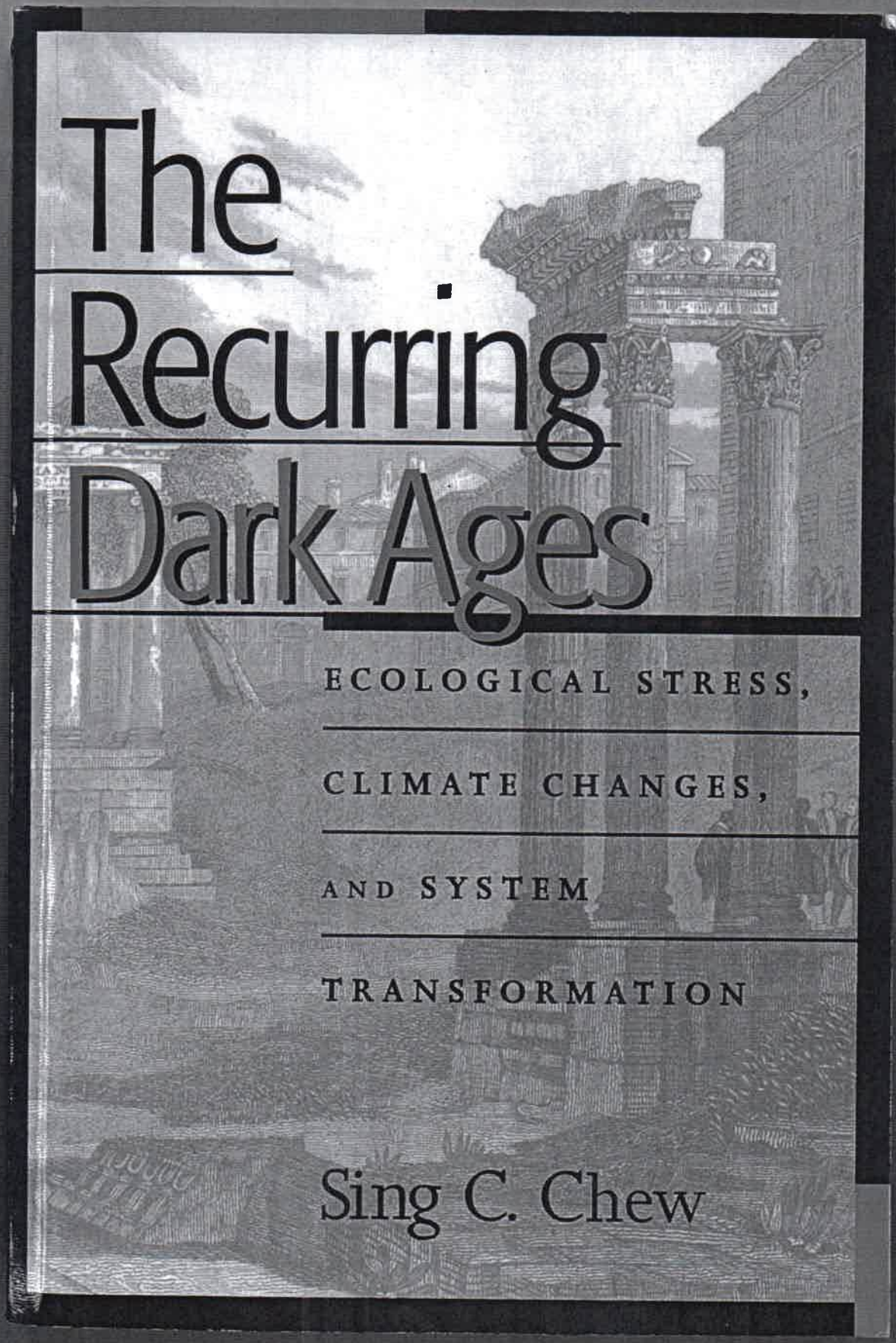
The Recurring Dark Ages
ECOLOGICAL STRESS,
CLIMATE CHANGES,
AND SYSTEM
TRANSFORMATION
Sing C. Chew

TRILOGY ON WORLD ECOLOGICAL DEGRADATION
by
Sing C. Chew

World Ecological Degradation: Accumulation, Urbanization, and Deforestation, 3000 B.C.–A.D. 2000

The Recurring Dark Ages: Ecological Stress, Climate Changes, and System Transformation

Ecological Futures: What History Can Teach Us

The Recurring Dark Ages

Ecological Stress, Climate Changes, and System Transformation

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System Crisis

PROLOGUE: SYSTEM CRISIS

The basis for the reproduction of material life over world history has been the wide-scale utilization of the resources of the natural environment. In *World Ecological Degradation*, the history of this utilization process was traced over geographic space spanning five thousand years of world history (Chew 2001). The recurring outcome of this process—based on the human communities' efforts to reproduce social life according to the social organizational patterns that have evolved—appears to be ecological degradation. Nonetheless, the motions of history do also suggest periods of ecological recovery of the degraded areas, and the penetration of new areas for the extraction of fresh natural resources to sustain further system/economic expansions. Therefore, viewed from the perspective of *la longue durée*, ecological degradation and recovery appear to recur in phases.[1]

As *World Ecological Degradation* has revealed, excessive ecological degradation leads to environmental collapse, and along these lines, there are certain phases of environmental collapses that occur mutatis mutandis with civilization demises. This relationship between environmental collapses and civilization demises suggests that when societal relations with the natural environment become exploitative and unsustainable over time, a social system crisis is triggered. As the natural environment plays a part in social system reproduction, we need therefore to widen our gaze for other factors that engender a social system crisis/transition beyond those that are social, political, and economic in nature.

In this subsequent volume to *World Ecological Degradation*, given the above set of sequences, the focus will be to deliberate on other nonan-

thropogenic factors conditioning a social system crisis by continuing our historical examination of the Culture-Nature relationship that was started in *World Ecological Degradation*. What calls for further exploration is the dimension of the natural environment and the part it has within the overall matrix that produces a social system crisis, and in the process, long-term and large-scale social change. By this consideration, the orthodox manner of explaining social system crisis along social, political, and/or economic factors can then be recalibrated. No doubt, there will be concerns, especially from positions that have considered anthropogenic factors as the only "primordial" elements for engendering a social system crisis and long-term social change. However, such stringent adherence to human factors needs to be reconsidered in view of recent studies focusing on other elements conditioning social system crises (Chew 2001, Kristiansen 1993, N. Brown 2001, Baillie 1994, Weiss 2000, Hughes 2001, Burroughs 2005).[2]

The way forward requires a redrawing of the baseline for our understanding of long-term social change and social system crisis. Nonanthropogenic elements need to be brought into play, of which besides the natural environment, the other crucial factors are climate and natural events such as tectonic shifts and volcanicity. Such an inclusion of the natural environment, climate, and natural disturbances as factors assumes an intimate interaction between natural systems dynamics and social systems dynamics that produces a series of tendencies that determine the parameters of social (world) systems reproduction. These tendencies are determined by the intensity of the Culture-Nature relationship in the reproduction of life, that is, the relationship between the social system and the natural systems. When the intensity of this relationship reaches critical limits over the long term, we have the appearance of a world (social) system crisis as well as a natural system crisis.

Social (world) system crisis means that the continued evolution of the system faces obstacles, and that necessary structural changes or adjustments have to be made for systems reproduction to continue. These crisis phases become the key periods for our understanding of the dynamics of world-system evolution and transition (long-term social change). Over world history, these crisis moments are rare. Historically, when they do occur, these phases are extremely impactful in terms of geographic coverage, and they extend over a long period in terms of socioeconomic and ecological recovery. In world history, these phases are known as the *Dark Ages*.

SYSTEM CRISIS AND ECOLOGY

Much scholarly attention has been directed to analyzing the socioeconomic and political processes such as capital accumulation, political hegemonic rivalries, technological changes (or the lack thereof), trade system collapses, social-political unrest, and border incursions to explain the basis for system crisis and long-term change (e.g., see Gills and Frank 1992, Wilkinson 1995, Goldstone 1991, Abu-Lughod 1989, Wolf 1982, Wallerstein 1974, Modelski and Thompson 1999, Amin 1982, Anderson 1974, Tilly 1992, Mann 1986). What perhaps needs more attention is the interaction between world (social) system and the natural system to flesh out further the conditions for system crisis. Along such lines, various studies have intimated the relationship between climatological and ecological changes with human organizations and activities (e.g., see Ladurie 1971, Berglund 2003, N. Brown 2001, Chew 2001, Kristiansen 1998a, Thompson 2000, Burroughs 2005). Some like Fernand Braudel (1972, 1981, 1982, 1984, 1989) have couched the social, political, and economic factors in concert with the natural environment and the climatological patterns as determinants of long-term and large-scale transformations.[3] However, what is still lacking is an exploration in greater depth and, on a longer-term basis, the impacts of climate and ecological changes on the generation of system crisis. After all, in the material reproduction of the world (social) system, we still rely on the natural system.

Given the above parameters, we need to *abstract historically* the several processes at work. The natural occurrences and shifts in terms of climate changes and natural disturbances, such as volcanic eruptions and earthquakes, independently condition the reproduction and evolution of the world system. Just considering only these elements would be myopic on our part, for we know through world history that social and organizational factors (urbanization, accumulation, wars, technological innovations, and population) also impact on world-system reproduction. Thus, human-induced changes to the ecology and the climate in turn form barriers to the reproduction of the world system.

Most models that attempt to explain long-term system change concentrate overwhelmingly on anthropogenic causes as I have suggested in the previous pages. If we consider the parameters at work in engendering a system crisis (see previous paragraph), the explanation requires the inclusion of the natural environment and other nonsocial factors, for they also form the basis for the reproduction of the world system. Moving a step forward, what needs also to be considered is the degree of weight these latter factors have in precipitating a system crisis. The answer cannot be sought theoretically, but rather within a framework of historical structures and processes and via an analysis of the historical dynamics of Nature-Culture relations and climatological trends.

Our task ahead is to sketch out a *theoretically generalized history* of Dark Ages or system crisis and, within the limits of available historical information, identify contingent factors and agents that could have en-

gendered each specific Dark Age phase or system crisis from the Bronze Age to the Iron Age of world history. *However, our overall effort in this exercise is to move away from just a history understood and interpreted within a geospatial-dependent and time-contingent framework. The aim is to abstract a theoretically generalized account of the dynamics and structures of world-system evolution from historical events.* Methodologically, we are considering Dark Ages in world history not only as a historical period of study, but also as a *historical-theoretical* concept to understand the historical moments of social system crisis and transition over world history. In this regard, we want to have an understanding of system crisis and long-term social change that is theoretically generalizable, albeit with *some conjunctural elements that are different.* The end point would be a social science history of long-term change, that is, a theoretically informed history of the evolution of the world system.

Such a theoretical-methodological attempt discussed above, and employed previously (Chew 2001), has been met with concerns and even skepticism by some specialists whose works have focused on a specific nation-state, local area, or region, and who are guided mostly by the naturalistic-scientific methodological conception of knowledge generation or subjectivistic-phenomenological interpretations (e.g., see Butzer 2005). "Find the data/interpretation and let the data/interpretation inductively inform us about what happened ecologically" seems to be the basis of such critiques of my approach, and thereby dismissing my attempt to provide coherence and structure to micro- or regional-level analyses so that the motions of world history can be understood. Without attempting to generalize and perform theoretically informed comparative analysis of various ecological transformative-structural outcomes across time and geographic space juxtaposing different archaeological, palynological, and historical sources, in my view, prevents us from seeing the big picture, and thus, world history.

A THEORETICALLY GENERALIZED HISTORY OF DARK AGES: DARK AGES AS A WORLD-SYSTEM PROCESS

Nature and Geographic Scope of Dark Ages

System crises are moments when system reproduction experiences obstacles and difficulties. The historical dynamics of Nature-Culture relations exhibiting system crisis moments appears in the form of Dark Ages. Over world history, such Dark Ages, or prolonged periods of widespread social and economic distress and ecological crisis lasting for centuries, are rare. Between 3000 B.C. to A.D. 1000, there have been identifications of only two or three such periods impacting Northwestern India, west Asia, the Mediterranean, and Europe. V. R. Desborough in *The Greek Dark Ages* identified such a phase of distress for prehistoric Greece:

> during these generations the changes that came about are little short of fantastic. The craftsmen and artists seem to vanish almost without a trace: there is very little new stone construction of any sort, far less any massive edifices; the metal-worker's technique reverts to primitive, and the potter, except in early stages, loses his purpose and inspiration; and the art of writing is forgotten. But the outstanding feature is that by the end of the twelfth century the population appears to have dwindled to about one-tenth of what it had been little over a century before.

A. M. Snodgrass' characterization of such a period in *The Dark Age of Greece* complements the conditions and extends it further to cover the collapse of trade and commerce across geographic boundaries beyond those of prehistoric Greece. Here is how he described it:

> the modern doctrine would hold that the following characteristics were present in the post-Mycenaean period: first, a fall in population that is certainly detectable and may have been devastating; secondly, a decline or loss of certain material skills; thirdly, a similar decline or loss in respect of some of the more elevated arts, of which the apparent loss of the art of writing is most striking to us . . . ; fourthly, a fall in living standards and perhaps in the sum of wealth; fifthly, a general severance of contacts, commercial and otherwise, with most peoples beyond the Aegean area and even with some of those within it.

Recently, John Bintliff (2004, 312) has again reiterated similar types of socioeconomic characterizations for prehistoric Greece:

> many other striking signs of "de-skilling" characterize this period: the disappearance of elaborate architectural complexes; impoverished assemblages of metal; the virtual absence of human representations; a dramatic decline in the number of dated occupation sites; very reduced evidence for foreign exchange compared with the preceding period; and no sign of political centers of regional control. Whatever the reasons for the end of the palace states, the reduction in social, economic, and artistic complexity was severe and persisted for many generations.

In *Memory and the Mediterranean,* Fernand Braudel identified these types of disruptions at the end of the twelfth century for the Mediterranean region:

> the move back into the past seems to have been most marked for Greece. Along with writing, the jewel amongst achievements, all the luxury arts

vanished too: jewelry, mural paintings, engraved precious stones and seals, sculpted ivory and so on. Only pottery turned on the wheel seems to survive, with the last relic of the Mycenaean style vanishing during the eleventh century to be replaced by the first proto-geometrical ceramics. At the same time, all links with the Middle East seem to have been severed after the Dorian invasion and would only be restored much later when Greece and the Aegean in the full flush of expansion began to trade once more with the Syrian ports and Egypt, establishing outposts on the coast of Asia Minor.

These socioeconomically and politically determined excerpts describe for us the social and economic conditions of the times, but there are no references to ecological and climatological changes. However, if we read Thascius Cyprianus' (cited in Toynbee 1939, 8) depiction of the period, he gives us an account of these latter conditions that were not addressed by the previous scholars:

This truth is proclaimed, even if we keep silence . . . , by the World itself, which testifies to its own decline by giving manifold concrete evidences of the process of decay. There is diminution in the winter rains that give nourishment to the seeds in the earth, and in the summer heats that ripen the harvests. The springs have less freshness and the autumns less fecundity. The mountains, disemboweled and worn out, yield a lower output of marble; the mines, exhausted, furnish a smaller stock of the precious metals: the veins are impoverished, and they shrink daily.

Recently, Marc Van De Mieroop in *A History of the Ancient Near East* has also wondered whether the recurrence of long periods of drought in the Ancient Near East could have serious consequences for the Near East leading to Dark Ages. However, with the paucity of records on the ancient climate of the Near East as he has noticed, he veered toward the side of caution by refraining from deriving a conclusion from such an association. Instead, he juxtaposed this issue by acknowledging the commonly accepted theme that emergence of the Dark Ages was a consequence of human factors. Listen to his thinking:

Long periods of drought could easily have occurred in the time span we study here, however. While we can assume that over the last 10,000 years the climate of the Near East has not substantially changed, it is certain that even marginal variations could have had serious consequences for the inhabitants. The question arises as to whether the so-called Dark Ages resulted from a drying of the climate which made rainfed agriculture impossible in zones usually relying on it, and which lowered the rivers to such an extent that irrigated areas were substantially reduced. Or should we focus on human factors in trying to explain such periods? So far, insufficient data on ancient climate are available to serve as historical explanation for the drastic political and economic changes we observe.

The above combination of excerpts from various scholars does provide a glimpse of what political, socioeconomic, and ecological conditions were like during a Dark Age. They provide us with the historical-theoretical contours of the ecological, socioeconomic, and political landscape of Dark Ages, and thus are our map for interpreting and understanding Dark Ages.

From a growth and social progress model, the above descriptions of widespread distress indicate that a significant crisis in social reproduction whereby production/appropriation, exchange/distribution, and consumption as interlocked processes were not maintaining comparable reproduction levels to the period prior to the phase of darkness.[4] Instead of social growth and development, we see stagnation and devolution. Viewed from a long-term perspective, these distressed phases suggest that system transformation is not just a process that propels forward in a linear or geometric fashion, but also one that constitutes processes of evolution (growth) and devolution (stagnation) as the periods of Dark Ages reveal.

The dynamics producing Dark Ages or crisis (devolution) in reproduction—assuming that the social reproduction processes have no priority of one over the other—should not be attributed to just *local* constraints hindering a region (such as prehistoric Greece) from reproducing itself within its social and ecological parameters. With the different levels and manner of interconnectedness of social formations in a world system, the roots of the crisis of reproduction are not solely limited to local or regional conditions, but to world-systemic dimensions as well, depending on the state of the evolution of the world system.[5] It involves, therefore, multiple levels of conditions and factors on a large geographic scale.[6]

Given the above, the constraints to system reproduction can arise because of different relations and interactions over time and space, and Dark Ages are the periods when these constraints manifest themselves. There are a variety of reasons and factors at different levels that could engender social reproduction constraints and hence crisis. For example, constraints can emerge as a consequence of a social formation's intensive relation with its ecological environment within and without. They can also be the result of the contradictions between inter- and intrasocial groups or the outcome of the incommensurability of different functions of the social formation giving rise to contradictions (e.g., a chosen social strategy that cannot be supported by the existing economy). Beyond this, reproduction limitations can also emerge because of unintended consequences from the social strategies chosen.

The numerous constraints and factors, such as contradictions between inter- and intrasocial groups or the incommensurability of different functions of the social formation giving rise to contradictions triggering crises

of reproduction, identified have been mostly derived from social, political, and economic roots. What is seldom discussed during these phases of Dark Ages is the social formation's relation with its ecological environment within and without. This neglect frames our perception that Dark Ages are characterized *only* by social, political, and economic depressive conditions. They exhibit conditions of acute social, economic, and political disruptions exhibited by trends such as:

- economic slowdowns and trade disruptions
- political unrest and breakdowns
- reduced social stratification and social simplification of lifestyles
- deurbanization
- increased migration
- population losses[7]

The above trends do not reveal to us the scale of ecological degradation. If explanations of crisis sequences are limited to only those of socioeconomic and political origins—Dark Ages therefore are not understood as periods circumscribed by ecological crisis and climatological changes—we will accordingly miss other factors and dimensions that might be determinative[8] or contingent in terms of explanatory power. Widening and deepening our gaze through the inclusion of the ecological landscape, the natural processes, and the climatological cycles that circumscribe our material lives would compensate for the deficit.

However, such an adjustment would mean a different line of reasoning and presentation of historical data (from the ecological landscape) that will lead to an explanation for sequences (Dark Ages) in world history from a different angle than what has been proposed to date. It would reveal that there are costs associated with the reproduction of socioeconomic life, and the consequence being a trajectory of numerous collisions with the natural environment as civilizations, empires, kingdoms, and nation-states seek to expand and grow (Chew 1999, 2001; Ponting 1991; Hughes 2001). Such collisions have a number of outcomes such as natural resource depletion, loss of species diversity, polluted oceans and rivers, siltation, population losses due to flooding, etc. (Chew 1999, 2001; Ponting 1991; Hughes 2001).

Examining the Dark Ages in greater detail reveals that the Culture-Nature relations during such a period exhibit trends and tendencies that are significantly different from expansionary phases (e.g., see Renfrew 1982). The socioeconomic patterns that emerged during these Dark Ages veered away from the usual intensive exploitation of Nature that normally characterizes the trends and dynamics of human societal reproduction. During such phases of world history, all expansionary trends that are

typical reproductive features of human communities display negative trajectories and tendencies, especially in the core areas of the world system.[9] In view of this, Dark Ages also represent ecological long phases reflecting the outcomes of the relations between Culture and Nature.[10]

With reduced socioeconomic activities, Dark Ages are perhaps periods of restoration of the ecological balance that has been disrupted by centuries of intensive human utilization of Nature. Several studies have indicated how the relations between human communities and the natural environment have impacted the former's economic reproduction and have also caused socioeconomic organizational changes and perhaps even their collapse (Kristiansen 1993, 1998a; Chew 1995a, 1997a, 1999, 2001, 2002a).

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 system define the historical tendencies and trajectories of the human enterprise (Kristiansen 1998b; Chew 1999, 2001). Therefore, perhaps the usual dictum that "economy in command" is the sole force underlying global transformation in the long term needs to be reconsidered. We need to file down further the key for understanding and explaining world-system dynamics and transformation (Chew 1999, 2001). It is the interpellation between "ecology in command" and "economy in command" that accounts for system transformation. Perhaps even more of the former than the latter is the underlying condition prompting a system crisis or transition.

World history has shown that the impacts of Dark Ages do not extend necessarily and evenly across geospatial boundaries of the system. As we have seen in *World Ecological Degradation,* ecological degradative shadows are cast by the dominant core over wide areas of the world system. These shadows thus are a consequence of core-periphery relations beyond those ecologically degradative effects that might be generated by the periphery itself. The articulations of the connections between and within regions during periods of world history between the core and the periphery determine the impact and spread of Dark Age conditions. Depending on the systemic connections of the world economy at a particular point in time, and the level of intensity of the Culture-Nature relations experienced by a given region, the extent of impact of a Dark Age period is uneven. The state of crisis and/or transition appears to have its greatest impact on the regions of the world system that are considered the core(s) of the system at the specific point in time. No doubt, this is related to the fact that it is in the core region(s) where Culture-Nature relations are at their most heightened levels. This does not imply that the periphery does not experience any crisis conditions. The connections that the core has with the periphery via several economic and political

processes ensure that at least some (if not all) crisis conditions will be felt. The extent is based on how incorporated the periphery is in the productive processes of the core(s).

At the nascent stage of world-system connections, it is very clear that during the *early stages* of the evolution of the world system, Dark Age conditions encountered in one part of the world system might not be felt as catastrophically and simultaneously as the part (both core and periphery) encountering these conditions. Over time, the lack of simultaneity of impact will develop to a synchronicity of impact of Dark Age conditions as the evolution of the world system continues, and as available areas of natural resources get reduced and the landscape becomes more and more degraded, thus increasing the vulnerability exposure level and leaving very little room for ecological recovery. In short, the ecological circumstances circumscribe the tendency of the synchronicity of Dark Age conditions being experienced across the world system. To some extent, Dark Ages also offer opportunities for some in the periphery to rearticulate themselves within the hierarchical matrix of the zonal production and reproduction processes.

Climatological changes are also associated with Dark Ages. Climatological changes and natural calamities when they occur during Dark Ages generate further challenges to social system reproduction. Their occurrences and impacts on social systems have been noted during periods of the Dark Ages (e.g., see Keys 1999, Chew 1999, Weiss et al. 1993, Weiss 2000, Weiss and Bradley 2001, Burroughs 2005). Higher-than-normal temperatures can generate salinization problems for agricultural cultivation, especially in areas where irrigation is extensively used. It could also lower harvest yields. The aridity that commonly occurs with high temperatures has often generated severe problems for pastoral herds because of the loss of foliage and grasses that have led to nomadic migrations, thus causing further social pressures on core centers.

If Dark Ages are prolonged crisis periods, then crisis provides opportunities. In other words, crisis conditions, though perhaps restricting continuous unrestricted expansion, provide the opportunities for the resolution of contradictions that have developed to such a state that inhibits the reproduction of the system. Such opportunities are presented timewise during the period toward the end of the Dark Ages when the socioeconomic conditions of deterioration are receding and the natural environment has started to rejuvenate. Thus, crisis enables the necessary adjustments to be made. It leads to pathways and processes that would mean system reorganization and perhaps even transition. Given this, Dark Ages provide the opportunity for systemic reorganization, perhaps also engendering systemic transition followed with redistribution of resources, political power, and economic concentration.

Duration of Dark Ages

Dark Ages therefore depict very specific moments in world history when system reproduction is in a state of crisis and/or transition. Resolution of the crisis requires an extended period (historically at least five hundred years) as the length of occurrence of specific Dark Ages have revealed. Such an expanse of time (ecological time) provides the window of opportunity for the ecological landscape to be restored and to enable economic productive capacities to continue. Especially with resource depletion, the need arises for innovations in social organization and technology.

If it is not possible for the ecological environment and trade networks to be restored, new geographic areas of ecological assets have to be located and/or the replacements of much-depleted natural resources for productions are adopted. Furthermore, technological innovations could also occur to address the issue of depleted natural resources so that some level of economic production can continue. Besides this, it warrants us to consider the different time durations (ecological time) for understanding the interaction between Culture and the natural environment compared to political and economic activities that necessarily are gauged along social time.

In certain circumstances, resolution of a system crisis might not necessarily lead to a system transition. In this case, the crisis is resolved because the ecological balance has been restored, thereby allowing for social reproduction on the extended scale to occur and because the state of the socioeconomic organizations and political hegemonies in place have the capacity to meet the contingencies of the restored ecological balance. If, however, these conditions are not in place, a new set of organizing and learning principles will need to be engendered to meet the contingencies of the transformed terrain generated by the crisis conditions of the Dark Age. In such a context, qualitative changes ensue and a system transition occurs. In this regard, perhaps what has been identified as long economic cycles or *conjonctures* might not reveal the long-term trends of the world system and thus might not be as valuable or insightful for our understanding of the long-term processes of the evolution of the world system. Instead, we suspect that perhaps these long ecological phases might be *the* system transition moments leading to structural changes of the system as a whole. These long ecological phases or Dark Ages ultimately reveal specific conjunctural elements and factors that come into play conducing a system transformation. The outcome is a transformed world system with a number of qualitatively socioeconomic and political structures. The transition from the Bronze Age world system to the Iron Age system (1200 B.C.–700 B.C.) was one such moment in world system history. What this means is that world system history is not a flattened history just ac-

counting for networks of trading links and economic cycles of expansion and contraction with little or no distinguishing differences between periods, rather it is a history that is one with ruptures through time leading to system reorganization and social evolutionary changes.[11]

Hence, Dark Ages are important moments in world history for they provide opportunities for the ecological balance to be restored, political and economic opportunities for some peripheral groups to advance up the zonal power matrix, and for reconfiguration of the hierarchical division of political economic power of the world system at specific conjunctures of world history. The rarity of such occurrences in the last five thousand years of world history suggests the resiliency of the ecological landscape to human assault. Besides this, it underscores further the different time duration for our understanding of the interaction between Culture and the natural environment measured along ecological time rather than social time, which is the gauge for political and economic activities. Given this, Dark Ages is a world system process that occurs in phases in world system evolution.

TIME, LANDSCAPES, ECOLOGICAL PHASES, AND CYCLES

Landscapes harbor histories of human activities. They reflect the outcomes of human impact and mask what had happened in the past. They are historical records of natural processes (wind, tectonic shifts), climate, human activities, and the growth cycles of animals, plants, trees, and other living things. On this basis, ecological recovery and restoration over the *longue durée*, if they occur, keep the histories of human exploitative activities hidden from the present. Our preoccupation with social, economic, and political events and the actions of historical agents is limited often to short time sequences established via the calendar or the clock. Nature's injuries caused by centuries of human excesses take much longer to reveal themselves in ways that impact the reproduction of human communities. When they do appear, the eruptions occur at the most extreme point of the cycle of the degradation process. As a result, we often fail to recognize the deeper swells of world-systemic connections underlying devolution of the system that are conditioned by ecological stress and climatological changes that need to be measured, analyzed, and considered not in decades but in centuries and/or millennia. Timescales of change thus are different in terms of length.

The longer duration is of importance when we are considering outcomes arising from the relationship between Culture and Nature. The impact of socioeconomic activity on the natural environment and hence the length of ecological crisis, I believe, is of a longer duration than, for

example, the three-hundred-year economic cycles of boom and bust believed to be pulsations of the world system (e.g., see Frank and Gills 1993). Neither the duration nor the frequency of the occurrences cycle rhythmically over three-hundred- or fifty-year periods, as would be characteristic of economic cycles. We should view these long periods of crisis as phases. The succession of phases is not necessarily evidence of a cyclical theory. The ecological crisis phases (Dark Ages) reflect the rhythms of natural and biological processes with their own distinct pulsations; however, these rhythms *do not necessarily correlate* with anthropogenic-induced social, political, and economic cycles nor have the same duration.

The disruption of natural rhythms of the ecological landscape via the process of the degradation of the environment extends over a longer term, at least as long as five hundred years or perhaps even more. Given this, whatever socioeconomic and political changes are triggered by the Culture-Nature relations appear only after very long periods of ecological stress when the degradation is most extreme. The same consideration should be given to those political and economic circumstances induced by natural processes and climatological changes. In other words, there is a long-term lapse between cause and outcome. We might therefore have time lags of unspecified durations depending on the state of the ecological degradation.

The harmonizing of social time measuring, for example, each fifty-to-three-hundred-year political economic cycle with ecological time that is based on natural processes and mechanisms, and hence of a longer duration (though measured on socially constructed time scale), is complicated by this long-term time lapse. What should be noted is that every political economic shift periodized along the social time continuum *cannot always be correlated* with signs of ecological stress and/or climatological changes because the latter changes operate on much longer time duration. As we have stated above, at times it *is difficult to link* ecologically degradative and climatological changes with political economic changes. The sparse information available on ecological stress caused by specific social systems, and the limited data on climatological and ecological changes during the early eras, further complicate our attempt. At best, the socioeconomic and political cycles can serve as *markers* for our efforts to demarcate the ecological crisis phases that are determined by natural and ecological processes.

Given the above, the natural processes, having their own ecological time rhythms, when placed within a social time continuum would extend over a longer duration. What this means is that attempts to use social, political, and economic cycles to demarcate and characterize specific periods of expansion and efflorescence of human-induced activities such as urbanization would have to be reassessed if ecological conditions are

considered as part of the explanation for such transformations. The time durations are necessarily longer than the fifty-to-three-hundred-year cycles that have been assumed to be the time parameters of world-system pulsations that are anthropogenically induced (e.g., see Frank and Gills 1992). Placed within the social time frame, these shorter social, political, and economic cycles nest within the longer ecological phases that last at least five hundred years or more.[12] What then does this long duration of Dark Ages signify in terms of world history? Do they demarcate for us the phases of the human socioevolutionary processes besides marking for us the phases of ecological degradation? The following chapters will examine the world-systemic nature of Dark Ages and their effects on the evolution of the world system in an attempt to address these questions.

NOTES

1. For an exposition of this long-term time duration, see Braudel (1980, 25–54).

2. In the early parts of the twentieth century, there were also other studies emphasizing nonhuman factors in engendering social system crisis, see for example, Huntington (1917).

3. For a fuller explication of Braudel's analytical levels of long-term change see Chew (1997b).

4. If a growth developmental model is assumed, the reproduction levels should be progressively higher rather than lower, hence instead of developmental evolution, stagnation or devolution would be the more appropriate concepts to describe these changes.

5. See, for example, Kristiansen's *Europe before History* for an elaborate articulation of the different levels of interaction and connectedness occurring in European transformation over one millennium.

6. Such a multiplicity of levels has been confirmed in the depictions of Dark Age conditions in prehistoric Greece by Snodgrass (1971).

7. The socioeconomic and political evaluations of Dark Ages in terms of conditions and factors leading to the onset of these periods are found quite commonly among the historical literature, especially for the Dark Age that occurred in the second millennium B.C. They ranged from cultural decadence, invasions and conquests by "barbarians" and nomadic tribes, internal conflicts, overcentralization of authority, famine and diseases, climate changes and tectonic shifts (Toynbee 1939, Childe 1942, Snodgrass 1989, Renfrew 1979, O'Connor 1983, Desborough 1972, Carpenter 1968, Bryson et al. 1974, Weiss 1982, Neumann and Parpola 1987, Bintliff 1982, Harding 1982, Schaeffer 1948, Van De Mieroop 2004, Bintliff 2004).

8. By "determinative," I mean constraints that do not allow the system to reproduce itself within its social and ecological parameters (see also Kristiansen 1998a).

9. For example, in the case of Mycenaean Greece during that Dark Age, we find several Culture-Nature trends and patterns that are subdued: fall in population levels, decline or loss in certain material skills, decay in the cultural aspects of life, fall in living standards and thus wealth, and loss of trading contacts within and without Greece (Snodgrass 1971, Desborough 1972).

10. See, for example, Snodgrass (1971) and Desborough (1972) for conditions of Greece during the second millennium B.C. Dark Age.

11. This conception of world system history is different from that proposed by Frank (1998).

12. Recent works by Modelski and Thompson (2001) have indicated longer phases of urbanization and deurbanization processes over world history. They have projected these phases to be at least one thousand years in duration.

II

THE CRISIS OF THE BRONZE AGE

2

Nature and Culture

Following the Neolithic Revolution, the Urban Revolution as a world historical process further framed the course of human history (e.g., see Childe 1950). One of the earliest signs of this urbanization process appeared in the riverine valleys of southern Mesopotamia, Egypt, and northwestern India over five thousand years ago and continued the transformation of the landscape by human communities that started with the advent of agriculture. The process of urbanization encompassed trade linkages and accumulation, cultural exchanges, and a specialized and differentiated division of labor across the system. This type of architecture of physical structures, social institutions, and commerce further heightened the hierarchical distribution of surplus within and between regions. Coupled with the population increases, the process of urbanization framed the level of extensive resources required to reproduce the system that emerged (Chew 2001).

Viewed from the perspective of the human community, underlying this world historical process was the expansion of production and trade, followed by cultural transformation and the growth of cities. Trade, production, and urbanization processes interacted with demographic increases to construct a human world of exuberance. Innovations in metallurgical processes and in the fabrication of commodities such as textiles and ceramics established the search for and removal of natural resources and forests. During the early Bronze Age, in the Mesopotamian valleys, ziggurats, public buildings, canals, granaries, and other facilities that depicted economic growth were erected coupled with extensive trading across the Arabian Sea and Red Sea through to Egypt in the West and the Harappan

civilization in the East (Chew 2001). For this period, the latter two centers had levels of urbanization and human specialization (division of labor) that were of the same scale. Temples, pyramids, grain storage areas, and citadels were constructed from burnt bricks, granite, and other materials that can be secured locally or imported.

Out of this urban and demographic transformation was the further development of a set of urbanized enclaves that specialized in resource extraction, trade exchanges, and commodity production in a systemic context extending initially from West Asia and the eastern Mediterranean to northwestern India (Chew 2001). Further expansion from the second millennium onward brought Europe and central Asia into this expanding network of urbanization, commerce, and trade exchanges.

Viewed from the perspective of Nature, such world historical processes induced a continuous and, perhaps over time, a 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. Rivers were dammed. Such wide-scale human activities such as deforestation led to soil erosion in the mountains and hills including the river valleys and the continuous impact of human activities further heightened the process. In all, socioeconomic activities along with wars were transforming the landscape with scars revealing the scale of such acts.

Notwithstanding periods of economic stagnation, such efflorescence of the human communities would ultimately lead to ecological distress. These periods emerged over very long durations. Associated with these long phases of ecological crisis are climatological shifts and eruptions of natural processes that also impacted the social, political, and economic landscapes. The combination of all these conditions induces a *systemic* crisis of the social system. Such systemic crises are what we have come to know as the Dark Ages. One such systemic crisis or Dark Age began about 2200 B.C., initially impacting northwestern India, the Gulf, Mesopotamia, and West Asia and had repercussions for the urbanized core areas such as Mesopotamia and the Indus (Chew 2001, Childe 1942). It marked the start of the system crisis of the Bronze Age.

Following the end of this phase of the crisis about 1700 B.C., new power centers emerged in the Near East, northern Mesopotamia, and the eastern Mediterranean. This systemic crisis emerged again about 1200 B.C. at the social system level and continued until 700 B.C., depending on the region, and impacted the main areas of Near Asia, Egypt, eastern Mediterranean, and central Europe (from 800 B.C. onward). These periods of crises not only were characterized by socioeconomic distress, regime transitions,

and center or hinterland conflicts, but they were also riddled with population losses, deurbanization, natural resource depletion, environmental degradation, and climatological changes. Negative ecological trends (such as deforestation) were observed from 2200 B.C. onward (Chew 2001). Temperature increases and aridity pulsated from approximately 2200 B.C. with warm periods and dryness alternating with cool conditions and moistness (Fairbridge et al. 1997, 603–6). Such ecological and climatological circumstances impacted the reproduction capacities of some parts of the system and reverberated throughout the system as the Bronze Age proceeded.

NATURAL AND SOCIAL SYSTEM CONNECTIONS

By the third millennium B.C., urbanized communities had emerged in the riverine valleys of Egypt, Mesopotamia, and northwestern India (and probably China as well). The areas of domestication were small for Egypt and Mesopotamia in comparison to the Harappan civilization in northwestern India. Upper Egypt covered only about 12,000 km^2 while Lower Egypt was about 11,000 km^2. Mesopotamia stretched for about 20,000 to 25,000 km^2. The Harappan civilization was about forty times larger in terms of area—almost close to one million square kilometers. In a semi-arid environment dependent on seasonal rainfall, the utilization of the Nile, Tigris, Euphrates, and Indus rivers to satisfy the reproductive needs of these urban complexes structured the linkage of these communities to the rhythms of the landscape and the climate. Hence, changes in climate and wind patterns impacted the harvests and the associated economic activities.

Mesopotamia, located in a vast land mass geographically distinguished as the Ancient Near East, and Egypt to its northwest, are both circumscribed within a natural environment defined by geological phenomena (earthquakes and volcanic eruptions), wind, rain, and water courses. The topography of this land mass is defined by three tectonic plates with the Arabian plate pressing to the North underneath the Iranian plate, forming a long depression when the two plates connect stretching from the Persian Gulf to the Mediterranean Sea. In this depression, the Euphrates and the Tigris flow and discharge into the Gulf. The African plate meets the Arabian plate on the western part of the Near East, creating a valley lined by mountain ranges such as the Taurus, Amanus, and the Lebanon Mountains.

To the east of Mesopotamia, in northwestern India, bordered by a mountainous plateau on the west and the Thar Desert to the east lay the Harappan civilization. To the north and northwest of the Harappans

4. Our position differs from that of Shaffer (1982), who has indicated that the Harappan civilization was primarily dependent on internal exchange.

5. Harappan goods were exchanged throughout the Bronze Age economic system as far West as southern Mesopotamia. Dales (1977) has periodized that there was a shift in trading routes of the Bronze Age economic system away from the Central Asian land trade routes to a maritime route by the mid–third millennium B.C. connecting the Indus valley via the Gulf to southern Mesopotamia. The trade on this maritime route started to decline between Mesopotamia, the Gulf, and the Indus Valley by the mid–second millennium.

6. Thompson (2001) has periodized the pulsations of the expansion and contraction of this trading world of the Near East.

3

Ecological Crisis and System Transformation

DARK AGES ARE ECOLOGICAL CRISIS PHASES

Social historians and archaeologists have noted the various phases in world history when Dark Ages have occurred. These periods cover centuries with perhaps the very earliest starting at 2200 B.C. to 1700 B.C., which Barbara Bell (1971) and Gordon Childe (1942) have defined as the first Dark Age of ancient history. This eclipse was followed by another sequence from 1200B.C. to 700 B.C., and a further phase starting from A.D. 300/400 (depending on the geographic locale) to A.D. 900. Between the fourth and the fifth centuries A.D., changed ecological, climate, and socioeconomic and political conditions emerged in the world system. Downturn socioeconomic conditions emerged earlier in the third century A.D. for the Roman Empire, and these conditions were prevalent through to the fifth century. Instead of demarcating the third century as the initiating century of the Dark Age of Antiquity, the fourth and the fifth centuries have been used as the prevalence of changed conditions were widespread.

If we periodize these Dark Age phases on a *social time* continuum, I wish to suggest that this first-known social/natural system crisis of the Bronze Age world system (there is an indication that there was an earlier crisis of the Bronze Age world system about 3800/3400 B.C.) started from 2200 B.C. and continued to 1700 B.C. At 1200 B.C., the social system crisis emerged again and lasted until 700 B.C., when it was finally resolved with the transition to the Iron Age. With the arrival of the Iron Age, system expansion continued through the early Iron Age. However, by A.D. 300/400, system crisis returned resulting in another prolonged period of ecological and socioeconomic distress that lasted until A.D. 900.

The extent of the impact of the Dark Age conditions in terms of geographic limits of the system is difficult to map completely, especially with the limited amount of available data to consider, and our present understanding of the level of the connectivity of the system at that time. Therefore a comprehensive coverage is beyond the means of existing available data; instead, the exercise will be to identify selectively the simultaneity and connectivity of the different areas of the world system that were impacted by the Dark Age conditions. As we have indicated previously, it should be noted that not all regions/zones of the world system were impacted simultaneously, for this is dependent on the state of connectivity between the regions of the system.

The above identified periods for the Dark Ages were dated from archaeological finds and literary accounts of social, economic, and political trends and activities. However, if we examine the pollen profiles of deforestation and reforestation, the periodization for the first Dark Age is much longer (see table 3.1). In fact, in *most* cases, continuous from 2200 B.C. to 700 B.C., there are no breaks indicating recovery after 1700 B.C., as the archaeological and literary accounts have indicated (see appendix 1 for arboreal pollen profiles for specified areas, and appendix 2 for *plantago* pollen profiles for specific areas).

Underneath the swell of socioeconomic expansion beginning about 1700 B.C., the structural conditions of ecological distress *continue*.[1] Through time, crisis conditions emerge again at the social system level before a needed reorganization of a social system can occur in order to resolve the system crisis that arose from contradictions in Culture-Nature relations. This continuous period of *uninterrupted* ecological distress from 2200 B.C.–700 B.C. means that natural or even human-induced regeneration takes longer, and has its own rhythm (ecological time), even though an expansion has started at the level of the social system with increasing social systems complexity noted.

Ecological distress in terms of landscape vulnerability is conditioned by the state of the forests and socioeconomic activities of the human communities. Pristine forests were removed during the Neolithic Revolution for agriculture initially, and with the formation of grasslands, pastoralism was practiced. Landscapes that have not suffered continuous deforestation and have forest reserves juxtaposed with agricultural or pastoral lands continue to be productive for the human communities. These landscapes are not as vulnerable to climatological and natural disturbance changes. In this case, we continue to see economic expansion in spite of a drop in pollen count indicating a deforested landscape.

From table 3.1, we get a view of the deforestation phases for the various parts of the world system starting from about 3800 B.C. onward. We

Table 3.1. Arboreal Pollen Profiles—Deforestation Periods

Area	*Phase 1*	*Phase 2*	*Phase 3*	*Phase 4*
Western Europe				
1) Belgium (Moerzeke)	3093 B.C.–2600 B.C.	2002 B.C.–1274 B.C.	A.D. 180–A.D. 544	
2) Germany 1 (Lake Constance)	2850 B.C.–2050 B.C.	1240 B.C.–230 B.C.	A.D. 600–A.D. 1480	
3) Germany 2 (Lake Steisslingen)		2175 B.C.–144 B.C.	A.D. 348–A.D. 1594	
4) Germany 3 (Ahlenmoor)		2200 B.C.–1700 B.C.	A.D. 169–A.D. 664	
5) Switzerland (Lobsigensee)	3920 B.C.–2170 B.C.	1253 B.C.–A.D. 767		A.D. 1055–
6) France (Le Marais St. Boetien)	3520 B.C.–585 B.C.		A.D. 327–A.D. 936	
7) Ireland (Arts Lough)	3726 B.C.–1653 B.C.		A.D. 352–A.D. 1094	
Central and Eastern Europe, Russia				
8) Bulgaria 1 (Besbog 2)		1730 B.C.–A.D. 1160		A.D. 1500–A.D. 1832
9) Bulgaria 2 (Mire Garvan)	3901 B.C.–2123 B.C.	1235 B.C.–A.D. 882		A.D. 1162–A.D. 1628
10) Hungary (Lake Balaton SW)		2683 B.C.–816 B.C.	A.D. 381–A.D. 1296	
11) Poland 1 (Bledowo Lake)	3633 B.C.–2518 B.C.	724 B.C.–A.D. 967		A.D. 1533–
12) Poland 2 (Puscizna Rekowianska)	3638 B.C.–1331 B.C.		A.D. 402–A.D. 881	
13) Poland 3 (Kluki)	3803 B.C.–665 B.C.		A.D. 452–A.D. 884	A.D. 1000–A.D. 1573
14) Byelorussia 1 (Dolgoe)	4800 B.C.–3850 B.C.	3400 B.C.–750 B.C.	A.D. 380–A.D. 1460	
15) Byelorussia 2 (Osvea)	3600 B.C.–330 B.C.			A.D. 1334–A.D. 1778
16) Ukraine 1 (Kardashinski Swamp)	3673 B.C.–2170 B.C.	1338 B.C.–A.D. 300		A.D. 1229–
17) Ukraine 2 (Starniki		2600 B.C.–727 B.C.	A.D. 93–A.D. 1400	
18) Ukraine 3 (Stoyanov 2)	3900 B.C.–2020 B.C.		A.D. 300–A.D. 1660	
19) Ukraine 4 (Ivano-Frankovskoye)	3937 B.C.–500 B.C.			
20) Ukraine 5 (Dovjok Swamp)		2700 B.C.–224 B.C.	A.D. 40–A.D. 800	A.D. 1200–A.D. 1700
21) Russia (Chabada Lake)	3800 B.C.–1737 B.C.	1400 B.C.–306 B.C.		A.D. 1405–
Northern Europe				
22) Sweden 1 (Ageröds Mosse)	3004 B.C.–256 B.C.		A.D. 435–A.D. 1682	

Table 3.1. *Continued*

Area	Phase 1	Phase 2	Phase 3	Phase 4
23) Sweden 2 (Kansjon)	3752 B.C.–A.D. 978			A.D. 1647–
24) Norway (Grasvatn)	4064 B.C.–3032 B.C.	1612 B.C.–A.D. 323		A.D. 1097–A.D. 1700
25) Latvia (Rudushskoe Lake)	3955 B.C.–1700 B.C.	627 B.C.–A.D. 837		A.D. 1300–
26) Greenland (Lake 31)	2864 B.C.–2178 B.C.	1700 B.C.–121 B.C.		A.D. 1139–
27) Finland 1 (Kirkkosaari)	3022 B.C.–A.D. 1537			
28) Finland 2 (Mukkavaara)	3618 B.C.–A.D. 1757			
29) Finland 3 (Hirvilampi)	4283 B.C.–3540 B.C.	2611 B.C.–696 B.C.	A.D. 389–A.D. 1040	
Mediterranean				
30) Greece (Edessa)	3998 B.C.–2852 B.C.	1941 B.C.–292 B.C.		A.D. 1026–A.D. 1800
31) Greece 2 (Khimaditis 1B)		1641 B.C.–A.D. 1700		
32) Italy (Selle di Carnino)	4539 B.C.–3000 B.C.		A.D. 436–A.D. 1220	A.D. 1529–A.D. 1634
33) Spain 1 (Saldropo)		2202 B.C.–774 B.C.	A.D. 300–A.D. 948	A.D. 1266–
34) Spain 2 (Sanabria Marsh)	3500 B.C.–1700 B.C.		A.D. 856–A.D. 1850	
35) Spain 3 (Lago de Ajo)		1884 B.C.–552 B.C.	A.D. 309–A.D. 1170	
36) Spain 4 (Puerto de Los Tornos)	4200 B.C.–A.D. 395			A.D. 1200–A.D. 1750
37) Spain 5 (Laguna de la Roya)	4500 B.C.–2728 B.C.	968 B.C.–A.D. 848		A.D. 1600
38) Syria (Ghab)		3592 B.C.–1505 B.C.	983 B.C.–A.D. 500	
39) Turkey 1 (Köycegiz Gölü)		2306 B.C.–616 B.C.	180 B.C.–A.D. 916	A.D. 1700–A.D. 1941
40) Turkey 2 (Beysehir Gölü)	3500 B.C.–2527 B.C.		243 B.C.–A.D. 1100	

Source: Based on data from van Zeist et al. (1980); Rankama and Vuorela (1988); Bottema (1974); Eronen and Hyvrinen (1982); Lazarova (1995); Stefanova (1995); Verbruggen et al. (1997); Bezusko (1987); Bezusko et al. (1985); Amman (1985); Watts et al. (1996); Penalba (1994); Binka et al. (1988); Khomutova et al. (1994); Bradshaw et al. (1988); Eisner (1995); Behre and Kucan (1986).

Note: The above pollen profiles were computed using counts of arboreal pollen grains as determined by stratified layers that were distinguished by years that were carbon-dated and calibrated. The number of arboreal pollen grains for each layer specific to each carbon-dated calibrated year were then analyzed in a time series using a polynomial function to determine the trend line. The trend line provided the increases and decreases of total arboreal pollen grains over the time duration specified by the specific palynological analysis from which the data of count of arboreal pollen grains were derived. The same analytical procedures were also used for the plantago pollen grains.

assume that during this early period of world history, the vulnerability of the landscape as a consequence of excessive deforestation was not at a crisis threshold in comparison to a millennium later, whereby following a long period of continuous removal of the forests by humans led to a landscape where the forests disappeared, and by this point in time, grasslands predominated.

For the reproduction of human communities, grasslands are naturally more vulnerable to climate changes without forest resources. Therefore, such a transformed landscape elevated the vulnerability of the human communities, and certain adaptations had to be made resulting in a changed economy. A situation of this nature emerged during the third millennium B.C. leading to technological and cultural adaptations or what A. Sherratt (1981) has termed the "secondary products" revolution. In such a case, from the second millennium B.C. onward, economic adaptation to a very open deforested landscape took place and conditioned the shift from agriculture to pastoralism proceeded incorporating the breakthroughs in technologies and animal husbandry. Coupled with the urban revolution and its set of accumulation and population dynamics, transformations continued. Such adaptations and development occurred in the Fertile Crescent to central and southern Europe including central Eurasia.

As history proceeded with intense land use to meet the structural socioeconomic dynamics that have evolved, by the end of the third millennium B.C., the vulnerability threshold of the landscape became more precipitous. Crisis emerged and social system reproduction was in peril. The Bronze Dark Ages were such periods, punctuated by climate changes and natural disturbances; crisis of social reproduction was at stake. The crisis emerged in those landscapes that were denuded following the above progression of landscape transformations. At the end of the third millennium B.C., these areas were around southern Mesopotamia, northwestern India, and to some extent Egypt (before the Middle Kingdom period), where Culture-Nature relations were at quite heightened levels to meet the needs of the densely populated hierarchical urbanized communities. Their associated hinterlands were also under stress as well.

Given the above, Dark Ages are periods of ecological crises—besides being characterized by anthropologists, historians, and archaeologists as commonly having declining population, trade and economic disruptions, deurbanization, and changes of political regimes. If this were the case, we would expect to find some proxy indicators of ecological degradation, such as deforestation levels, in those devastated landscapes, soil erosion, and endangered species underlining these periods. Along with these ecological indicators, climatological changes such as temperature, rainfall, and natural disturbances also punctuate these periods as well.

Besides natural processes of loss and regeneration, ecological stress levels are outcomes of Culture-Nature relations. These relations are determined by the expansionary dynamics of the process of accumulation in the world system, urbanization processes, and population levels. With *conjonctures* of economic expansion and its other related processes, we would expect to find extreme signs of ecological stress such as deforestation reflecting and *following* these economic expansionary phases. These *conjonctures* of economic expansion serve as markers identifying the periods of extreme exploitation of ecological resources. The scale and scope of ecological degradation is determined by the connectivity of the world system, as well as by the nature of core-periphery relations for the period in question. What this means is that ecological degradation can be quite overarching because of the relations between regions of the world system and the global division of labor existing during the particular period in question. Coupled with these dynamics of accumulation, urbanization, and population circumscribing and underlining the pace of ecological degradation, conflicts and wars further exacerbate the degree of ecological degradation.

THE FIRST PHASE OF THE CRISIS

The ancient world of the Near East and northwestern Indian subcontinent during the third millennium was characterized by a system of overlapping core regions instead of a single dominant core as we have mapped above (e.g., see Gills and Frank 1992, Chew 2001, Kohl 1987a). Within such a political economic matrix, each core interacted with its immediate hinterland as well as with other cores, leading to certain core regions attempting to shape their adjacent hinterlands and at times trying to control them. Given such political incursions and trading initiatives, systemic connections were established (as indicated previously), and during moments of systemic crisis, crisislike conditions reverberated throughout the system, providing opportunities and constraints depending on the circumstances. Such were the conditions that permeated the late third millennium Bronze Age during the Dark Age crisis period starting about 2200 B.C.

As stated previously, the accumulation of surplus, urbanization, and population growth are the prime drivers of the processes of the social system, which in turn define the social system's interactions with the natural system. The collapse of the natural world results from the excessiveness of the accumulation of surplus, urbanization, and population growth—the dynamics of the social world. These dynamics are played out in an interacting fashion. For example, whether the growth in urbanization and population spurs trade or whether trade furthers urbanization and population growth is difficult to delineate.[2] We know that with the formation and development of cities and urban areas, there is also the deepening of the division of labor. This, in turn, fosters the emergence of a variety of technical skills. With the evolution of a specialized division of labor coupled with trade exchanges, new goods are produced, and combined with the agricultural surpluses derived from the rural areas, the trajectory of urban transformation and growth propels forward. Furthermore, the agglomeration of people in urban environments leads also to innovations and ideas being exchanged and adopted. In turn, trade, while injecting resources into the urban areas, is also enhanced.

The interacting relationships between urbanization, population, and production/trade mean that resources from the natural system are utilized so that the social systems can be reproduced. In *World Ecological Degradation,* the level and scale of resource use by the core centers from near and afar in the third millennium B.C. were traced. This history started on an intense trajectory from the fourth millennium onward and by the third millennium B.C., after one millennium of drawdown of the natural capital, the natural and social systems were exhibiting signs of stress-type conditions. Coupled with these signs, there were climatological changes and tectonic shifts during this Dark Age period.

Deforestation

With its many uses, wood has been an important commodity in the reproduction of social life since the Neolithic Revolution (Chew 2001). Over world history from at least 3000 B.C. onward, 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 (Chew 2001, Perlin 1989, Williams 2003, Yasuda et al. 2000). As such, deforestation was the order of the day. More than 4,500 years ago, we find the Mesopotamians and the Harappans deforesting their own hills and mountains and conducting military campaigns and trade relations with their peripheries to seek a constant wood supply to reproduce their urbanization and accumulation processes. In the Mesopotamian case, high-quality timber was sought through either military expeditions or trade in the Zagros and Taurus mountains, the Caspian Sea area, and the eastern Mediterranean (Rowton 1967, Willcox 1992, Yasuda et al. 2000). 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 (Lal 1997). Timber was also sought as far away as the Himalayas. By no means were the Harappans and the Mesopotamians the exception—the Egyptians

of the Old Kingdom was a consequence of decentralization, dynastic weakness, a shift of wealth and power to several provincial centers during Dynasty 6, the loss of royal power due in part to the trade monopoly with Syria being undercut by the Akkadian conquest of Byblos, and civil wars, and so forth.

10. For an extensive account of the political economy of Crete and the Minoan civilization, see Chew (2001) and Kristiansen and Larsson (2005).

11. To say that Crete was in an expansionary mode during this time of the first phase of the Dark Age starting about 2200 B.C. requires clarification. This expansion during a Dark Age suggests that only the southern portion of the Bronze Age world system was deeply impacted by the downturn trends and that Crete was not in the core of the system at this time.

12. Crete's political-economic strength in the Bronze Age trading world was by no means equivalent to that of Mesopotamia, Harappa, and Egypt. Its urban settlements and palace complexes, which directed its commercial and manufacturing capacity, were much smaller in scale. Measured on the Mesopotamia-Harappa urbanization scale, the palace complexes at Crete were no larger than fair-sized villages of the early Dynastic Mesopotamia. Nevertheless, with the Gulf trade collapse from around 1700 B.C., Crete, because of its location as well, managed to exploit the trading opportunities.

13. Profits were extremely high. About 100 percent for tin and 200 percent for textiles were garnered by these Assyrian merchants (Bryce 2002, 87).

14. Thompson (2001) has periodized the pulsations of the expansion and contraction of this trading world of the Near East.

15. It is beyond the scope of this study to address the connections and exchanges between these cores and peripheries in terms of sociocultural patterns and cosmologies during the Bronze Age, and furthermore, a complete and extensive study has been made by Kristiansen and Larsson in their book, *The Rise of Bronze Age Society: Travels, Transmissions, and Transformations.*

16. There is a dispute over the chronology of this destruction. It was either during the early fourteenth century or in the early twelfth century (Drews 1993).

17. Morris (2000), however, has argued that the shift from egalitarianism to stratification might not be the case. Rather the grave burials reflecting an upper class strata, the *agathoi,* prompt some to conclude that a shift to stratified society by the eighth century did not represent the total spectrum of Athenian society, and that the lower order people were disposed of (or buried) in a different way and have not been excavated by the archaeologists.

18. The spread of tin bronze–alloying technology from the Near East and the Aegean took over five hundred years.

19. See Kristiansen (1998b) for a discussion of the various types of hoarding, the possible reasons for the practice of hoarding, and the nature of whether the hoard is a dry or wet hoard.

20. It has also been suggested that the axe hoards can be reconsidered as recycled ingots for they were cast to reflect everyday use (Huth 2000).

21. Morris (2000) has suggested that perhaps there was no bronze shortage. He says that iron items were found in the graves in a higher proportion than bronze objects because there was a shift in cultural tastes and a preference for iron pins over bronze ones.

III

THE CRISIS OF ANTIQUITY

4

Intensification of Natural and Social System Relations

DARK AGE OF ANTIQUITY

Social system restoration and expansion returned to the eastern Mediterranean about 700 B.C. after over five hundred years of ecological, socioeconomic, and political disruptions. By no means was socioeconomic rejuvenation uniform throughout the system. For peripheral Europe, especially the central and eastern parts, there were signs of ecological and socioeconomic deterioration: a consequence of the regional expansion in agriculture and mining from 1100 to 750 B.C. to meet regional demands after this region experienced trade disruption with the Mediterranean and Near Eastern economies during the Dark Age. In this regard, unevenness of economic expansion in the system does not mean the lack of connectivity of the system. Rather, it shows that at this early period of world system history, the ecological capacities differ between regions/zones. Economic expansion in the core areas after 700 B.C. does not necessarily translate to an overall system expansion, especially in peripheral areas that experienced a regional boom when the core areas were in crisis. Such was the case for central and eastern Europe, whereby centuries of regional expansion (1100–750 B.C.) led to ecological distress by the eighth century B.C., which in turn pushed these areas into socioeconomic decline at a time when the cores areas were rebounding from a Dark Age.[1]

Despite this unevenness of expansion, for the core emerging from centuries of reduced economic activities and saddled with a growing population and a landscape that had been intensively cultivated and mined for centuries, there was a need to locate new areas for settlement and production. Starting as early as the tenth century B.C., these trading and coloniz-

ing plans were under way, primarily undertaken by the Phoenicians, the Greeks, and the Etruscans. As the eastern Mediterranean was already well connected to the existing trading system, even though there were disruptions during the prior Dark Age, it was to the western Mediterranean that most of the efforts were placed. The rich resources of Iberia, Italy, North Africa, and so on were potential areas for such expansion and colonization. Included in this expansionary thrust is the further intensification of trading relations between the Mediterranean and Europe utilizing the river systems such as the Rhône-Soane.

The above initiatives were similar to the later "voyages of discovery" undertaken by the western European powers in the fifteenth and sixteenth centuries A.D., for they established trading posts, settlements, and towns to facilitate trade and resource extraction. Such designs naturally led to capital accumulation and increased urbanization. As always, population growth ensued. What followed were centuries of socioeconomic expansion and political developments and conflicts that stretched from the western Mediterranean to the Near East. From Philip of Macedon to Caesar, we find the further intensification of empire building and slavery along with the slow evolution of the city-state and citizen rights. Such were the socioeconomic and political tendencies that shaped the world (social) system. The incessant socioeconomic and political forces that underlay this system expansion meant that the natural system continued to be under great assault. The resiliency of Nature to such anthropogenic acts of violence finally gave way about A.D. 300/400 with the onset of another Dark Age. By this period as well, the weather had also started to change. As I have indicated previously, Dark Ages are conjunctures whereby ecological ruptures occur periodically when the natural system is under tremendous stress; therefore the Dark Age of Antiquity that follows parallels the prior Bronze Dark Age with its ecological distress, its deurbanization and population losses, its climate changes, its diseases, its large-scale migrations, and its political collapses. It is to this systemic collapse that we now turn.

WESTWARD AND EASTWARD EXPANSIONS

Westward economic exploration ensued with much fervor after 800 B.C. by the Greeks with the establishment of city-states and colonies, though the Phoenicians and Minoans initiated these exploratory ventures much earlier, about 1300–1100 B.C. Whereas the Phoenicians were focused on setting up trading colonies, leaving governance to the local elites, the Greeks pursued their economic objectives via the establishment of the polis or city-states and migrant settlements, thus transforming the politi-

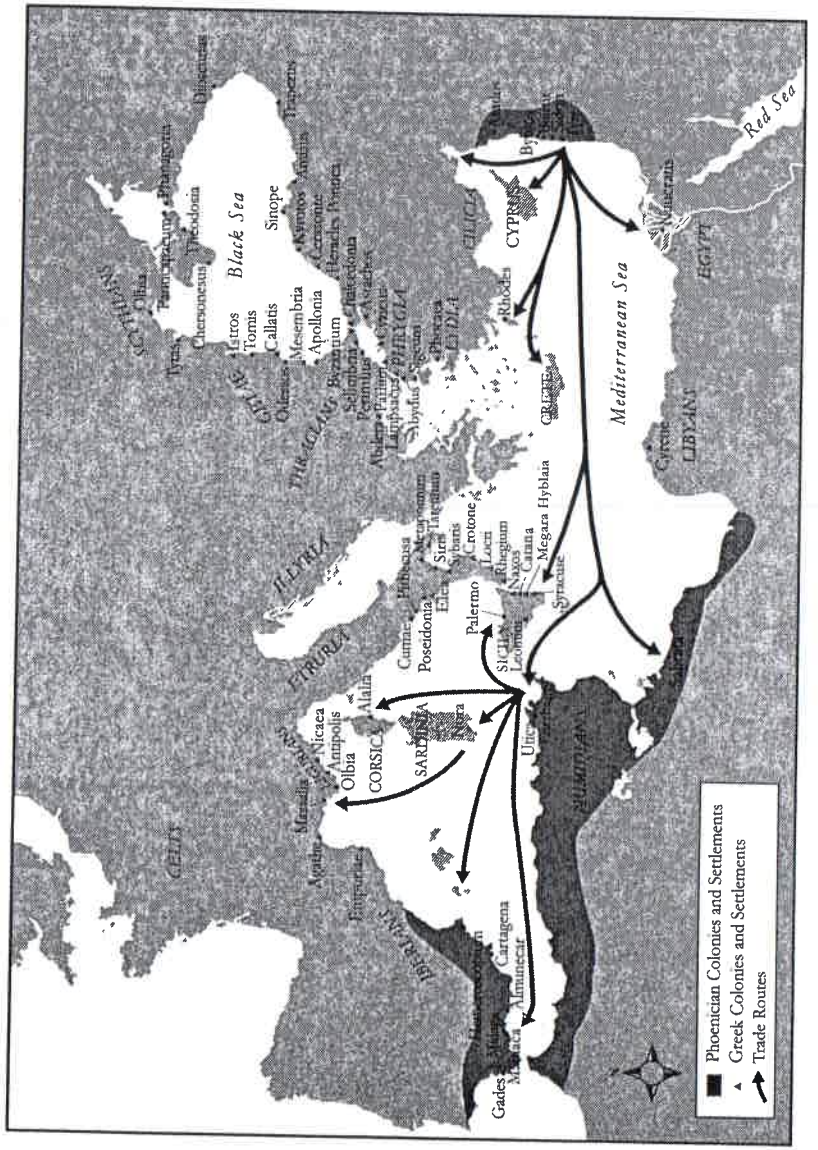

Figure 4.1. The Mediterranean with Phoenician and Greek Colonies and Settlements

5

A Period of Darkness

Periodization of historical epochs has often been subjective and dependent on what the scholar wants to depict and examine. For most historians and archaeologists, the periodization has been based on a number of variables, such as societal complexity, political organization, and cultural development to economic forms of organization and production. Most often, the focus has been on the core political entity and defining the period as, for example, the Roman period or the Hellenistic period. Such broad temporal descriptive depiction does not offer us much understanding of the ecological, social, economic, and political environments. To get a sense of the direction of what is occurring on a regional or a world system basis, we need to be more analytical in our periodization by demarcating periods of stress that are punctuated with climate changes and ecological degradation within an established political-cultural complex such as the Roman Age.

In this sense, periods of Dark Ages over world history can be considered as chronological markers indicating moments of system stress at both the social and natural system levels. At the social system level, Randsborg (1991) attempts to periodize macrolevel social change for Europe and the Mediterranean during the first millennium A.D. by pinpointing the start of the third century A.D. as a "time of crisis and reorganization of the Roman Empire," and the fifth century A.D. as "the time of great migrations" and the collapse of the western Roman Empire. Such an effort gives us a sense of direction in terms of the social conditions of the times and suggests to us that starting from the third century A.D., Europe and the Mediterranean were experiencing structural changes, especially for the

Roman Empire, which at this point covered a large portion of the European/Mediterranean land mass. At the macrolevel, it seems that it was a prolonged crisis that spanned a number of centuries that finally ended by the tenth century A.D., albeit with some periods of efflorescence.

There have been widespread accounts of socioeconomic and political transformations and stress during this period; however, there has been no attempt to periodize, at the natural system level, the ecological stress that the system is encountering. There have been limited efforts to periodize climate changes occurring during this time (e.g., see Curry 1928; Lamb 1968, 1982a; Brown 2001; Randsborg 1991). This provides another opportunity to examine some of the structural changes that were occurring and compare this crisis of antiquity with the Bronze Age system crisis that we analyzed in chapter 3. What follows is an attempt to juxtapose climate changes and the ecological conditions at the natural system level with the ongoing socioeconomic and political transformations occurring during this period of darkness.

CLIMATIC CHANGES AND POLITICAL UPHEAVALS

As we have stated in chapter 3, climate changes such as reduced precipitation or temperature increases could affect socioeconomic activities particularly in the agricultural sphere, and especially so, in marginal areas. Besides this, the physical changes that are caused by humans, such as erosion because of intensive cultivation, and climate changes connected with the reduction of forest cover or agriculture would further have a significant impact on the landscape and the reproduction of the social system.

Just like the third millennium B.C., as depicted in chapter 3, there were climate shifts in Europe and the Mediterranean in the first millennium A.D. For the first two centuries after Christ, there were signs of higher humidity followed from the third century onward with relative dryness (Briffa 1999, Randsborg 1991, Lamb 1981, Allen et al. 1996). This was to change after A.D. 400 with relative precipitation going up until A.D. 500 and then followed with increasing drought from A.D. 500 until the end of the millennium.

During this period in Africa, there was relative aridity from about 800 B.C. to A.D. 400 and between A.D. 600 to 1250 with regular rainfall in the fourth and fifth centuries (Veschuren 2004). The water levels of the Nile were lowered from A.D. 600 to 850 (Robertshaw 2004). For Asia, specifically China, climate changes also occurred between A.D. 300/400 to 900. Abnormal drought conditions were observed between A.D. 400 and 700 (Needham 1959). There was a warm period between A.D. 1 and 240 followed by a cooling period between A.D. 240 and 600/900 (Bao et al. 2002, Ge et al. 2003). Others such as Tan and Liu (2003) and Brown (2001) have

indicated of a warm period from A.D. 600 to 800. The aridity extended from the fourth to the sixth centuries A.D. (Brown 2001).

It is clear that there were climate changes occurring in Europe, the Mediterranean, and Africa, though the changes seemed to appear at different times. A warming trend started about the third century A.D. and was repeated in other parts of the world in a later period, for example, in Africa and China. Adding to such climate changes, Curry (1928) has even suggested that there was a regular succession of climatic cycles lasting approximately 640 years in duration, with about 300 years of increasing aridity. As a consequence of such climatic turbulence, a series of alternating periods of migration and consolidation in Europe and Asia can be traced from the fifth century onward (Teggart 1969). Gibbon (1966) in his major study on the decline of the Roman Empire had referred to the cold temperatures leading to frozen rivers such as the Rhine and the Danube that allowed barbarian (Germanic) armies to cross, enabling them thus to invade the western Roman Empire. These invasions generated disturbances and stress to the social system. The invasions were at times a drain on the Roman treasury, which had to fund war campaigns or to transfer tax collection rights to the Germanic tribes and/or buy them off with gold and silver, thus further crippling the Roman economy.

The start of the third century A.D. was a period of crisis throughout the Roman world, especially in the western part of the empire. Incursions increased in frequency, especially in the western portion of the empire after A.D. 259. On the eastern frontiers, the Goths were attacking the lower Danube, while the Persian kingdom under the Sassanids was creating unstable conditions in the East. In the West, the Franks were pressuring the frontier on the lower Rhine, and the Alamanni tribes during the A.D. 270s were raiding the frontier. By A.D. 330, the imperial capital of the empire was moved eastward to Byzantium and rechristened as "Constantinopolis" (see figure 5.1).

By A.D. 400, the Roman army in the West could no longer defend the frontier adequately, and the battle with the Visigoths clearly showed this. Such a defeat meant that Goths had invaded the northern empire, finally leading to the attack on Rome in A.D. 410. Eventually, through a set of compromises, the Goths settled in southwestern Gaul. Other Germanic tribes followed with the Swabians moving into northwestern Spain and the Vandals taking over western North Africa by A.D. 435. At the same time, the Roman army was also preoccupied with handling the Huns, who had left their pastoral lands due to arid conditions. This was the first wave of tribal incursions.

By A.D. 476, the various kingships of the Germanic tribes took over some of the Roman emperor's rights in the western portion of the empire. By A.D. 500, the Franks controlled northern Gaul, the Burgundians were

IV

SYSTEM TRANSFORMATION

6

From the Past to the Future: Whither System Transformation?

The global environmental crisis looms on our horizon. As a result, whether it is global warming, deforestation, or species extinction, there is an overwhelming concern of the dangers we face in the twenty-first century. Such fears are further wedded to the view that the impending crisis of the environment is a new phenomenon that humanity faces, and that this new thematic is the result of the excesses of capitalism, and the associated economic and social changes that have occurred over the twentieth century.[1] This latter assumption, however, is historically myopic, for it does not take into account the many phases of environmental crisis that have occurred throughout the course of world history for the last five thousand years (Chew 2001). Historically, socioeconomic and political crises are connected with such an environmental crisis period. Therefore, it is also a period of crisis when human evolutionary transformation has been stymied. A phase when human economic progress is at a standstill. A time widely known and commonly understood as the Dark Ages of human history.

From the previous chapters, over world history, there have been at least three occurrences (2200–1700 B.C., 1200–700 B.C., A.D. 300/400–900) of these devolutionary phases or Dark Ages. Given the reduced socioeconomic activities, Dark Ages provide opportunities for ecological restoration as well. From historical records, in spite of their devolutionary tendencies, Dark Ages should also be seen as moments of opportunity for societal learning and power shifts, for crisis conditions often provide other possibilities. Therefore, what results from these devolutionary periods are system reorganizations and transformations as we have seen in this book.

Given the above, such a trajectory of historical recurrences provides us with the opportunity of realizing the past in order to understand the present and possible future(s). However, the historical myopia of the social sciences has traditionally prevented a consideration of the past with its patterns and structures in order to understand the present. This concluding chapter is an attempt to overcome this. What follows is an attempt to be mindful of past patterns for an understanding of our present conditions—one that is fraught with global ecological, socioeconomic, and political crises.

FROM THE PAST TO THE PRESENT

Global pasts as periodized via Dark Ages reveal trends and tendencies of the evolution of the world system. From the Fertile Crescent five thousand years ago, the occurrences of Dark Ages have revealed not only the intensive relationships of human communities with the natural environment, but also the outcomes of these encounters. As the world system evolved over time, the occurrence of Dark Ages extending over wider and wider geographic space revealed the interconnectivity of socioeconomic and political relationships. Places where Dark Ages have not been experienced or appeared later in time suggest to us that these locales had not been incorporated into the evolving world system at that particular point in time when a Dark Age was occurring. Given these parameters, we can demarcate this ever-widening spread of Dark Age conditions in the course of world history when such a period appears. Table 6.1 and figures 6.1 to 6.3 outline the impact of Dark Ages across the zones of the evolving world system over world history. It is very clear from table 6.1 and figures 6.1 to 6.3 that with the occurrence of each Dark Age in world history, the geographic spread has widened increasingly from one Dark Age to the next. It also underlines the continued socioeconomic expansion, evolution, of the world system. The first Dark Age, from 2200–1700 B.C., demarcates the impact from the Fertile Crescent to the eastern Mediterranean and all the way to northwestern India and traversing right through to the borders of western China (see figure 6.1). Besides those areas that were impacted during the first Dark Age, the second Dark Age (1200–700 B.C.) encompassed central, eastern, and northern Europe and Arabia (see figure 6.2). The last known Dark Age that occurred in antiquity reveals the extensive nature of the spread of Dark Age conditions in Europe and Asia (see figure 6.3; Chew 2005b, Sarabia 2004). With the state of globalization of the socioeconomic and political processes of the world system to date, such historical trends and tendencies of past Dark Ages suggest that should the next Dark Age appear, the geographic impact no doubt will encompass all the continents of the world.

Figure 6.1. Dark Age Crisis 2200 B.C.–1700 B.C.

Table 6.1. The Geography of Dark Ages over World History, 2200 B.C.–A.D. 900

Period	Geographic Coverage
Bronze Age	
2200 B.C.–1700 B.C.	Northwestern India, Persian Gulf, Mesopotamia, Turkmenistan, Egypt (recovered by 2040 B.C.), Anatolia, Greece, Crete (recovered by 1900 B.C.), southern Levant (Palestine, Sinai, Jordan)
1200 B.C.–700 B.C.	Egypt, Crete, Greece, Anatolia, Persian Gulf, Mesopotamia, Turkmenistan, Israel, Palestine, Jordan, Sinai, Arabia, Central, Eastern, and Northern Europe (from 750 B.C. onwards)
Iron Age	
A.D. 300/400–A.D. 900	Spain, Gaul, Britain, Germany, Italy, Greece, Southern Levant (Palestine, Sinai, Jordan), Anatolia, Mesopotamia, North Africa, Central, Eastern and Northern Europe, China, Japan, and Korea

Nobel Prize winner Paul Crutzen (2000) has declared that we are in an epoch unlike any of those that have preceded it. Instead of considering ourselves as living in the Holocene period—the period since the last glaciation—we should consider that we are now in an epoch of what he has defined as the Anthropocene. The Anthropocene is a period that is defined by one creature: a creature that has dominated all other species and has become so dominant that its actions have altered the planet on a geological scale. That creature is the human being. The start of this epoch is supposed to be about the 1780s, when the steam engine was invented. For us, however, this demarcation of when the epoch started is not crucial nor that important. Rather, what is important is the acknowledgment that an epoch has begun whereby stressed ecological conditions engendered by humans has been initiated again.

Within the ambit of our generalized theory of Dark Ages, this indicates the possibility of the start of another Dark Age phase. Others who have not utilized long-range analysis nor shared our perspective on this are also in agreement that we are facing a global environmental crisis. Warnings of the environmental crisis trends have been announced at various global meetings organized by the United Nations from Rio de Janeiro to Johannesburg since the 1980s. Studies have been published sounding global environmental alerts starting from the Brundtland Commission on the Environment to the World Commission on Forests and Sustainable Development (1999) and through to the Intergovernmental Panel on Climate Change. In addition, selected scholarly publications, such as Paul and Anne Ehrlich's *One with Nineveh*, James Speth's *Red Sky at Morning*, Edward Wilson's *The Future of Life*, and Meadows et al.'s *Limits to Growth: The 30-Year Update* have also addressed this issue.

The prognosis is dire regardless of which study or intergovernmental report one considers. Global warming, species extinction, soil erosion, pollution, fresh water and resource scarcities, and deforestation are the major signs and tendencies that the current globalized world faces. These trends and tendencies are hardly new in the course of world history, as the previous pages on the characteristics of Dark Ages have outlined. They are repetitions of the past, albeit in the past they might not be as intense, as widespread, and as globally encompassing.

We know from our previous discussion that Dark Age tendencies operate in phases that are not necessarily periodic in nature. Hence, we cannot pinpoint a possible beginning or end of the crisis, as the latter timing depends on the state of degradation of the environment (assuming the reproduction of material life is dependent on natural resources), and the opportunities for recovery depend on either natural renewal or the incorporation of new territories. Furthermore, the data presented in the previous chapters are too limited to allow us to project dates for crisis emergence or its end. What we can do, however, is to look for similar ecological and socioeconomic trends and tendencies comparing past Dark Ages to our present conditions. If we hypothesize along this line, we can begin to see such parallels of present conditions with the past (Chew 2002a).

Before we do this, let us reiterate what we have traversed in our long journey in the previous chapters of identifying trends and tendencies of previous Dark Ages so that an assessment and comparison can be made with current and projected conditions that are ecological, climatic, socioeconomic, and political in nature.

History has shown that prior to and during Dark Ages, there are signs and indications of climate changes. These occurrences appear with temperature increases or decreases and with either increases or decreases in rainfall. As we have indicated in the previous chapters, any changes in temperature or rainfall have tremendous consequences on human economic activity, as well as for the occurrences of diseases that are either directly or indirectly a consequence of these changes. Ecologically, the landscape shows signs of wear and deterioration. Deforestation, soil erosion, and species extinction are evident when combined with a denuded landscape.

Intertwined with these trends, we have also witnessed socioeconomic reversals in terms of the growth and progress of human communities, kingdoms, and civilizations. Population patterns start to show signs of leveling off or dropping. We also have deurbanization and migration of populations, in most cases, from the peripheries to the core areas. Political instability becomes the order of the political landscape with wars and conflicts emerging over natural resources.

Simplification of lifestyles and innovations to meet contingent stressed ecological, socioeconomic, and political conditions emerge to deal with

the transformed environment that has been conditioned by scarcity and climate changes. The result is a set of structural changes followed with system transformation.

PRESENT AND POSSIBLE FUTURE ECOLOGICAL AND CLIMATIC CONDITIONS

Numerous studies have documented present and possible future ecological and climatic conditions that face the planet. Starting from 1982 in the United Nations Charter for Nature, the planet's ecological resources were seen as limited. Five years later, one of the major global warnings came in 1987 from the World Commission on Environment and Development. In its report, *Our Common Future,* the characteristics and extent of the condition of the species and ecosystems were outlined. Even in 1987, there was already scientific consensus on the rate of species extinction never before witnessed in the history of the planet. Habitat alteration was being conducted on such a global scale that it posed a grievous threat to biodiversity. Besides an impending biodiversity crisis, the report warned of the scale and pace of deforestation and noted extinction patterns that were unprecedented on a global scale in world history. Associated with this is the likelihood of climatic changes, and along with the accumulation of greenhouse gases, global warming is anticipated in the early parts of the twenty-first century. This global warning of the Brundtland Commission also alerted us to the impending crisis of global energy resources.

Aware of the fact that the primary energy resources we use are nonrenewable, the commission alerted us to the finite nature and the impending scarcity that we face. The scale of global threat is further increased in the area of global warming and environmental risks with the nonrenewable energy sources that we use. Of these threats, the Brundtland Commission identified four that have severe repercussions for the environment: (i) carbon dioxide emissions from the burning of fossil fuels leading to climate change, (ii) urban-industrial air pollution caused by atmospheric pollutants, (iii) acidification of the environments from pollutants, and (iv) the risk of nuclear reactor accidents and the problems of waste disposal and the dismantling of reactors after their service life is over (World Commission on Environment and Development 1987, 172). In all, the greatest threat, as the commission viewed it then and it continues to this day, is global warming causing climate changes on a world scale.

Population growth was one of the key trends that the Brundtland Commission declared should not continue in light of the available natural resources. Consumption patterns are uneven, with those in the core consuming much more than those in the periphery, thus further deepening

the ecological crisis. Decreasing mortality rates in the periphery in the 1980s further added to the rate of population growth. At 4.8 billion in 1985, the commission projected that the world's population will reach 6.1 billion by 2000 and will top 8.2 billion by 2025. Such rates of growth will imperil global food security situations, and food security will be at risk with climate changes.

Urbanization was also identified by the Brundtland Commission as an issue in light of ecological scarcity besides the other social problems that it generated. According to the commission in 1987, the number of people living in urban areas tripled in the thirty-five years since 1950 to 1.25 billion. Knowing the amount of resources urban communities have utilized throughout the course of world history, as we have discussed in *World Ecological Degradation,* this size of growth over such a short period with continuing diminished ecological resources meant impending crisis if this trend was not arrested. The commission came to the same conclusion in its report.

Completed almost twenty years ago, the Brundtland Commission's warnings about crisis conditions and ecological stress have been repeated almost word for word over the years in governmental and scholarly studies. Without going into each specific report or scholarly study, let us briefly review a few of the key ones to show the echoing of the trends and tendencies that the Brundtland Commission had already identified twenty years ago. The United Nations Conference on Environment and Development held in Rio de Janeiro in 1992 announced similar trends and tendencies in its Earth Summit '92 report to the world. Harvard biologist E. O. Wilson's *The Future of Life* approaches the ecological degradation and crisis from the view of the natural sciences. Indicting humanity, Wilson (2002) joins the many noting how we have decimated the natural environment and drawn down the nonrenewable resources of the planet. In doing so, according to Wilson, we have accelerated the destruction of ecosystems and caused the extinction of species, some that have been here for at least a million years. Beyond this, just as we have mentioned in the previous chapter, Wilson also raised the issue of global warming as a consequence of anthropogenic activities.

Along a similar vein, but more comprehensive in nature, are Paul and Anne Ehrlich's *One with Nineveh.* The Ehrlichs' book mirrors the Brundtland Commission's report and Earth Summit '92 except that the Ehrlichs, writing almost twenty years later, identified environmental trends and tendencies that have changed somewhat to a situation that is even more critical. With the exception of population trends, what was discussed by the Brundtland Commission and at Earth Summit '92 were repeated, albeit with different emphases reflecting the interests of the Ehrlichs. According to the Ehrlichs, despite the fact that the world population will keep growing to 10.6 billion by 2050, based on a high projection, the United Nations

has projected a slow decline. This projection is interesting if we consider vis-à-vis our theory of Dark Ages whereby there is a population loss or decline during a Dark Age period.

James Speth's *Red Sky at Morning* repeats the trends of all the previous studies that we have discussed briefly in the previous pages. As such, it confirms the scenario of a natural environment that is devastated ecologically through deforestation, pollution, landscape transformations, and species extinction. The condition is made worse with climate changes and an approaching natural resource scarcity, especially in the area of nonrenewable energy. Projections of natural resource scarcity on a global scale have also been made by the Club of Rome (Mesarovic and Pestel 1974) and Meadows et al. (1972, 1992, 2004). It is a common theme among most reports and studies that have been published for the last thirty years. The most recent update by Meadows et al. (2004) outlines very severe impending scarcities with declining availability of natural resources, water, and agricultural farmlands. Of these resources, the declining availability of water is a serious threat to the reproduction of socioeconomic life. To Meadows et al. (2004, 71), the major rivers of the world such as the "Colorado, Yellow, Nile, Ganges, Indus, Chao Phraya, Syr Darya, and Amu Darya Rivers are so diverted by withdrawals for irrigation and cities that their channels run dry for some or all of the year."

Deforestation is epidemic throughout the planet (World Commission on Forest and Sustainable Development 1999). Before the advent of agriculture, there were about 6 to 7 billion ha of forests (Meadows et al. 2004). Now there are only about 3.9 billion ha left. It is clear that only one-fifth (1.3 billion) of the planet's original forest cover remains. Half of this is in Russia, Canada, and Alaska with the rest in the Amazon. The United States (not including Alaska) has lost 95 percent of its original forest cover, Europe essentially does not have any left, and China only has about three-fourths of its forests.

Species extinction is also the trend of the late twentieth and twenty-first centuries. It is estimated that 24 percent of the 4,700 mammal species, 30 percent of the 25,000 fish species, and 12 percent of the 10,000 bird species are in danger of extinction (Meadows et al. 2004). For plants, 34,000 of the 270,000 plant species are at risk. Overall, the average species population has declined by more than one-third since 1970.

Just like the scarcity and availability of nonrenewable resources at the end of the Bronze Age, we are also approaching scarcity and availability of fossil fuels, such as oil, for this Iron Age. There is substantial consensus that the world production of petroleum will reach its maximum by the first half of this century, after which it will start to dwindle in terms of output. After three decades of exploitation starting from the 1970s, according to Meadows et al. (2004), 700 billion fewer barrels of oil, 87 billion fewer

Table 6.2. Annual Production and Resource Life Expectancy of Oil, Gas, and Coal

Resource	1970 Production	2000 Production	Resource Life Expectancy
Oil	17 billion barrels	28 billion barrels	50–80 years
Gas	1.1 trillion m^3	2.5 trillion m^3	160–310 years
Coal	2.2 billion tons	5.0 billion tons	very large

Source: Based on data from Meadows et al. (2004, 90).

tons of coal, and 1,800 fewer trillion cubic feet of natural gas are available. Meadows et al. (2004), estimating resource life expectancy, projects for oil a life span of 50 to 80 years (see table 6.2) and for coal a very large life expectancy. The latter, however, could not be much of a substitute because of its climate-warming tendency.

The Intergovernmental Panel on Climate Change and the United Nations Environment Programme (2002) issued alerts projecting warming of the global climate and the likely aridification of some portions of the globe. According to the panel, the global surface temperature has increased by 0.6°C over the twentieth century, which is the largest increase of any century during the past 1,000 years. Snow and ice cover have decreased about 10 percent since the late 1960s with rainfall increasing in some areas especially in the mid to high latitudes of the Northern Hemisphere and decreasing over much of the Northern Hemisphere's subtropical land areas.

Given the above trends and tendencies of the global environment, what does it tell us about the present and the future conditions in terms of another Dark Age? We discuss this next.

Dark Age Conditions?

The recurring nature of these Dark Ages over world history does suggest certain tendencies that we might wish to consider in light of the ecological crisis that we face today. The indicators of current ecological stress, socioeconomic trends, and climatological changes do suggest certain comparability with the previous Dark Ages that we have examined in the previous chapters. If this is the case, we might be approaching another Dark Age, if we are not in it already.

We know from the past, the changes that occurred in the ecological, socioeconomic, political landscapes and climate during the past Dark Ages. To reiterate, during those Dark Ages, deforestation reached extreme levels as a consequence of the previous phase of incessant growth of the world system. As we have discussed in the previous section, we are witnessing such deforestation levels today. Furthermore, the World Commission on

Forests and Sustainable Development (1999) has raised the alarm on the ferocity of the deforestation globally, and others have also confirmed the pace of cutting during the twentieth century (Chew 2001, Noble and Dirzo 1997, Marchak 1995, Tucker 2000, Williams 2003). Soil erosion, flooding, and species endangerment, which are often the outcome of deforestation that has occurred in previous Dark Ages, are also being signaled by scientists and environmentalists as dangers we are facing and will face in the foreseeable future. At the level of the social system, in addition to what was identified in the previous section, Grimes (1999) and McNeill (2000) have documented for the contemporary period the various environmental degradative outcomes from intensive and extensive resource extraction to atmospheric pollution. For the latter, as indicated in *World Ecological Degradation*, atmospheric pollution was also occurring at the end the Greek (First Dark Age) and Roman (Second Dark Age) eras and the medieval period, and this was encountered as far away as Greenland.

With the recent reports on climatological changes by the Intergovernmental Panel on Climate Change and the United Nations Environment Programme, anthropogenically induced climate change in terms of global temperature increases are expected for this decade and beyond. Such increases will have significant impact on socioeconomic life and water supply, if it has not happened already. Similar climate changes have also been reported during previous Dark Ages, and we have noted the impacts these changes had on the socioeconomic and political landscapes of the social system then. In the World Disasters Report of 1999 by the International Federation of Red Cross and Red Crescent, it was suggested that global warming and climate change may have been responsible for the harsher natural disasters and flooding that we have been experiencing. The contemporary changes in ocean temperature (the El Niño and La Niña phenomena), which have also occurred in the past, have caused severe hardship for the communities bordering the Pacific Ocean of the Americas (Fagan 1999). Droughts triggered by El Niño have caused huge forest fires in Brazil and Peru. Besides El Niño effects, in 1998, for example, typhoons and floods killed 500 and affected 5 million in the Philippines; floods killed 4,150 and affected 180 million people in China; killed 400 and affected 200,000 in Korea; killed 1,000 and affected 25,000 in Pakistan; killed 1,400 and affected almost 340,000 in India. Monsoons killed 1,300 and affected 31 million in Bangladesh, and killed 3,240 and affected 36 million in northern India and Nepal. Two hurricanes killed a total of 14,000 people and affected about 7 million people in the Caribbean and Central America. Economic costs alone are staggering. Losses were $165 billion in Central America and the Caribbean, $2.5 billion in Argentina, $868 million in Korea, $223 million in Bangladesh, and $150 million in Romania.

In view of the above, such contemporary ecological patterns tend to reflect the same trends and tendencies of previous Dark Ages in terms of ecological degradation and climate changes. The work of Modelski and Thompson (1999) with demarcated phases of concentration of the world economy with economic expansion, population growth, and urbanization, and so on, followed by phases of dispersion in which there are trade collapses, deurbanization, migration, and falls in population levels further dovetails with our analysis. In addition, Modelski (1999a) has noted a phase of dispersal (deurbanization, trade collapses, etc.) starting from A.D. 1850 or 1900 of the modern era that further reinforces our suggestion that perhaps we are now experiencing Dark Age conditions or heading into one.

SYSTEM TRANSFORMATION?

Let us use the patterns and tendencies of the past to be our guide. The recurring nature of these Dark Ages is troubling. It seems that over the course of world history, human communities have continued to repeat the materialistic practices of the past and have thus engendered ecologically stressful outcomes. Coupled with these circumstances, we find, over world history, movements to protect or conserve Nature along with attempts at recycling (Chew 2001). The current efforts to protect the environment need to be considered in view of these long-term dynamics of a historical system with its set of repetitive socioenvironmental practices. To this extent, what impact do such current environmental actions have in light of the dynamics and structures of the historical system? The impact of such activities does reduce and temper the intensity of our impact on Nature and might help to reduce the length of a Dark Age period should it occur.

Unlike past Dark Ages, the options today are limited in terms of the various paths for system recovery. In the previous Dark Age period, the world system was not as globalized and encompassing, and the system could expand in terms of the search for natural resources and labor, thereby enabling previously degraded and exploited areas to recover. At this stage of the globalization process, planet Earth is fully encompassed, and thus if ecological collapse (Dark Age) occurs there are few replacement areas for system expansion. Besides this, the level of connectivity of the world system in terms of production and reproduction processes means that the collapse will be felt globally, unlike previous Dark Ages in which not all the peripheral areas were impacted by the collapse.

The recovery path of incorporation of new geographic areas is no longer an option, as the world system is now globalized and connected,

unless we consider tapping the aquatic resources following the melting of the Arctic ice cap or outer space planetary conquest as an opportunity for expanding the limits of the world system. Even if this latter option is considered, the path is fraught with difficulties in view of the current state of the global environment, the extent of globalization processes such as accumulation and urbanization, the size of the world's population, and the political imperative to pursue anthropocentric progress beyond the limits of the current planet. Terra forming has been broached in some circles, but this has not been declared the official policy of any legitimate core nation-state.

Thus the only choices left for recovery, if social progress and development are the goals, would be not to extensify the geospatial boundaries of the world system following the practices of the past, but instead to intensify the socioeconomic processes of the world system to meet the conditions of incessant accumulation, urbanization, and population growth; to develop new technologies that can deal with the scarcity of natural resources; or to totally reorganize the manner in which human societies have organized the reproduction of material life. However, before this can happen, and if we follow the trends of past Dark Ages, we can anticipate first reversals in socioeconomic growth, and disruptions and instability of political regimes along with climate changes and natural disturbances in view of the current environmental crisis. These are the characteristics and conditions we could face as we slide further into a devolutionary phase (Dark Age) of world system development. All indications suggest that the degradation of the environment will increasingly accelerate with the current economic globalizing forces all over the planet and especially with the ecologically impactful rapid industrialization and advanced technological developmental strategies of the People's Republic of China and India in the short to medium terms. Besides the incessant consumption of nation-states in the core zone, People's Republic of China and India pose major challenges for our planet's natural resource availability in view of their population sizes, and their potential megapollution sources. For example, China's oil consumption has risen from 230.1 million t in the year 2000 to 308.6 million t by the year 2004, which is a 35 percent increase over four years (*China Daily* 2005, 1). If the past is any indication, the Dark Age conditions will fortify and deepen in the short to medium terms.

Like previous Dark Ages, we will continue to see social, political, and economic turmoil, much like the Bronze Age crisis that occurred almost four thousand years ago. During those times, natural resource trade disruption and shortages led to the adoption of a new base metal. Economic scarcities and social constraints, such as population losses and deurbanization, led to the development of new political governance and political formation, such as the Greek polis, while other political

entities such as Assyria, Babylonia, and Egypt continued their traditional political monarchical systems. Where sociopolitical changes occurred, traditional elites lost their economic and political dominance. In short, major socioeconomic and political restructuring took place then that led to a new path of political experimentation and different ideas of human governance and equality, that is, the promotion of authority being vested in the community and the sanctioning of individual human rights. All these occurred within an environment of natural resource constraints and ecological stress whereby these conditions induced the rethinking of the normal practices of governance of the past based on empire and kingship and the adoption and experimentation with different formulations, for example, the Greek polis.

In the late twentieth and twenty-first centuries, we are also witnessing numerous political unions, instabilities, and collapses in Africa, Asia, Latin America, and Europe. The formation of regional unions such as the European Community, the Association of Southeast Asian Nations, Economic Commission of West African States, and the African Union, for example, are political attempts to redefine political sovereignty and political rights. The collapse of the former Soviet Union and various other countries in Africa along socioeconomic lines are cases in point. By no means are these latter occurrences over—as the Dark Age crisis proceeds and deepens, more instability will appear.

The present levels of natural resources availability reflect similar tendencies to conditions over four thousand years ago during the Bronze Age crisis. It is clear we are seeing the increasing scarcity of fossil fuel availability as we have outlined in the previous section (Meadows et al. 2004, 90). The condition is critical especially when most of the world's industries and reproduction of social life is dependent on oil. Replacement base materials for commodity production will need to be determined and adopted. The trend tends toward carbon composites and silicon-based materials. The production of these base materials requires not only energy but also fresh water in abundant quantities. It is clear that these natural resources will increasingly be limited in terms of known sources and replacement sources or alternate forms of energy will be needed. It is not clear that the solution will be there. Some, like Rifkin (2002), have suggested a hydrogen-based economy, while others are stating and hoping that new technologies will save the human population or at least those in the core zone of the world system (e.g., see Ehrlich and Ehrlich 2004).

Beyond ecological devastation and the dwindling supply of natural resources for global consumption, we anticipate climate changes and natural disturbances as we have experienced in previous Dark Ages over world history. For example, in a recent study on the impact of climate change on the state of California, which has the fifth largest economy

in the world system, the magnitude of the effects anticipated appears to be catastrophic (Hayhoe et al. 2004). It is projected that by the end of the century for California, under one scenario, heat waves and extreme heat will quadruple in frequency with heat-related mortality increased by two to three times, alpine and subalpine forests will be reduced by 50 to 75 percent, and the Sierra snow packs will be reduced by 30 to 70 percent. Another scenario with more elevated climate changes will further exacerbate the conditions delineated. The decrease in the Sierra snow packs will mean cascading impacts on reduced runoffs and stream flows, which will impact agricultural production in the central valley of California—a major agricultural production zone for the United States and the rest of the world.

Increasingly, evidence of tectonic shifts and El Niño have pervaded the latter half of the twentieth century, and most recently, the tsunami-related devastation in late December 2004 in Southeast Asia and the south Indian region are comparable to the tsunami event that impacted on Crete and the eastern Mediterranean during the late Bronze Age. Added to this is the most recent devastation on the southern coast of the United States by Hurricane Katrina. The World Disasters Report by the International Federation of Red Cross and Red Crescent that we cited earlier has documented the costs to economies and political systems. It has been suggested that global warming and climate change may have been responsible for the harsher natural disasters and flooding that we have been experiencing. The 2004 tsunami event in South Asia, Thailand, Indonesia, and Malaysia had devastating economic costs and loss of lives. This was then followed by the large-scale property damage caused by Hurricane Katrina in the southern part of the United States. The costs in terms of economies and human lives have not been realized fully for these recent natural disasters. If such natural disasters continue to surface in repetitions for the foreseeable future, the impact on the global economy will be extremely destabilizing.

Climate changes, landscape degradation, neocolonial exploitation via transnational operations, and indigenous elite domination have dislocated rural populations, which has led to large-scale migrations within and between nation-states. These migrations have occurred since the sixteenth century and will continue through the twenty-first century and beyond. Much like previous Dark Ages where we found evidence of movements across vast expanses of landmasses, we also see large-scale legal and illegal migrations on all continents of the world system today. The much-discussed illegal Mexican and Latin American migration into the southern United States is not a unique situation. Illegal and legal migrations have occurred everywhere in this globalized world since the sixteenth century. What is clear is that the movement has been from the

periphery and semiperiphery to the core areas, and on occasions, from the core to the periphery during periods of expansion to extensify the boundaries of the world system.

Unlike previous Dark Ages, we have not yet witnessed the extensive deurbanization and population losses that we have evidence of in the previous Dark Ages. In the case of deurbanization, this development has started to manifest itself. We have witnessed signs of urban decay in the urban areas of the core zone with the closure of plants and factories in the late twentieth century, and the movement of the population out of the urban zones because of job losses, crime, environmental degradation, pollution, and contamination. There is also the call for urban renewal and the revitalization of the inner core of the cities. The urban renewal programs have had mixed success. In parts of Eastern Europe that were members of the former Soviet Bloc, there have been signs of urban "shrinkage" and population losses. The deurbanization of New Orleans because of a natural disaster should also be considered.

Deurbanization will occur further should energy shortages start to appear and climate warming begin, since urban living is the most intensive in terms of natural resource consumption, as everything has to be transported to an urbanized landscape to reproduce socioeconomic and political life (Chew 2001). The current architectural designs and infrastructures do not afford the opportunity to conform to temperature increases nor are they geared for living for long periods under conditions of energy shortages and high temperatures. Definitely, those living in the enclaves in the core zone will experience tremendous daily living challenges. Preliminary circumstances of this nature have occurred in West Africa in the 1980s, though not in the core zone, and in Europe during the summer of 2003.

Population losses have yet also to appear. It is anticipated that the global population will peak about 2035 to approximately 7.5 billion persons and then retreat to 7.4 billion by 2050 based on a low projection by the United Nations (Ehrlich and Ehrlich 2004). Furthermore, from 2000 to 2050, acquired immunodeficiency syndrome (AIDS) will reduce the population by 479 million. If a medium projection is used, the numbers come up higher, reaching 8.9 billion by 2050; if a high projection is used, the total by 2050 would be 10.6 billion. The latter would mean a doubling in just 25 years. There is no reason to believe that previous trends during prior Dark Ages of population losses will not be repeated. It is too early to suggest that population declines will not occur. Climate changes impacting crop harvest will generate famines; natural catastrophes, such as earthquakes, El Niño, and tsunamis, will take lives, and so will diseases and conflicts as a result of natural resource scarcity. We have already seen a glimpse of the effects of a tsunami in South Asia and Southeast Asia where over 200,000 lives were lost. Diseases such as AIDS have reduced

populations as well. The United Nations has estimated that by 2050, the world population will be reduced by 200 million due to AIDS, and seven countries in Southern Africa will have little or no population growth (Ehrlich and Ehrlich 2004).

The above tendencies are likely to occur in the medium to long term and perhaps in the short term, if short means within this century. What is clear is that the global threats are the warming of the planet, the rapid deforestation of the world's forests, the loss of arable land and clean water, all of which form the basic material conditions for the reproduction of material human lives. Besides all the above trends and tendencies, Dark Ages are supposed also to be system transformative. What can we expect in terms of structural socioeconomic and political changes? Let us use what happened during the late Bronze Age as a guide to anticipating possible tendencies.

WHITHER SYSTEM TRANSFORMATION: THE FUTURE IS STILL OPEN[2]

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 (Chew 2002b, Sheratt and Sheratt 1993).

The adoption of iron brought to an end centuries of bronze use that was in the control of palace economies and elites. Gordon Childe (1942) 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 were isolated as a consequence of Dark Age conditions, for iron was available locally. It led to the development of local iron-producing industries (Snodgrass 1971). The low cost of iron, because it was available locally, facilitated its widespread use in agriculture and industry (Childe 1942, McNeill and McNeill 2003).

All over Europe, the Mediterranean, and the Near East, 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 metalsmiths fabricating the iron implements to reproduce material life. Such an explanation is also supported by Heichelheim (1968) and Polanyi (1977),

who suggested that the widespread adoption of 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 (1968). 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 consequence of changing prices and the falling demand in the copper, tin, and bronze trade, 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.

As well, at the social system level, the Dark Age crisis thus ushered 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 in the eastern Mediterranean were dissolved. What emerged was the continued differentiation of commercial and economic structures from the political structures (Polanyi 1977). 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 eighth-century Greece (Morris 1987, 1988b). As Morris (1988a, 752) has stated it was 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 resulted in the development of isolated communities during the Dark Age that 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, that is, 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 (1947), Assyria, Babylonia, and Egypt continued as Bronze Age states.

The above revealed what occurred in the past; there is no reason to consider that what happened will be repeated in similar fashion. The adoption of a new base metal during the late Bronze Age was systems transformative because it reduced the monopolization of bronze manufacturing of the palace-based monarchical systems and thus opened the opportunity for other communities to fabricate iron. According to Childe (1947), the manufacture of iron was made possible by traveling metalsmiths who when paid for their services, transmitted their knowledge. It has been stated that the shift to iron democratized the world system in terms of giving political entities room for expansion and thus jeopardized the traditional Bronze Age monarchical systems. Will we see this pattern of the resolution of natural resource scarcity for the current world system as it evolves into the future? That is hard to predict.

If we consider the advent of the computer (digital) revolution (age) as analogous to the adoption of iron production at the end of the Bronze Age, the predominance of computer-based systems in the current era with its decentralized production, design, and manufacturing becoming increasingly the norm, could be viewed as systems transformative. Clearly, the computer-oriented industries and their associated innovations and uses, such as the Internet, have provided the opportunities whereby others can participate and take advantage of the innovations besides those based in the core countries. Thus, the varied uses and innovations have also precipitated and opened up access to information and innovations for those that are dispossessed or are technologically deficient. It is still too early to evaluate the impacts of such developments to sociopolitical organizations. What is clear is that we are heading toward an ecological crisis of scarcity and degraded landscapes.

If this is the case, perhaps we will witness different political and economic trajectories for the world system. There will definitely be a continuance of the current economic and political systems (with authoritarian overtones) similar to what happened during the late Bronze Age. We project that continuation will be based on how structured the political and economic system was prior to the crisis and how much impact each entity experienced during the height of the Dark Age crisis. Those that persist will be those that were the most structured politically and economically (like Assyria, Babylonia, and Egypt at the end of the Bronze Age crisis) prior to the crisis or those that were impacted the least. They

will have the least pressure to rethink and restructure. However, if history can be our guide, such systems will not continue in the very long term because they will be less innovative than those that had to proceed on other possible trajectories that are not resource intensive in terms of material production.

What possible trajectories are there? As human history is always an *open process*, there will be experimentation and adaptation based on the materialistic circumstances other social systems face. This we will discuss in detail in the forthcoming final volume of my exploration in ecological world system history. In a preliminary sense, I will however offer one possible trajectory as a conclusion to this volume.

If we assume the scenario that there is a tremendous scarcity of resources, deurbanization, and population losses, much like the Greek societies at the end of the Bronze Age, innovations will occur to adapt to the constricted natural environment. Furthermore, with scarcity of resources, such as energy, isolation also becomes an issue. In this case, isolation occurs because there is no energy available for transportation, and the current established political-economic systems based on a centralized and federalized configuration of command and control will be dysfunctional when communities are isolated from federated systems. In this context, a different type of political and economic structure will have to be considered and developed. With scarcity of natural resources, such isolated communities will need to rely on the immediate landscape for the reproduction of socioeconomic life. They will be isolated, community-governed social systems structured in conformity to the landscape and available natural resources to reproduce social life. Historically, the early Greek societies during the Dark Ages of 1200 B.C. are such historical occurrences. The other would be the monasteries that came into existence during the crisis of antiquity (chapters 4 and 5) that possessed the characteristics of self-sufficient entities that relied on their immediate ecological landscape for the reproduction of socioeconomic life in a decentralized political system.[3]

Such a shift in political economic structure requires a total rethinking of social, economic, and political structures and processes. By this time, there should be the realization of living in an interconnected natural-social world. It is very unlikely that if such a scenario occurs, the reorientation will be prompted by a voluntaristic human agency shift, but more likely it will be engendered by the structural conditions these communities faced in terms of ecological and natural resource scarcities as a consequence of Dark Age conditions. It will be just like what the Greeks faced during the end of the Bronze Age. From a social evolutionary point of view, this possible transformation might not be viewed as progressive from a modernist point of view, for we will encounter a sociocultural and sociopolitical

lifestyle reconfiguration conditioned by a Dark Age whereby ecological sustainability is the basis of organization not by choice but by circumstances and necessity. If this is the case, production and exchange will probably be guided by very different rules, possibly via use value instead of exchange value, and as a result, the sociopolitical order is one that will be quite different from the past. If this is the case, this might be the system-transition "progressive" scholars have been debating over the years.

Notwithstanding our brief argument given above, it is very difficult to project which political systems in the current configuration of the world system will propel along which trajectories. It is all dependent on the extent of their reliance on the ecosystem and the level of impact they sustain from Dark Age conditions. If history can guide us, there will be numerous trajectories just like what happened during the final Bronze Age crisis. What is clear is that with the level of globalization that we are witnessing today, almost all will be impacted tremendously. Such is the human nightmare we will face in the future. For some who eschew progress and modernity, Dark Ages conditions might not be viewed as a nightmare experience, but as a period that provides opportunities for Nature to recover, and for social systems to realign with the natural system: hence, a period of brightness. Notwithstanding this, for all of us, there is always hope. That hope is that our common future is still open!

NOTES

1. This is not to suggest that the current global environmental crisis is similar in terms of intensity and perhaps in nature as well. What is being asserted is that "global" environmental crisis is not a new phenomenon as various scholars have attributed, but one that has occurred in the past in the form of Dark Ages as we have suggested in the previous chapters.

2. A full detailed presentation of studies and information underlining the argument presented in this section including a discussion of the environmental movement and environmentalism will be made in the final forthcoming volume (entitled Ecological Futures: What Can History Tell Us) of my three-volume series on five thousand years of world ecological degradation.

3. Early Christian monasticism that started in Egypt in the fourth century was an attempt to live within the limits and boundaries of Nature. Work and agriculture was considered as the exploitation of Nature. Unmodified nature is what is important. An authority structure was rejected (Bergmann 1985).

Appendix 1

ARBOREAL POLLEN INFLUXES