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Ecological Contradictions Through Ages: Growth and Decay of the Indus and Nile Valley Civilizations

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ABSTRACT The principal meaning of ecology is adaptation in environment. Since the time of Darwin, environment has been conceived as the total web of life where in all plant and animal species interact with one another with physical features in a particular unit of territory. Ecology has a particular role in moulding the culture and history of a particular region and has great contribution towards the splendour of a nation. But natural hazards created out of ecological imbalance bring about devastating results. An analysis has been made in this paper to show the effects of ecology rendering growth and decay of two river valley civilizations that existed 4000 years apart in the annals of world history.

I

Ecology has followed a pattern of historical development similar to that of many other branches of science. Man is today faced with an ecological crisis. The researchers like Collier, Cox, Johnson and Miller show (Collier et al., 1973) that the warning signs of this crisis appear in specific problems, such as the imbalance of food production, excessive growth of human population, the reduction in productivity of major areas of land and water due to pollution and mismanagement, the gradual change of regional and global climate resulting from urban activities and agricultural practices, the destruction of different wild life species, disturbance of natural biotic atmosphere and the increase in number of pest disease organisms. These problems are symptomatic of disturbance of processes operating at the level of biosphere as a whole and irregularities capable of reducing the quality and productivity of the world environment below existing level. According to Webster, (Webster, 1950) the biological meaning of ecology is the mutual relations between organisms and their environment. This concept of adaptation interaction is used to explain the origin of new genotypes in evolution of phenotypical variations and to describe the web of life itself in terms of competition, succession, climaxes, gradients and other auxiliary concepts. Many of these problems involve relationships of major concern in the world political set up of the country. Cultural, economic and historical factors have contributed much to the emergence of these ecological problems. Again, these ecological factors have on the reverse paved the path for reshuffling of the above phenomenon of a nation. Ecology has traditionally been defined as the branch of Biology concerned with the study of inter-relationships between organisms and their enviroment. In the context of developing environmental crisis, however, ecology has indeed become something more – a science of survival.

II

To illustrate this point, two case studies can be cited which may be termed as ecological paradoxes of history. The Indus Valley Civilization which flourished in India approximately in 2000 B. C. is a paradox of history. It is quite evident from different kinds of analysis that ecological factors had favoured much in the flourish of the civilization. Studies of historians like Mortimer Wheeler, (Wheeler, 1960) reveal that ample and equable rainfall in the Indus valley had made the plain alluvial and made it fit for human habitation. It was more than a repelling environment for great cities like Mohenjodaro and Harappa, which were more than three miles in circumstances to exist some thousand years ago. Probably large amount of local fuel were available in the Indus valley. The floating timbers from the Himalayan forests were used to prepare burnt brick which was a special characteristic of the Indus cities – Harappa, Mohenjodaro, Chanhodaro and Sutkajender. These cities were easily accessible by water whilst other sites were less accessible and were seemingly content with stone and brick. The Indus valley people were mainly dependent on irrigation and overseas trade which were possible because of the rain-fed soil and the easy access to sea.

There are many hypotheses which have been assumed to explain the end of the Harappans in the region of the Indus valley. The theory that postulates the destruction of the Harappans by the Aryans is a fairly well-known one. Another important postulate in this regard is that which attributes to natural causes, such as the gradual worsening of the environment and the encroachment of the desert due to desiccation. Wheeler says (Wheeler, 1960 a, b), "History would suggest that the process of desiccation was already far advanced by the time of Alexander the Great, whose returning army was decimated in the cheerless wastes of the Makran." It may be that an increasing aridity had already contributed in the downfall of the Indus cities. This aridity could have been caused by the northward movement of the Atlantic cyclone on the hypothesis that these were at one time deflected southwards to the latitude of Northern Africa and extended to Arabia, Persia and India. This hypothesis which has been favoured by both Wheeler and Piggot does not find much support since its validity is doubtful on the grounds of paleo-climatology. The general consensus now is ever since the end of Pleistocene period, the general physiography and climate have been relatively stable. But there was of course local decrease in rainfall because of the change in the ecological balance due to the changing flora and fauna or the changing scenario as a result of human activity. This part may be analysed a little elaborately. Lack of rainfall was caused due to deforestation. Again, deforestation was caused for the growing need of timber- wood which was used to burn bricks. Probably, the floating timber in the river Indus had not been sufficient to fulfill the requirements of highly modernized brick-built cities of Mohenjodaro and Harappa. The forests which attract rainfall became gradually exhausted and in turn the rainfall became scanty. Deforestation was also probably a major cause of much soil erosion which increased both the silt load and flooding potential at the river Indus. This in turn must have affected the construction and maintenance of any form of irrigation system and hampered the process of continuity of the civilization in the lower alluvium by the Harappans. "The causes of erosion", according to the study of Malik (Malik, 1968) "may also have been of various techniques of intensive cultivation, depletion of soil nutrients by inadequate crop rotation, the disturbance of the natural patterns of drainage by the slow rise of the river bed and banks as a result of silting," thus affecting the entire infrastructure of the community.

The frequent and severe floods had in fact accelerated the silt deposits at the mouth of the river Indus which had choked off Mohenjodaro from the sea, causing a rise in the water table that must have been a prime factor in the destruction of Mohenjodaro. Inadequate maintenance of dams and irrigation channels hastened the downfall of the civilization. Falling off in agricultural standards, internal break up of the administration, lack of planning, untidy housing and the use of old bricks in the reclining days were some of the glaring reasons to show the growing apathy of the people towards maintenance and order.

The river Indus had also changed its direction leaving large tracts of land not only barren, but infected with germs due to reduction in precipitation of moisture. A large number of people fell victim to disease and pestilence spread all over the cities. People began to move southwards to Lothal and Saurashtra region in search for food and shelter. Thus the socio-cultural pattern of the Harappan civilization was probably getting out of hand with the spread of the culture to the south and east of the Indus valley. Seven layers of the civilization have been found after excavation in 1924, which indicates that the civilization was seven times built and seven times ruined due to some ecological problems.

III

Let us now analyze another paradox of history – the erection of the Aswan Dam on the river Nile. The Egyptian civilization was a gift of the river Nile in the ancient days. The Nile valley appears to have been unfit for human habitation during the stone ages; it was only when the Nile ceased to be a raging torrent and had deposited alluvium suited for starting agriculture that settlers from Libyan Steppe drifted in. According to Margaret A. Murray (Murray, 1957), they brought with them the knowledge of pottery and agriculture, showing that though not necessarily far advanced, they already possessed the conception of the rudiments of civilization. So, this civilization also had been a gift of ecology. It is to her dry climate and dry soil that Egypt owes the preservation of the material that makes it possible to trace the

course of her development from the barbarism of the remote past to the full flower of civilization and then to its decay. No other country has given so rich a harvest to the archeologists, nor can any other country show such splendour of material, such beauty of technical skill and such power of artistic expression extended over such a long period.

The entire economy of Egypt i.e. the U.A.R. of today is also tied to the ecology of the river Nile. The Nile is one of the largest rivers in the world that enters the U.A.R. from the south, carrying water, silt and nutrients from the Ethiopian highlands over 1,500 miles in the south .It flows northward through the Sahara Desert, where the annual rainfall ranges from 10 inches down to nearly zero and then empties into the Mediterranean Sea via a rich delta about 100 miles in width.

The Nile valley comprising perhaps 1/30th of the total area of the U.A.R. is consequently the center of agriculture and population. Almost all of U.A R.'s 33 million people live here. Until construction of the Aswan Dam, this population was dependent on agricultural production of about 6 million acres of river flood plain, augmented by an expanding Mediterranean fishery and by importation of food.

Historically, the pattern of agriculture in the Nile valley has been closely tied to the annual cycle of the river. Just like the river Indus, the river Nile too inundated almost every year. These floods were destructive in many ways, but they also helped in the process of the enrichment of the civilization. These floods used to flush salts and deposit rich layer of organic silt which acted as fertilizer. They have in fact maintained the fertility of the Nile valley for over thousands of years. But, it was in order to check the yearly floods that artificial devices had to be undertaken. The Nile is dammed at several points. At Aswan, in the south, the Aswan High Dam is the fourth in the series of dams that were begun in 1902.

The construction of the Aswan High Dam, initiated by the Late President Gamal Abdul Nasser and assisted by Russian Government, was an unique construction towards the betterment and modernization of agriculture and industry of the U.A.R. Just north of the border between Egypt and Sudan lies the Aswan High Dam, a huge rock fill dam which captures the world's longest river, the Nile, in the world's third largest reservoir, Lake Nasser. The dam, known as Saad el Aali in Arabic, was completed in 1970 after 18 years of work. It was to add 1.3 million acres to the cultivated land area and permit year round cropping of much of the cultivated land. It was to provide cheap electrical power to encourage industrialization. Lake Nasser, behind the dam was projected to be 310 miles in length and to have a surface area of about 2,000square miles. Collier and others' study show (Collier et al., 1973 a, b) that the purpose of the lake was to store 163 million cubic metres of water- enough to provide an irrigation reserve for several years of low river flow. The 12 generators of the dam were designed to produce 10 billion kilowatts of electrical power annually.

This gigantic project for converting a semi-arid land to an advanced agricultural-industrial region was going on well for decades, but problems later cropped up in that area from different directions due to ecological imbalance. After the dam was completed, about 300,000 acres of lands were reclaimed. Though production has now been accumulated to a good extent, several serious complications have developed in the Nile valley from the late half of the 20th century. The silt, which was so long used as natural fertilizer and had been stored during flood, became exhausted. Almost all the Nile silt was now being deposited at the bottom of the Lake Nasser. Seepage and evaporation account for a loss of about 12 to 14 % of the annual input into the reservoir and thus decreasing its storage capacity. This had also resulted in problems at downstream. The need for artificial fertilizer was increasing, but this need could not be always sufficiently met in that region. So, both the quality and quantity of the harvested crops showed signs of decline in many areas.

In addition, the flood waters formerly used to flush the excess of salt especially in the delta area, where soils tend to be water–logged. Farmers have been forced to use about a million tons of artificial fertilizer as a substitute for the nutrients which no longer fill the flood plain. Further downstream, the Nile delta is having problems due to lack of sediment as well since there is no additional agglomeration of sediment to keep erosion of the delta at bay, so it slowly shrinks. Even the shrimp catch in the Mediterranean has decreased due to change in water flow. Poor drainage of the newly irrigated lands led to saturation and increased salinity.

Over one half of Egypt's farmland is now rated medium to poor soils. In such soil, salt from deeper layer of soil is also brought out through capillary movement of water. After the erection of the dam, this flushing of salt has stopped and salinity in soil has increased in the delta region and in the upper part of the Nile valley. This has brought about serious damaging effect in the agriculture of the region. Without any preventive measures, the excess of salinity in soil will soon turn the land into waste land.

The construction of the dam has automatically reduced the load of silt in the river. But without a proper silt load below the dam, it tends to weaken the foundation of the dam for repeated erosion. This erosion is expected to be checked to a certain extent with the completion of the Nile Cascade Project. The delta coastline, in the opinion of Sterling (Sterling, 1971), was formerly protected by the annual deposition of millions of tons of silt, is now receding in some areas at a rate of several yards per year.

On top of all this, the modern researchers like Wagner (Wagner, 1971) uncover the fact that the expansion of canal irrigation has increased the spread of several diseases including bilharzia, malaria and trachoma which are carried by adequate invertebrates. Bilharzia is a disease caused by the flat- water parasites. The parasitic disease schistomiasis has been associated with the stagnant water of the fields and the reservoir. These parasites have life- cycles alternating between man and various species of pulnonate snails. These parasites infect man in the carcaria stage. Carcarias are minute; they penetrate the skin, the skin of human body wading in water. This has occurred because fresh water snails have spread into the permanent irrigation ditches in areas formerly irrigated. Previously, these snails were excluded by seasonal drying up of ditch and pond habitants. Where this spread has occurred, the incidence of Bilharzia has increased almost from a level of zero to as much as 80% The increased incidence of Bilharzia has added several million new cases already causing an economic loss of about $500 million annually. Some studies indicate that the number of individuals affected has increased since the opening of the High Dam. "Egypt is the gift of the Nile", wrote the Greek historian Herodotus in the fifth century B. C. and now the Nile River and the Aswan High Dam is Egypt's lifeline. About 95% of Egypt's population live within twelve miles from the river. Were it not for the river and its sediment, the grand civilization of ancient Egypt probably would have never existed. Though it has been thirty years since the construction of the High Dam, it seems that there has not been enough time for the ecosystem of the Levantine Basin to reach a new level of ecological equilibrium. The results of the new investigations, however, reveal the direction in which the pelagic ecosystem is adjusting. The recent recovery of total fish landings, particularly the sardine catch, is an important indicator among many, but the mismatch between low primary productivity and relatively high levels if fish production in the region still presents a paradox or puzzle to scientists. Current and future research may shed light on what can be called the "Levantine Basin Paradox", the existence of greater catches of fish and shellfish then can be supported by the poverty-stricken, nutrient depleted waters of the Levantine Basin.

IV

These complex problems can be solved by understanding of ecological relationships. It requires an understanding of the dynamics of complex assemblage of species in the Eastern Mediterranean. A harmony should be there between ecology and scientific devices. Even beyond this, it requires an appreciation of the pattern of input and cycling of species in salt and soil materials and it requires an appreciation of how these control the basic fertility of the lands and offshore waters of the Nile Valley The Aswan Dam is only one example of the extent to which human technology is now modifying the world environment.

The Indus valley civilization, which prevailed approximately 4000 years ago, was destroyed due to lack of men's knowledge of ecological consequences. Deterioration of the biotic atmosphere, namely, deforestation, lack of rainfall, pestilence, soil erosion etc slowly paved the path of its ruin. The people of the Indus valley were much absorbed with more refined tastes like making luxury materials of bronze or planning their city in an artistic way. It cannot be always expected from people living thousands of years back to have ecological knowledge of sophis-ticated level to protect themselves from natural damages. On the contrary, it is expected that the people of modern U.A.R should have

better knowledge of the same to protect the Nile Valley from natural calamities. It was in order to check the natural calamities that the Aswan Dam was created. It is an irony of fate that the sophistication of science of the 20th century has also failed to check ecological disaster in that region. Erosion, disease and reduction of silt deposition in the lower Nile Valley have further intensified the problems in spite of construction of dam of such high mechanism. Thus, the lapse of thousands of years also could not prevent the two river–valley civilizations to be the prey of the same ecological imbalance.

The Aswan High Dam, 100 meters high and nearly 4000 meters in length, is piling up with silt behind its massive walls, "slowly but surely making it obsolete", observes Marq De Villiers, in his book, 'Water' (De Villiers, 2003) he also states that, "the nutrient-rich ooze no longer makes its way to the Mediterranean and this has led to the collapse of the sardine fishery in the Nile Delta." Similarly, identical situation exists in the case of marine life and the depleting wet lands in the Indus Delta which spreads to over 300 sq km which used to receive 150 MAF of silt containing water in the Arabian Sea. This flow drained with its one million tones of silt to the delta country every day; but this process has ceased owing to impediments in the up stream. Mangrove forest area of 300,000 has been reduced to 100,000 hectors. Riverine forests on the banks of the Indus are facing the gradual extinction due to water stress. Sea water has intruded 30 to 50 km up the river down stream the Kotri Barrage; some 1.2 million acres of agricultural land has so far been devoured by the sea threatening the livelihood of 400,000 fishermen and their dependents residing on 100km of the Sindh coastline.

The considered opinion of ecological and hydrological experts is given by Marc De Villers, who said that "if the Aswan Dam is indeed an ecological disaster, its worst perils are hidden in Lake Nasser, the 600 km long reservoir formed by dam, where everything looks peaceful." The feluccas ply the waters as they have done along the Nile for 40 centuries, are identical in style to the boats depicted on the frescoes at Luxor and Karnak. The ecological damage and intrusion of sea in the Indus River affect the cultivable land, wet land and the rich marine life. Now Thal canal takes care of the rejected Kalabagh dam water diversions. According to Marc De Villiers, "a change in the character of the world waterways, permanently altering the ecosystem of entire drainage basins, in some cases the local micro-climate, and in the least one case, the Nile permanently changing a flow pattern that sustained civilization for 5000 years."

At the most, none of the goals of alleviating poverty had been met. A protagonist of dams (Hussain, 1981) says that, "we in Pakistan are blessed with perennial rivers like the Indus which is fed by mountains and glaciers of the Himalayas. But we are most unfortunate in having not utilized the full water and power potential of the Indus." Where the water for more diversions and reservoirs would come in face of accurate water shortage? Dams are being decommissioned in the 21st century. Already we have 'water-stress' crises between upper and lower riparians as sharing of the Indus – Water is not being done under the provisions of 1991 Water Accord. The Indus is no more perennial down stream from Kotri; yet letters are printed in justification of unilateral and arbitrary decisions for construction of Kalabagh Dam (Dawn, 7.3.02):"We in Pakistan are defying historical lessons that big dam can bring prosperity to nation by providing water and energy". So, in conclusion it may be stated that both the Indus Valley Civilization and the Nile Valley Civilization, which were one- time prides of mankind and which were intended to change the trend of mankind became the victims of ecological disaster in some thousand years lapse and both the civilizations have been today described as paradoxes of history.

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