

A COMPANION TO ANCIENT EGYPT

VOLUME I

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CHAPTER 1

The Physical Context of Ancient Egypt

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1 Introduction

Nothing formed ancient Egyptian culture and religion more than its landscapes. From the Nile River to the harsh Eastern and Western deserts, the swampy Delta, and the fertile Nile Valley, the varied landscapes within and surrounding Egypt influenced ancient Egyptian thought in every way possible. Deities represented specific aspects of landscapes, while creation myths reflected an annual environmental cycle. Pharaonic Egypt was, and continues to be, an oasis in the Sahara Desert. Seeing Egyptian landscapes as an integrated whole, however, is something that has only recently begun to capture the interest of Egyptologists and archaeologists in contrast to the longer trajectory of Egyptology. Ancient Egyptian landscapes cannot and should not be considered unto themselves; they need to be evaluated through landscape use, development, and modernization, the latter of which is devastating ancient Egyptian landscapes more than any other single issue.

This chapter examines ancient Egyptian landscapes through a broad scope, focusing on specific case studies per region rather than attempting to discuss every facet of ancient Egyptian landscapes chronologically. Each case study covers a sub-period (c.3000 BC–800 AD) and will be based on an archaeological site or region in the Delta, Nile Valley, Fayum, Luxor, Sinai, and Western/Eastern deserts. A number of modern issues, including urbanization and looting, will be discussed in terms of their effects on sites throughout Egypt.

Why is Egyptology not as well-known for the study of its ancient landscapes, like other regions of the ancient Near East? For example, McAdams' survey work in the 1960s laid the groundwork for the entire field of ancient Near Eastern Landscape Archaeology (McAdams 1981). Other Mediterranean landscape studies either ignore Egypt or only mention it in passing (Alcock and Cherry 2004: 3–9; Wilkinson 2003a). This is changing, with the inclusion of Egyptian landscape studies in forthcoming Egyptology books, conference volumes, and in university courses. Egypt's landscapes, ironically, were the very thing that discouraged their detailed study. Initial

voyages of discovery discussed Egyptian landscapes in great detail, yet focused primarily on tombs, temples, and related monuments. Monumental remains attracted people to excavate in Egypt, but the beauty of her modern landscape invited archaeologists to return each season. It would take roughly 170 years for archaeologists to start conceptualizing ancient Egypt sites in their broader contexts.

2 A History of Ancient Landscape Exploration in Egyptology

Early explorers to Egypt formed the basis for the field of landscape archaeology in Egyptology. Herodotus provided the earliest written description of ancient Egyptian landscapes (Herodotus 2003 (reprint)). Although his writings were not entirely accurate, this encouraged future archaeologists to explore further. Lavish illustrations of ancient monuments of landscapes also encouraged the practice of landscape archaeology in Egypt. Landscape archaeology is, at its core, examining ancient human remains in their broader geographical contexts, and the images created by early explorers like Richard Pococke and Frederick Norden allowed this contextualization to take place (Pococke 1743; Norden 1757).

No group had a greater impact on landscape archaeology in Egyptology (and for future studies on the physical context of ancient Egypt) than the Napoleonic expedition of 1798–1801. Napoleon's broader intent of invading Egypt brought naturalists, artists, architects, engineers, and historians to explore, measure, and draw every aspect of the country. This exploration of ancient Egypt remains one of the first true archaeological surveys in the broader field of archaeology. Given the general and brief description of a number of archaeological sites in the *Description de l'Égypte*, the Napoleonic survey team did not spend large amounts of time at each place but, nevertheless, provide information that has long since been obscured by modern building or site removal. The richly painted tombs and temples of Luxor and the pyramid fields further north merited far greater attention to detail. Maps from the *Atlas Géographique* volume in the *Description de l'Égypte* remain of great use to landscape archaeologists today (Jomard 1820). Correcting the Napoleonic maps with satellite imagery reveals a high level of accuracy. Another early contribution to Egyptology was the Lepsius expedition, sent by the Prussian government in the 1840s. Maps from this expedition cover a wider area than the *Description de l'Égypte* maps (from Egypt to Ethiopia) (Lepsius 1849).

Exploration and documentation by John Gardner Wilkinson and Giovanni Belzoni (to name a few) (Wilkinson 1841; Belzoni 1822) furthered both the field of Egyptology and landscape archaeology by allowing specific locations of archaeological sites to be mapped. Auguste Mariette used Strabo to help him locate the potential location of the Serapeum, which he subsequently excavated. Nevertheless, this was one of the first major uses of ancient texts to relocate ancient sites in Egypt, another hallmark of landscape archaeology (Wortham 1971: 83). Another source for early Egyptian cartography is the map of Egypt compiled by Mahmoud Bey using geometrical measurements, noted for its high degree of accuracy (Bey 1872).

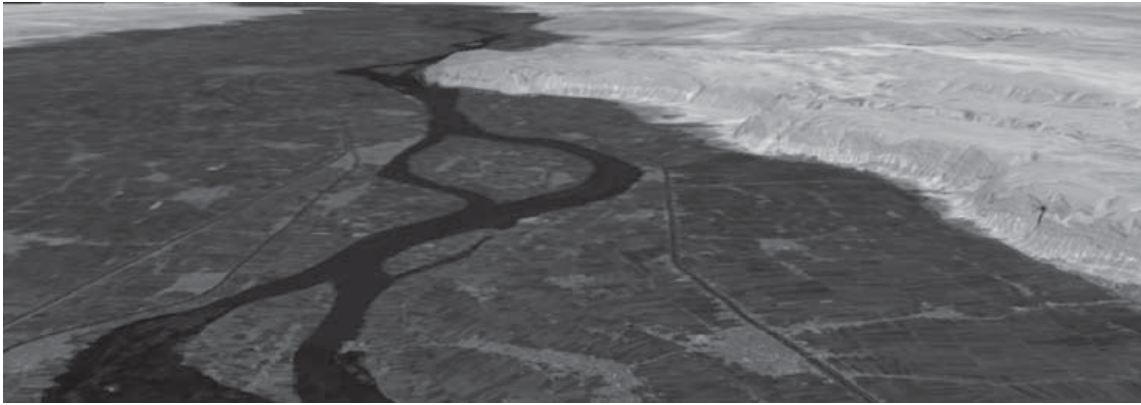


Figure 1.1 Quickbird satellite image showing the Nile in relation to broader agricultural fields. Image courtesy of Google Earth Pro.

Archaeological investigations recording the locations of many sites occurred in higher frequency towards the turn of the nineteenth century, especially with survey-oriented work taking place in the Delta (in part influenced by the Delta research of the Egypt Exploration Fund) (Chaban 1906; Edgar 1907; Daressy 1912). Investigations at specific sites allowed for more in-depth research into their general environments, such as Caton-Thompson's work in the Fayum that discovered preserved grains in buried baskets and allowed a reconstruction of ancient planting patterns (Caton-Thompson and Gardner 1934).

The 1970s brought with it a renewed focus on settlement archaeology, especially with the work of Manfred Bietak, Barry Kemp, David O'Connor, and Mark Lehner at Tell ed-Daba (Bietak 1975), el-Amarna (Kemp and Garfi 1993), Abydos (O'Connor 2009), and Giza (Lehner 1997) respectively. These archaeologists revolutionized the study of ancient Egyptian landscapes with advanced archaeological excavation methods and the use of archaeological science to study ancient faunal remains, and general environments. Comparisons could take place between highly idealized tomb paintings of landscapes and what the environment may have looked like in specific time periods. More studies were now taking place focusing on broader ancient Egyptian landscapes, specifically the work of the Egypt Exploration Society in the Delta (from the 1980s onwards), the work of John and Debbie Darnell in the Western Desert (Darnell 2002), the work of Salima Ikram and Corinna Rossi in Kharga Oasis (Ikram and Rossi 2002), and Sarah Parcak's work in the Delta and Middle Egypt (Parcak 2003; 2004a; 2007; 2008; 2009a; 2009b). To gain a real understanding of ancient Egyptian landscapes one must start with one of its central features: the Nile.

3 The Nile

Each year the Nile deposited rich silts along its banks, allowing the people of ancient Egypt (in good flood years) to gather sufficient crops to feed their families and livestock to the extent that the elite could focus their efforts on art, music,

architecture, and foreign expeditions. Unlike the Nile further south in Nubia, there were no cataracts to impede travel up or down the Nile, making it ideal for transportation of goods and ideas. The Nile allowed for excellent fishing, as well as hunting (especially in prehistoric to early time periods in its marshes), and grazing for livestock. Good flood levels were so important to the ancient Egyptians that they connected annual floods with the religious myth of the wandering eye of the sun, which told the story of the goddess Hathor bringing annual inundation waters from the south (Darnell 1995).

The Nile River is 6670 km long, originating at Lake Tana in the Ethiopian plateau, (at 1830 m elevation) and Lake Victoria in East Africa (at 1134 m elevation). Annual monsoon rainfalls filled these Sub-Saharan lakes and fed the Blue and White Nile and main Nile river before the construction of the Aswan High Dam (in the early 1900s and 1960s) (Said 1988: 1–7). Most of the water reaching Aswan comes from precipitation directly related to the Indian Monsoon rainfall, so lower monsoon rainfalls could have disastrous effects on the Nile flooding levels.

Many studies exist describing the long-term geology of the Nile (Said 1990), which is outside the scope of this study. It is more important to explore what effect the Nile had on the overall development of ancient Egyptian landscapes, specifically, just how much the annual Nile inundations caused ancient landscapes to change. To assess this change, one must begin by asking how much the Nile moved over time, both horizontally and vertically. A river so famed for its unpredictable annual flooding levels would, like so many other great rivers today, have meandered from East to West and West to East over time.

Recent work by Egyptologists and archaeologists using satellite remote sensing, coring, and survey, has determined that the Nile was anything but stable in antiquity, and that much of our knowledge regarding ancient Egyptian landscapes and Nile location needs reassessment. Archaeological exploration work in Luxor using a combination of deep cores and Shuttle Radar Topography Mission (SRTM) data has suggested the full Pharaonic period extent of the Nile's eastward migration patterns. Based on the scientific data, we find that the early-to-predynastic Nile flowed past Medamud to the SE of modern Luxor, migrating at a rate of 2–3 km every 1000 years (Hillier et al. 2007: 1011–15). During Pharaonic times, the Nile migrated from the East to West near Karnak Temple, and in the Middle Kingdom times, the temple was probably located on an island that filled in as the Nile moved west (Bunbury and Graham 2005: 17–19).

The Nile River, its movements, and annual silt depositions over time must be evaluated from a larger ancient landscape perspective, as has been done in examining the great Nile bend at Qena with RADAR imagery (Stern and Abdel Salaam, 1996, 1696–8). Consider the overall landscape surrounding el-Amarna, as well as the associated modern development issues. As one embarks from the ferry at the modern town of et-Till, the landscape slants upwards towards the east, flattening out to a plain where spoil heaps from 150 years of excavation often cover known houses and additional features. Each year encroaching agriculture cuts into more and more of the site, especially a large agricultural area slightly to the south of the Central City. This development affects the choices of present day archaeologists, led by Barry Kemp (Kemp 1982–95). The work of the Amarna team balances the need to excavate



Figure 1.2 Coring work in the modern fields to the west of el-Amarna. Courtesy the author.

new architectural features with cataloguing past excavated remains. Much of Amarna's landscape has already been lost to agricultural expansion, with 90 ha lost since the 1980s, as demonstrated by old maps, aerial photographs and satellite imagery.

The total landscape of Amarna is only beginning to be understood in terms of its longer-term environmental changes. A coring study, initiated by the author, taking place along the floodplain edge to the west of the city, suggests significant landscape alterations over the past 1600 years. The study retrieved 30 cores at a range of 1 m–7 m in depth, from the surface of the cultivated area to the desert surface. The coring revealed some Amarna period material in the cultivation to the west of the central city. All other datable material culture (pottery) from the cores matched Late Roman period (c.400–800 AD) wares.

Coring results show that the Nile deposited an average of c.5 mm of silt per year in Middle Egypt, five times the silting rate found in the Delta (Butzer 1976: 23). This 1 mm per year Nile silt deposition is most often cited by Egyptologists, yet is from the area of ancient Egypt that would have traditionally had the lowest silt deposition rates: The Nile would have had more silt to discharge upriver and would have spread its silt over a far greater area further north. Higher silting rates would be expected further south where the average Above Sea Level measurements are higher than the Delta.

Combining the coring results with the survey results suggest that Nile has shifted between 0.6 and 1.2 km to the east over the past 1200 years in Middle Egypt, cutting into and likely washing away part of el-Amarna's Central City area (and thus answering the question of why few crop-marks can be seen in the modern fields). We cannot

say with any certainty exactly where the Nile flowed during the Amarna period. Two 7 m deep cores taken to the south of et-Till and just outside Hagg Kandil reveal likely locations for canals, based on deep clay and silt deposits (Parcak 2005; 2007b). Whether or not these canals date to the Amarna period will require further work, but they show how past landscape changes in ancient Egypt cannot be viewed through any single archaeological lens.

4 Landscapes and Climate Change in Ancient Egypt

Ancient Egyptian landscapes must also be viewed through the lens of climate change. This affected ancient Egyptian landscapes far more broadly than the Nile, although the changes are far less easy to view. At what time and where should one begin? One might associate climate change with only the start of ancient Egyptian civilization, c.3000 BC, but determining exactly how the civilization started means going back even further in time. Earliest remains (from the Neolithic Period) are buried beneath many metres of silt in the Nile Valley, while many other settlements remain to be discovered (Parcak 2007a; 2008; 2009a; 2009b).

In early parts of the Paleolithic Period (c.500,000–12,000 years ago) the Nile as a whole was much smaller in size, composed of smaller channels. Early groups living at both Bir Tarfawi and Bir Sahara East lived in savannah and wooded savannah areas, with animals such as hartebeest and gazelles. During the Middle Paleolithic (c.175,000–45,000 years ago) people lived along the Nile at sites such as Wadi Halfa, where archaeologists have noted higher rainfall levels. Conditions became too arid in the desert c.70,000 years ago for inhabitation, and the Nile changed course c.45,000 years ago. Archaeologists have noted no remains in the Sahara in the Upper Late Paleolithic period (c.45,000–12,000 years ago) (Wendorf and Close 1999, 6–14; Wendorf and Schild 1980). Additional rainfall between 14,000–12,000 years ago in Eastern and Central Africa caused the White Nile to flow much more strongly, which, in turn, contributed to much stronger annual Nile flooding. Around 12,500 years ago this additional rainfall caused the Nile to flow in the single channel it has today (Hassan 1980, 421–50; Hassan 1999a, 15–16).

A cooling period of 9 degrees C has been noted across East Africa and South-east Asia c.9000 BC, with many sand dunes advancing south. Populations would have moved into the Nile Valley owing to the increasing aridity of the Sahara, which would have caused lakes or streams next to seasonal campsites to dry out. This is noted, in particular, in the Fayum, where archaeologists have discovered hundreds of campsites dating to c.9000–6000 BC (Caton-Thompson and Gardner 1934). Domesticated sheep and barley have been noted around 8,000 years ago, during the Epipaleolithic period. The climate shift caused a cultural response, with changes noted in stone tools and pottery. During the Neolithic Period, people living along the Nile Valley cultivated wheat and barley, as well as tending to their flocks of domesticated cattle and sheep. For the first time, farmers altered their landscapes with building dykes and irrigation ditches. It is not known if the cultivated crops came from Southeast Asia via trade or via immigration (Wenke 1999: 17–22).

During the Predynastic period climatic conditions allowed Egyptian civilization to develop. The ancient city of Hierakonpolis provides a good case study. It represented an ideal habitat owing to good Nile flood levels, fertile soil, nearby raw materials in the Eastern Desert, the proximity of a (now defunct) Nile channel, and an easily established irrigation system. The environment apparently remained stable during this time, allowing economic growth (Hoffman et al. 1986: 175–87). A similar situation existed in the eastern Delta, which lay along the trade routes without desert access to metals and mineral resources but had good agricultural lands allowing settlements to take hold and grow. The influx of state organization and local officials overseeing irrigation systems throughout Egypt coincided with an increasing need for crops and the material required to farm new lands.

A stable climate led to broad growth in all aspects of Old Kingdom society and culture, which led to a search for raw materials and products abroad. This shows the overall need to obtain the produce from more agricultural lands to support the increasingly expansive state, cult, and royal projects (Eyre 1987b: 5–47). Even with Old Kingdom trade shifting to the royal Memphite court, the state would have needed increasing and large amounts of agricultural produce and livestock to support the construction and maintenance of pyramids, temples, state projects, and royal cults. The royal court would have benefited from large numbers of agricultural settlements whose produce (and related landscape alterations) could feed workforces and craftsmen numbering in the tens of thousands (Lehner 1997: 224–5).

Why the Old Kingdom, a period of tremendous prosperity, “collapsed” is debated by Egyptologists. They have suggested economic, political, and environmental factors, or some combination thereof (Seidlmayer 2000: 118–47). Hydraulic agriculture, and, thus, landscapes in ancient Egypt were an integral part of the economy. Having an organized system of dykes and canals allowed the development of new land for agriculture and created a reliance on increased resources. This, in turn, increased the potential for disaster if floods were low. It seems that this is precisely what happened. Culminating around 2200 BC, it appears an occurrence known as the “4200 KA BP Event” (Weiss and Bradley 2001: 609–10) took place. This “event” encompasses the changes in patterns of monsoon rainfall and Mediterranean westerlies which led to droughts and cooling periods in Africa and Asia. Egypt most likely experienced a drought during this time, which is evidenced by coring done in the Delta that detected iron hydroxides (dating to c.4200–4050 BP) in the soil (a signature for drought) (Stanley et al. 2002a: 395–402). The base flow from the White Nile was also low at this time (Stanley et al. 2002b: 71–4). Upper Egypt would not have faced as many disastrous effects from a likely drought as the Delta at the end of the Old Kingdom, because of a reliance on the principal branch of the Nile that held more water than the Nile’s subdivided Delta channels. Although much more work is needed to understand what exactly took place at the end of the Old Kingdom, this recent research shows how important it is to consider environmental perspectives in addition to other archaeological and historical data.

Higher Nile floods were noted during the Middle Kingdom by late Twelfth Dynasty inscriptions, with higher Fayum lake levels recorded multiple times (Butzer 1976: 52). Throughout Egyptian history Nilometers recorded years of high and low floods, especially at places such as Elephantine. A period of high floods did not

automatically mean a prosperous year: They could, in fact spell disaster if the waters did not recede in time for planting. Key factors, such as long-term fluctuations in precipitation, flood levels and river courses, could affect dramatically the fortunes of individual settlements, resulting in the decline and abandonment of some sites and the foundation and flourishing of new riverine sites, especially within marginal regions. Egypt's annual flood levels varied (for example, good flood levels were recorded during the Late Period), but did not play as significant a role in periods of decline as socio-political factors.

5 What did Ancient Egyptian Landscapes Look Like?

The archaeological record shows that parts of ancient Egypt looked radically different from Egypt today. To what extent would an ancient Egyptian feel out of place in modern Egypt? Aside from modern conventions such as roads, cars, and cities, an ancient Egyptian would not feel at home throughout most of modern Egypt. With changing Nile flood levels, landscape changes, and population increases there is much more of occupied Egypt today. A modern Egyptian would feel equally out of place in ancient Egypt. Only very elderly Egyptians can remember what Egypt looked like during periods of partial inundation (Kemp, 1989, 11). In the summer, much of Egypt's floodplain would have been transformed into a series of islands. Outside inundated areas the Delta would have appeared as a number of swamps connected to lagoon and lake systems. The deserts and mountainous areas in Sinai, and the Eastern and Western Deserts (as well as deserts/mountains of Nubia) would probably be the only entire landscapes recognizable by the ancient Egyptians. To learn what ancient Egypt landscapes looked like (i.e. floral and faunal remains), archaeologists rely largely on highly idealized tomb scenes as well as archaeological data.

Early Egyptian fauna was diverse, and included elephants, lions, gazelle, hartebeest, leopards, ibex, oryx, and wild cattle. Human activity caused the extinction of certain animal species in Egypt, such as hippopotami (Osborn and Osbornova 1998: 144). Donkeys could be found throughout Egyptian history, with the earliest evidence coming from Maadi c.3600 BC. It is not known exactly when cats were domesticated in ancient Egypt, while dogs are known from the Predynastic period onwards (Houlihan 1996: 74–91). Geese are known from the Fifth Dynasty onwards, while domestic fowl were not known until c.1500 (with a rooster found on a potsherd in the Valley of the Kings) (Gautier 1996: 305). Longhorn cattle are known from the Predynastic period onwards, while hornless cattle are known from the Eighteenth Dynasty onwards. Short-horned cattle are present but not common during the Old Kingdom and become more widespread over time, (as seen in tomb scenes) (Houlihan 1996: 10–21). Sheep can be found in the archaeological record from the Neolithic period onwards. Wool sheep replace hair sheep during the Middle Kingdom via trade with Asia, which is also the period when goats decline. Fat-tailed sheep, quite common in Egypt today, were likely introduced at a much later period of time (Osborn and Osbornova 1998: 186–93). Pigs and horses can be found from the Second Intermediate Period, with mules used as pack animals during the New

Kingdom (Houlihan 1996: 33–9.) Camels, also quite common in Egypt today, could not be seen in Egypt until the first millennium BC (Osborn and Osbornova 1998: 155–6). Exotic animals could be brought back to Egypt for palace zoos, such as the famous botanical garden of Thutmose III at Karnak (Houlihan 1996: 200–1).

What did the physical landscape of Ancient Egypt look like? In general, one would see papyrus, reeds, rushes, and lotus flowers along the Nile and its channels. Studies on charcoal (Gerisch 2004) have shown flora species prevalence, which included a number of common ancient Egyptian plants such as acacia, tamarisk, date and dom palm, persea trees (use for crafts and for its fruit), the sidder tree (used for dowels), sycamore, and willow. Mudbrick houses could be seen atop gently sloping mounds, covered in palm branches and supported by palm log rafters (Bard 1999: 558–61). While the floodplain/desert margins have greatly altered over the past 2000 years, the change from desert to floodplain would have been just as abrupt in antiquity.

6 The Delta and Sinai

No landscapes of Egypt have changed more dramatically than the Delta and the North Sinai coastlines. Many projects have studied these regions, using coring, systematic survey, and satellite imagery analysis to reconstruct past landscape changes. For example, Jean Phillipe-Stanley's coring work in the Delta has revealed a great deal about both past landscape evolution and related climate changes (Stanley and Warne 1993: 628–34). Broad landscape changes through time can be viewed not just with the subsurface soil data, but with the changing locations of ancient settlements, which would have thrived or failed in line with the evolution of nearby river channels. Much less of a picture is available for Upper Egypt, as it has not yet been systematically cored from north to south and east to west.

In Pharaonic times seven Nile Delta branches existed: the Canopic, Bolbinitic (Rosetta), Saitic, Sebennyitic, Mendesian, Tanitic, and Pelusiac branches. Each branch had smaller channels or tributaries. Five Nile branches degenerated with silting due to tilting in the early Holocene (Gamilli and Shaalan 1988: 223–43), while the Nile branches shifted westward. Although the Nile and its branches changed course many times over the centuries, only two branches remain in the eastern Delta: the Pelusiac branch (the Bahr Faqus today) and the Tanitic branch (the Bahr Mamis), which flowed by Tanis (Bakr 1988: 41–62). The silted-over branches are still partly visible, and, using ground-based remote-sensing techniques, an Egyptian team found buried Nile channels near the old Sebennyitic branch (Gamilli and Shalan 1988: 223–43). Another team used SIR-C RADAR imagery to locate former branches of the Nile connected to Alexandria during the Roman period (Stanley and Jorstad 2006: 503–14).

The Delta in antiquity looked very little like the Delta of today. It was a series of swamps and lagoons, and changed shape and size dramatically over thousands of years due to the Nile's sediment discharge, sediment removal by oceans, and the fact that the Delta as a whole was a sediment trap (Stanley 2002c: 98–117). A number of survey

projects have already aided in past landscape reconstruction, especially the work of Manfred Bietak, The Egypt Exploration Society Delta Survey, and ongoing work by the author (Parcak 2003; 2004a; 2004b). This work has detected 44 previously unknown archaeological sites and has incorporated survey data with data on 119 known archaeological sites in the East Delta to suggest locations for past river channels. The proposed model suggests an approach from the bottom up, using survey data to glean information about site placement, function, and changes through time. Site placement also allows us to examine environmental trends. Using site dates over time, it is possible for researchers to suggest possible previous Nile river channels that can later be confirmed through coring. For instance, prior to the formation of the Menzala lagoon, beginning in the fourth century AD, the Mendesian branch of the Nile flowed past Mendes and its satellite maritime port at Tell Tebilla. As early as the Old Kingdom Tell Tebilla provided an ideal location for the formation of a town, being well located to exploit both riverine and maritime transportation routes (i.e. trade) and regional floral and faunal resources (e.g. hunting, fishing, cultivation, animal husbandry). Using old maps and satellite images, the team working at Tell Tebilla showed how the site decreased in size, from 1000 m × 1000 m in the 1800s to 360 m × 360 m today (Parcak 2007a). Even so, using landscape topography, the archaeological team has hypothesized the potential location of Tell Tebilla's harbor. Tell Tebilla's ancient name was *R-nfr*, or "Beautiful Mouth," showing how the name of a place could reflect its larger role in the broader Egyptian landscape (Lloyd 2002; Mumford 2004).

Sites are not only hidden by modern settlements: Silting over of sites has left countless numbers of ancient villages and cities of all sizes, as well as landscapes, many metres below the current ground level. How much information is "missing" beneath the ground in Egypt that cannot be detected? Even using Google Earth, a free online imagery visualization program, can aid in detecting buried features. To the west of the site of Tanis there are significant numbers of cropmarks, revealing that the city could have been twice as large in antiquity. At Tell ed-Daba, additional cropmarks show buried features in the entire area surrounding the extant surface site remains (Parcak 2009b).

Similar approaches have helped archaeologists reconstruct ancient landscapes of the North Sinai and West Sinai coastlines. At the site of Tell el-Borg in North-east Sinai archaeologists have used a combination of satellite photographs, coring, and sediment studies to locate a paleolagoon system. This area was important in the New Kingdom as Tell el-Borg was located along the "Ways of Horus," a series of fortresses located along the North Sinai coast. Archaeological research has shown how important a role the paleolagoon system played in general fort defence (Moshier and El-Khalani 2008: 450–73). Another fortress site, Tell el-Markha, located in the el-Markha Plain (130 km south of Suez), played a crucial role in Old Kingdom mining expeditions to Wadi Maghara. The fortress, measuring 44 m in diameter, is located 210 m from the coastline today. Geological investigations have revealed that the coastline was located no more than 150 m away in antiquity. The expeditions would probably have coincided with the seasonal appearance of water running in small springs flowing slightly to the north of the site (Mumford and Parcak 2002; 2003).

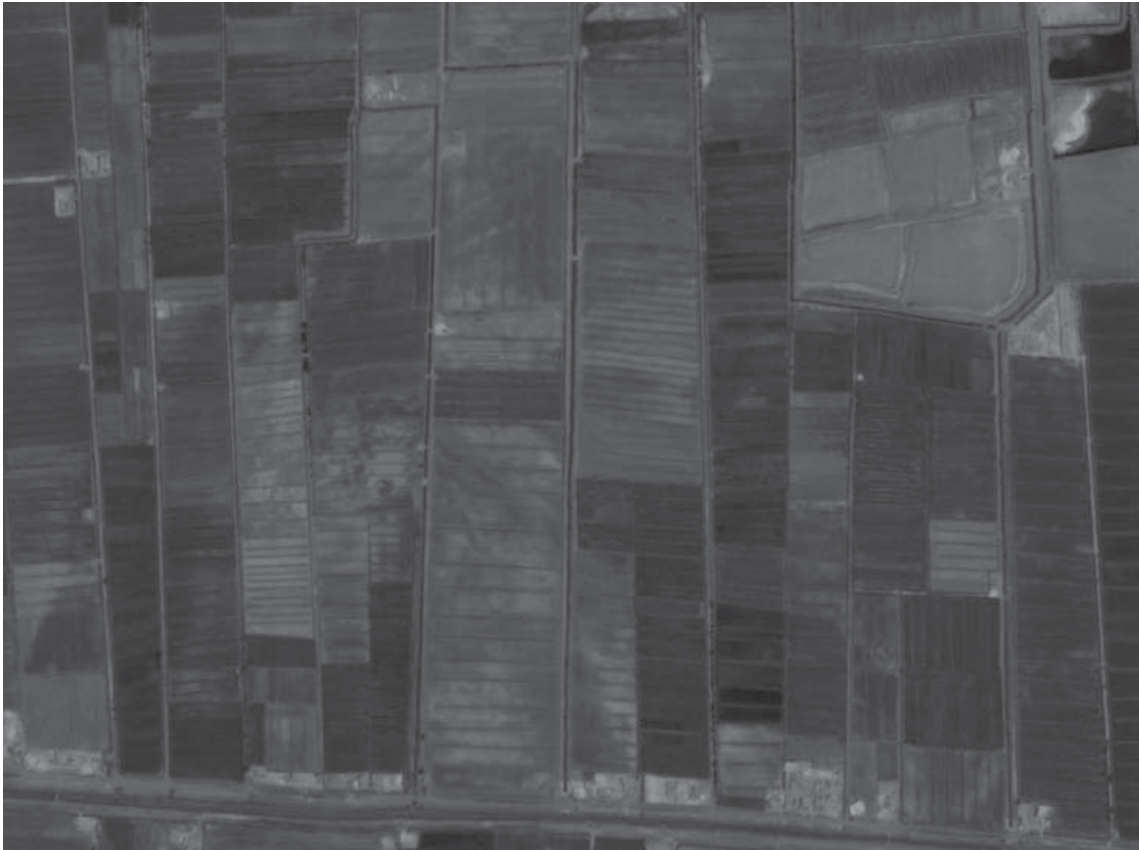


Figure 1.3 Quickbird satellite image revealing cropmarks to the west of Tanis. Image courtesy of Google Earth Pro.

7 Ancient and Modern Landscape Changes

It is essential to think about the dynamic nature of Egypt's past landscapes. Many settlements first appeared on *geziras*, or “turtlebacks,” before 3000 BC, often located along river edges. Flood-plain dwellers based their settlements on *gezirahs* to remain safe on high ground, above the annual Nile floods. Over time, these towns expanded. The ancient Egyptians built over their predecessors' houses, and periods of economic decline or destruction contrasted with periods of prosperity. These different periods have created different archaeological horizons and settlement patterns. Silts from high floods, household collapse debris (mud brick), and related material culture created fill layers within and between the shells of houses. As many towns lay enclosed within large walls and were restricted to finite mounds and *gezirahs*, they could only expand upwards. This building pattern formed archaeological *tell* sites with complex stratigraphies, as well as organic structures (Kemp 1972: 657–80), which occur throughout the ancient Near East. The whole town could be abandoned altogether in one phase while major rebuilding activity could occur in a following period. The reconstructed urban and demographic patterns are infinite.

Actual physical changes to ancient landscapes are an additional factor to consider. Each year the Nile's floodwaters left silt deposits (Butzer 1976: 23), which caused the landscape surrounding archaeological sites to rise. Abandoned sites and portions of sites in

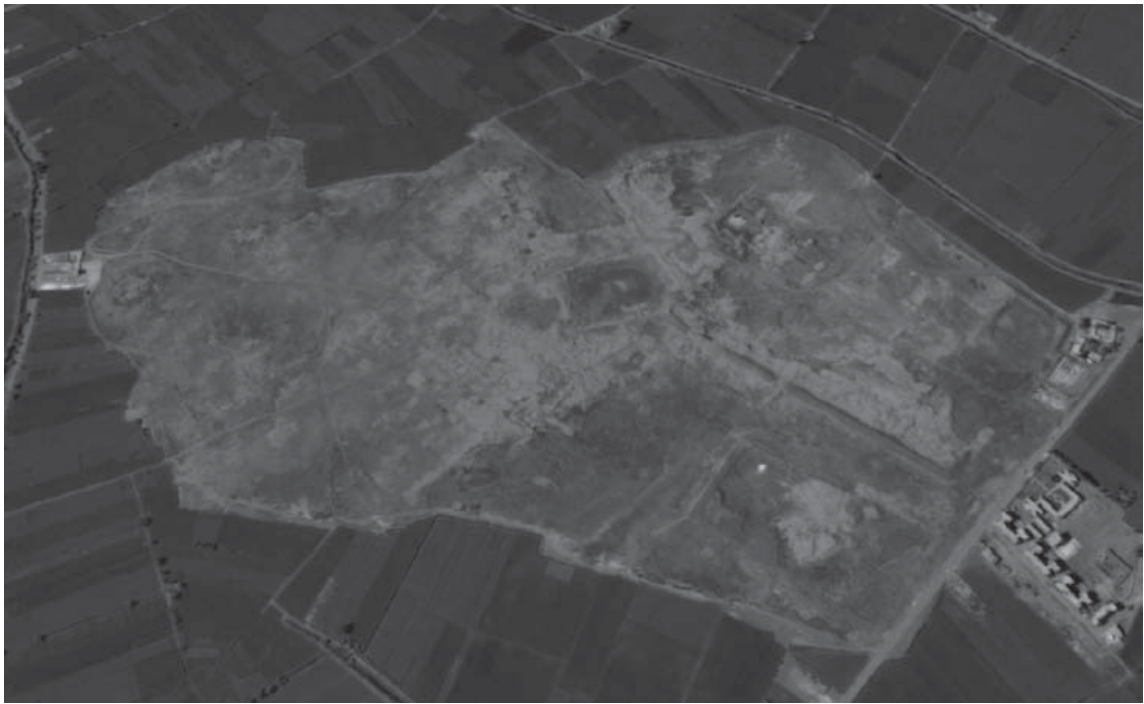


Figure 1.4 Quickbird satellite image draped over Shuttle Radar Topography Image at the site of Mendes. Image Courtesy of Google Earth Pro.

low-lying areas would eventually be covered over by Nile silts, with some occupation located above a sterile silt layer. Large-scale silting stopped after the construction of the Aswan High Dam, but Egypt's massive population growth in the past seventy years is altering the landscape in more diverse ways than the former annual Nile flooding.

Changes in archaeological sites are closely entwined with these landscape and social changes and may influence how and why people chose to settle somewhere in the first place. This, in turn, affects how we might identify those sites and associated landscapes. Desert outposts, farming communities, and pyramid towns may all represent settlements containing people, but their primary purpose and functions differed widely. These factors affected their layout and growth. How and why ancient people chose to settle in various regions are just as important to our understanding of settlements as our knowledge of the landscapes surrounding them. Archaeological survey designs should take all these factors into account, in particular, satellite remote-sensing and subsequent ground survey. Specific satellite remote-sensing analysis methods work better in different areas. Some methods deal well with vegetation and landscape changes, while other methods help in highlighting key features within a landscape. All satellite types have limitations in floodplain environments and are best suited primarily for evaluating surface features. Having clear project goals assists in choosing which methods to use for the overall ancient-landscape analyses, in particular, if one is interested in studying either broad-scale or more localized environmental trends.

Today, Egypt's landscape is equally dynamic, with rapidly expanding towns and agricultural development on desert regions (e.g. North Sinai irrigation and agriculture program) (Lenney et al. 1996: 8–20). When comparing satellite images of Egyptian towns and fields from 2002 with the same towns and fields on maps from

the 1920s, one realizes immediately how much settlements have grown, while agricultural lands have expanded into the desert. These factors and the need for *sebakh*, or fertilizer, have caused the levelling or covering over of innumerable archaeological sites. In many cases, modern settlements covering ancient sites have preserved the earliest levels from destruction (below and between modern foundations) but are not free for detailed excavation. Archaeological site looting (prevalent across the globe), urbanization, population increases, and pollution are all affecting modern archaeological landscape exploration (El-Gamily et al. 2001: 2999–3014). Egyptologists need to strategize and plan carefully to help preserve past landscapes for future work. This can be done in part through the use of satellite remote sensing.

8 Finding Egypt's Ancient Landscapes from Space

How can Egypt's ancient landscapes be approached, since there are innumerable modern and ancient processes affecting the way sites appear today? All these modern and ancient processes must be considered during project research design. Results need to be checked against what is already known in the area and then verified on the ground. Any type of survey, excavation or coring, will be biased; ancient and modern processes “select” the archaeological evidence that remains, while modern surveying and excavation techniques allow the selection of specific areas for detailed examination. Many techniques (e.g. coring, resistivity and artefact density) are employed to make sure the best areas are chosen for excavation, with satellite remote sensing analysis used to detect past and buried landscapes.

The very nature of ancient site and landscape formation processes in Egypt lends itself to detection from remotely sensed satellite images. Archaeologists have stressed the bias of Egyptian archaeology towards monumental and funerary sites and away from ancient settlements in the Nile Valley and the Delta. In addition, how Egyptologists conduct landscape surveys (to the extent they have been conducted in the past) has been at odds with other regional archaeologists working in the Ancient Near East (Jeffreys 2003: 1–3). Regional survey work in Egyptology had been largely neglected due to this bias and has consequently missed thousands of ancient settlement sites and related landscapes in favor of tombs and temples in places like Luxor. This is now changing (Bietak 1979: 156–60).

Geospatial studies on ancient Egyptian landscapes are beginning to revolutionize our understanding of ancient Egyptian human-environment interactions. They started when RAF pilots took the first aerial photographs of Egypt during the 1920s and 1930s (Rees 1929: 389–406), specifically focusing on large monumental sites in Luxor and Giza. During the Nubian salvage campaign archaeologists employed aerial photography to document landscapes for mapping purposes. (Vercoutter 1976: 2; Zurawski 1993: 243–56.)

Remote sensing has been invaluable for several projects working in Egypt's desert regions. With the development of remote-sensing monitors such as Landsat and RADAR Missions (SIR-A/B), Wendorf and his team conducted a major archaeological investigation using a SIR-A RADAR image. Through their analysis they

detected “radar rivers,” or ancient river channels (some up to fifteen km in width), beneath the sands of the Bir Safsaf in the Western Desert. They carried out survey work in the region, discovering hundreds of new Paleolithic and Neolithic sites along the paleodrainage systems (McHugh et al. 1989: 320–36; McHugh et al. 1988a: 1–40; McHugh et al. 1988b: 361–79; Wendorf et al. 1987: 43–63). Another study from Egypt’s western desert used ASTER data to create Digital Elevation Models in determining the Holocene land use potential of the region. Analysis found that site placement matched the potential water catchment areas (Bubenzer and Bolten 2003: 2). At the site of Widan el-Faras in the northern Fayum, a Corona image was used to map work in a basalt quarry (Bloxam and Storemeyr 2002: 23–36).

Other recent work includes a Japanese team identifying areas for reconnaissance around pyramid sites using a variety of satellite images. Identifying the spectral signatures of limestone monuments and other methods of analysis gave the team thirty-eight possible sites buried beneath the sand. Ground-truthing revealed that four of the sites contained such remains. Subsequent excavations led to the discovery of a late-Eighteenth or early-Nineteenth Dynasty tomb measuring 47 m in length (Yoshimura et al. 1997: 3–24). The South Sinai Survey and Excavation Project incorporated both surface survey work and the application of multiple analytical techniques to Landsat satellite images to detect new and already identified archaeological sites in el-Markha Plain along the west Sinai coast. The satellite image clarified regions with dense vegetation clusters and showed that modern vegetation beside known archaeological sites reflected ancient water sources (Mumford and Parcak 2002). A Czech team has incorporated Quickbird imagery and subsurface survey to gain a better overall understanding of the pyramid fields at Abusir in creating a GIS for the region (Barta and Bruna 2005: 3–7). Work at el-Amarna (Parcak 2005) has shown how features beneath the desert can be recorded on Quickbird imagery (which has a resolution of 0.6 m).

The author’s satellite archaeology work in diverse parts of Egypt has revealed the complexity of attempting to locate last landscapes hidden beneath and within modern ones. Although ancient Egypt contains many significant historical and archaeological areas, such as national, provincial, and cultic centres, smaller areas need to be chosen as study models for remote sensing analysis and ground survey. The author chose two main study areas in the Delta and Middle Egypt for initial satellite archaeology work. There is a total of 33,000 km² of fertile land in Nile Valley and Delta, with the Delta covering 22,000 km² and 160 km × 250 km in area. The East Delta survey area measured 40 km × 50 km, representing 11% of the entire Delta, while the Middle Egypt area measured 15 km × 30 km, representing 3% of the Nile Valley landscape.

The regions chosen in Middle Egypt (near el-Amarna) and the Delta (in the landscape surrounding Tell Tebilla) have much in common topographically but differ in their historical and archaeological significance. Both areas encompass relatively flat floodplains. In contrast, mountains and undulating landscapes can often obscure archaeological sites and are often trickier regions for satellite remote-sensing work. Flood plains facilitate locating new and known archaeological sites as many stand metres above the surrounding landscapes (Parcak 2009b: 128–30).

In Middle Egypt, there is potential for long-term continuous site occupation along a more stable river course, unlike the Delta where more dramatic river course changes

have caused greater settlement shifts. Furthermore, destruction from looting and modern development has obliterated more archaeological sites in the Delta, while relatively less intensive site destruction in Middle Egypt allows more sites to be located and safeguarded. The studies used previous satellite archaeology work across the globe for comparison, as no large-scale satellite archaeology work had yet been conducted in Egypt's floodplains. Satellite imagery used for the study included Corona imagery, Landsat, ASTER, and Quickbird satellite images, and Shuttle RADAR Topography Mission data. One of the principal issues was using the multi-spectral capabilities of the satellite imagery to differentiate between ancient settlements and the modern towns covering them. This was achieved by running algorithms to detect the ancient soil, which had higher moisture content than the modern soil due to a higher concentration of organic debris. The study detected

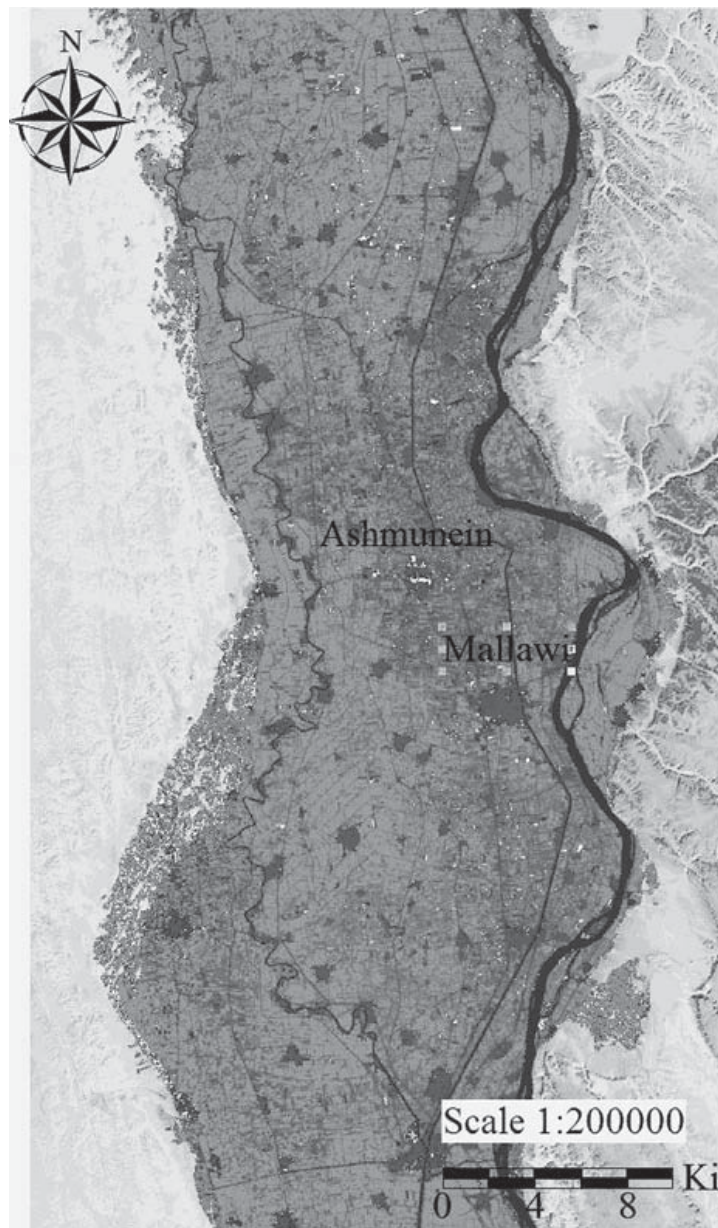


Figure 1.5 Landsat satellite image showing a large area in Middle Egypt. The darker pixels indicate areas of archaeological interest. Image Courtesy of NASA.

44 previously unknown ancient sites in the Delta, and 43 in Middle Egypt. These were ground truthed during surveys and follow up archaeological work from 2003 to 2007.

The study revealed that thousands of ancient settlements and associated landscapes remained to be discovered in both the Delta and Nile Valley floodplains. Modern and ancient processes have combined to make detection of these past landscapes difficult but not impossible. The diversity of landscapes (desert, agricultural/floodplain) and associated settlement types in Egypt mean archaeologists should employ as many ancient landscape detection techniques as possible.

9 Mapping Ancient Egyptian Landscapes

Without good maps, plotting changes in ancient Egyptian landscapes would not be possible. Town names have changed over the course of time and are added, renewed, or abandoned without being checked by cartographers. Prior to survey work, Egyptologists consult Porter and Moss's *Topographical Bibliography* (Porter and Moss 1960–99) and Gardiner's *Ancient Egyptian Onomastica* (Gardiner 1947) to study specific place names, while specific studies of past landscapes have largely relied on foot survey (Kessler 1981).

The 1940 U.S Army Survey of Egypt maps have a high degree of detail. The maps, at a scale of 1:50,000, provide topographic contour and detailed maps of towns and land features, especially archaeological sites. The Egyptian General Survey Authority maps, at a scale of 1:50,000, gives town outlines but very little general detail and no contour maps. Compiled from aerial photographs of Egypt, the map series has a great deal of distortion around its edges. The 1942 British Survey maps, at a scale of 1:100,000, do not have road details, but have excellent topographic contour lines. The Egyptian Map Authority cadastral series, at a 1:2500 scale, is good for general use but must be obtained locally from agricultural authorities. At the present time Geographic Information Systems and satellite remote sensing allow the creation of highly detailed and accurate maps. They are very useful in that maps can be created in 3D by draping high-resolution satellite data over global topography data.

10 How to find Ancient Egyptian Landscapes

Many of Egypt's ancient landscapes are buried, either beneath modern fields, towns, desert sands, or layers of ancient settlements. How those layers can be retrieved depends on local archaeological conditions. It is important to consider exactly what tools might be used by Egyptologists to locate past settlements and associated landscapes. These techniques include resistivity, magnetometry (Dolphin et al. 1977; Giddy and Jeffreys 1992: 1–11; Kemp 1985; 1989; 1995) and ground-penetrating radar (GPR) surveys as well as dousing, which was successfully attempted at the site of el-Amarna (B. Kemp, personal communication). Along with coring and

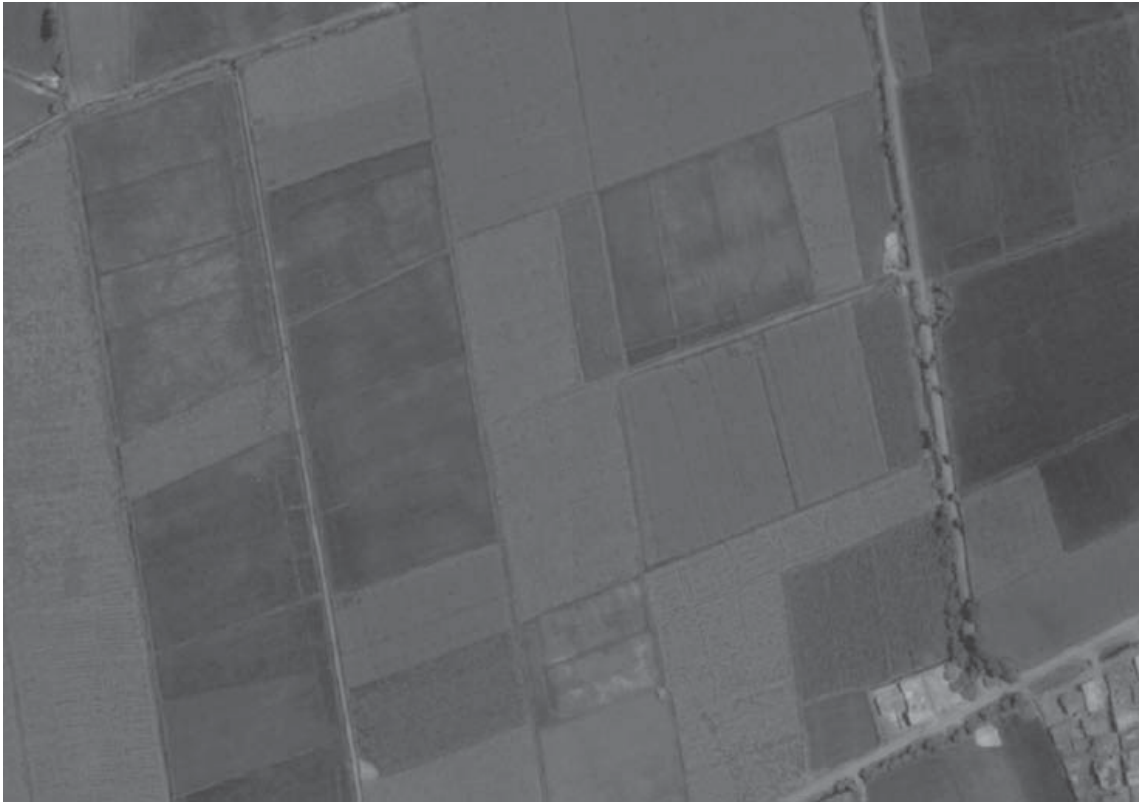


Figure 1.6 Quickbird satellite image revealing cropmarks in the vicinity of Piramesse. These show large numbers of buried structures which have been detected by magnetometry. Image courtesy of Google Earth Pro.

excavation these are the main tools Egyptologists have used to detect subsurface remains, which include a full range of feature types (houses, walls, and tombs) as well as entire cities. It is easy to misinterpret this technical data, which is why having a specialist on site is crucial.

The Delta has had the majority of subsurface landscape and feature detection work done when compared to the rest of Egypt. Work at Pi-Ramesse has taken place on a large scale, and has shown palaces, houses, and related structures now all buried under modern fields. The excavation director, Manfred Bietak, actually rents the land to be surveyed from modern farmers (Becker and Fassbinder 1999: 146–50). At the archaeological site of Tell Tebilla, magnetometer work helped archaeologists to pinpoint a large complex for excavation, which was revealed to be a large tomb preserved to 7 m (Pavlish 2004). Extensive subsurface survey work has taken place at Saqqara, which has shown a number of buried complexes as well as an ancient road (Mathieson 2000: 27–39). Additional work at Abydos has also revealed significant subsurface remains, including potential early dynastic tombs (Herbich 2003: 13–56). Ground penetrating radar, which has been used with great success in other regions of the world, (Meats and Tite 1995: 229–36; Meats 1996: 59–381), may not yet have been applied to locate past Egyptian landscapes and sites, but holds much promise for future work.

What are the relative advantages and disadvantages of using these technologies in Egypt? Their resolution is excellent, yet the cost of bringing in specialists to Egypt means that it may not be possible for all excavations and surveys. Purchasing the

equipment is often not feasible, as it can cost tens of thousands of dollars. Without trained specialists a great deal of error can be introduced into collected data. Time may be another constraint; if one has 100 sites to survey in a short period of time, there will only be time to use subsurface detection techniques on select sites. When, then, should Egyptologists employ subsurface detection techniques? If excavation is not possible (because of time or funding constraints), the archaeologists can use them to gain a sense of general site layout. By locating specific architectural features, archaeologists can surmise dates (in conjunction with surface pottery) associated with possible landscape changes, including sites beneath modern fields (Becker and Fassbinder 1999: 146–50).

Coring remains the best way to reconstruct past landscapes (von der Way, 1997), given that silt deposition over the past 5,000 years has obscured the majority of ancient Egypt's floodplain landscapes. Wide-scale and systematic deep coring would take a significant amount of time, yet there are currently no methods of on-ground detection of deeply buried surfaces other than using coring. Using a machine to core beyond the 7–10 m depths currently reached by Egyptologists would aid immeasurably, especially understanding broader settlement shifts in relationship to changing Nile flow patterns. In addition, the coring may aid in locating deeply buried ancient settlements from much earlier periods of time. Looking at this broader picture would aid Egyptologists in gaining a better understanding of past human-environment interactions.

Such a project would undoubtedly reveal numerous buried archaeological sites and would be invaluable for landscape evolution studies. Owing to current cost and time constraints for such a coring survey, perhaps a smaller series of random cores should be placed between known surface sites until more efficient technology exists to perform subsurface landscape scans. Hyperspectral satellite images such as ASTER can detect far more subtle landscape changes than SPOT or Landsat satellite images and may aid in revealing potential subsurface sites. Landscape modelling may, in future, take place with LIDAR (for LIght Detection And Ranging) sensors, which can record subtle detail variations such as cropmarks (Roughley 2001).

What, then, defines an ancient Egyptian archaeological site, and to what extent can it be differentiated from an ancient Egyptian landscape? Under conventional archaeological terminology even a single potsherd found in an agricultural field would be considered a site. We do not, however, know what this sherd represents without additional survey. Perhaps it is a single discarded sherd from a larger site nearby, or perhaps wind or water moved it from where it was discarded originally. All areas where archaeological sites, features, and material culture are found should be important, regardless of their overall size. Archaeological sites are a lesser (but integral) part of a landscape whole; water sources, ecosystems, and habitats all make up ancient landscapes, and all need to be considered. We will likely never know the full extent of specific ancient Egyptian landscapes, as too many modern and ancient processes have combined to obscure them. Archaeologists can generalize based on ancient texts and attempt to be more specific by using a range of scientific tools. It is most important to recognize the past and present processes that have caused entire landscapes to evolve and to understand how past peoples might have reacted to these broad landscape changes.



Figure 1.7 Quickbird satellite image draped over Shuttle Radar Topography Image at the quarry of Wadi Maghara. Image courtesy of Google Earth Pro.

Creating a catalogue of ancient Egyptian landscape types is essential to the field of Egyptology and would certainly assist in establishing what tools might be best to locate the past landscapes. Determining which landscapes would fit into such a catalogue would not be as straightforward as one might assume. Would one create landscape types for each of the Egyptian nomes, or would one have broader categories such as “floodplain (Delta)” and “floodplain (Middle Egypt)”? Would each landscape type need to be restricted to something ever more specific? For example, would a quarry landscape be enough, or would archaeologists need to subdivide into specific quarry types? There are hundreds of categories to consider. The element of time is another factor. Landscapes shift and change depending on local conditions and global weather patterns. What may have been a grape farm may shift to a desert outpost area in times of drought. Time and change in relationship to landscapes are two factors only beginning to be considered in Egyptian archaeology and will have an impact on how the field advances in the next twenty-five years or so.

11 The Future of Landscape Archaeology in Egypt

Given the advances in archaeological practice, where should Egyptologists focus their efforts for detecting past landscapes? Ancient Egypt’s landscapes are palimpsests, and ancient Egypt needs to be reconceptualized as through a more “layered” history. First, Ancient Egypt’s landscapes need to be better defined, and archaeological sites

must be thought of in much broader contexts. No archaeological site ever existed unto itself, as past peoples have relied on numerous natural resources to survive and flourish. Using advanced scientific approaches (e.g. residue analyses, mass spectrometry, soil micromorphology), archaeologists will be able to ask questions regarding more subtle landscape changes. Using these and other findings, archaeologists may be able to take the past architectural and landscape renderings of ancient Egyptian landscapes and turn them into a more digital-based reality. There are countless ancient sites, river channels, field boundaries, and other landscape features to locate, dating to all of ancient Egypt's time periods. The subfield of landscape archaeology within Egyptian Archaeology is only beginning but holds much promise for future research.

FURTHER READING

A good starting point for reading about landscapes in ancient Egypt is Butzer 1976. For reading about the Nile and general geology, Said 1988 and 1990 provide good overviews. No single book has yet been written on the landscapes of ancient Egypt, but many good articles exist that discuss environmental change on a local level. This includes articles by Manfred Bietak, Barry Kemp, and Fekri Hassan (listed in the bibliography). For a general overview for how one might approach past landscapes see Parcak 2009b which contains a number of Egypt-based case studies.