoan Crete [101] (p. 68). These ecologically devastating trends were also repeated throughout the Bronze Age system. Mainland Greece—which provided the wood supplies to Crete when Crete's supply ran out—and other areas in Europe and Central Asia showed such scars as well. Intensification of land use and animal husbandry led to severe alteration of the landscape. Population increases along with the adoption of the ox-drawn plow further exacerbated the intensity of land utilization. Pollen record from Osmanaga Lagoon in southwest Greece in Messinia shows extreme forest removal by 2000 BC [102] (p. 5). Between 1600 BC and 1400 BC, the pine forests in Messinia were totally wiped out due to agriculture and overgrazing. Soil erosion was endemic and was controlled by terracing and the building of terrace walls. As a consequence agricultural production was affected. In the Argolid, production of cereals and olive oil generated deforestation of oak trees on the hillsides. It resulted in large amounts of earth and water draining from the slopes onto the plain of Argos and filling up stream beds leading to extensive flooding [103].

Besides terrace walls to deal with soil erosion, other technological solutions were also tried, such as the building of dams to divert water courses and dikes to facilitate drainage [104]. However, by the late second millennium BC such efforts began to fail. Erosion became uncontrollable during the Dark Age crisis of 1200 BC when socio-political life was at a standstill and population density had dropped precipitously [105].

With scarcity of wood for fuel, metallurgical and pottery works were affected which resulted in further population decline. Population migration followed the closure of these manufacturing centers, and the abandonment of Phylakopi coincided with the deforestation of Melos, where the town was located. Towns and settlements disappeared. In southwest Peloponnese, the number dropped from 150 to 14. Other regions experienced similar declines; Laconias, Argolid, Corinthia, Attica, Boeotia, Phocis, and Locris all registered losses [9,67].

In Southern Europe, there were also degradative impacts on soil formation from Urnfield settlements [59]. Kristiansen and Larsson [61] have also documented widespread ecological degradation in the Caucasus as a result of mining for metals to supply the Eastern Mediterranean and

the Near East. It was also repeated for the mining area of Kargaly in the Urals that supplied metals to the whole steppe region where deforestation was the consequence according to Kristiansen and Larsson [61]. Time-series of arboreal pollen profiles of Central and Eastern Europe including Russia parallels the deforestation trajectories.

Collapse came for the Eastern Mediterranean when circumstances started to change. Ecological stress coupled with climate changes and natural disturbances impacted on Crete, Greece and the Near East. For Crete, such arid conditions impacted on agricultural production. This development was serious, as it was an important part of Cretan exports needed to offset its import of wood and other natural resources. Furthermore, geological conditions also provide grounds for the arguments made first by Marinatos [106] and followed by Chadwick [107] and Warren [108] on their impacts on Crete. The volcanic eruption on Thera following the earthquakes killed vegetation and destroyed the Minoan naval fleet. The loss of this fleet undermined Crete's power to exercise its dominant position in this region of the world system. In addition, these natural system conditions should also be considered with the political changes impacting on Crete. From 1500 BC onwards, the increasing competitive roles played by the Hittites and Kassites through their expansion and dominance of Anatolia and Mesopotamia corralled Crete's dominance. Blended into this political mixture, the ascendancy of Mycenaean Greece eclipsed the economic position that Crete enjoyed. Furthermore experiencing the loss of their sources for natural resources located on the Greek mainland that by this point in time were increasingly under Mycenaean control; Crete's reproductive capacity was stretched. Faced with these desperate conditions in the spheres of the social system and the natural system, Minoan civilization slid downhill.

What occurred in Crete was repeated in Mycenaean Greece except it was much later starting around 1200 BC By this time the natural environment was severely stretched. Rhys Carpenter's [109] thesis of climate change leading to the demise of Mycenaean Greece needs to be considered. Basically, Carpenter's proposal is that with the shift in the tracks of the cyclonic storms, which normally bring rain to Mycenaean Greece, arid conditions resulted during the 13th to the 12th centuries. As a consequence, the socioeconomic structure was impacted. Chadwick [107] and Drews [110] have challenged this thesis with Lamb [111], Braudel [58], Bryson *et al.* [112], and Bryson and Padoch [113] supporting Carpenter's position.

Along with these desperate conditions due to climate changes and natural disturbances, invading forces of Dorians and Sea Peoples made the circumstances even more dire. Such invading forces most likely have also been displaced from their habitation due to changing climate conditions and natural disasters. Climate changes and disruptions in trade routes also played a part in the overall reproductive capacity of the Hittites and the Egyptians in the other parts of this system. Lowered Nile flows affected Egyptian agriculture leading to famines. The Hittite Empire's grain shortage led to growing imports from other parts of the world system through Ugarit, and from the Syro-Palestine area. In all, the crisis was system-wide affecting the Aegean, Central and Western Europe, Egypt, Anatolia, Palestine, and Babylonia.

7.2. Socioeconomic and Political Transformations

Greece encountered a decline in socioeconomic life from 1200 BC till 700 BC, such as decline or loss of certain material skills, decay in cultural aspects of life, a fall in living standard and thus wealth, deurbanization, population losses, and loss of trading contacts within and without Greece (see for example [9,49–51,63,114–118]). The archaeological evidence unearthed suggests socioeconomic patterns that are distinctively different from the style and level of socio-cultural life prevailing prior to the onset of the Dark Age.

Population decreases occurred between 1250 BC and 1100 BC Morris [114–116] has estimated losses of about 75% followed with emigration from the core areas of the Mycenaean civilization, this trend continued for central Greece as well by 1100 BC According to Snodgrass [50] between the 12th and the 11th centuries, there was a reduction of over three quarters of the population.

Pottery and other objects recovered from excavated sites along with the architecture and design of dwellings reflect ecological stress and scarcity of natural resources. Architectural standards were lowered and there were very few signs of good stone-built construction. Small stone construction was prevalent, and we also increasingly see signs of mud-brick construction. Mud-brick structures predominated in the building structures between the 11th and 10th centuries. The emergence of a class of handmade burnished pottery, "Barbarian Ware", had few obvious links to Mycenaean styles. The appearance of this style has been attributed as an economic response to the collapse of centralized production with the demise of the palace economies, and a regression to simpler technology [119]. Furthermore, pottery styles of the period in Greece became austere, unlike the decadent style of the previous era.

Starting with the Submycenaean style of pottery (*ca*. 1125 BC–1100 BC), the austerity of the design can be seen. As Desborough [49] has put it, the standards deteriorated sharply not only to the making of the pottery but also to the painting and decoration. The design was of the simplest kind and "was a virtual bankruptcy . . . and often carelessly applied" [49] (p. 41). The variety of styles in terms of vase shapes of this type of pottery was also reduced. Rutter [120] has also suggested that luxury vases and other pottery items were quickly abandoned as necessary frills when hard times hit. There was less variety of material goods, the artifactual correlate of a less complex social order. The emergence of the Protogeometric style (*ca*. 900 BC) continued to reflect the austerity of the period [50]. Snodgrass [51] has also alerted us to the appearance of hand-made pottery during the Dark Ages. The reversion to hand-made pottery when the pottery wheel had been adopted previously suggests to us the decay of manufacturing production or even perhaps the loss of manufacturing skills. It could also mean that with social decay and collapse, there was a revival in the utilization of indigenous material in view of the disruption in trade routes.

In terms of decorations and finishing, the bulk of the pot or vase was usually left plain in the natural color of the clay and the decorations covered a third of the surface area at most [49]. The lack of intense firing also suggests to us dwindling energy supplies. The compass and the multiple brush were used for decorating the pottery. As recovery proceeds and the balance of Nature is restored, we find the plain, rectilinear or curvilinear patterns in pottery designs giving way to images depicting animals and humans. In the later Protogeometric style period, we already saw the introduction of silhouette figures of a horse or a human on the design. If we consider the decay of cultural life and the loss of the art of writing, and view pottery design as a way the potter as artist could depict sociocultural life then, the motifs that we find in these pottery designs would summarize life in Dark Age Greece. By the late Geometric style period, we find scenes of organized groups of men in uniforms, the portrayal of warfare and chariots depicting social life when the Dark Age was receding, and the return of biodiversity with animals and sea creatures being depicted.

Beyond pottery styles, other objects recovered indicate a scarcity of natural resources, especially metals, or that the supply sources had dried up. The use of obsidian, stone, and bones for blades and weapons underscores such scarcity, and also suggests that trading routes and centers for sourcing the metals might have disappeared or disrupted. Other primitive materials reappear as apparent substitutes such as bone spacer-beads for amber in jewelry, and stones were used to replace lead in sling bullets. Objects buried with the deceased increasingly were made out of iron such as iron pins and fibulae and even weapons, which all in the past were bronze, and bronze wares only returned towards the end of the Dark Age period [51]. Where bronze was used, it was found on the bulb of pins thus revealing the scarcity of bronze [49,50].

Ecological scarcity required a downscaling of material and cultural lifestyles. Such changes are reflected in burial practices that exhibited a reorganization of life along modest lines. The design of clothing and shoes was of the plainest kind [50]. A one-piece woolen garment without requiring cutting or sewing gained popularity among the female population in Submycenaean Athens and became the predominant dress design in the Protogeometric Period. Pins for dresses were scarcely used. The downscaling process is exhibited further in the formation of decentralized communities and

associated population losses. The collapse of the palace driven economies with centralized monarchies were replaced by smaller political organizations dominated by an aristocrat and his family.

Whether this life-style is one that was actively sought as a consequence of ecological scarcity or occurred as an outcome of the depressive conditions of the Dark Age is difficult to gauge. It is clear however, that there was a shift from the Mycenaean way of reproducing life for they longer provided practical models. The loss of sophistication is clearly seen and as Morris [116] (p. 207) has stated, "in their funerals people seem more concerned with showing what they were *not* than with what they were". What we are sure of is that as recovery proceeded—we begin to witness this by the mid-half of the 10th century BC—trading networks were re-established and communities revived. Such an upswing was characterized by exuberance, materialistic consumption, and accumulation. As the social system recovered, we see the rise of the Bronze industry, increasing quantity of pottery buried in the tombs, the quantity of gold deposited in the burials, and signs of social cultural recovery. During the Dark Age, materialistic consumption declined, and most of the trading networks disappeared or were restricted only to the area of the Aegean Sea.

What the Dark Age of this period represented for the Mediterranean region is one where extreme degradation of the ecological landscape precipitated socioeconomic and organizational changes to meet the scarcity of resources so as to reproduce some semblance of cultural and economic life of prior times. As a consequence, systemic reorganization occurred at various levels, from the way commodities were produced to clothing fashions and designs. Hierarchical social structures disappeared during the Dark Age, as evident by burial practices, and were restored when recovery proceeded [117]. To Whitley [117] (p. 20) burial practices "may be seen as an expression both of social relations and ideology . . . " During the Dark Ages, there was a shift from multiple tombs burial to single burials which reflected the change from an emphasis on heredity signifying a stratified order with ruling classes to one which reflect no expectations of descendants and little regard for extravagance [51]. The single tombs lack monumental significance and architectural quality. From the graves excavated of the Protogeometric Period (*ca*. 900 BC) there are no indications of disparities in wealth and social distinction, as exemplified in the Athenian graves. Distinction was based on age and sex rather than other social dimensions [117] (p. 115). This was to change by the Early Geometric Period (*ca*. 860 BC–840 BC) where there is an amplification of status of the person buried. Social and sexual identities of the person interred became more evident. Thus, we find the return of a hierarchical pattern and a departure from the more egalitarian structure of the Protogeometric Period. Such hierarchization continued in the Middle to Late Geometric Periods (*ca*. 770 BC–700 BC). By this period however, there was also a breakdown of the aristocratic order with the arrival of early state formation, though social hierarchical differentiation remained in place.

With the Dark Age, not only was there a loss of population, but deurbanization was also underway. The latter process continued giving rise to small communities with lower population levels [90,91]. Seen from an ecological point of view, this downscaling provided the necessary timing for Nature to restore its balance, and for socioeconomic life to start afresh when recovery returned. The collapse of the palace economies enabled the ecological landscape to restore itself that in the past were intensively exploited by the palace driven economics. In the Argolid and Messenia, according to Deger-Jalkotzy [121] (pp. 123–124), the land recovered and the tree population increased. Furthermore, with the loss of centralized control from the various palaces, not only deurbanization occurred but also decentralization. Each region thus had the opportunity to search for new mechanisms and ways to administer and reproduce socioeconomic life in general. New trends emerge following the collapse of the palaces as a consequence of the unexpected liberty that resulted from the collapse, and each region/community began to make contacts with others outside Greece towards the end of the Dark Age.

From these small communities, in the case of Greece, the preconditions for the rise of the Greek polis (cluster of villages) were put into play, and what followed was a flourishing of political and economic life as soon as the social system recovered [51]. Muhly [122] (p. 20) has put this in a

succinct fashion: "the importance of the Dark Age, then, must be that it created the conditions that made possible the growth of this distinctly Greek political organization". To this extent, the stressed ecological conditions that engendered deurbanization and the formation of small isolated communities precipitated the rise of the polis and the Greek city-states. We need to realize, therefore, that perhaps scarcity of resources can also have productive outcomes which otherwise under bountiful conditions might not have occurred. Stanislawski [123] (p. 18) has suggested that instead of seeing the Greek Dark Ages as a period of darkness it should be seen as one of enlightenment with contributions such as: the first use of stone-walled agricultural terraces, the use of chicken eggs in domestic diet, the beginning of the spread of alphabetic writing, the spread of iron, the general use of olive as food, and the first use of waterproof plaster.

Systemic reorganization occurred, and the lengthy duration of the Dark Age is one that we need to note. The fact that it is of such a long duration underscores the length of time required for ecological recovery to take place, and the immensity of the degradation that occurred. What followed in the recovery phase, however, was a Dark Age-conditioned social-cultural and political lifestyle that formed the basis of Western civilization as we know it today.

Given that Dark Ages in world history are significant moments signaling system crisis and system reorganization; the final phase of the Bronze Age crisis led to ecological recovery, certain political-economic realignments and reorganization, and the transition to a new working metal: iron. The Dark Age crisis was *system transformative* for it led to fundamental social system changes evolving to a set of new patterns [25,26,96].

The adoption of iron brought to an end centuries of bronze use that was in the control of palace economies and elites. Gordon Childe [63] has suggested that cheap iron with its wide availability provided the opportunities for agriculture, industry, and even warfare with the adoption of iron as the base metal. With trade route disruption and copper scarcity, the adoption of iron use spread further, especially among the communities in Greece that was isolated as a consequent of Dark Age conditions, for iron was available locally. It led to the development of local iron producing industries [51]. The low cost of iron because it was available locally facilitated its widespread use in agriculture and industry [63,124]. Cultivation was made easier with iron plowshares in heavy clay soils. This enabled the rural communities to participate further in the economy beyond subsistence, and in maintaining a class of miners, smelters, and metal smiths fabricating the iron implements to reproduce material life. Such an explanation is also supported by Heichelheim [125] and Polanyi [126], who have suggested that the widespread adoption iron was the result of the opportunity for rural communities in south Russia, Italy, North Africa, Spain, Gaul, Germany, and Eurasia to work the heavy soils with iron implements, thus increasing their production levels. Production increases can be seen by the fluctuations in grain prices according to Heichelheim [125]. The consequence of such transformation is that the urban elites in the Near East who in the past controlled the grain and other commodities trade suffered losses as a consequent of changing prices, and the falling demand for copper, tin and bronze, which they also controlled.

As a result of the above, the social structures were transformed with the formation of different regional centers in the periphery and in the Mediterranean. The opportunity for the farmers to farm in heavy clay soils utilizing cheap iron implements also provided the conditions for economic and system expansion following the end of the Dark Age where in the past these areas were not as productive. It enabled economic expansion, and the move into newer areas for agriculture as by this time some of the older settled areas were ecologically degraded and overworked.

In addition, at the social system level, the Dark Age crisis thus usher forth the dissociation of high value commodities away from the control of the palace/state, for by the end of the Dark Age, the command palace economies were in the Eastern Mediterranean were dissolved. What emerged was the continued differentiation of commercial/economic structures from the political structures [126]. Instead of bureaucratic palace centered trade, we see the development of mercantile city-states where merchant enterprise replaced the palace-controlled exchange. With this transformation, new forms

of political powers and structures emerged. We have the emergence of a new political structure, the city-state (polis) in the Aegean, and the continuation of empire type political structures where the rule was via direct political and military control.

The new political structure, the polis, as a social organization and political concept emerged in 8th century Greece [114,115]. It was, as Morris [115] (p. 752) has stated, unique among ancient states for "its citizen body was actually the state". The rise of such a state form was a consequence of the collapse of the aristocratic society during the Greek Dark Ages. Other factors also precipitated its formation. Deurbanization and the loss of population in the urban areas resulting in the development of isolated communities during the Dark Age engendered the structural conditions for the development of the polis. In addition, with the scarcity of resources and the abundance of poverty leading to less hierarchical social structures, the groundwork for the development of the polis was also put into place. The polis thus was one where all authority was divested to the community unlike previous political forms in Mycenaean Greece. Force, therefore was located in the citizen body as a whole, and thus there was little need for a standing military. Individual natural rights were not sanctioned by a higher power and the highest authority was the polis, *i.e.*, the community. Such a political structure found expression in the Aegean. However, in other parts of the Near East, divine kingship was maintained with some minor modifications. According to Childe [63], Assyria, Babylonia, and Egypt continued as Bronze Age states.

Recovery returned around 700 BC with social systems expanding and growing in complexity again. Expansion came first in the form of colonization by the Greeks in two phases. Between 775 and 675 BC such expansion was for agricultural purposes, where the soils and lands of Greece which were degraded after centuries of erosion and intensive cultivation could no longer produce to meet the needs of the population. The excessive population mostly comprised of poor peasants who were turned into tenant farmers (*hectemores*) with debts that were increasing, and thus forced to swell the cities. With the state of the degraded environment in Greece, with the exception of Boetia, Attica, and Sparta where internal colonization was still possible with some fertile agricultural land left, expansion of the system came with migration to other arenas such as Italy, Sicily, Southern France, and West Asia. Growth in this case comes from a colonization process that was extensive in nature, and a consequence of the ecological crisis of the Dark Age that has just ended. Following the success of the agricultural colonization strategies with surplus generation, a second round of colonization from 675 BC to 600 BC followed, mainly focusing on commercial activities. With this phase of colonization, trade routes were further fixed and strengthened. Wealth for the colonial cities was derived from agricultural exports, trade and production. Other growth poles of the system then were Egypt, Persia and Phoenicia, and as Braudel [58] (p. 225) puts it, the Mediterranean never became a "Greek Lake." With these different centers, no polity ever gained control of the Mediterranean. It was only the arrival of Rome that the Mediterranean became a Roman sea. The growing rise of Rome and the demise of Greece did not interrupt the continuous degradation of the environment [9]. Forests were removed in Northern Africa and almost everywhere Roman rule was established. Mines were dug in Spain, with cities, roads, and production facilities established within the Roman Empire. Crisis emerged again 700 years later, around AD 400 with similar trends and tendencies in terms of ecological and socioeconomic variables like that of the Dark Ages that occurred during the Bronze Age. This time the collapses were not Mesopotamia, Harappa, Mycenaean Greece, Crete or the Hittite Empire, but it was the Western portion of the Roman Empire and the system of the Iron Age.

8. System Crisis in Bronze Age East Asia

The archaeological record reveals the presence of human communities from the Korean peninsula throughout Manchuria, the Gulf of Bohai in East Asia, the Yangtze river, and the islands of Japan as early as the Paleolithic period in 3000 BC [127]. Beyond indication of the dispersal of human communities across East Asia, there is evidence to substantiate the claim that contacts between these communities predate Dark Age periods [127,128]. In particular, one can surmise that due to geographic

proximity the peoples of present-day China and Korea have an early history of economic and cultural exchanges. Early in the prehistory of East Asia, one observes contacts among Yemaek, Mongol, Manchu, Han, and other Northern tribes in the Korean Peninsula [129]. In addition, Chinese records indicate the habitation of local tribes such as the Puyo, the Okcho, the Yemaek and the I-Lou in Korea [129]. Furthermore, during China's Shang Dynasty (1600 BC–1046 BC), the Chinese settled at Lolang near modern day Pyongyang. In fact, around 1200 BC, in Northwest Korea, a state was founded under Chinese rule. The Chinese presence was further solidified on the Korean peninsula in 109 BC with an invasion that established four commandeered centers of Chinese administration at Nangnang [130].

8.1. Socioeconomic and Political Connections

Archeological research of the region reveals, five major trade routes in East Asia well in use prior to the 6th century BC: (1) the North route from Siberia; (2) the Korean route via its peninsula and across the Tsushima or Korean Strait; (3) the Jiangsu and Zhejiang route across the East China Sea to Kyushu; (4) the Taiwan and Fujian route via Ryukyu Islands to Kyushu; and (5) and the south sea route from the South Pacific via South China Sea islands to Manchuria [127,131–133]. These major trade routes physically illustrate the ability of human communities early in East Asian pre-history to engage in cultural and economic exchanges. Moreover, the presence of minor routes, or sub routes, through the Korean peninsula also further provided the linkages that connected the Asian mainland to the Japanese islands [127].

Although different explanations have surfaced regarding the flow of goods and people in East Asia, from an archeological perspective the South China Sea was a major route for cultural and economic exchanges [128]. This interaction is observed in the similarities exhibited in jade jewelry, lacquerware, agricultural cultivation, construction, and crops along the East China Sea route [128]. The cultural and economic linkages between China and Japan become evident in the presence of *ge*-shaped large earthenware pots, *yinwen* pottery, circularly-arranged tribal houses and mound-shaped graves in Japan [128]. Scholars note the similarity between items found in Japan and those in the lower Yangtze basin. Further back in history to the New Stone Age, some 7000 years ago, excavation at the Hemudu site in Eastern China revealed the presence of wooden oars and clay boat models [128]. During the same period, similar sites in the Zhoushan Islands off the coast of Zhejiang Province also reveal the ability of ancient communities to travel via waterways [134]. The route from the lower Yangtze basin via the East China Sea to Korea and Japan, was the preferred course of travel in the Late Shengwen period, during the tenth century BC, and became more popular during Japan's late Jomon and Yayoi periods (1500 BC–AD 500) [128]. Agricultural exchanges were not solely confined to seed or crops, but archeologists argue that the origins of the Japanese stone ax, ploughshares, hoes, and crescent-shaped harvesting knives can be traced to the Yangtze basin [128]. Physical evidence suggests that interactions between human communities in East Asia continued and intensified throughout the Bronze Age, and into the Iron Age.

Early iron use in China can be traced back to the Shang period (1766 BC–1122 BC) in a comparable sense to the utilization of iron in the West. Specifically, meteoritic iron was utilized, and was occasionally used in later periods [135–139]. The diffusion of iron throughout East Asia can be tied to the smelting of ore in China's Southern provinces. In this regard, Huang Zhanyue [140,141] provides evidence, along with persuasive arguments, that the smelting of iron in China began in the south and spreads to the Korean peninsula and Japan. Wagner [142–144] reviews Huang Zhanyue's [140] evidence and, coupled with other archeological data, has suggested that iron artifacts can be dated to as early as the Zhou Dynasty, and specific pieces may yet prove that the use of iron can be traced to earlier periods [145].

Chinese involvement on the Korean peninsula from the Shang to the early Han Dynastic period (1600 BC–AD 9) undoubtedly came to affect the political, cultural, and economic life of its inhabitants. China's influence was intensified as successive Chinese kingdoms emerged and sought to expand their political control. For example, during the early Han dynasty Chinese commandeering centers were

established within the present-day geographical territory of Korea. Of these commandeering centers Lolang formed the core of Chinese colonial administration during the Han period [142–146]. Lolang not only served an important political role, but also proved to be an important economic point whereby Chinese goods could be distributed to points across Korea and Japan. As the Chinese administration center on the peninsula, Lolang "was in essence a Chinese city where the governor, officials, merchants, and Chinese colonists lived. Their way of life in general can be surmised from the investigation of remains unearthed at T'osong-ni, the site of Lolang administrative center near modern Pyongyang. The variety of burial objects found in their wooden and brickwork tombs attest to the lavish life style of these Chinese officials, merchants, and colonial overlords in Lolang's capital" [146] (p. 14).

Political administration by China of portions of the Korean peninsula influenced not only those populations under direct Chinese rule, but communities further South and East who were exposed and drawn to Chinese culture. The commandeering centers on the Korean peninsula brought China closer and "ultimately (created) a new China-oriented elite class" [146] (p. 14). Within areas outside of Chinese control the absorption of Chinese culture by local populations led to increased economic and cultural exchanges. As the most economically and culturally advanced society in East Asia, China attracted "neighboring states, which coveted the highly advanced Chinese culture" [146] (p. 14).

Although portions of the Korean peninsula were not under direct Chinese political control, the Chinese influence "is apparent from the fact that for the most part the leaders of the ... states in the Southern half of the peninsula willingly accepted the grants of office and rank, official seals, and ceremonial attire that constituted ... tokens of their submission to Lolang's (and China's) authority" [146] (p. 14). The availability of natural and human resources on the Korean peninsula made the area economically attractive to the Chinese who "were able to command the labor services of the native population they governed, for (enterprises such as) the large-scale cutting of timber. It is known, too, that iron ore deposits in the Southeast corner of the peninsula were supplied to Lolang" [146] (p. 14).

Although Japan is geographically disconnected from the Asian mainland by the sea, its islands were once connected extensions of the mainland when Ice Age sea levels fell [127]. Historically, land bridges at one point served to link the Chinese mainland to Japan. Early in East Asia's prehistory, initial habitation, cultural growth, and production were closely tied to the Asian mainland. Once the land bridge disappeared, the sea not only separated them, but also provided a method of transportation. According to Wagner [142] (p. 35), the sea makes "it logical that Japan was continuously influenced by mainland cultures since (East Asian prehistory)." Beyond analyses of early maritime trade, archeologists have unearthed ancient East Asian trading links following the discovery of meteorological tools [127]. Further substantiating the connections between human communities, Sima Qian, in the *Records of the Gran Historian*, writes about the use of horse-drawn war chariots introduced from the West and spread through Central Asia during the Shang Dynasty (1600 BC–1046 BC).

8.2. East Asia During the Final Phase of the Bronze Age Crisis

While the early Chinese Shang Dynasty (1600 BC–1046 BC) experienced a political and territorial expansion, the late period is characterized by fragmentation. Entering the Zhou period (770 BC–256 BC) warring factions in China sought to consolidate their power. In the "Annals of Zhou", written by Sima Qian (*ca*. 100 BC), the struggle between Shang and Zhou is well documented. East Asia has undergone periods where political, social, and economic life is disrupted. Although the duration and the precipitating agent of these disruptions requires some specificity, several general points, as related to trade, can be made about a Dark Age period in East Asia. First, previously established trade networks were disrupted. The disruption of trade networks leads to a decrease in economic and cultural contacts between human communities in the region. Secondly, the decrease in trade linkages creates a climate were local products are looked to as substitutes for previously imported foreign objects. However, the imprint of previous exchanges still manifests itself physically in the products

that are manufactured, but they increasingly take on a local character. Third, as a result of linkages being disrupted cultural exchanges are also impacted and facilitate the re-emergence of local practices. During the Dark Age period in East Asia, this leads to indigenous or local practices being re-embraced. The archeological record, coupled with the reading of historical documents, indicates that in East Asia the disruption of cultural exchanges leads to a re-emergence of indigenous or local practices. Although we observe the presence of indigenous practices, and locally produced goods, during the pre-Dark Age period, Chinese objects and practices are predominant. As early as the Shang Dynastic period, there is a strong Chinese influence in Korea and Japan as evident in tools and objects traceable to the Yangtze basin. After a successful period of economic and cultural growth in East Asia, problems in the Chinese mainland lead to a decrease in trade exchanges. Internal crisis in China comes to impact the Korean peninsula and Japan.

Additionally, political fragmentation is an important aspect of Dark Ages. The chaos, disorder, and disruptions that characterize these periods in human history are in many respects the result of political strife and struggles over power. During the breakup of Shang rule around the 11th century BC, political power in China was transferred to local warlords. These local warlords were not content to share the Shang Empire. This resulted in the political disunity of China that carried into the Zhou period (770 BC–256 BC). The perpetual military incursions by competing warlords in China extended into the Korean peninsula. Although historically the peninsula has always had a Chinese presence, the move toward greater Korean autonomy from China can be traced to the disorder and wars that engulfed the Asian mainland during subsequent periods. The goal of expansion brought the Chinese Empire to Korea, but it also resulted in disastrous wars and ineffective expeditions.

In addition to the political fragmentation and wars, population loss and dispersal also characterizes Dark Age periods. There is evidence that a cooling period during Japan's late Jomon period (2000 BC–1000 BC) led to a significant depopulation and a downsizing of large settlement areas [147]. Additionally, one can surmise that the constant fighting not only resulted in population losses from combat, but war was also responsible for food shortages and emigration. In particular, border areas suffered mass departures as people attempted to flee war torn areas.

The human imprint in East Asia is clear in the earth because of the industrious husbandry of hundreds of generations, in the degradation of forests, in the eroded and impoverished lands, and in the barren unproductiveness of formerly fertile and populous terrain, all of which attest to prolonged human abuse. Environmental degradation, climate change, and social upheavals all serve as precipitating agents that led to a contraction of the social system and created an opportunity for a restructuring. In subsequent years, that extend into the Chinese Zhou Dynastic period (770 BC–200 BC), core-periphery relations are transformed, political boundaries are reconfigured, trade relations are intensified, and cultural practices are impacted.

8.3. Climate Fluctuations in Bronze Age East Asia

Preceding the rise of China's first dynastic period (2100 BC–1600 BC), prehistory reveals the formation of settlements during the Neolithic Age. Advances in agriculture led to settled communities and the beginnings of city-states. Prehistoric culture in East Asia is characterized by the development of systems of social stratification and the accompanying cultural objects typical of agricultural societies. Communities in East Asia succumb to the first phase of the Bronze Age crisis (2200 BC–1700 BC) during this Neolithic period as fluctuations in climate led to floods, drought and a disruption of settled agriculture. The collapse of Yueshi Culture in East Asia exemplifies the dependent character of social development [148]. Human communities do not develop separately from the limitations, setbacks, or good disposition of nature.

From the Neolithic Age onward, climate fluctuations in East Asia have been documented [149–151]. Historically, these have led to the collapse and flourishing of cultures, population growth and decline, and have halted and supported social development. Related to climate fluctuations, desertification cycles, and decreasing biological diversity over the last 5000 years in the region have been cited as

a reason for the emergence and downfall of past empires [152]. Militaristic incursions by outsiders and internal socio-political conditions have long been explanations for the settlement patterns observe in East Asian history. However, it is important to incorporate the observations made in recent paleoclimactic studies that document changes in the physical environment of the Bronze Age world [153].

In the midst of the final phase of the Bronze Age crisis (1200 BC–700 BC), the archaeological record reveals a relocation of human communities [154]. The Western Zhou period (1046 BC–771 BC) in China is characterized by forays into neighboring communities, infighting amongst royals, and peasant uprisings. Although socio-economic issues partly explain the dissatisfaction amongst groups in Zhou society, and the impetus for migration, climate aridity around 1150 BC also pushed people out of former political and economic centers [155]. Written records of the time also corroborate the relocation of peoples. During the Bronze Age crisis, the change in climate led to excessive flooding. From the 16th century BC till 771 BC, several floods struck the Asian mainland that led to migration [156]. Historically, cultural adaptation is observed as a response to challenging social and environmental conditions. However, as demonstrated in East Asia, peoples also sought resource rich areas to recreate lifestyles no longer supported by the current physical environment.

Suggestive of the ebb and flow of history and the cyclical nature of climate, in subsequent periods, human communities are again equipped with the necessary physical conditions to support a sedentary lifestyle. Moving pass the final phase of the Bronze Age crisis and into the Zhou Dynastic period (1046 BC–256 BC), the climate begins to stabilize in the later periods of the Chou Dynasty [154]. Ultimately, an improved environment contributed to the bourgeoning of Bronze Age culture in East Asia and the prosperity observed during the Han Dynasty (202 BC–AD 220). Although climate and other exogenous factors impact social development, it is understood that human activities also contribute to the trajectory of communities.

8.4. Climate and System Crisis

It is clear from our theoretically informed historical narrative that the drivers that caused system crisis have their origins in Culture's relations with the natural environment. Included in this equation are the changes in climate. The late Bronze Age system crisis that impacted both West and East—even though at this point in time, from 1200 BC to 700 BC, there were no systemic connections in terms of trade, cultural exchanges, and socioeconomic relations between the two regions—suggest to us that climate is an important driver that impacted on the social formations in both regions consequently leading to changing socioeconomic and political demise and transitions.

Is climate the factor that is "determinate in the last instance", to borrow a phrase from structural Marxism, for our understanding and explanation of system crisis and transformation? We suggest it is certainly a factor, amongst others, that deserves attention. For the discipline of the social sciences, this might be quite unsettling as the discipline's *raison d'être* is to discover the socioeconomic and political factors that determine the social evolution of human social formations. Our historically informed theoretical framework has demarcated the factors that engender system transformations and crisis. By considering social system evolution over the *long historical time and geographic space*, we have been able to discriminate the relative impacts the various socioeconomic and political factors along with other natural environmental and climatic factors that determine the trajectory of system evolution. The fact that the late Bronze Age crisis showed parallel outcomes between the East and West when systemic trade, cultural and political connections were not in existence (or minimal at best) at this time period in world history, it has enabled us to pinpoint that climate should be considered and further research may reveal it is a principal driver that caused the cacophony of socioeconomic and political change that followed.

8.5. Concluding Remarks

While acknowledging that systemic crisis and transformation feature anthropogenic causal agents, our research makes clear that a more comprehensive study of system transformations must include Nature and the climate. Study of past system crises can inform our understanding of contemporary trends and the potential adjustments that await modern society. To the latter, despite the negative imagery the adjective "Dark" connotes, Dark Ages provide an opportunity for human creativity and ingenuity to surface in response to changing social and physical conditions. The creativity has a lasting impact that, even when conditions do change, endures and comes to alter and influence the character of subsequent exchanges between peoples.

This study also demonstrates that human history can be broadened beyond an anthropocentric discussion of peoples' circumstances, to include an examination of the impact human activities have on the Earth. Tangible remnants of the past remain, such as historical texts and artifacts, which provide vivid evidence of humankind's reach and the ability of human communities to interact directly and indirectly through large expanses as part of a Eurasian global economy. Climate changes and environmental degradation in the ancient world ominously shadows the present and speaks to the humanocentric conduct evident in ecological relations to this day.

Historically, a pattern is observed where periods characterized by prosperity, growth, consumption and materialism, are then followed by a "Dark" epoch that ushers in wars, disease, political instability, economic decline, and a curbing of previous consumptive habits. The social and physical circumstances necessary for unimpeded growth are disrupted allowing for the opportunity for Nature to recoup its losses [9]. This research illustrates that human populations, in interacting with each other and their environments, attempt to accommodate social, political, economic, and cultural activities to very specific environmental conditions. As a result, *the climate* and the ecological landscape are not only central to our analysis, that they should be recognized as the factors that inform the structure of economic and cultural practices that, in turn, conduce the trajectory of social systems.

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