Environmental Sustainability in Ancient Egypt "I Have Never Stopped the Flow of Water"

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Abstract

Ancient Egyptians were blessed by the vast amount of natural resources and an amble climate which enabled them to establish their civilization. Nature was a major source in ancient Egyptian theology and art. It is often said that for thousands of years Egyptians lived in absolute harmony with their environment, using its resources for food, medicine, building and crafts. The present article aimed to research how far Egyptians were successful in managing their environment in a sustainable way that is in a manner which did not prevent contemporary or future generations from pursuing the same lifestyles.

Keywords: Environment, ancient Egypt, air quality, water management, recycling

Introduction

Any observer of ancient Egyptian art can notice that Egyptians had notable appreciation for nature. Indeed walls of tombs, temples and palaces were filled with scenes that show the diversity of animals, plants and landscapes that the ancient artists wanted to document so that they enjoy during the afterlife. Moreover, Egyptian mythology was based on gods and deities that are represented in numerous manifestations and phenomenon of nature: the sun, the sky, air, humidity and Nile were all given divine personifications. Egyptian religion venerated the forces of nature and directed people to cooperate with them rather than interfering (Hughes, 1992).

Yet in how far was this theoretical appreciation reflected on the environment in terms of sustainability. Below we attempt to apply the modern concept of environment sustainability on ancient Egyptian daily practices concerning water management, agriculture, air quality, preserving biodiversity and recycling.

Environmental sustainability

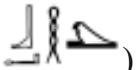
Environmental sustainability is certainly not a simple term to define since scholars vary widely on the domain of its aspects. The most quoted definition in literature is the one presented by the Bruntl and Commission's report (1987, 27) which introduced the broad concept of sustainability and stated that sustainable development has to "meet the needs of the present without compromising the ability of future generations to meet their own needs".

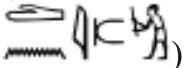
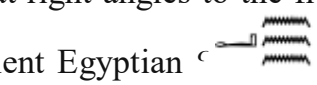
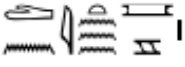
Another definition states that environmental sustainability is the "responsible interaction with the environment to avoid depletion or degradation of natural resources and allow for long-term environmental quality" (Singh, 2019).

Morelli (2011) has compiled 15 guiding principles for environmental sustainability under five categories:
-societal needs,
-preservation of biodiversity,
-regenerative capacity,
-reuse and recycle
- Constraints of nonrenewable resources and waste generation.
The present paper adopts the definition of the Bruntland Commission's report.

Water management, delivery, treatment and disposal systems

Ancient Egyptians called the Nile  *itrw-ꜣ* (the great river) (Zein and Heragi, 2020). Indeed the socio-economic life of ancient Egyptians was closely connected with the river Nile (Gemmill, 1928). It is widely believed that the annual Nile inundation was the most major occasion that occurred in the whole country during the ancient history of Egypt (Rolfe, 1917). This is because the main economic activity in Egypt, namely agriculture, was dependent on moderate floods of the Nile.

Yet the Nile was not always generous or consistent. A recent statistical analysis was conducted for the period 1900–2000, from which 20-year time spans were examined. The result was that within each 20-year span, the number of years above the average was seven, the number of years below the average was seven, and the number of years around the average was 6 years (Noaman and Elqousy, 2019). Interestingly the well-known story of Joseph in the Old Testament describes a similar pattern of Nile inundation (King James Bible, 1769/2019, 1 Genesis 41: 2-7). There seems to be reasonable grounds therefore to assume the same pattern in ancient Egypt. Consequently, for a span of 7 years the land of Egypt was inundated by a flood (ancient Egyptian *bꜥḥw* ) which left most of the land underwater and for another 7 years there were arid conditions which harmed agriculture. Indeed, ancient records describe occasional drought. Neferrohu (Breasted, 1935, p. 248) for example described the misery and chaos which took place in his era. Speaking to his own heart he states "the river of Egypt is dry; one may cross it on foot. When one shall seek water for the ships for sailing it (the river), his way becomes shore and shore becomes water".

Therefore, to manage and to leverage the predictable cycle of inundation for the purpose of agriculture in Egypt, ancient builders constructed three types of river amenities: dams (ancient Egyptian *dni* ) at right angles to the flow of the Nile, separating the Nile Valley into basins, dykes (ancient Egyptian ) which were built along the banks of the river and canals (ancient Egyptian *dnit* ) which diverted excess amounts of water during high floods. When the water arrived at the mouths of the canals,

the dams between the canals and the river were opened and the basins and canals flooded. Then the water was left in place for about two months until it evaporated or drained. To preserve the system, the canals and narrower dishes had to be sustained with regular maintenance to avoid their clogging and the dikes had to be restored to their original height (Baba et al., 2018). To reduce the force of flood and nourish the fields all along the valley with silt, the ancient Egyptians made cuttings through the embankments.

The first evidence of water management for irrigation was the mace-head of King Scorpion (Ahmed et.al, 2020) who is shown holding a hoe and apparently digging a canal whose water is shown flowing beneath him. The scene can alternatively indicate that the king is laying the foundations of a dam or dike.

Note. The Scorpion Macehead. From *Protodynastic Egypt* by Adams, B., & Ciałowicz, K. M., 1997, p. 8.

One of the earliest accounts of dams in Egypt was mentioned too by Herodotus (Jansen, 1983) who attributed the construction of a dam at Kosheish about 20 upstream of Memphis to King Menes of the first Dynasty. He also mentioned that Menes shifted the course of the Nile diverting it to the east side of the valley prior to establishing the capital. To achieve this, he is said to have constructed a gigantic dam across the Nile close to the Libyan hills to close a branch of the Nile flowing through the Western Desert depression. He is also claimed to have enlarged and deepened the branch flowing through the Valley and the Delta and strengthened its embankments. The aim of this was to make water available for agriculture and to protect communities from high floods (Noaman and Elqousy, 2019). Critics to this account state however that the size of such a project would have been far beyond the reach of building capabilities at the time. Moreover, there are no archaeological traces for Menes's giant dam endeavour.

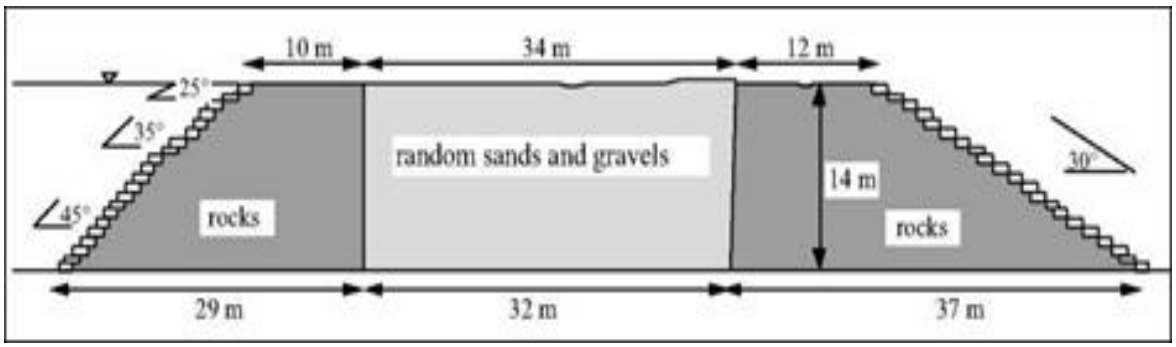


Fig.1. Note. Cross section of the structure of the Sadd el Kafara dam. From Sadd-el-Kafara: the world's oldest large dam. International Waterpower & Dam Construction by G. Garbrecht, 1985, International *Water Power & Dam Construction*, *37*, p. 74.

As for archaeological evidence of other ancient dams, the well preserved masonry remains of one of the oldest and greatest known dams in ancient times, Sadd-el-Kafara (fig.1), built during the reign of king Khufu, were discovered in the Wadi el Garawi ten kilometres southeast of Memphis. This dam which was built of gravel, stone and earth aimed either to impound water for the pyramid workman community next to the nearby queries (Jansen, 1983) or to protect cultivated and inhabited areas downstream from the violent floods (Библиотека строительства , 2015). It seems however that, due to the lack of a spillway, the dam failed shortly after construction finished since there is no trace of siltation in the reservoir. It is possible that ever since this dam failed ancient architects learned their lesson and according to Kérisel, (2001, p.102) "gigantism was ruled out".

Yet other smaller national water projects succeeded, namely the enlarging of a branch of the Nile known as Bahr Yousef to divert water for the reclamation of the Fayum basin into agricultural land during the Middle Kingdom (Jansen, 1983). For this purpose, two regulating dams, at 10 k distance from each other, were constructed at Hawwara and diverted a large part of the water of Bahr Yousef Nile branch. It was most likely Sesostris II or Amenemhet III who widened and deepened a channel connecting the Mer-wer lake (or lake Moris) to the Nile. The lake, known today as Berkat Qaroun, had two purposes. First it served for flood management to store excess water during high floods. Secondly it acted as a reservoir which can provide waters for irrigation in case the Nile flood had shortened (Britanica, 2014) .

Criesel and Cockel (2021) made a lengthy contrast between the methods of river management practised by ancient Egyptians and the modern dams constructed on the Nile, in particular the Aswan high dam, preferring the former over the later. Recognizing the beneficial sides of the Aswan high dam in flood management and energy production, Abd-El Monsef et. al (2015) highlighted its huge environmental and safety cost which can be summarised as following:

- The vulnerability against military operations threatens to drown the whole country downstream.

- The annual loss of 10 billion m3 by evaporation in Lake Naser.
- The acceleration of the regression of the delta.
- The disappearance of the agricultural system used by the pharaohs and
- The salinization of the Egyptian soil.

No ancient dam, to our knowledge, was built on the main course of the Nile on the extreme south whose construction would have impacted the environmental balance to the lands north of. That the Egyptians sufficed with diversion dams on the branches of the Nile mostly Delta, has preserved the supply of the fertile alluvial soil to Egypt. Preserving the flow of the main course of the Nile agrees with confession no. 35 in book of the dead in which the deceased states: I have never stopped the flow of water (Budge, 2008).

Criesel and Cockel (2021) have compared the modern choice of digging a gigantic reservoir (Lake Naser) to the common sense decision of ancient Egyptians to divert excess water to a nearby natural depression (Lake Moris). The authors believed that Tushka depression would have sufficed the purpose of water management to the south of Egypt. If modern planners learned from the wisdom of pharaohs, the monuments of Nubia and entire communities that had to be relocated would have been spared.

The water supply systems in Egyptian settlements have existed from at least the Old Kingdom and seem to be state operated. Driaux (2016) has concluded that when the city was at a distance from a water source, the state did not install complex installations such as pipe networks or wells to fetch water, but preferred a simpler system using the manpower available. Evidence from the towns of Dier Almadina and Tell Alamarana implies that a state dominated water transport system was in place to transfer water from wells outside the city to *srwt* “water places"  where it becomes accessible to inhabitants of settlements. Such “drinking-places' ' were most likely installations equipped with jars and located in squares, probably in the middle of a town, or at several spots along the settlement. The water would have been provided on a daily basis, and the city inhabitants would be permitted to have the amount of water that covered needs, likely under the supervision of an overseer. The method of water transport is hinted by textual evidence (mainly on ostraka) from Dier al Madina which mention *ỉnw mw*  “water-carriers” (Wood, 2017). According to the source, they had to bring water from outside the village and used to hire donkeys to transport water. Potsherds found along the route to the village of Tell Amarna from a nearby well show that water was transported in a kind of amphora, most probably carried by donkeys.

Once water arrived to inhabitants it was not directly bootable as it had to be treated first from?. Egyptians would most probably let water stand for some time before being used, until mud mixed in has settled to the bottom. After 1500 BC, Egyptians discovered the

principle of coagulation. They applied the seeds of the Moringa oleifera tree or chemical alum (a mineral mined from the oases of Dakhla and Kharga) for suspended particle settlement (Enzler, 2018).

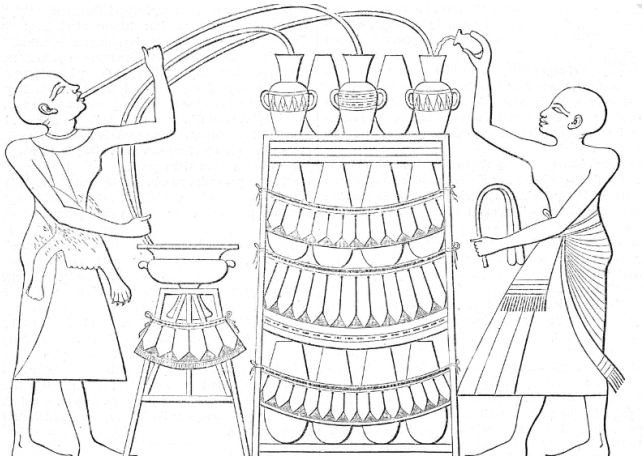


Fig. 2. *Note*. Siphons in the tomb of Amenophis II From *La Civilisation égyptienne* by Erman and Ranke, 1952 fig. 74.

A scene in the tomb of Amenophis II (fig.2) has led Ewbank (1972) to conclude that siphonsware were used in Egypt at least as early as 1450 B.C. Such a scene shows two men flanking a group of vessels. Into three of these siphons are inserted; two apparently in action, and one of the men is pouring water from a smaller jar while the other is in the act of charging a ship on by sucking. The contents of the jars are being drained into a large vase on a base.

No textual or pictorial sources in ancient Egypt explain wastewater management, but since the middle of the 3rd millennium BCE there are a variety of archeological finds that show the methods of dewatering of houses, temples, and tombs as well as industrial sites such as washhouses and mummification workshops (Köpp-Junk, 2020**).** Canals were one method of dewatering sites. They were either made with stone blocks or slabs or were cut in a u-shape into stone blocks, which were either covered or left open. The u-shaped channels were built of waterproof sandstone, granite, or more frequently limestone. These drainage channels ran through the outer wall into a vessel or straight into the desert sand dry wells, shafts, and waste pits. Although no complete system was attested, Köpp-Junk (2020) assumed that drainage canals could also lead directly to the Nile. If waste water was poured directly into the river this would certainly contradict the beliefs of the ancient Egyptians who is quoted saying in chapter 125 in the version of Nebsebi of the book of the dead (negative confusion) " I have never fouled water" (Wallis, 2003).

Agriculture and pest control

At the dawn of history the marshy and wet terrain of ancient Egypt was adequate for fishing, hunting and gathering, yet not for agriculture. In spite of that as population increased and natural resources of fauna and flora deteriorated, the solution was to claim more pieces of land for farming. Egyptians divided the year to 3 seasons according to the agricultural cycle: the season of inundation (*ꜣḫt*), the season of growth (*prt*), and the season of harvest (*šmw*). Although the water supply was inconsistent depending on the size of the Nile flood, Egyptians adopted basin irrigation which enabled them to establish a civilization whose main economic activity was agriculture. As Hughes stated "The sustainability of ancient Egyptian agriculture was made possible by the annual flood of Nile" (1992, p.13). This is because in addition to adding natural sediments, the annual inundation also washed away toxic waste and salts from the soil, maintaining its fertility for thousands of years. The convenience of basin irrigation was that no additional watering was necessary for a winter yield of wheat, barley, or flax, and that there was no need to add fertilisation because the silt was full of organic matter and minerals (JANÁK, 2016).

Fig.3. Note. Two types ploughs in a Bani Hassan tomb from *A history of technology (Fall of ancient empires, Vol. 1)* by Singer, E., Holmyard, E. J., & Hall, A. R.,1954, Fig. 43

Grain was the first crop to be grown after the flood season**.** First step in planting grains was ploughing as soon as the flood began to recede to churne the soil up, which circulated the nutrients. Ancient Egyptians used both hand ploughs and those pulled by oxen (Janick, 2002). A tomb of Bani Hassan dating to the Middle Kingdom shows both types (fig.3). Sometimes the land was ploughed for a second time to cover the seeds (Fussel et. al, 2020). Second step was sowing which was done immediately after ploughing. Indeed seeds were scattered ahead of the plough or dropped directly afterwards into the forrows. Livestock animals like sheep or oxen were led over the land to tread the seed. . Crops were sown in November and left to grow until May (Singer et al., 1954). Final step was harvesting which was done by a handheld sickle, a popular scene in ancient Egyptian tombs (fig. 4).

Fig.4 Note. Harvesting grains by a hand held sickle in a Theban tomb From *Food: The gift of Osiris (Vol. 2)* by Darby, W. J., Ghalioungui, P., & Grivetti, L., 1976, Fig. 11.4c.

The main ancient grain crops were those used for bread and beer and included barley and several wheats. Egyptians also grew several types of indigineous and imported fruits and vegetables such as dates, doums, figs, grapes, carobs, pomegranates, olives and apples peaches, pears,onions, beans, garlic, leeks, lentils, peas, cucumbers,radishes, cabbages, and lettuce (Noaman and Elqousy, 2019).
Egyptians depended on agriculture for more than their nutritional needs. They were creative in employing plants, using them for medicine (Ritner, 2020), as part of their religious practices, in the production of clothing (flax), dye (henna), furniture, grooming (lotus flowers), boats and writing material (papyrus).

As for post harvest treatments, pesticides were not known yet. Consequently ancient farmers used mechanical methods for pest control. Sunning grains before storage was an ancient Egyptian practice to protect the yield because heat activated internal infesting insects and caused them to complete their life cycle before storage. This also lowered moisture content making the stored grains less susceptible to infestation (Evans and Weinstein, 2021). Another method for pest control was burying grains in sand less than one meter deep. This method eliminated moisture and space that allowed the pests to grow. Silos with a hole made of mat reed and pottery jars sealed with mud were used for storage. Because cereal grains continued to respire carbon dioxide that displaced available oxygen, these sealed containers were primitive forms of fumigation chambers in houses. As insects are less active in cooler temperatures, barns were frequently found underground. (Veiga, 2012)

Although Egyptians used sustainable methods of farming and irrigation, the mere land use for agriculture had its environmental cost. Hughes (1992) summarised the adverse effects of agriculture on the ancient Egyptian environment. Although Nile floods protected the soil from salination, the latter occurred in irrigated areas above the flood line and was a major issue in Fayum. Deforestation was a huge problem too. To support an ever-increasing population ancient farmers had to remove vast forests of fig, jujupa, acacia and other wetland plants. Pastoring contributed further to deforestation since cattle consumed even smaller natural trees. Natural habitats of animals gradually shrank and even the symbolic plant papyrus became less common.

Animal diversity and welfare

Animals were very much appreciated and chirchered in ancient Egyptian culture; almost all deities were represented as animals or animal headed figures such as Amun, Sobek, Hathour, Sekhmet, Selket, Thoth, Anubis, Wadjet, Taweret…etc. Several species of animals were kept as sacred animals in the temples including cats, bulls, snakes, crocodiles, and Ibis birds from which millions of mummies exist. Egyptians took great care in protecting their sacred animals. Ironically their refusal to injure any led to the conquest of their country. According to the historian Polyaenus VII.9, Cambysis hoarded in front line of his army dogs, sheep, cats, ibises a head of his army knowing how dear Egyptians held these animals to their hearts and how they would refuse to compromise their lives. It is claimed that Cambyses II, after his victory, hurled cats into the faces of the defeated Egyptians in scorn for people who surrendered their country and their freedom for the safety of common animals (Mark, 2017).

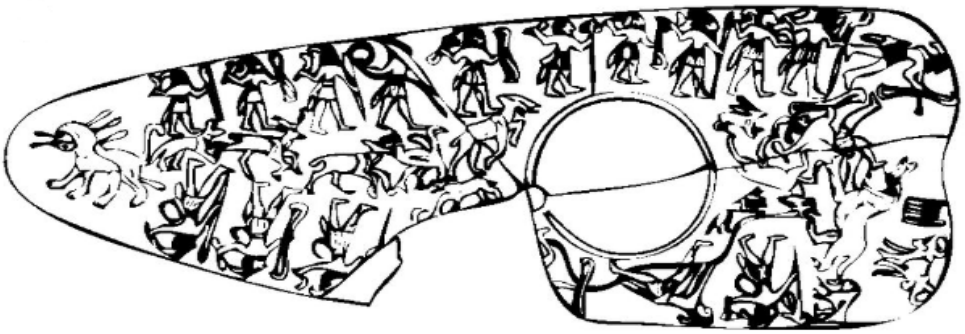


Fig. 5. Note. Line drawing of a ceremonial palette accessioned (no. EA20790) in the British Museum. From Collapse of an ecological network in Ancient Egypt. Proceedings of the National Academy of Sciences. By Yeakel, J. D., Pires, M. M., Rudolf, L., Dominy, N. J., Koch, P. L., Guimarães, P. R., & Gross, T, 2014, fig. 1.C.

Ancient Egyptians domesticated animals such as cows, goats, swine, donkeys, camels, horses, cats, dogs, baboons, and several kinds of birds. Such species were used for food, for agricultural activities, for transportation or as pets. The latter were held high in their owner's life to the extent of being mummified and buried with them. One incident included a pet monkey buried under the feet of a 21st Dynasty priestess (Mark, 2016). Heroduts stated that in case of fire, Egyptians would evacuate their cats before themselves.

On the other hand, and aside from scared animals and pets, wildlife used to be hunted and killed as game or for trophy (Hughes, 1992). As a matter of fact, hunting and fishing were considered sports and ritual practices in ancient Egypt. A mudstone ceremonial palette (no. EA20790) in the British Museum shows human hunters stalking and capturing lions, gazelles, hartebeest, and an ostrich with bows, spears, boomerang sticks, and lariat (fig.5). Other hunting tools included nets and angles (fig.6).

Fig. 6 *Note*. Khunmhotep hunting birds by a net . From *Beni Hasan (Vol. 1)* by Newbearry et. al, 1893, pl. 33.

Aside from hunting, Hughes (1992) concluded that deforestation of land for agriculture led to destruction of Habitats of wild animals, birds and aquatic creatures shrank gradually until they disappeared. Eventually hunting became a symbolic activity practised by the noble and represented in their tombs.

Yeakel et al. (2014) has paralleled paleontological and archaeological evidence of existence of animals from Egyptian antiquity with ancient depictions of mammals to trace their extinctions over a 6,000-y span after noticing that late Predynastic ceremonial palettes depict lions, wild dogs, and many species of ungulates including oryx, hartebeest, and giraffe none of which exist in Egypt today. They concluded that out of thirty seven large-bodied mammals that were spotted in Late Pleistocene/early Holocene Egypt, only 8 remain today.

The earliest documented extinctions in Egypt included large-bodied herbivores, such as elephants, giraffes, native camels, oryx, and two species of kob. The extensions were attributed to the shift of the ancient economy from mobile pastoralism and gathering to agriculture and hunting, as well as climate changes to a more arid weather. Yet there might be other explanations for the disappearance of some species. The zebu (bos indicu), a subspecies of domestic cattle characterised by a hump, for example appeared during the new kingdom when it may have been brought by Syrians as tribute. It was probably mixed with other Egyptian types until it merged completely.

Janak(2010) noticed that among the three kinds of ibis species that are attested from ancient Egypt the numbers of the northern bald ibis seem to have decreased gradually since the end of the Old kingdom. He attributed the decline to climate change and human disturbance. Taken into consideration however that mong thousands of mummies of sacred birds of numerous species, no northern bald ibis has been spotted , might make the former reason more possible especially that the end of the Old Kingdom is marked by an arid era known as 4.2 kiloyear climate event

Air quality

Air pollution is not a modern phenomenon. As a matter of fact, it is coeval with mankind (Makra. 2015). Air pollution of inner spaces has started with the discovery of fire and was generated by using fuels for heating and cooking. In ancient Egypt food could be cooked by stewing, baking, boiling, grilling, frying, or roasting, all of which require the use of fire. Bread ovens and cereal processing tools have been excavated in houses, estates, temples, and, recently, in a complex associated with the Giza pyramids (Samuel, 1999).

Excavations in the workers settlement south of the Sphinx in Giza also found that Wood was the main fuel used in the bakery ovens, and the analysis of wood charcoal from the site carried out so far shows that over 99 percent of it came from acacia trees (Murray, 2004). Moreover, animal dung has served as fuel in rural areas of Egypt during Pharaonic times just as it does in modern day(Budka et. al, 2019).

Wood burning produces huge quantities of localised outdoor air pollution, which has recently been recognised as a Group 1 human carcinogen by the International Agency for Research on Cancer (Doctors and Scientists against Wood Smoke Pollution, 2020). Indeed, cancer was known in ancient Egypt. Actually the first ever description of the terminal disease was found in Egypt and it dates back to the second intermediate period. It's called the Edwin Smith Papyrus and it describes 8 cases of tumours of the breast that were removed by cauterization. Yet overall, it has been estimated that the risk of cancer was 100 less in ancient Egypt compared to modern societies. The estimate was made after archaeologists uncovered six cases of cancer while studying 1,087 mummies buried between 3,000 and 1,500 years ago in the Dakhleh Oasis (Jarus, 2018).

Smell pollution was an issue when cities could not get rid of waste. The besieged inhabitants of Hermopolis for example preferred surrendering their town than coping with their own stinking air (Brimblecombe, 1995).

Supporting the case of air pollution in ancient Egypt, anthracosis and silicosis have regularly been found in the lungs of mummies (Tapp, 1975; Walker et al, 1987). Anthracosis is a chronic lung disease resulting from repeated inhalation of coal dust. It's possible that this disease was caused in ancient Egypt by lamp fumes and cooking fires, sealed inside a house (Veiga, 2012). Silicosis on the other hand is a long-term lung disease caused by inhaling large amounts of crystalline silica dust, which is produced by drilling, crushing, cutting, or grinding rocks such as quartz. That rock was used in ancient Egypt to make jewellery, vessels, amulets, inlays, sarcophagi, and scarabs. Silica can also be found in brick, mortar, slate and granite, popular art and building materials in ancient Egypt.

Roger Montgomerie et. al (2012) who researched the lungs of 15 separate Egyptian mummies has uncovered evidence of particulates, tiny, microscopic particles that irritate

the lungs, indicating that Egyptians may have been exposed to air pollution thousands of years ago. Commenting on his find, Mr Montgomerie told LiveScience: 'I would say it (air pollution) would (in ancient Egypt) be less than modern day, but not much less.'

Recycling

Recycling lowers the consumption of natural resources and reduces waste by reusing materials and repurposing objects (Cudjoe et al., 2021). In ancient Egyptian society, as was the case in all pre-modern societies, goods and materials were scarce and of great worth, hence they were often recycled (Brand, 2010).

Although there is no ancient Egyptian term for recycling or reusing, these concepts were practised often. The most common way of recycling we know from ancient Egypt was the reuse of stones as building materials (Björkman 1971; Helck 1985). That practice was not only motivated by cost reduction but also by the desire of Egyptian kings to pass legitimacy from previous royal generations (Brand, 2010). In some cases however stones were used after old monuments were dismantled to wipe away the memory of certain kings, the Talatat of Aamarna being used in filling of Karnak walls by Horemheb and Ramsis II is the most prominent example (Katheryn A, 1999).

The most commonly re-employed materials were metals, due to the fact that they were both valuable and easily melted down and reshaped into new items. The copper chisels used by the tomb workers from Deir el-Medina, for example, were gathered and weighed for recasting after they had decayed (Brand, 2010).

Wood was also reused, a practice which makes sense economically since good quality wood in ancient Egypt had to be imported. In the site of Wadi Gawasis near Safaga which dates from Old Kingdom to New Kingdom pieces of wood from ancient repairs were discovered. These had red paint outlining areas that needed to be removed from planks, most probably due to tear and wear. This indicates that the wood was to be reemployed in one way or another, either in other ships or for general uses. Many Egyptians were buried in new coffins put together from pieces of older coffins; some made only a few generations earlier (Kennedy, 2016). Ironically the wood of old coffins could have been obtained by tomb robbers who would have emptied the original owners, those who probably paid a fortune for their "eternal homes". Frankfurt (1941) assumed that the wooden linings of some Tarkhan burials were salvaged materials from a wrecked Nile craft that were not adequate for furniture since they contained holes. Creasman (2013) noted some lashing and joinery marks in the subsidiary burials of tomb 3500 in Saqqara in a manner like those seen in burials at Tarkhan. He concluded that those too were not virgin timbers when used to construct the burial. Moreover, inconsistent radiocarbon dates obtained from wood from two Twenty-First Dynasty coffins from the Theban necropolis indicate the use of old wood, some of it probably dating back as old as the Middle Kingdom (Creasman, 2013).

During Roman Egypt, pottery shreds were used as labels or stoppers in the eastern desert queries. amphora spikes and mortar were used for the construction of ovens . Complete old amphorea stuffed with earth were used for construction of a jetty (Tomber, 2011).

Conclusion

The Nile was the centre of ancient Egyptians' lives. Our ancestors recognised this fact to its fullest. For this reason, they were very careful when interfering with the flow of the Nile. Even when managing its floods, they sufficed with small dams and canals and left the main course of the Nile intact, contrary to modern planners. They also used natural depressions as reservoirs instead of digging artificial lakes.

Although state operated water delivery to settlements, no complex pipe or canal system was set up and the delivery was run by water carriers and donkeys instead. Drinking water was purified by the simple principle of colligation and by using siphons.

Basin irrigation was essential in renewing the organic content of soil; those areas which were irrigated by canals, such as Fayum, suffered siltation later. Pesticides were not known in ancient Egypt and only simple mechanical methods were used to protect yields from invasion of pests.

Although ancient Egyptians venerated certain animals and adopted others as pets, their unregulated hunting coupled by the deforestation of land for agriculture led eventually to extinction of at least 17 species by the end of the Pharaonic era.

Air quality was not the best in ancient Egypt since the activities of cooking, heating, quarrying,and building produced air pollutants that caused cancer and many lung diseases for inhabitants.

Recycling was a common practice in ancient Egypt and it was driven by economic motives to reduce cost and labour, as well as the need to drive legitimacy from ancestors or hide memories of certain eras. Stone, wood, metal, and pottery were reused many times and for generations.

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الملخص العربى

الاستدامة البيئية في مصر القديمة

" أنا لم أوقف جريان النهر"

مي فاروق محمود

كلية السياحة والفنادق- جامعة مدينة السادات

الملخص

عاش المصريون عبر ألاف السنين في محيطهم البيئي في تناغم ظهر في المناظر التي سجلوها على مقابرهم وفي نصوصهم .فلقد عرضت الجدران تنوعا كبيرا في البيئة الحيوانية والنباتية و تنظيما دقيقا في أنشطة الري والزراعة .كما ذكرت نصوص كتاب الموتى في الاعتراف السلبي حرص المصري على عدم تلويث المياه وعدم تحويل مجرى القنوات .ولكن كيف انعكس تقدير البيئة ذلك على حياة المصري في الواقع؟ لقد تتبعت الورقة الحالية أنشطة المصري القديم في إدارة مياه النيل، توصيل المياه للمدن، تنقية المياه للشرب ,التخلص من المياه الملوثة ,الدورة الزراعية ,مكافحة الآفات ,التعامل مع الحيوانات ,مدي نقاء الهواء وسلوكيات إعادة استخدام المواد .

واستنتج الباحث أن المصري القديم حرص كل الحرص على عدم المساس بمجرى النيل الأساسي عند إقامة الجسور، وقد يكون ذلك نابع من فشل مشاريع ضخمة للجسور في القدم لكنه قد يكون نتج أيضا عن إدراكه أن التلاعب بالنظام البيئي بشكل كبير قد يسفر عن نتائج وخيمة .لذلك فقط اكتفي الملوك المصريين بإقامة جسور صغيرة وقنوات ضيقة توازي النيل او تقطع منه لري الأراضي البعيدة نوعا ما .كما أنهم استخدموا المنخفضات الطبيعية لتخزين المياه عوضا عن حفر بحيرات صناعية .أما في الزراعة فقد استخدموا ري الحياض وقد كان ناجحا حيث ان غمر الأراضي بالتربة يجدد محتواها العضوي ويغسل الأملاح الضارة .كما أنهم استخدموا طرقا ميكانيكية لمكافحة الأفات لحماية المحاصيل حيث لم يكتشفوا المبيدات الحشرية .لكن الزراعة على الجانب الأخر سببت أضرارا بيئية حيث أن إزالة مساحات من النباتات الطبيعية قد قضى على بيئة العديد من الحيوانات .كما أن الصيد الجائر قد أدى إلى انقراض عشرات الأنواع منها خلال التاريخ المصري القديم .

أما بالنسبة لجودة الهواء فاتضح أنها لم تكن عالية خلال الحضارة المصرية .فأنشطة الطبخ والتعدين والتحجير كانت تنتج ملوثات كثيرة إلى حد ظهور مرض السرطان والعديد من أمراض الرئة في المومياوات المصرية القديمة .كانت اعادة استخدام المواد سلوكا شائعا في مصر القديمة وقد ساهمت بالتأكيد في التقليل من استخدام المواد الأولية وتخفيض النفايات.

الكلمات الدالة: البيئة, مصر القديمة, جودة الهواء, ادارة المياه, اعادة الاستخدام