

The Discovery of Tropical Mangroves in Graeco-Roman Antiquity: Science and Wonder

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It is largely agreed today that mangrove is endangered and that it needs protection. The 2010 issue of the *World Mangrove Atlas* indicated that a fifth of the world's mangrove ecosystems have been lost since 1980. It is little known that twenty-four centuries ago the ancient Greeks, sailing across the Indian Ocean and Red Sea, discovered mangroves, and it is even less well known that they observed them not only with wonder but also with scientific acuity.

1. Historical and geographical facts

a) From the beginning to Alexander the Great

When Alexander the Great died in 323 BC, the ancient Greeks were aware of three mangrove areas respectively located in the Red Sea (named by the ancient Greeks the 'Arabic Gulf'), the Arabian Sea (commonly known to Graeco-Romans as the 'Erythraean Sea') and the Persian Gulf. The Red Sea mangroves were probably seen some time before the expedition of Alexander the Great to India (328–5 BC), while mangroves in the Arabian Sea and Persian Gulf were discovered after the young king had decided to leave the Indus valley and return to Babylonia. By the end of the fourth century BC the famous disciple of Aristotle, Theophrastus, in his *Enquiry into Plants*, preserved in part what the Graeco-Macedonians had seen and had reported, but the data are unfortunately very scarce (see below, Appendix 1). Even scantier data are to be found in the *Anabasis of Alexander* by Arrian (1st to 2nd century AD). Pliny the Elder (1st century AD) does not provide any additional material.

i. The mangroves of the Arabian Sea (Erythraean Sea) and the eastern shores of the Persian Gulf

During the summer of 325 BC, Alexander divided his army into two contingents for voyage back to Babylon; the first being commanded by the great king himself. They left in September and completed their journey by land, walking mostly along the coast. The second contingent was shipped by a 'companion'¹ of Alexander named Nearchus, who served as a fleet commander. The fleet was ordered to leave the mouths of the Indus and reach the interior of the Persian Gulf. Unfortunately, the winds of the summer monsoon delayed the departure of the ships. After waiting several days Nearchus finally departed. He sailed along the Gedrosia and the Carmania (the coasts of Pakistan and Iran), then crossed the Strait of Hormuz, passed along the eastern shore of the Persian Gulf, and finally reached Susa in mid-February 324 BC.

¹ Companion (Greek: *hetairos*, or *philos* [friend]). The *Hetairoi* were members of the Macedonian aristocracy who enjoyed the trust and friendship of the Macedonian regent and formed the elite cavalry of the Macedonian army.

The men of both groups saw, while travelling, several mangrove areas. However, that the best descriptions originated more from Nearchus and his companions than from Alexander's party is not surprising (see below: Appendix 1, i).

No doubt the sources of Theophrastus' information originated from the *hetairoi* who accompanied Nearchus, although their names are never quoted by him. (Theophrastus vaguely refers to them as 'they'). Presumably Nearchus himself must have brought in some information. According to some scholars, he is even among the sailors the only source for Theophrastus. In fact there must have been other informants, such as Androsthene of Thasos, whom I will mention later. Onesicritus, Nearchus' chief pilot, appears also as a serious provider of information. After the death of Alexander, he wrote a book entitled 'How Alexander was educated', now known only from references in other works, dealing mostly with the expedition in India. It was criticized by other ancient writers for containing fabulous and erroneous information but apparently also contained relevant evidence, particularly in the field of botany. We may, not counting the men whose names have disappeared, identify other potential sources of information: Ptolemy, Clitarchus, Archias of Pella, Anaximenes, Chares of Mytilene and Orthagoras; all of them having taken part in the Indian expedition. But actually their presence can hardly be detected in the sparse documents that have survived, so that we cannot take them into consideration. However, the case of Aristobulus, another companion of Alexander, deserves a special attention.

Aristobulus returned to Babylonia by land with Alexander. He saw and described in his now lost 'Memoirs' a mangrove in Gedrosia. Arrian, who had read Aristobulus' work, preserved a short fragment mentioning the Gedrosian mangrove forest. Unlike the sailors to whom Theophrastus refers, Aristobulus (a keen observer) described the trees from the point of view of a land traveller:

In the desert there were also other kinds of trees, one of which had foliage like that of the bay-tree, and grew in places washed by the waves of the sea. These trees were on ground which was left dry by the ebb-tide; but when the water advanced they looked as if they had grown in the sea. Of others the roots were always washed by the sea, because they grew in hollow places, from which the water did not retire; and yet the trees were not destroyed by the sea. Some of these trees in this region were even thirty cubits high. At that season they happened to be in bloom; and the flower was very much like the white violet, but the perfume was far superior to that of the latter.²

Here the mangrove is described as a part of the vegetation of the Gedrosian desert, *viz.* it is considered as a special kind of plant growing on the shores of Gedrosia. Nevertheless, we note that both descriptions, either from the sea or from the land, match each other for the greater part.

ii. The mangroves of Bahrain (Tylos)

Shortly after the successful return of Nearchus' fleet to Babylonia, Alexander the Great, desiring to achieve the conquest of the whole world, planned a circumnavigation of the Arabian Peninsula from the Shatt el Arab to Suez. Three naval expeditions were launched in

² Arrian, *Alexandri Anabasis*, 6, 22, 6–7 (trans. E. J. Chinook).

the autumn of 324 BC in order to achieve this objective. The fleet leaders, Archias of Pella, Androstenes of Thasos and Hiero of Soloi, were ordered to skirt the western shore of the Persian Gulf, so far totally unknown to the Greeks, then pass the Strait of Hormuz and eventually reach the northern Red Sea. In the event, none of them left the Persian Gulf. Nevertheless they all reported their observations to Alexander on their return.

Serious evidence shows that the mangroves of Bahrain main island (named Tylos by the Greeks) were noticed by Androstenes, as Theophrastus, who used his relation (below, Appendix 1), assures us. That Hiero saw or described Bahrain's mangroves is uncertain. Archias probably did not see the mangrove, since he reported to Alexander that there was no forest on that island.³ Either he did not sail along the same side as Androstenes or he did not regard the mangrove trees as a forest. The latter hypothesis, which does not fit the ancient representation of the mangrove (see below, part 3.a), may certainly be rejected. In conclusion, Androstenes was the main, if not the only source of Greek information about the coastal forests of Bahrain. He did not discover an unknown landscape as he had already observed the Gedrosian and Carmanian mangrove forests while returning with Nearchus the year before.

iii. The mangroves of the Red Sea (Arabian Gulf)

While Alexander's explorers were sailing along the western shores of the Persian Gulf hoping to reach the Strait of Hormuz, others were ordered by the king to explore by ship the Arabian Peninsula from a starting point in Egypt. At the same time as Hiero of Soloi was beginning his journey, a fleet departed from Heroôpolis (an ancient town located near Suez) under the command of Anaxicrates, another of Alexander's *hetairoi*. They managed to go as far as Bab el-Mandeb Strait but were shortly after forced to turn back. Thanks to Theophrastus we can learn a little about this expedition. Some mangrove areas in the Gulf of Suez are indeed referred to by this author (see Appendix 1). Unfortunately Theophrastus' text is not clear and we cannot draw any certain conclusions. Some groves may have been discovered by Anaxicrates in the Gulf of Suez, but the text also suggests that they were known before his voyage.

Theophrastus, regrettably rather vaguely, points out another mangrove area situated much further south on the western shore of the Red Sea. He says that 'laurel trees' and 'olive trees' grew somewhere 'above Koptos' (now Qift in Egypt), 'in the part of Arabia which lays along the Erythraean sea' (which means in this case the African shore of the Red Sea). The terms 'above Koptos' need a proper explanation. 'Above' refers to a land journey from the Nile banks (i.e. Koptos) to the Red Sea. This sentence means that there were 'marine trees' beyond Koptos, somewhere on the shore of the Red Sea. In other words, people who travelled (for example for trade purposes) across the desert in order to reach a harbour⁴ may see laurel and olive groves standing in salt water. As we know that the tracks leading from the Nile to the Red Sea were used from the Egyptian 11th dynasty (late second millennium BC), we can therefore suppose that some Greeks had heard about those mangroves before the time of Alexander. Theophrastus may thus have collected information from them.

³ Arrian, *Alexandri Anabasis*, 7, 20, 6.

⁴ In the Hellenistic period two ports, Myos Hormos and Berenike, were established on the Egyptian coast of the Red Sea. They were connected to Koptos (Qift) and Apollinopolis (Edfu) by tracks.

b) After Alexander: the Hellenistic and Roman period

Undoubtedly the observations of the Greeks not only began but also reached their climax during the rule of Alexander. From the ensuing Hellenistic period⁵ we receive scarce evidence. There is a short notice by Megasthenes, the famous ambassador of the king Seleucus I, dealing with Indian mangroves, but it is of little value.⁶ The occasional presence of the Seleucids in the Persian Gulf might not allow serious observations, and apparently nothing new was said about marine forest in this part of the world.

However, thanks to the first Ptolemies who started hunting African elephants for military purposes, knowledge of Red Sea mangroves expanded a little. Many officers and hunters dispatched into coastal areas of Eritrea and Somalia reported what they saw, although briefly. The best information is delivered by Agatharchides of Cnidus (2nd century BC)⁷ who benefited from the information they had collected. Thus, dense woods of ‘olive’ in the northern islands of the Red Sea, probably located around the Gulf of Suez, are pointed out. Agatharchides also describes ‘olive groves’ standing somewhere on the Sudanese or Eritrean seashore and argues that the Ichthyophagi (Fish Eaters) used these trees to build their huts. Finally he mentions ‘olives trees’ submerged in a tidal area around the strait of Bab el-Mandeb (Assab in Eritrea? Musha islands?). Later, Artemidorus, another scientist who lived in the first century BC and quoted by Strabo, tells us that Greek explorers sailed along the African coast of the Red Sea and the northern Somalian shore as far as Cape Gardafui. They noticed large mangroves (‘olive grove’, ‘laurel grove’), stating that ‘the whole of coast [of the African shore of the Red Sea] has palm-trees, olive groves and laurel groves, not only the part inside the straits [viz. Bab el-Mandeb], but also most of the part outside.’⁸

Very little data from Roman times survives. Pliny the Elder, who used Hellenistic information, and especially Theophrastus, adds very little to the ancient knowledge. (He seems to have been told about mangrove forests in Taprobane (Sri Lanka) when meeting an embassy in Rome). In the first to second centuries Plutarch had a rough knowledge of the mangroves, repeating what he had read in earlier books. After Plutarch, no further testimony is worth mentioning. This is a surprising fact considering that, after the discovery of the monsoon, an increasing number of ships crossed the Indian Ocean for trade purposes with the result that knowledge should logically have expanded.

Indeed many Greek merchants left Alexandria for India, Arabia and eastern Africa, where they bought luxury goods. While sailing along the coasts of Kenya, Tanzania, Zanzibar and Sri Lanka, or across the Gulf of Bengal, they saw mangroves which were more spectacular and more varied than those growing along the edge of the Red Sea and the Sea of

⁵ Usually the era following the death of Alexander (323) and ending with the final defeat of Cleopatra VII and Mark Antony (30 BC: the battle of Actium). Alexander’s empire was divided after many wars into four kingdoms ruled by the following Graeco-Macedonian dynasties: the Ptolemies (Egypt & southern Syria); the Seleucids (Asia Minor, Northern Syria, Mesopotamia, Persia); the Antigonids (Macedonia); and the Attalids (Asia Minor). Each of them was defeated by Rome.

⁶ Antigonus, *Historia mirabilium*, 132: ‘According to Callimachus, Megasthenes, the author of the *Indika*, says that trees grow in the Indian sea’.

⁷ Agatharchides was a Greek historian who wrote a treatise on the Erythraean Sea which was epitomized by Diodorus the Sicilian and the Byzantine scholar Photios.

⁸ Strabo, 16, 4, 14 (trans. H. L. Jones).

Oman. But there is so little evidence that we have to assume that these men did not pay serious attention to those forests. For example the anonymous author of the *Periplus of the Erythraean Sea*⁹ (1st century AD) reports somewhere in Somalia a place called in Greek *Daphnôn megas* ('the large laurel grove'), a name which is obviously related to a mangrove swamp. However, this merchant does not bother about providing any description.

2. From observation to understanding: the scientific enquiry

The remaining literary evidence proves that the quality of knowledge and the accuracy of observation diminished continuously. This lack of interest in mangrove forests which especially occurs during the Roman times cannot be explained convincingly, but it is easier to look for the reasons why the only serious botanical inquiry came during the Hellenistic era.

a) The support of the scientific inquiry: the accurate observations of Alexander's companions

Actually, concerning the Hellenistic period, what we read in Theophrastus proves that the observations made by Alexander and his friends surpass those of the explorers and hunters of the Ptolemaic kings. The former paid extraordinary attention to detail and reported their observations with accuracy. Generally the latter only mentioned the forests they saw. In fact the companions of Alexander the Great, not to mention the king himself, were educated men truly interested in science and nature. This is demonstrated by fragments from their monographs quoted, for example, by Strabo or Arrian, in which zoological, physical, botanical or anthropological issues are discussed.

Once they had crossed the Indus to invade India, they knew they would have the opportunity to see for themselves many phenomena which no Greek had seen before. Aware of being the first to do so, they noted attentively the unbelievable features of mangrove and tried to solve difficult issues, such as how can trees grow in salt water? Although very few of their theoretical ideas have survived, we do know that they inquired into the effects of salt water on plants, referring perhaps to the old Ionian physics – the philosophical and rational inquiries into *physis* which flourished in the sixth century BC in Asia Minor. As far as we can guess from Theophrastus' book, they probably carried out experiments, such as opening the fruit of white mangrove in order to see its internal structure, or digging out the mud to examine the roots of the trees. The autopsy¹⁰ of these men was supported by their personal value and wide culture. There was also a sort of intellectual emulation, each one of them trying to outdo Alexander himself, who tackled difficult problems such as finding the Nile sources. Under these conditions, within quite a short space of time, much was written about those natural phenomena seen in India and in Erythraean Sea.

This outstanding situation never occurred again, even during the intensive explorations in the Red Sea when Egypt was ruled by the Ptolemies. The Ptolemaic explorers hardly

⁹ A list of harbours and markets in Red Sea and Indian Ocean. The anonymous author also enumerates the goods to buy and sell in each port. See Hakluyt Society publications: *The Periplus of the Erythraean Sea by an unknown author With some extracts from Agatharchides 'On the Erythraean Sea'*, transl and ed. by G. W. B. Huntingford, 1980, and *Agatharchides of Cnidus On the Erythraean Sea*, trans. and ed. by Stanley M. Burstein, 1990.

¹⁰ Literally translated from Greek: 'seeing by oneself'.

equalled their predecessors. Even if they managed to describe some *Avicennia* or *Rhizophora* groves, they lacked scientific curiosity. All their reports have now disappeared, but from some fragments preserved by Diodorus, Strabo and Photius we get the impression that mangroves were simply regarded as landmarks for sailors or places of anchorage. I surmise that both the political background and the purposes of the seafaring had changed and that the ability of the explorers was no longer of the same standing.

b) The value of Theophrastus' enquiry

Theophrastus' writings on plants appeared around thirty years after Alexander the Great had died.¹¹ The outstanding chapter dealing with the forests of the Erythraean Sea shows how the accurate descriptions of Alexander's friends became, through Theophrastus' genius, scientific knowledge. We owe to him the first synthesis concerning the mangrove. After gathering the diverse and scattered pieces of information he had found in the reports of Alexander's friends, he managed to compose an overview of these trees which were absolutely unknown to Greeks. Moreover, while he personally had not observed a single tree about which he speaks, he was able to elaborate critical questions and propose either conclusions or assumptions. What were these botanical issues?

Firstly, Theophrastus was careful to classify the mangrove trees among the plant species. The answer was not easy to find because they looked like 'normal' trees (with trunk, branches, leaves, blossom and fruit), except they were not at all damaged by salt water. The criterion of the biotope was used to solve the problem. Theophrastus divided the botanical species into two classes: the terrestrial and the aquatic plants, the latter being produced either in fresh or salt water. The mangrove trees were thought to belong the category of saltwater aquatic plants. Within this category, Theophrastus distinguished two classes: 1) the small submerged marine plants from the Mediterranean and the Atlantic (e.g. seaweed);¹² 2) the plants growing in the Erythraean Sea (viz. the Red Sea and the Arabian Sea), namely low plants but above all the *Rhizophora* and *Avicennia* species. As a result, these trees were defined by Theophrastus as tropical plants specific to coastal warm areas of the inhabited world.¹³ Starting from a taxonomy problem he reached the ecological question and therefore invented the concept of mangrove without creating the word.

Secondly, Theophrastus tried to solve the problem of survival in a saltwater environment. In other words he tackled the biological issue, certainly the most difficult one. How could some trees, in every way similar to those growing on earth, resist the salt water that flooded them and washed their roots? Two assumptions appear in Theophrastus' text. The first had perhaps been borrowed from the companions of Alexander. Observing trees growing in salt water in the eastern Persian Gulf without detecting around any trace of fresh water, they thought those were 'fed' on sea water, like seaweed, except that they were larger and produced leaves, flowers and fruit. But apparently this hypothesis was difficult to accept. It contradicted the common experience of every farmer (most ancient Greeks lived from farming) who knew that saline soil does not allow plants to grow. That is why another assumption arose which seemed to be preferred by Theophrastus because it did not refute

¹¹ *Theophrastus: Enquiry into Plants*, transl and ed. by A. F. Hort, New York, [Loeb Classical Library](#), 1916.

¹² See Theophrastus, *Hist. plant.* 1, 4, 2; 4, 1, 5; 4, 6, 1.

¹³ According to the old Ionian physics both animals and plants were larger in the southern and eastern parts of the world, supposedly because they were heated by the sun.

common experience: the roots were supposed to suck up fresh water from the earth (in a way that Theophrastus could not explain), while the sea water did not harm the tree.

It is not difficult to understand why Theophrastus was unable to go further. He obviously lacked the accurate descriptions and the scientific knowledge and concepts we have now. It is only in the past century that the mangrove ecosystem has been understood and the biological questions (adaptation to low oxygen, limitation of water loss, evacuation of salt, viviparous reproduction, etc.) have been solved. Nevertheless, it is worth quoting in conclusion this short definition from the Wikipedia encyclopaedia: ‘Mangroves are trees and shrubs that grow in saline coastal habitats in the tropics and subtropics – mainly between latitudes 25°N and 25°S. The saline conditions tolerated by various species range from brackish water, through pure seawater ..., to water of over twice the salinity of ocean seawater ...’. The saline conditions and the tropical habitat, which characterize first of all this ecosystem, were pointed out by Theophrastus 2400 years ago. Although this brilliant scientist obviously could not investigate further, he managed to define the major features of the mangal forest.

The excellence of Theophrastus’ research was not matched for centuries. The best of post-Hellenistic knowledge remains, in the current state of documentation, the Natural History of Pliny the Elder. But H. Bretzl has already shown that this collection of scattered observations depends largely on Theophrastus, and that Pliny did not improve on the botanical inquiry. The remainder of knowledge from the Roman period reduces, or nearly so, to a few unimportant remarks of Plutarch, who did not pay serious attention to mangrove nor made any inquiry because he was only interested in the miraculous fact that trees grew in salt water. The coastal forests were only briefly mentioned, generally to support a philosophical discussion (below, Appendix 1, iv).

3) The mangrove landscape in the Graeco-Roman representation

While sailing along the mangrove swamp of coastal Pakistan or Iran, the captains sent out to explore by Alexander the Great discovered a landscape they had not seen before. Not only did they accurately examine the trees but they also noticed some characteristics of this tropical scenery. After them the hunters and explorers launched by the Ptolemies into the Red Sea and the Gulf of Oman put into words how they perceived this natural area. Actually their relations (echoed by Theophrastus, Strabo, Pliny, etc.) disclose what must have been the Graeco-Roman perception of this peculiar landscape, which is dramatically different from ours.

a) A marine forest

Basically mangrove was nothing but an extraordinary kind of forest, because of the trees growing in the sea. Therefore the Graeco-Romans reduced this landscape to only two components, trees and sea. This coupling is expressed in most of texts, including the shorter ones (see, for example, Appendix 1: Theophrastus 4, 7, 1; Pliny, 13, 135; Plutarch, *De facie*, and note 5). All texts depict a landscape with trees more or less permanently submerged from their roots to their trunks. Whereas nowadays the mangrove forest is considered as an intertidal ecosystem and a specific kind of wetland, it truly appeared to the Graeco-Romans as a marine forest. The Hellenistic observers were also struck by the fact that these trees grew

close to one another, forming very dense stands, although limited in width (see, for example, Appendix 1: Theophrastus 4, 7, 7; Diodorus 3, 19, 3).

How the Mediterraneans perceived the coexistence of the trees and the sea is the most interesting point. According to several passages the natural formation made by trees standing in the sea reaches neither stability nor harmony. Being constantly subject to daily tides, the mangrove was depicted as unstable. The ancient explorers were struck by the ground appearing and disappearing, or the foliage, green when immersed, turning white when drying out (see below: Appendix 1: Theophrastus, 4, 7, 3).

The idea of a dynamic opposition supports the ancient representation of the mangrove landscape. Indeed, for the Graeco-Romans, the two elements from which the mangrove is made are in conflict: the sea is seen as an active element, because its waves and salt (the most effective arm of the sea) attack the trees. The trees, as a passive and unprotected element, suffer much but manage to survive (see above: Arrian; below, Appendix 1: Theophrastus 4, 7, 5; Agatharchides [Photius]; Pliny, 12, 77). The mangal forest is considered to be the result of a struggle between trees and sea, finally won by that which was apparently the weaker.

b) Few men and wild animals

Few authors refer to the relationship between the native inhabitants and the mangroves growing nearby. The most interesting passage pointing to a human presence is given by Agatharchides. This author reports that in the Arabian Gulf some tribes named as *Ichthyophagi* (Fish-Eaters) exploited the trees. They made their shelters from branches of 'olive trees' collected from a mangrove swamp, a region in which they did not live. This description, according to Agatharchides, proves how mankind manages to adjust to its environment and to benefit from it even if it is very harsh. It proves also that nature, by providing wood in a completely desert area, supports the natives' livelihood. These olive trees make the Ichthyophagi's life easier since 'they protect [them] against the sun while allowing them to enjoy the freshness coming from the sea' (below, Appendix 1: Diodorus 3, 19, 3). This bare fact (i.e. the huts made from branches of white mangrove) is used by Agatharchides to formulate a philosophical and ethnographical lesson.

More is known from other ancient authors concerning the exploitation of the mangrove. Pythagoras, an historian who lived in the Hellenistic time, relates that the Troglodytes, a tribe living on the African shore of the Red Sea, used mangrove wood for making a musical instruments.¹⁴ When Androstenes says that the leaves of *Aegiceras majus* are not edible, there is actually an implicit reference to the use of mangroves as a food source, maybe for cattle (below, Appendix 1: Theophrastus 4, 7, 7). Finally, since the Greeks were aware of the medicinal properties of *Avicennia* and *Rhizophora*, it is likely that some people, probably natives, penetrated more or less into the mangroves to incise barks and to collect tears (see below, Appendix 2, 4).

Nevertheless the Graeco-Romans generally conceived the mangrove forest as a place devoid of human presence. No doubt the travellers did not stay long enough to learn about the real relationship between the local communities and this natural formation. In any case, this

¹⁴ Athenaeus of Naucratis, 4, 82, 184a.

representation should reflect a real situation for it is probably more difficult for men to survive in a mangrove swamp than it is in a tropical forest.

Very surprisingly no animal appears in the Graeco-Roman mangrove landscape. Since nutrients are abundant, this ecosystem hosts a varied marine life and, as a consequence, an often spectacular birdlife. Tourists who nowadays visit mangroves can watch many different animal species, e.g., crabs, which abound at low tide; waders, pelicans, or even mudskippers (*Periophthalmus* spp: an amazing kind of fish with its prominent eyes, which can survive out of water). But perhaps with the exception of the latter, no wildlife was recorded by the ancient explorers.

We can hardly understand why the Greeks and Roman have depicted a ‘silent’ mangrove landscape. In fact we must remember that the ancient seamen and travellers probably did not enter this kind of area. They may have stayed alongside because they had no reason to cross such places. This fact may explain why the Graeco-Romans characterized dramatically the mangrove landscape only as a marine forest.

c) A miraculous landscape

Whether the mangrove landscape was experienced by the travellers or was discovered by the readers of their narratives, it no doubt surprised them because it did not fit their ordinary perception of the world. Some sentences show clearly how much the Graeco-Romans were amazed by those trees rooted in the sea instead of the ground (e.g. see below, Strabo; Appendix 1: Agatharchides [Photius]; Pliny 12, 37). The surprise is also expressed through a stylistic antinomy (above: Arrian; below, Appendix 1, Plutarch, *De facie*). In reality, from the ancient point of view, this unbelievable marine forest belonged to the category of *paradoxa* (marvelous, incredible things), which are indeed the major criterion in understanding landscape geography in antiquity.

In the Graeco-Roman representation the *paradoxa*, whatever they are (animal, human, phenomena), contradict common experience. That is why most of them were located at the edges of the inhabited world. Generally speaking, the *paradoxa* are phenomena beyond explanation or even rationality. In fact the mangrove forest offered the Graeco-Romans two forms of *paradoxon*:

a) The strange aspect of the trees defined a ‘visual *paradoxon*’; for instance the stilt roots of the *Rhizophora mucronata* (below, Appendix 1: Theophrastus 4, 7, 5) or the salt expelled by the leaves (below, Appendix 1: Pliny 12, 77 ; 13, 135).

b) That the mangrove grew in a hostile environment, for trees were commonly thought to need fresh water and not to be rooted in a flooded soil (see Plutarch, Appendix 1) was also another miraculous fact (e.g. above: Arrian; below, Appendix 1, Theophrastus 4, 7, 1-2; Pliny, 13, 139). This reversal of the *Physis* (viz. the order of nature) made the second kind of *paradoxon* not only visual but also intellectual.¹⁵

¹⁵ Which Theophrastus nevertheless tried to explain in a scientific way (see above).

The latter marvel was dramatically observed on the African coast of the Red Sea, where mangrove swamps stand in front of desert areas. The trees lived where they should not have done, while, facing the mangrove, the land, which should have been covered by plants, was void. For the Graeco-Romans it was as if the ground was unsuited to vegetation while conversely the sea was able to produce terrestrial plants: ‘Along the whole of the coast of the Red Sea, down in the deep, grow trees like the laurel and the olive, which at the ebb tides are wholly visible above the water but at the full tides are sometimes wholly covered; and while this is the case, the land that lies above the sea has no trees, and therefore the peculiarity is all the greater’ (Strabo).¹⁶

The companions of Alexander, who in the Indus delta tied the ropes of their boats to the tops of trees at high tide, felt in another way the strange confusion in the natural elements that were the mangrove landscape. The Indian marine forest, combining earth and water in a new way, may have reminded them of ancient flood myths which were later so expressively depicted by Ovid:¹⁷

And now one vast expanse,
the land and sea were mingled in the waste
of endless waves – a sea without a shore.
One desperate man seized on the nearest hill;
another sitting in his curved boat,
plied the long oar where he was wont to plow;
another sailed above his grain, above
his hidden dwelling; and another hooked
a fish that sported in a leafy elm.
Perchance an anchor dropped in verdant fields,
or curving keels were pushed through tangled vines;
and where the gracile goat enjoyed the green,
unsightly seals reposed.

Conclusion

The shore ... sank suddenly into a low line of mangrove wood, backed by primeval forest. The loathy floor of liquid mud lay bare beneath. Upon the endless web of interarching roots great purple crabs were crawling up and down ... All seemed one horrid complicated trap for the voyager; there was no opening, no relief, nothing but dark ring of mangrove ... All was foul, sullen, weird as witch’s dream. Happily, no landscape dark and drear as this pollutes our British shores, and threatens the mariner with delirious death.¹⁸

Describing a landscape is a matter of point of view. The above text was written in the nineteenth century and reflects what was probably a common feeling among Europeans at this time. Fortunately, the invention of ecology (*viz.* the scientific study of the relation of living organisms to each other and their surroundings) – not to speak of some current sources of

¹⁶ Strabo, 16, 3, 7 (trans. H. L. Jones).

¹⁷ Ovid, *Metam.* 1, 292–230, trans. B. More.

¹⁸ W. H. D. Adams, *Wonders of the Vegetable World*, London, 1867, pp. 49–59 (quoting Kingsley in the first paragraph).

concern – has changed our representation of mangrove. The Graeco-Romans, especially in the Hellenistic era, had a dramatically different attitude, and their genuine astonishment raised an outstanding scientific inquiry which still deserves our admiration.

Appendix 1: Textual evidence

i) Theophrastus, *Enquiry into Plants*, vol. 1 (trans. A. F. Hort¹⁹)

4, 7, 1. (Red Sea) And in the sea called the Red Sea a little above Coptos in Arabia²⁰ there grows on the land no tree except that called the ‘thirsty’ acacia, and even this is scarce by reason of the heat and the lack of water ...

2. But there are plants in the sea, which they call ‘bay’ and ‘olive’. In foliage the ‘bay’ is like the *aria* (holm-oak), the ‘olive’ like the real olive. The latter has a fruit like olives, and it also discharges a gum from which the physicians compound a drug for stanching blood, which is extremely effective ... In the gulf called ‘the gulf of the Heroes’, to which the Egyptians go down, there grow a ‘bay’, an ‘olive’ and a ‘thyme’; these however are not green, but like stones so far as they project above the sea, but in leaves and shoots they are like their green namesakes ... These tree-like growths are about three cubits in height.²¹

3. (From the mouths of the Indus to eastern Persian Gulf) Now some, referring to the occasion when there was an expedition of those returning from India sent out by Alexander, report that the plants which grow in the sea, so long they are kept damp, have a color like seaweeds, but that when they are taken out and put in the sun, they shortly become like salt. They also say that rushes of stone grow close to the sea, which none could distinguish at sight from real rushes ...

4. On the islands which get covered by the tide they say that great trees grow, as big as planes or the tallest poplars, and that it came to pass that, when the tide came up, while the others things were entirely buried, the branches of the biggest trees projected and they fastened the stern cables to them, and then, when the tide ebbed again, fastened them to the roots. And that the tree has a leaf like that of the bay, and a flower like gilliflower in colour and smell, and a fruit the size of that of the olive, which is also very fragrant. And that it does not shed its leaves, and that the flower and the fruit form together in autumn and are shed in spring.

5. Also they say that there are plants which actually grow in the sea, which are evergreen and have a fruit like lupins.

(Eastern Persian Gulf) In Persia in the Carmanian district, where the tide is felt, there are trees of fair size like the *andrachne* in shape and in leaves; and they bear much fruit like in colour to almonds on the outside, but the inside is coiled up as though the kernels were all united. These trees are all eaten away up to the middle by the sea and are held up by their roots, so that they look like a cuttle-fish. For one may see this at ebb-tide.

¹⁹ *Theophrastus: Enquiry into Plants*, transl and ed. by A. F. Hort, New York, [Loeb Classical Library](#), 1916.

²⁰ The translation is not reliable on this point. Theophrastus does not say that Coptos is in Arabia, but that the mangroves grow in the Arabian part of the *Erythra thalassa* (Indian Ocean), viz. the Arabian Gulf (Red Sea).

²¹ About 1.35 metres.

6. And there is no rain²² at all in the district, but certain channels are left, along which they sail, and which are part of the sea. Which, some think, makes it plain that the trees derive nourishment from the sea and not from fresh water, except what they draw up with their roots from the land. And it is reasonable to suppose that this too is brackish; for the roots do not run to any depth. In general they say that trees which grow in the sea and those which grow on the land and are overtaken by the tide are of the same kind, and that those which grow in the sea are small and look like seaweed, while those that grow on land²³ are large and green and have a fragrant flower and fruit like a lupin.

7. **(Bahrein)** In the island of *Tylos*, which is situated in the Arabian Gulf,²⁴ they say that on the east side there is such a number of trees when the tide goes out that they make a regular fence. All these are in size as large as a fig-tree, the flower is exceedingly fragrant, and the fruit, which is not edible, is like in appearance to the lupin ...

8. They say that there are other trees with a flower like the gilliflower, but scentless and in size four times as large as that flower.

ii) Agatharchides, *The Erythraean Sea*

Diodorus the Sicilian (trans. C. H. Oldfather²⁵)

3, 19, 3. A third method by which the *Ichthyophagi* find a dwelling for themselves is as follows. Olive trees grow about these regions in very great numbers and their roots are washed by the sea, but they bear thick foliage and a fruit which resembles the sweet chestnut. These trees they interlace, forming in this way a continuous shade, and live in tents of this peculiar kind ...

3, 39, 2. Above this harbour²⁶ are situated three islands, two of which abound in olive trees and are thickly shaded.

Photius, *Library*, 460a

Concerning the olive trees standing in the channel mentioned above (Bab el-Mandeb straits?), he [Agatharchides] speaks of this astonishing fact: at high tide they are fully immersed; at low tide they are washed by sea; nevertheless they bear leaves all the time.

iii) Pliny the Elder, *Natural History* (trans. H. Rackham²⁷)

12, 37. On the Red Sea, which at this point we have called the Persian Gulf, the tides of which are carried a long way inland, the trees are of a remarkable nature; for they are to be seen on the coast when the tide is out, embracing the barren sands with their naked roots like polypuses, eaten away by the salt and looking like trunks that have been washed ashore and left high and dry. Also these trees when the tide rises remain motionless although beaten by

²² Theophrastus means: 'no fresh water'.

²³ *Viz.* the land regularly flooded by the tide.

²⁴ *Viz.* the Persian Gulf.

²⁵ *Diodorus of Sicily*, trans. C. H. Oldfather, et al., London & Cambridge, Mass., 1933-67.

²⁶ *Viz.* Myos Hormos, now Quseir al-Qadim in Egypt.

²⁷ *Pliny : Natural History*, trans. H. Rackham, et al., London & Cambridge, Mass., 1947-63.

the waves; indeed at high water they are completely covered, and the evidence of the facts proves that his species of tree is nourished by the brackish water. They are of marvelous size, and in appearance they resemble the strawberry-tree, but their fruit is like almonds outside and contains a spiral kernel.

38. In the same gulf is the island of Tyros, which is covered with forests in the part facing east, where it also is flooded by the sea at high tide. Each of the trees is the size of a fig-tree; they have a flower with an indescribably sweet scent and the fruit resembles a lupine, and is so prickly that no animal can touch it.

12, 77. In Arabia (*viz.* African Red Sea coast) there is also an olive endowed with a sort of tear out of which a medicine is made, called in Greek *enphaemon*, because of its remarkable effect on closing the scars of wounds. These trees grow on the coast and are covered by the waves at high tide without this doing harm to the berry, although accounts agree that salt is left on the leaves.

13, 135. Shrubs and trees also grow at the bottom of the sea – those in the Mediterranean being of smaller size, for the Red Sea and the whole Eastern ocean are filled with forests ...

139. But in the East it is a remarkable fact that as soon as we leave Coptos passing through the desert we find nothing except the thorn called ‘dry-thorn’ ... whereas in the Red Sea there are flourishing forests, mostly of bay and olive, both bearing berries ... The soldiers of Alexander who sailed from India gave an account of some marine trees the foliage of which was green while in water but dried up in the sun as soon as it was taken out and turned into salt ... In the same part of the earth (*viz.* the Indian ocean) also the rising tide submerges forests, although the trees are higher than the loftiest planes and poplars. Their foliage is that of the bay tree, and their blossom has the scent and color of violets ; the berries resemble olive ... The smaller of these trees are entirely covered by the tide, but the tops of the largest stand out and ships are moored to them, as well as to their roots when the tide goes out.

iv) Plutarch (trans. W. W. Goodwin²⁸)

Quaestiones Naturales 1

What is the reason that sea-water nourishes not trees?

Is it not for the same reason that it nourishes not earthly animals? ... Nor, though sea-water be aliment to marine plants, as it is to fishes, will it therefore nourish earthly plants, since it can neither penetrate the roots, because of its grossness, nor ascend, by reason of its weight ... Or is it because drought is a great enemy to trees? For sea-water is of a drying faculty; upon which account salt resists putrefaction, and the bodies of such as wash in the sea are presently dry and rough ... Or is it because sea-water is not fit to drink and bitter (as Aristotle says) through a mixture of burnt earth? For a lye is made by the falling of ashes into sweet water, and the dissolution ejects and corrupts what was good and potable ... As for what woods and plants men talk of growing in the Red Sea, they bear no fruit, but are nourished by rivers casting up much mud; therefore they grow not at any great distance from land, but very near to it.

²⁸ William Watson Goodwin, trans. & ed., *Plutarch's Essays and Miscellanies; Plutarch's Lives and Writings*, New York, 1905.

De facie quae in Luna apparet: And the provinces of Gedrosia and Troglodytis,²⁹ which lie near the ocean sea, being by reason of drought barren and without any trees, there grow nevertheless in the adjacent sea trees of a wonderful height and bigness, and green even to the very bottom; some of which they call olive-trees, others laurels, and others the hair of Isis.

Appendix 2: Mangrove species recognized by Greek explorers

The best textual evidence provides a great deal of descriptive details. However, from a purely botanical point of view, it is not entirely satisfactory, mostly due to the lack of taxonomy and of standardized botanical glossary. In other words, ancient botanical description does not follow any rules. In many cases a single comparison was considered as a valuable description needing no further explanation.

Moreover the circumstances in which the mangroves were observed should have affected the description process. Let us consider for instance the case of Alexander's friends, the best observers. They went across the Indian Ocean and the Persian Gulf in a hurry, because it was basically a military expedition. Thus it was not easy for them to quickly but carefully examine the tropical marine forests from their boats. Indeed, there were only few places where they stayed long enough to watch the plants more closely: the Indus' mouths (where Nearchus had to wait the south-east monsoon cease to depart) and near the island of Keshm (Iran) where he joined Alexander's ground forces. The explorers sent by the Ptolemies apparently did not stay in order to to examine mangroves, not to speak of the traders.

²⁹ *Viz.* The coast of Sudan and Eritrea.

	Reference. Geographical location	Main charact- erization	Main criteria of description	Botanical name. Vernacular name
1	Theophrastus, <i>H.P.</i> 4, 7, 5 Pliny the Elder, <i>H.N.</i> 12, 37	Tree with almond-like fruit	a) Fruit similar to the almond fruit 'curled, as if it was compressed on all sides' b) Large height of the tree c) Tree similar to the Greek strawberry tree (<i>Arbutus andrachne</i>) d) Leaf similar to that of the <i>Arbutus andr.</i>	<i>Avicennia officinalis</i> L. / <i>A. marina</i> (Forsk.) Viehr.
	Pakistani-Iranian coast Eastern Persian Gulf			White mangrove
2	Theophrastus, <i>H.P.</i> 4, 7, 4 Pliny the Elder, <i>H.N.</i> 13, 141 Arrian, <i>Anab.</i> 6, 22, 6–7	Tree with flower like gilliflower (or white wallflower)	a) Stilt roots b) Flower similar to that of white wallflower (<i>Matthiola incana</i>) c) Fruit similar to olive	<i>Rhizophora mucronata</i> Lamk.
	Pakistani-Iranian coast Unlocated islands (in the Indus' mouths?)			Red mangrove
3	Theophrastus, <i>H.P.</i> 4, 7, 5 ; 4, 7, 6 ; 4, 7, 7 Pliny the Elder, <i>H.N.</i> 12, 38; 13, 141	Tree with fruit like lupine fruit	a) Fruit similar to that of lupine b) Very fragrant flower	<i>Aegiceras majus</i> Gaertn. (= <i>A. corniculatum</i> (L.) Blanco)
	Pakistani-Iranian coast. Bahrain			Black mangrove (river mangrove)
4	Theophrastus, <i>H.P.</i> 4, 7, 2 Pliny the Elder, <i>H.N.</i> 12, 77 ;13, 139 ; 23, 72 Agatharchides of Cnidus in Photius, <i>Library</i> 450b; 456b; in Diodorus Siculus, 3, 19, 3; 3, 39, 2 Strabo, 16, 4, 18 Dioscoride, <i>De materie medica</i> 1, 105, 6 Oribase, <i>Coll. Med.</i> , 14, 62	Olive tree	a) Fruit similar to the olive or chesnut fruit b) Medicinal properties of juice and gum	<i>Avicennia officinalis</i> or <i>Rhizophora mucronata</i> (uncertain)
	Red Sea. Northern Somali coast.			
5	Theophrastus, <i>H.P.</i> , 4, 7, 2	Laurel tree	Leaf similar to that of holm oak (<i>Quercus ilex</i>)	<i>Avicennia officinalis</i> or <i>Av. Marina</i> ? (uncertain)
	Red Sea. Northern Somali coast.			

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