

The Ecological Consequences of Evolutionary Cultural Transformations: The Case of Egypt and Reflections on Global Issues

Fekri A. HASSAN

Institute of Archaeology, University College London, London, UK.

INTRODUCTION

Humanity is faced today with the grim prospects and disturbing current realities of loss of resources, deterioration of habitats, and economic failures. Our predicament can be clearly seen in the light of our cultural evolution from a small population of itinerant bands of foragers in the Pleistocene past to an agro-industrial global civilization. Although the transitions were neither uniform nor identical in various parts of the world, the impact of the advent of agriculture and industry were global. They were also profound.

In our search for an understanding of our present predicament and for feasible solutions to the ecological crisis, it is prudent to reflect upon the ecological implications of our evolutionary journey. In this regard it is useful to consider the course of human cultural evolution from a cross-cultural perspective, as well as to focus on specific case studies. I will attempt here to draw upon my knowledge of Egypt as a manifestation of global cultural developments (Hassan 1974, 1987, 1988, in press A, and in press B). Egypt may have its peculiarities, but it also shares with many other countries the key evolutionary transitions from hunting-gathering to agriculture, the rise of a nation-state and civilization, a history of encounters between civilizations, a colonial experience, and the trials of a developing nation in a global industrial techno-complex.

PARADIGMATIC STATEMENTS

In the following pages, I develop the thesis that among hunter-gatherers, the concept of self and the sense of self-esteem were linked primarily with social affiliation expressed in terms of a sharing ethos. Later, the advent of agriculture led to the emergence of a hierarchical society which added "status" as another dimension of gaining self-esteem. However, in archaic agrarian societies, access to status goods was monopolized by and restricted to nobility (landowners, priests, and governors) and

royalty. In such societies opportunities for social mobility were limited. Recently the advent of large-scale commerce and industry destroyed the *ancient regime* and created opportunities for social mobility, which has promoted consumerism. The rise of mass consumerism of status goods over the last two hundred years has been responsible for an unprecedented onslaught on the resources of the earth. Consumerism, within an industrial/technological way of living, is intimately cross-linked to an ethos of competition and a movement “against” others. This ethos is intertwined with a psychology of aggression and conflict, which fosters an ideology of dominance and competition towards the earth, other members of society from different classes or social categories, and nations.

Discourse on environment and civilization is often phrased in terms of (1) environment as a stage for cultural performance, (2) the impact of climatic or other environmental change on cultural change, triggering agricultural innovations, and the destruction of civilization, or (3) the impact of culture on the environment, e.g., the role of technology in modern industrial nations in destroying human habitats.

I adopt here the view that the relationship between environment and culture ought to be regarded in terms of a cybernetic model with multiple networks characterized by various feed-back linkages. Culture and environment are mediated by the actions of individuals in human societies who are conditioned by their own cultural upbringing, and who are participants in the making of present and future cultural achievements. Humans act within groups, expressing and influencing collective behavior and ideology. They act within a specific territorial setting and at a given time in a historical trajectory.

The actions of individuals are inseparable from their world view, ethos, values, concerns, interests, fears, modes of perceiving environmental possibilities and potentials, knowledge-base, patterns of decision-making, and problem-solving. Individuals are situated in societies that are embedded in a cultural past and inter-linked with other human groups by bonds of variable strengths. Communication from one generation to another, between members of the same society and between peoples of different cultures transmits knowledge and serves as an intermediary between thoughts and actions.

Working on a human scale in a cultural matrix, human groups are ultimately situated in a natural setting characterized by a specific geographic distribution of resources within a given landscape. In many respects, nature behaves independently of human actions (e.g., natural climatic fluctuations, volcanic eruptions, etc.), and behaves according to processes of succession, causal networking, and concatenation. The long-term characteristics of an environment (climatic stability, fluctuations, and secular changes) are crucial for interpreting cultural change. However, the role of the environment should not be restricted to its potential impact on promoting change, but also on its innate resistance to certain actions (e.g., lack of certain resources, obstacles to transport, etc.). The vulnerability of natural environments to human actions, especially following industrial practices, has also linked humans with nature in an intimate causal interrelationship.

From this perspective, I wish to emphasize the concept of “habitat” as a central con-

cept in human ecology. A habitat is defined as an interactive setting of human activities within a specific spatiotemporal frame. The habitat varies in spatial range and temporal depth depending on culture. Bands occupy small regions by comparison to empires. Access to past environmental information varies also from one culture to another depending on the relative role of oral tradition and written historical documents. Ideology (religious, philosophical, or aesthetic views) and technology also define the kind and pattern for exploiting or conserving resources.

An analysis of the relationship between the environment and civilization is inadequate if it does not take into consideration not only the forces that influence the spatial and temporal range of human activities, the size and composition of the social unit, but also the objectives of the encounters between people and nature.

Our relationship with nature is largely dependent upon our desires. Desires are ultimately grounded in biological and psychological human needs, but are largely shaped by culture. Basic human needs for food, water, sleep, air, affiliation, and identity are compounded by our needs for security and safety from predators and adverse natural forces. These simple needs were reasonably satisfied as long as our numbers remained limited.

In general, interactions with nature are linked with such activities that concern securing food and shelter, protection, seeking friends and mates, recreation and enjoyment, and extracting resources for display and consumption of status goods. These interactions provide the immediate interface between people and nature. The collective impact on the earth is the result of localized activities by people situated within certain cultural traditions who not only set the range of limits and opportunities for certain economic activities, but more importantly provide a set of values and sensibilities that structure and delineate how we define and construe nature.

TOWARD A SOCIOECOLOGY OF CULTURAL TRANSFORMATIONS

Anthropologists recognize various stages of cultural transformation. Major transitions include the advent of agriculture and the adoption of industry. I recognize here the following cultural modes:

- I) Foraging
- II) Specialized hunting, fishing, and gathering
- III) Subsistence farming and nomadic herding
- IV) Low-tech agriculture
- V) Proto-Industrial agriculture
- VI) Agro-industry
- VII) Agribusiness

These modes are arranged in a hypothetical evolutionary order from foraging to agribusiness. In general, the evolutionary sequence is a model of developments that occurred in different parts of the world at different times. The evolutionary sequence is a

result of convergence as well as cross-cultural interactions. "Older" modes still survive in many parts of the world.

The cultural modes identified here are defined on the basis of subsistence, technology, and economic pursuits. However, they may also be characterized in terms of population growth rates, size of individual population units, spatial mobility, settlement pattern, and other cultural attributes.

Although it is clear that industry and overpopulation are major causes for our current ecological crisis, it is important to explain the sociocultural matrix that perpetuates industry and encourages rapid population growth. I suggest that population increase after agriculture (Table 1) was linked with the social and economic advantages of a large family and the relatively low cost of rearing children. I also propose that the rise of a managerial, military, and religious élite with the advent of state societies provided a stimulus both for population increase and consumerism. In archaic states before medieval times, consumerism was limited to a small segment of society. The breakdown of archaic societies and the advent of global commerce must be regarded as the key factor responsible for the rise of modern capitalism, financial institutions, militarism, and mass consumerism. It is the combination of rapid population increase and the growing demands for consumer goods by the majority of the world's population that continue to drain and spoil the earth's resources.

The rise of social hierarchy in agrarian societies had led to an emphasis on acquisition of material status goods as the primary focus for gaining self-esteem. Whenever possible, achievements and "success", measured by the ability to acquire, consume, and display material status goods, became the focus of human behavior. This re-fashioning of self and self-image, in terms of status, is in marked contrast to the growth of a sense of self in terms of one's fulfillment of social duties in a context of belonging, affiliation, sharing, and solidarity.

The emergence of a hierarchy of status was closely linked with the emergence of managers and chiefs following the adoption of agriculture. The ruling élite displayed their power and status by rare and expensive natural and manufactured objects. These items were usually of low or secondary value as food or practical items. This marked

Table 1. World Population estimates.

Final Palaeolithic	9 million
Neolithic	50 million
BC/AD	300 million
1300	400 million
1650	550 million
1800	1 billion
1850	1.3 billion
1950	2.5 billion
1977	4.3 billion
1992	5.5 billion

the emergence of an “inverted economy” based on the production and consumption of costly goods of little or no subsistence value (Hassan 1983).

LOW-TECH AGRICULTURE AND EARLY AGRARIAN STATES

Agriculture must be regarded as the beginning of a new domain of human existence, predicated upon the ability to increase yields from natural resources through human intervention to unprecedented levels. By contrast, hunters and foragers are limited by the natural yield of wild game, aquatic resources and plants. Improvements in food procurement methods or food processing, e.g., trapping, use of bow and arrow, nets, fishing spears and so on increased the amount of wild harvests, but the ceiling of carrying capacity could not be lifted much higher. It is estimated that hunting and foraging by the end of the Pleistocene could not have supported more than 10–12 million people (Hassan 1982: 203–204). Hunting and gathering were also linked with a peripatetic model of existence that minimized the impact of people on their habitat.

The advent of agriculture beginning *c.* 10,000–8,000 years ago in the Near East and later in many parts of the world was followed in Mesopotamia and Egypt by the rise of state societies dominated by a governing élite. Agrarian state societies also emerged in other parts of the world following the introduction of agriculture. The exact character of political organization varied, but the state was, in general, under the rule of a king. In Egypt the king was divine. In other cases, kingship was sanctioned by divine or cosmic powers.

With the rise of early agricultural state societies we witness the beginning of an economy marked by a differentiation in the standard of living between a majority of farmers living at subsistence level and a small élite with a higher standard of living. Access to goods was controlled by the ruling élite. The total world population and number of human groups were small. Under such conditions the impact of early agrarian societies on the environment was not substantial. Social organizations based on kinship and patronage alleviated and mitigated natural disasters and periodic fluctuations. People lived in small, cooperative communities close to nature. Extensification was possible and rates of population growth were limited. Technological improvements were not of the dramatic magnitude observed in later historical times.

In the Nile Valley, hunters and foragers exploited a wide range of large and small mammals, fish, birds, vegetables, legumes, and aquatic plants. The most important animals captured included wild cattle, hartebeest, and gazelle. The yield from all resources would have allowed a population density between 0.11–0.27 persons/sq. km or 0.34 to 0.82 persons/square mile (Hassan 1974: 154). In southern Egypt, with a total of 10,379 sq. km, the total population may not have exceeded 3,000 persons. The total population of all Egypt could not realistically have been greater than 10,000 persons, consisting most likely of 10–15 “tribes” or regional population units.

The advent of agriculture was marked by the potential for increased food yield. High productivity was achieved by increasing the size of the labor force, especially required during the time of land preparation, sowing and harvesting. This provided an

incentive both for an increase in family size, and the number of people engaging in collective subsistence activities.

Storage and processing of food led to year-round residency close to the fields. Seden-tariness and large co-residential populations represented the beginning of deleterious assault on the environment. Wild game and plants, wood for fuel, and other resources around the early farming villages were quickly reduced or depleted. This forced people to depend more heavily on domesticated plants and animals.

Increased yields from farming also led to dependence on a few selected resources. In Egypt, barley and wheat became the major staple food. Domesticated animals consisted mostly of cattle, sheep/goats, and pigs. Settlements were located close to the fields at the edge of the floodplain. The minor amounts of wild plants in the diet of early Predynastic people (around 5000–3800 B.C.) clearly indicate that by that time wild plants were either depleted or replaced by domesticated food.

By 3800 B.C., permanent villages existed all over Egypt. The population jumped to a few hundreds of thousands. The total population perhaps did not exceed 450,000 people, with a population density that did not exceed 20 persons/sq. km. It was likely in the range of 10–20 person/sq. km.

Agricultural systems are vulnerable due to the impact of agricultural practices on soil fertility and their susceptibility to inclement weather, flooding, droughts, and pest infestations. The vulnerability of agricultural systems promotes extensification — expansion into neighboring cultivable land. Occasional shortages also may be overcome by economic integration of neighboring farming groups. Economic exchanges between hunters, herders, foresters, or miners and farmers may also establish regional or even interregional exchange networks.

During the Predynastic period (5000–3000 B.C.) political changes included a transition from village corporate societies into chiefdoms, and eventually to provincial states (Hassan 1988). There is abundant evidence from mortuary goods for the emergence of an élite who had access to status goods that included precious stones (including gold, silver, and lapis lazuli), stone vases, rippled knives, ivory combs, bracelets and armllets, and copper objects. The tombs of the élite were spatially segregated from those of the commoners. They were bigger, better constructed, and more elaborate. By the end of the Predynastic, urban centers with their own cemeteries emerged in various parts of Egypt and are clearly manifest around Nagada and Hierakonpolis in Upper Egypt.

The rulers began to form regional alliances and federations. Territorial integration of neighboring regions in Egypt culminated in the initial attempts at unification of Egypt as a nation-state perhaps as early as 3300 B.C., and with effective unification of the country from 3000–2800 B.C. By that time Egypt was ruled by a divine king, a priesthood, and a bureaucracy. Provincial chiefs, loyal to the king, administered rural communities in numerous provinces. They ruled from towns connected to the villages by direct roads and canals, and had access to the capitals of southern and northern Egypt by Nile boats.

In later times, the unity of Egypt under central authority was shaken repeatedly and the country was fragmented into warring camps. A nation-state, as in Egypt, is com-

posed of various political provinces, unified by ideological and economic bonds between the chiefs of the provinces and the king. When central authority weakens for whatever reason (weak ruler, palace rivalry, economic disasters, invasions, etc.), powerful chiefs may attempt to claim the throne. As early as the Second Dynasty (c. 2770 B.C.), the unity of the country was threatened by rival claimants to the throne. By 2130 B.C., Egypt was divided and ruled from two different capitals. The country was destabilized probably as a result of economic failures caused by inadequate Nile flooding. Later (New Kingdom and Late period), the rise of generals in a military society also led to frequent upheavals. These cycles of unification and fragmentation are typical of traditional agrarian state societies. The "diastrophic" events of disruption have their toll on the environment, and must be considered as a key feature in the socioecology of agrarian states.

Agrarian state societies also provided the incentive for technological improvements in order to increase revenue. However, it seems that it was not until the New Kingdom (1550 B.C.) that improved irrigation, due to the use of a simple water-lifting device (the *shaduf*), provided the basis for an expanded area under cultivation, to perhaps as much as 30% of the floodplain. By Graeco-Roman times, productivity and land area were increased as a result of marling, manure fertilization, adequate canal irrigation, the use of the water-wheel for irrigation (*saqqia*), drainage, reservoirs, and cultivation of two crops a year with sorghum as a summer crop.

AGRICULTURE, EMPIRES AND MILITARISM

During the seventeenth century B.C. Egypt was attacked by warriors from the eastern frontiers. The invader, known as the Hyksos, took control of the Delta by 1640 B.C. The invasion may have been, at least in part, precipitated by climatic droughts during the peak of a dry period and the country may have also been weakened as a result of a series of low Nile floods. Egypt responded by developing a military machine that repelled the invaders, but consequently Egypt was transformed into a military power with a standing army and investment in military technology and organization. For the next five centuries (1550–1070 B.C.) Egypt clashed with the military empires of the Near East and after a series of triumphs, a combination of low floods and political turmoil, the rising power of priests and military generals weakened the country. Turmoil prevailed from 1070 to 525 B.C. The rule of Egypt came under the high priests of Thebes, "Libyan" families from the Delta, Nubians, and rival kings. This eventually made Egypt vulnerable to the rising military powers in adjacent regions. Persian, Greek and later Roman armies marched into the country and turned it into a colony.

Since the New Kingdom, militarism became a dominant theme in Egyptian state affairs. The demands of a military society in ancient Egypt, as in other military societies, placed a burden that had to be met by increasing production. This is indicated by an increase in land area from the Old Kingdom to the Graeco-Roman period from about 1 million feddans to about 2.25 million feddans (2.17 million

acres). Productivity also is estimated to have increased from about 450 kg/feddan to 800 kg/feddan (Hassan in press).

The rise of the Egyptian empire during the New Kingdom, was paralleled in the Near East by other empires (e.g., the Assyrians). The emergence of the Persian empire and the following Greek/Macedonian empire heralded the beginning of Imperial dominions extending from Greece to India. In 525 B.C. Egypt fell to the Persians and in 332 B.C. Alexander invaded and established the Macedonian Dynasty, which was followed by the Ptolemaic Dynasty, lasting until 30 B.C., when Egypt became a Roman colony and the granary of Rome.

Under Philadelphus (246 A.D.) as much as 1.5 million artabas (33.8 million kg) were supplied to Rome. Under Justinian, the amount increased to 8 million artabas (18 million kg). The population of Egypt, providing the necessary labor for agricultural production, rose from an estimated 1.25 million people during the Old Kingdom to 3.25 million people during the Graeco-Roman period.

The Roman World consisted of 60 million (about one/fifth of the world population then). The empire became too large after 180 A.D. to remain stable, and in order to defend it, Diocletian (284–305 A.D.) enlarged the army from 300,000 to 500,000. However, Rome suffered from increasing costs of defence and bureaucracy: increasing taxes and inflation brought the empire to the verge of collapse.

Militaristic regimes, often linked with imperial expansion, can lead to disruptions of farming activities, depopulation, and emigration as a result of battles. Military activity also causes major disruptions and can lead to severe ecological problems related to neglect of soil conservation and irrigation works, or aggregation of refugees in marginal habitats, as well as the intensive exploitation of wild food resources.

AGRICULTURE, AN INDEX OF ECOLOGICAL IMPACT

The increase in population size and the emergence of a ruling élite and functionaries, albeit small (5–10% of the total population), meant an increase in the ecological impact on local resources. In Table 2, the temporal changes in the ecological impact from the late-Palaeolithic to Graeco-Roman times in Egypt are indicated as a function of 1) the total population, 2) the proportion of élite and urban functionaries and, 3) their relative rates of consumption. The ecological index obtained presents a rough indicator of the relative impact on the Nile Valley, and is based on population estimates, and relative rank estimates of one unit of consumption per forager; 1.5 per farmers, deteriorating later to less than one; three units of consumption for functionaries and well-to-do urban dwellers; and 30 units of consumption for nobility and royalty. The proportion of the latter ranges from 1–3% (Braudel 1979), whereas the proportion of the functionaries (the middle sector) may be estimated at between 8 and 12% of the total population depending on the historical circumstances. The simple ecological impact index shows the relative magnitude of ecological impact of consumption on the environment calculated as ratio of the total consumption units of the late-Palaeolithic. Thus, by Graeco-Roman times the ecological impact of the

Table 2. Mock estimates of probable ecological impact in successive historical periods for Ancient Egypt.

Period	Population size	Total consumption units	Simple Ecological impact Index	Ecological/ population ratio
Late Palaeolithic	10,000	10,000	1	1
Early Predynastic	100,000	150,000	15	1.5
Late Predynastic	400,000	630,000	63	1.58
Old Kingdom	1,200,000	2,088,000	208	1.74
New Kingdom	2,000,000	3,736,000	374	1.86
Graeco-Roman/Arab	3,250,000	6,646,725	664	2.05
1300–1700	3,500,000	7,077,500	708	2.02
1859	5,125,000	10,378,125	1038	2.03
1966	3,000,000	69,000,000	6900	2.3
1982	4,400,000			
2000	(69,000,000)			

Egyptian population was about 600–700 times that of late-Palaeolithic hunters and foragers. It was also 44 times greater than that of early farmers and about three times that of the Old Kingdom.

COMMERCE AND PROTO-INDUSTRIAL AGRICULTURE

Conditions similar to those that prevailed in Ancient Egypt by Graeco-Roman times continued more or less the same during the Arab period until about the thirteenth century A.D. The population of Egypt fluctuated around a mean of about 2 million people from 634 A.D. to 1180 A.D. The ecological impact was also mostly within the range of that of Graeco-Roman times. Similar conditions prevailed in other agricultural countries in the world. Low agricultural technology was characterized by a moderate impact on the environment. The situation was altered with the advent of agrarian technology including mechanized farming, fertilizers, monocropping over large areas, speciality crops, multiple cropping, large-scale land reclamation, and irrigation. The advent of such techno-agriculture was, in essence, a second agrarian revolution that had two major consequences: (1) it allowed commerce and manufacturing to flourish; and (2) it permitted populations to grow to meet the demands of techno-agriculture, commerce, and later industry. From an ecological standpoint more people meant a greater impact on human habitats. The increase in world population was also accompanied by the rise of a greater percentage of high-level consumers with a relatively greater impact on the environment.

In Europe, agrarian changes commenced around the eleventh century A.D. when commerce within continental Europe and across the Mediterranean ushered in a new commercial segment of society, which eventually expanded at the expense of the

church and nobility. The new commercial regime fostered secular and practical knowledge and later facilitated the emergence of a new industrial technology, and an agro-industrial economy. The new regime benefited from the inherited knowledge of previous civilizations. Ancient knowledge was introduced to Europe through the efforts of Arab scholars who culled, preserved and synthesized scholarly contributions in all fields of knowledge from Persia, Iraq, Greece, Egypt, India, and China. Arabs also laid the foundation of a system of knowledge based on observation and experimentation that served as the basis for western science and technology.

The dawn of European hegemony thus rested on the fruits of cosmopolitan learning, new trade opportunities, and a new socio-political order in which merchants and financiers were becoming a distinct and powerful élite. Trade and commerce, backed by military might, linked Europe with many parts of the world providing slaves and cheap natural resources.

The role of commerce in promoting agriculture and militarism can also be observed in the Japanese experience in the fourteenth to the fifteenth centuries when Kyoto became a political and a cultural center. The basis of the Japanese economy was agrarian, and as in Europe, improvements in farming technology, greater use of draft animals, new crops, and new strains of rice led to an increase in agricultural productivity. Also, as in Europe, this stimulated commerce and manufacturing, which in turn stimulated accumulation of capital and technological developments. Japan exported fine swords, copper, sulfur, folding fans, and screens of consummate craftsmanship. Commercial developments fostered the growth of markets and market towns. The activities and privileges of the merchants were safeguarded by powerful families, religious institutions and the military.

In England, the period from 1540 to 1850 witnessed key changes in agrarian activities and an increase in productivity. The changes included bringing more land under cultivation, local specialization, cultivation of fodder crops, new crop rotations, field drainage, and the use of the scythe in place of the sickle.

Egypt's involvement in the world market economy from the thirteenth to the eighteenth century seems also to have led to agrarian changes that included bringing more land under cultivation. From Graeco-Roman times, the area under cultivation in feddans averaged 2 million feddans, with a low of 1.53–1.6 million in 975–1090 A.D. From 1298 to 1798, the area cultivated averaged 4.25 million acres. The population of Egypt also rose from an average of 2 million persons to approximately 3.5 million between the late-thirteenth and the sixteenth century. The collapse of Egypt's commercial role and the despotic rule of the Ottomans affected Egypt adversely, as indicated by the drop in population in 1799–1802 to 2.5 million. There is also evidence from pollen data in the Fayum lake that canals were not maintained, and that agricultural conditions worsened.

The world from 1300 to 1800 witnessed an increase in population from 400 million to one billion persons. This doubling of world population conforms with the observed population increase in Egypt. This suggests that even if there was no increase in the intensity of ecological damage, the impact of human activities on the planet would have at least doubled over five centuries.

AGRO-INDUSTRY AND INDUSTRIALIZATION

Expansion of commerce in Europe depended upon increasing food production, specialized farming of “cash” crops, and manufacturing. By the seventeenth century, specialized farming (flax, tobacco, and hops) replaced subsistence farming in many places in Europe. By the 1780s, complex machinery and the invention of the steam engine ushered in the stage of mechanized agriculture and industry. The steam engine was first used commercially in 1785, but did not enter widespread use until after 1820. Use of coal and oil, and the growth of the chemical industry heralded a new phase in our impact on the earth. The addition of hydrocarbons, tar, smoke, sulfur dioxide, nitrogen oxides, carbon dioxide, heat, chlorofluorocarbons, and hazardous waste are the greatest threat to the resources that sustain humankind. They contribute to climatic perturbation, disease, ocean death, destruction of vegetation, and disappearance of species.

The advent of modern industry, mass production, steam engines, and subsequently other advanced technological means of industrial production have drastically altered the structural relations between nature and humankind. Consumerism became rampant. Political and religious order that restricted access to status and luxury goods gave way to mass consumption. Industrial production promoted and encouraged mass education for clerical and factory work. Industry and trade also led to an explosion in banking and administrative (bureaucratic) sectors. These developments were associated with greater opportunities for social mobility, which significantly increased the number of potential consumers. In addition, traditional nomadic herding or raising livestock shifted to livestock ranching and later to poultry and egg factories, beef-feedlots, artificial food processing, and automated production. Food production also became linked with the world market economy. Food became a commodity aimed at generating profit rather than feeding people and combatting hunger. Food products in the agribusiness became divorced from the subsistence needs of the local communities. Governments and business, with little or no interest in the affairs of farming communities, or the long-term productivity of the land, dictate the cultivation of certain crops with no regard for local demands or habitats. These transformations in food production must be regarded as among the most devastating developments in our relationship with nature. Accelerated deforestation, soil erosion, loss of soil fertility, addition of toxic substances to ecosystems, and the destruction of natural habitats are among the leading causes of the current global disaster.

The industrial transformation was also accompanied by a shift from rural communities to urban industrial, administrative, and trade centers. Whereas at one time the temple dominated the landscape of a human settlement, the bank and factory chimneys mark the skyline of new industrial settlements. The dramatic increase in people living in cities and the cancerous growth of city size since the eighteenth century is phenomenal. The impact on the environment has been catastrophic. The areas within the catchment of the city are heavily impacted as a result of food and other resources that must sustain the inhabitants of the city. In addition, the city is an ecological sore spewing toxic and hazardous substances threatening regional and global habitats.

The transition from a rural to an industrial urban setting was not only associated with a change in the natural landscape, but also accompanied by a change in the landscape of human society. Kinship organizations were swept away. Traditional values toward land, animals and plants were rapidly eroded. As a result, attitudes toward nature have shifted from conservation and harmony to exploitation and conquest.

In addition, the transition was accompanied by the development of an ideology of planning, engineering, and empirical and positivist science. The machine became the metaphor for human life. Beginning with the Renaissance and culminating as an ideology during the Enlightenment, the firm belief in laws, systems and rational planning set the tone for practical affairs in the nineteenth and twentieth centuries. Nature became decidedly the subject of human control and domination.

The rise of nation-states and international communication, as well as technological advances in warfare, have led to global disparities that divide our world, fostering resentment, violence, and destructive competition. The global disparity in standards of living and economic opportunities has resulted largely from the change in the balance of power between Europe and the rest of the world, leading to a phase of western imperialism. Although traditional imperialism has receded, the balance of economic, military, and political power is still tipped in favor of the West (and more recently Japan). Poorer countries strive to emulate the western model of industrialization. The imitation of the West leads to a demand for goods as a means of achieving (the appearance of) higher status. Unfortunately, the fictive improvement of status is often at the expense of adequate nutrition, health, and education. It also drains poor countries of savings for investment in basic projects for building infrastructure and economic development.

Hunger and poverty, the outcome of global disparities, are aggravated by high rates of population growth (among poor nations) that have no parallel in human history before the seventeenth century. Paradoxically, the poor need more children to increase family income and for support in later years. Lacking social and financial security the poor increase in numbers, and thus poor nations become poorer. The expectations of the poor are also increasing as a result of the promotion of consumer goods by global electronic media: hence any alleviation of living conditions is aggravated by a change in what constitutes poverty. Moreover, the material advancement of rich nations continues to widen the gap between rich and poor. The new revolution in industrial production (based on advances in microelectronics, bioengineering, and materials science) may doom non-industrial nations to worse levels of poverty.

In Egypt, scientific and industrial agrarian innovations were first introduced by Mohamed Ali, who ruled Egypt from 1805 to 1849. His attempts at industrialization were sabotaged by various foreign powers (Britain, France, Austria, Russia and Prussia) but were later revived by Ismail (1863–79). However, industrial activities were modest, a result of the desires of colonial powers to maintain Egypt as an agrarian state. Ismail, who wished to transform Egypt into a modern European-like society, depended on loans from foreign investors and governments for his modernization plans. Eventually, a French-British commission took control of Egyptian finances. In 1882, in response to rising nationalist feelings, the British colonized Egypt. It was not

until 1954 that Egypt regained its full independence.

Under colonial rule, industry in Egypt was never fully developed because of a lack of industrial and financial institutions, and the export of capital. Commercial activities since Ismail, however, contributed to urbanization. Linkage with world commerce through the cultivation of cotton, the emergence of small-scale agrarian industries, and the rise of government bureaucracy to manage the commercial activities of foreigners, led to an increase in urban population and the rise of government functionaries and professionals.

The population increased responding to greater opportunities for work in the cities and the new land opened by perennial irrigation for each crop. After 1952, the revolutionary regime made serious steps toward building industrial institutions, attracting more people to the cities, and encouraging further population increase. Major reclamation projects were also undertaken adding 863,000 feddan from 1960 to 1969. The annual average rate of population growth increased after 1952 to 2.38% in 1960, 2.54% in 1966, and 2.71% in 1976, compared with 1.78% in 1947 and 1.09% in 1907.

By 1966, the population of Egypt climbed to 30 million, twelve times the population in 1821. The urban population increased from 19% in 1966 to 41% in 1992. The increase in urban population was concentrated in greater Cairo and the port cities, Alexandria, Suez, and Port Said. In 1966, Cairo was inhabited by about 5 million people. Today there are about 15 million people in Cairo. The urban population exerts a heavy toll on the environment as a result of uncontrolled small factories, emission from motor cars, fumes from ovens, garbage, continuous building activities, etc. The increasing population of Egypt has also placed a heavy burden on the land. The use of fertilizers has risen from 4.5 kg/feddan of cropped area in 1917 to 70 kg/feddan in 1945–1939. Salinization and other soil problems pose a serious threat. The increasing number of people is also encroaching on the low desert bordering the Nile Valley where the archaeological remains of Ancient Egypt are located. Egypt also faces a severe water problem and further irrigation projects may prove to be ecologically unsound.

In Egypt and elsewhere, masses of poor people are striving to improve their living conditions. They aspire to increase their income by working hard and minimizing production costs in order to obtain consumer status goods. They are tantalized by the wealth of an urban élite and profiteers, and by western images of power and success transmitted to every home via TV. The interconnections between consumerism, inequalities of power, economic disparities, population, and poverty combine to promote “dirty” industrial production, deterioration of living conditions, and destruction of natural resources. More people continually demanding more goods makes a tremendous impact on our planet. The increase in world population has to be multiplied by a factor proportional to the increase in the rate of consumption per capita. In addition, the nature of items consumed exerts great pressure on certain critical resources (e.g., certain animals, minerals, and fossil fuels). They are also associated with the production of pollutants that are contributing to the deterioration of local and regional resources. Moreover, they are sufficiently widespread and of such intensity that they have begun to interact with biospheric and atmospheric processes.

CONCLUSIONS AND FINAL REMARKS

The grim situation humanity faces today is the result of evolutionary developments that began with the advent of agriculture.

Our impact on natural resources and the earth has increased at a rate much greater than that of the incredible population increase that attended the transitions from hunting-gathering to the present. With the advent of state society, the emergence of a ruling élite signaled the emergence of “super-consumers” who had a much higher standard of living compared with that of the rest of the population.

In traditional societies the proportion of this category of consumers was small (1–15%), and had remained low until the break-down of the archaic state (which lasted well into historical times, as in medieval Europe). The rise of global exploration and world trade promoted technological innovations which destabilized traditional political regimes based on king and church. Industry and consumerism associated with opportunities of social mobility were not only associated with a dramatic increase in population, but also with the emergence of large number of “middle” consumers. Consumption, in this context, was geared towards the acquisition of material goods that display and signal status in the social hierarchy. Food, shelter, and clothing, for example, ceased to be merely for meeting biological needs, and became primarily symbols of prestige and power.

Industrial and commercial powers subjected the majority of humanity to secure raw materials and man-power, creating a global rift between affluent and poor nations. However, the whole world became linked in a social hierarchy with the behavioral patterns of the powerful industrial/commercial nations as the model to emulate. Accordingly, the number of middle-consumers significantly increased. Moreover, the level of expectation continues to rise as the gap between the affluence of the powerful and the poverty of the mass of humanity widens.

Industrial and commercial agriculture was expanded and intensified to meet the demands of the rising numbers of consumers. But, industrial and commercial production proved to be far more destructive to human habitats because of its massive impact on the land, and the use of harmful and hazardous substances (e.g., fertilizers, pesticides, fuels) and practices (mechanized tilling, dams, and “reclamation”, deforestation, specialized crops, etc.).

Industry and commerce also fostered the emergence of cities that serve as ecological “hot-spots” inflicting great damage to the planet. Installations in industrial nations have also contributed over the last 200 years to pollution and environmental damage. At present, poor nations, in order to compete with affluent industrial nations cannot afford to pay for “clean” industry.

The ecological crisis cannot be solved by technological fixes or simple restorative remedies. To halt further deterioration and destruction of our planet and our local habitats, we must re-examine our values and cultural practices. We also need to re-examine our predicament not from that of separate, competing nation-states but from the vantage of a long historical trajectory and a global perspective.

Our onslaught on the environment is embedded in an ethos of conquest and con-

flict. As long as our ethos and world-view is based on a confrontation with others and nature, efforts to remedy our present predicament are rather slim. The practical solutions are political, technological, and social, but such practical solutions are not possible without a change of heart. In an essay on the *“Future of Science”*, Bertrand Russell concluded that the progress of science was not a boon to mankind since science had enabled the holders of power to realize their “evil” purposes. Reviewing the ill-effects of science, Russell remarked that “Science is no substitute for virtue; the heart is as necessary for good life as the head.” Only kindness, he concluded, can save the world.

We are often tempted to search for technological or managerial solutions to our contemporary problems. I hope that it is clear, from my survey of the ecological consequences of cultural transformations, that technology and management are not separable from ethos and ethics. We are motivated to acquire material goods for reasons that are embedded in a hierarchical ethos and a sense of self-esteem based on the acquisition and display of material goods. The industrial ethos is combative and aggressive, nation against nation, class against class, individual against society, man against nature, and man against man. Although this ethos has its roots in ancient state societies, it has never been as destructive to humanity and nature as it is today because of the cancerous growth of the human population and the spiraling number of “super-consumers”. The ecological crisis is only one symptom of a deeper malaise. We cannot continue to look the other way as millions die from starvation and war and pretend that we will not be affected. The suffering of others dehumanizes us. We cannot also continue to ignore the evil consequences of our desire for status (consumer) goods or the degradation of our natural habitat. Pollution knows no national boundaries. Each country is under siege. The ethos of short-term gains fostered by industrial and post-industrial practices is potentially disastrous for our own children and catastrophic for our grandchildren. The change in ethos is the responsibility of those who are aware of the magnitude of the danger. People must demand and guarantee their ecological rights, and they ought as individuals and organizations to persuade and pressure politicians, the media, and industry to promote a sound ecological ethos, ecologically benign technology, and an alternate ideal of self-esteem based on the social virtues of modest living, compassion, and sharing. We are not prisoners of the past. We have passed through many transformations in a long journey of failures and successes. We have reached summits of intellectual and artistic achievements, but we now face the peril of degradation and dehumanization. Five thousand years of history has molded us into a single global civilization. Our failure will be unprecedented in its magnitude and ramifications. Luckily, in an age of information we are also capable of looking at the past to shape the future. Collectively we have the resources to turn our world around and avoid the path of destruction. The ruins of ancient civilization remind us of the fragility of power. What endures of a civilization is not so much the glory of things, but the invisible moments that bind us together and the wonder of playing at the eternal shores of nature.

REFERENCES

- Baines, J. and Malek, J. (1984): *Atlas of Ancient Egypt*. Phaidon, London.
- Braudel, Fernand (1979): *The Wheels of Commerce: Civilization and Capitalism Fifteenth–Eighteenth Century*, Vol. 2. Harper & Row, New York.
- Hassan, F. A. (1974): *The Archaeology of the Dishna Plain: A Study of a Late Palaeolithic Settlement in Upper Egypt*. The Geological Survey of Egypt. No. 59, 174 pp.
- Hassan, F. A. (1983): Earth Resources and Population: an Archaeological Perspective. In Ortner, D. (ed.) *How Humans Adapt*, Smithsonian Institution Press, Washington, D.C.
- Hassan, F. A. (1987): Desert Environment and Origins of Agriculture in Egypt. In *The 1986 Proceedings of the Sixth International Conference of Nubian Culture: Past and Present*, Uppsala, Sweden. pp. 17–32.
- Hassan, F. A. (1988): The Predynastic of Egypt. *Journal of World Prehistory* Vol. 2, No. 2.
- Hassan, F. A. (1990): Desertification and the Beginnings of Egyptian Culture. In Schoske, Sylvia (ed.) *Studien zur Altägyptischen Kultur*. Akten des Vierten Internationalen Ägyptologen Kongresses, Munich 1985, Band 2. Helmut Buske Verlag Hamburg. pp. 325–331.
- Hassan, F. A. (1993): Population Ecology and Civilization in Ancient Egypt. In Crumley, Carole (ed.) *Historical Ecology*. pp. 155–181. School of American Research, Santa Fe, New Mexico.
- Hassan, F. A. (1993): Town and Village in Ancient Egypt. In T. Shaw, P. Sinclair, B. Andah, and A. Okpoko, eds. *Food, Metals, and Towns in Africa's Past*. pp. 551–569. Routledge, London.
- Kelley, A. C., Khlaifa, A. M. and El-Khorazaty, N. (1982): *Population and Development in Rural Egypt*. Duke Press, Durham, N.C.