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Proving Widespread Deforestation of the Ancient Mediterranean as Myth: A Detailed Examination of How Anthropogenic Activities During Antiquity Affected the Mediterranean Landscape

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Proving Widespread Deforestation of the Ancient Mediterranean as Myth:
A Detailed Examination of How Anthropogenic Activities During Antiquity Affected the
Mediterranean Landscape

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Submitted in partial fulfillment of the requirements for graduation in the department of
Environmental Policy

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ABSTRACT

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This thesis examines the debate surrounding the possible deforestation of the ancient Mediterranean landscape through anthropogenic activities. Until the ancient Mediterranean landscape is understood more clearly, it is impossible to impose current beneficial land-use laws in order to conserve and preserve the future landscape of the region. Currently there are three predominant views surrounding the debate: (1) deforestation did occur and drastically altered the landscape from a forested region to a more desert-like region, (2) human activities did not cause deforestation, rather the Mediterranean has always been home to a distinct and resilient landscape that is able to regenerate following the cessation of these activities and (3) anthropogenic activities carried out in antiquity did not cause widespread deforestation due to the resilience of the vegetation however, areas that were exploited for a long period of time typically show signs of deforestation.

Taking into account these three prominent theories, the different forms of evidence used to generate them are evaluated in an effort to determine the validity of the theories. As well as, individual case studies are presented to validate the ultimate conclusion drawn, that widespread deforestation did not occur in the ancient Mediterranean; rather heavy deforestation was rare and confined to small areas such as those that supplied goods to large city centers.

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CHAPTER ONE: INTRODUCTION

For years, the Mediterranean landscape has puzzled scholars and scientists with its distinctive climate and vegetation that are extremely dissimilar to other ecosystems found around the world. It is so distinct, in fact, that only four other regions (California, Chile, parts of Australia and South Africa,) possess the same characteristics.¹ As Emma Underwood and her associates speculate, “The exceptional diversity in the Mediterranean biome is due largely to the number of rare and endemic plant species, which are often supported by unique climatic conditions.”² This distinct climate of the Mediterranean biome is characterized by cool, wet winters and hot, dry summers. Other things peculiar to the Mediterranean biome are its abundance of short woody shrubs and fire prone vegetation, as well as its high frequency of natural “disasters.”³ More than any other region of the world, the Mediterranean is prone to deluges, fires, earthquakes and other natural processes that can significantly alter the landscape over a short period of time. These distinct characteristics, coupled with the fact that the climate is too young for Mediterranean plants to have fully adapted to it, make it difficult to determine current land-use practices.⁴ Currently, one of the main issues scientists have in terms of analyzing future threats for the region is the general lack of information known about un-forested landscapes.⁵ As the following quote from Underwood et al. illustrates, this lack of knowledge hinders our ability to correctly preserve this unique region of the world.

¹ Jeff Corbin, Class lecture BIO 324, 10/11/13

² Underwood et al., *Threats and biodiversity in the Mediterranean biome*, 194

³ Jeff Corbin, Class lecture BIO 324, 10/11/13

⁴ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 361

⁵ Underwood et al., *Threats and biodiversity in the Mediterranean biome*, 194

“Without a deeper understanding than that afforded by current global-scale assessments, the effectiveness of conservation efforts to reduce the loss of biodiversity in the Mediterranean biome is likely to be limited.”⁶ Favorable conservation efforts that work in other regions are often of little use in the Mediterranean and may even cause harm to the uncommon ecosystem. To demonstrate this point, in their article Underwood, et al. write that “Modifications of natural fire regimes is promoting the invasion of alien plant species and altering successional trajectories of recovering plant communities in some Mediterranean regions.”⁷ A.T Grove and Oliver Rackham also advise current Mediterranean inhabitants to utilize the rough-land and natural features that are present for their “traditional uses” rather than how they are being treated now. Gorges, deltas and karsts are abused (and even some are being used for things such as rubbish dumps) because modern citizens do not appreciate their beauty and are unsure of how to treat these uncommon natural features.⁸ In order to generate beneficial land-use practices for the current Mediterranean it is essential that the landscape be properly examined and understood; something that has yet to be done.⁹

Unfortunately, understanding the past landscape of the Mediterranean is an extremely daunting task due to the lack of comparable landscapes, deficient evidence and scholars’ preconceived notions on the subject. For years it has been debated whether the Mediterranean has always been home to these uncommon landscape features or whether it has degraded over time because of human exploitation. To gain a better understanding

⁶ Underwood et al., *Threats and biodiversity in the Mediterranean biome*, 188-189

⁷ Underwood et al., *Threats and biodiversity in the Mediterranean biome*, 194

⁸ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 364

⁹ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 362

of the subject, scientists have been busying finding empirical evidence in the region and historians have used their knowledge of everyday life in antiquity to interpret this evidence. However, because we are no longer able to view the ancient Mediterranean landscape, interpretation of the evidence is often unique to each scholar. This results in a debate about the region that is split mainly into three different perspectives. The first viewpoint is that the Mediterranean has endured severe deforestation and is now very different from its original forested landscape. The second opposing position is that the Mediterranean has not been deforested by anthropogenic activities and some human activities were actually beneficial to the ancient landscape. The third perspective draws on points from the two previous viewpoints and lies somewhere in the middle of them. This idea is centered on the fact that widespread deforestation of the region did not occur; nevertheless certain parts such as city centers have been heavily deforested by the anthropogenic activities of antiquity. The following review of the current literature used in this paper is intended to help the reader understand these three main viewpoints more in depth.

Literature Review:

Those who believe deforestation drastically altered the Mediterranean from a forested region to a degraded desert often base their work around one central argument. This literature revolves around the fact that people in antiquity used the items found in their natural surroundings.¹⁰ The scholars then utilize ancient evidence to identify an unsustainable relationship between human and earth in the ancient Mediterranean that has left the region heavily deforested. In consensus with the other pro-deforestation literature,

¹⁰ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 173

J. Donald Hughes provides examples of regions in the ancient Mediterranean that have been severely deforested solely through anthropogenic activities. He states that inhabitants of the ancient Mediterranean cleared land for agriculture (often through fire,) used timber for fuel and wood for building, and allowed animals to graze freely. From this information, Hughes concludes that the ancient Mediterranean inhabitants frequently exploited their surroundings, especially those living in areas such as city centers.¹¹ In his first work, “How the Ancients Viewed Deforestation,” Hughes relies mostly on ancient works of art to defend this claim. He examines the work of ancient authors such as Vergil, Strabo and Theophrastus to gather information about things such as wood shortages, pastoralism, conservation laws and more.¹² In a later article, “Ancient Deforestation Revisited,” Hughes utilizes more empirical evidence to defend his conclusion, this time citing an anthracology study conducted by Jean-Louis Vernet and a palynology study by Henry Lamb.¹³ However, one downfall of Hughes’ scholarship is that he does not provide the reader with nearly enough empirical evidence to determine that widespread deforestation occurred. He heavily relies on ancient works to prove his point yet there is no way to validate the ideas in these works; his argument would be stronger if he provided the reader with more empirical evidence. He also imposes his findings from one area onto the entire Mediterranean region.¹⁴ In an area that is home to so many different micro-regions it is important to find evidence for each place individually rather than generalize one finding across them all.

¹¹ Hughes, *Ancient Deforestation Revisited*, 45

¹² Hughes, *How the Ancients Viewed Deforestation*, 437-443

¹³ Hughes, *Ancient Deforestation Revisited*, 47-52

¹⁴ Hughes, *Ancient Deforestation Revisited*, 49

Although many scholars accept this idea of an altered landscape, others challenge it. The literature stating that the Mediterranean has not been deforested is based around the notion that the landscape is filled with uncommon vegetation that is highly resilient to human activities and natural disasters. Grove and Rackham determine that the Mediterranean has always been a distinct region and anthropogenic activities had little effect on deforesting the ancient landscape. They open their book, *The Nature of Mediterranean Europe*, by stating the four strands of the Ruined Landscape Theory. The first strand is based on travelers who arrived to the areas and thought they were deforested because ancient painters and poets created false impressions in their works. The second strand of the theory is that floods are abnormal and that forests are the only way to prevent them from occurring. Scientists who believed trees increased the amount of rainfall that occurred create the third strand of the theory. And the fourth and final strand is based upon the idea that the islands of the Mediterranean must have incurred damage because Europeans that settled on islands more recently have altered those.¹⁵ Throughout their book, Grove and Rackham provide evidence and examples as to why this theory of Ruined Landscapes is not true and rather the idea that the Mediterranean has been deforested is a misconception created by people who are unfamiliar with any land that is not forested. To illustrate their point, the authors provide multiple examples of areas that were able to re-grow their original vegetation following the cessation of human activities. They also demonstrate that often places that are assumed to have once been forested have little evidence stating that they ever truly were. In *The Nature of Mediterranean Europe*, Grove and Rackham provide countless examples and lots of

¹⁵ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 8-9

empirical evidence in an effort to convince the reader that large-scale deforestation has not altered the landscape. The authors are careful to balance their own opinions with the evidence in order not to overpower their findings with interpreted theories. They spend a great deal of time working to disprove other theories that are currently offered about the ancient Mediterranean. This is a great tactic on their part because after learning about the contradictory evidence the reader is left unsure whether the original is true. However, this also presents a downfall for Grove and Rackham as they are often more concentrated on disproving current theories rather than searching for new evidence that could uncover information about other regions or other activities.

Other authors draw a conclusion that lands somewhere in the middle of these two viewpoints. This literature draws on points from both of the previous opinions, such as believing that the ecosystem is extremely resilient yet certain places, like city centers, were heavily used to the extent that the landscape is unable to re-grow. W.V. Harris, Peregrine Horden and Nicholas Purcell all hold the belief that large-scale deforestation caused by anthropogenic activities was uncommon in antiquity. Harris states that “Classical Greek deforestation, in a weak sense of the term (land clearance, with some trees left behind) was widespread, but in a strong sense of the term it was probably restricted to Attica and the immediate supply area of a few other cities.”¹⁶ In his paper, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, Harris uses empirical evidence from pollen samples and alluvial sedimentation to conclude that, while ancient Mediterranean societies often practiced sustainable relationships, in areas where they did not, deforestation occurred. He illustrates this best when discussing wood

¹⁶ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 194

and timber use by the Romans. He states that although there was a considerable demand for it, things such as woodland management laws and effective distribution systems kept the Romans from running out of wood or heavily deforesting the area. However, the areas surrounding the Roman Empire that often supplied the area with wood were most likely deforested.¹⁷ Harris also strongly argues that there is simply not enough information on the subject as of now to make a definitive conclusion. He ends by saying that more work on the subject should be conducted as well as scientists and historians need to work together more closely to come up with clear definitions and a larger amount of verified sources.¹⁸

In their book, *The Corrupting Sea*, Horden and Purcell examine four regions in the ancient Mediterranean. Their book does not exclusively focus on how the ancient landscape was affected by anthropogenic activities but they do conclude that the region has not changed greatly since antiquity.¹⁹ They also go on to state that some areas of minor deforestation were “seen as a ‘good thing’ because it improved the landscape for agriculture.”²⁰ Horden and Purcell state that the Mediterranean can either be looked at in terms of an interactionist or an ecologizing approach.²¹ They highlight the fact that the Mediterranean is composed of small micro-regions and scholars who only study these small regions or only study the Mediterranean in its entirety often miss critical pieces of information. They emphasize that the Mediterranean is a region of small micro-regions all interconnected to form one distinct region and therefore the Mediterranean must be

¹⁷ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 173

¹⁸ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 193-194

¹⁹ Horden and Purcell, *The Corrupting Sea*, 28

²⁰ Hughes, *Ancient Deforestation Revisited*, 45

²¹ Horden and Purcell, *The Corrupting Sea*, 2

studied that way. Horden and Purcell agree with Harris that more information needs to be gathered and that scientists and historians need to work more closely together. They warn that a scholar should not rely solely on historical information or solely on ecological information rather they must be analyzed together in order to draw accurate conclusions.²²

All three of these perspectives surrounding the ancient Mediterranean landscape provide essential pieces to the unsolved puzzle. However, the research I have conducted on the subject most similarly relates to that presented by Harris. The following chapters will outline my views on the ancient Mediterranean landscape from the Neolithic era to the Iron Age. To begin I will evaluate the types of evidence that are used for the subject, examining the pro's and con's that are often associated with each of them. Following that I will take a more localized approach in order to analyze empirical evidence to support my theory that widespread deforestation of the ancient Mediterranean did not occur due to anthropogenic activities; rather heavy deforestation was rare and confined to small areas, especially those that provided goods to large cities. Without additional evidence it is difficult to reach a definitive conclusion about the ancient Mediterranean landscape but analyzing current information will hopefully provide a tentative background that can be used to determine beneficial conservation and preservation techniques for such a unique area.

²² Horden and Purcell, *The Corrupting Sea*, 47

CHAPTER TWO: EVALUATION OF EVIDENCE

Determining what the pre-Neolithic Mediterranean landscape looked like is a daunting and complicated task. Without solid evidence and with few similar climates to compare it to, it is almost impossible. Nevertheless, this has not stopped historians and scientists who have been working for centuries to determine whether the Mediterranean has become deforested over time. As I mentioned earlier, the puzzling Mediterranean region is particularly difficult to piece back together because of its diverse nature. No two areas share similar traits. This makes it impossible to generalize findings across the region and often evidence found in one area, can only determine the landscape present in that particular area. As a result, the existing evidence on the Mediterranean is segregated and few places present detailed accounts. The pre-Neolithic landscape of the region is still largely unknown as scholars are constantly searching for new evidence. They rely on four main types of evidence to gather this information and draw theoretical conclusions. Ancient art and literature allow insight into past Mediterranean landscapes and often illustrate ancient laws that determined day-to-day woodland management techniques. Palynology, (pollen analysis,) anthracology (charcoal analysis,) and erosion are more scientific forms of evidence compared to ancient art and literature. These three forms of evidence leave sediment in certain areas and are then excavated and studied further in order to determine what landscape was once present in the area.²³

Prior to beginning the evidence section, I would like to inform the reader that there are many smaller types of evidence, (hydrology, soil studies, ice cores, et cetera)

²³ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 11

employed to determine the ancient Mediterranean landscape as well.²⁴ In this chapter I am choosing to concentrate on ancient works of art, palynology, anthracology and erosion because to date, they are the most widely used and most conclusive. Scholars will sometimes use other forms of evidence to justify a small part of their theory or such but generally, these other forms of evidence are tentative and cannot be used to validate an entire theory. One common form of evidence I chose not to include in this section is computer modeling. Computer models are utilized to create “vegetation maps” that depict hypothetical vegetation patterns of the ancient Mediterranean landscape.²⁵ These computers models are constructed using the evidence collected through palynology, anthracology and erosion evidence though and are frequently deemed unusable because their predictions are based upon problematic evidence and their generalized conclusions are theoretical.²⁶ Therefore, I chose to not include computer models and rather focus this chapter on the three forms of evidence that are used to construct them. In the following section, I will elaborate more on each of the four forms of evidence and provide case studies that illustrate how the specific evidence is utilized today to help determine pre-Neolithic Mediterranean landscape patterns.

Ancient Art & Literature

When using works of art as evidence to determine the past Mediterranean landscape, scholars frequently use ambiguous words that have multiple meanings, especially across different languages. For the ancient Mediterranean this most often

²⁴ Hughes, *Ancient Deforestation Revisited*, 55

²⁵ Hughes, *Ancient Deforestation Revisited*, 53

²⁶ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 193

becomes an issue with words such as deforestation, desertification and forest that have multiple different meanings but are regularly compared across works as meaning the same thing.²⁷ Therefore, it is vital that prior to using an ambiguous word such as one of these to describe past Mediterranean vegetation, the author clearly define his or her interpretation of the word. In the following paragraph I will exemplify the importance of defining words by using the word “deforestation” as an example.

Authors Harris, Hughes and Grove and Rackham all use the exact same word, “deforestation,” throughout their literature but none uses the same definitions. Out of the three authors, Grove and Rackham provide the most lenient definition for deforestation. They state, “degraded land is often rich in animal and plant life, strikingly beautiful, loved and valued as an amenity by its inhabitants...”²⁸ Thus, implying that deforested land not only is able to grow back but also that change in vegetation is not necessarily a bad thing. For the most part, Harris agrees with Grove and Rackham’s definition of deforestation as he states it is a manmade occurrence shaped by man clearing the land for farming and such. He believes natural events such as flooding or natural forest fires do not cause deforestation and only an area that has been permanently cleared with no re-growth occurring can be described as deforested.²⁹ Hughes on the other hand, has an opposing view, using deforestation to describe an alteration of vegetation from the original. He uses deforestation to describe any area in the Mediterranean that is lacking a lush forest.³⁰ Unlike Harris, Grove and Rackham, Hughes believes even an area

²⁷ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 175

²⁸ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 16

²⁹ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 175

³⁰ Hughes, *Ancient Deforestation Revisited*, 45

experiencing re-growth or an area that has been filled in by alternative vegetation has still been deforested.³¹

Problems with definitions, such as this one, can be seen throughout ancient work as well. Over time, many words meanings have been slightly altered as well as language barriers create problems. For example, Medieval and early-modern Spanish writers use the word “monte” to describe all natural land even though it technically is translated as mountain. This preceding example illustrates how easy it is to incorrectly interpret an ancient landscape. Ambiguous words create problems when trying to decipher an ancient text and determining whether the area was filled with forest, maquis, savannah or actual mountains. It also demonstrates how critical it is that scholars try and determine the message the original authors were trying to convey rather than simply interpreting the word to align with their own modern day views.³² As one scholar writes, “It is, quite simply, important to tease out the full meaning, within the context of the culture which produced it, of any text which survives. So there will always be a need for those specialist linguists who revel in the dissection of ancient texts.”³³

In significant ancient texts that are read today, there is little written about the scenery Greeks often focused more on the politics and philosophy in these books. Even writings done by the Romans, who were more concentrated on describing the scenery, often added fictional elements to the landscape in order to make the texts more appealing. Many wrote about places to which they had never traveled or described false magical lands. One Roman author, (among many others) Aelian, constantly created works of art

³¹ Hughes, *Ancient Deforestation Revisited*, 45

³² Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 18

³³ Freeman, *Egypt, Greece and Rome: Civilizations of the Ancient Mediterranean*, 7

that contained both fact and fiction thus making it extremely hard to determine what is true and what is not true, when read centuries later. Grove and Rackham warn against confusing what people have said about the landscape with what really is the history of the landscape. Often travelers who stumbled on more arid parts of the Mediterranean automatically assumed deforestation based upon fictional works of literature that described the area as heavily wooded. These travelers would then return home and make false statements claiming that the land had been altered to a worsened state.³⁴

The issues that plague these larger, better-published texts are generally avoided in smaller ancient works of literature such as letters and journal entries. This literature is often extremely helpful to scholars as it allows them to peek into the past and see how the civilians treated the Mediterranean landscape day-to-day. There is generally little fiction in these works and it often allows modern day scholars to learn more about daily life and woodland management techniques that may have not seemed important enough to be written about in a larger text. For instance, on the small island of Chios, stone tablets with writings of farm leases and woodland management techniques have been found. Finding ancient laws written out, such as the one about coppicing, can also provide insight as to what timber techniques were present during the time.³⁵ Other tablets found near the Italian coast outlining farm leases describe the land as very similar to the land found in the area today with almost no changes.³⁶ It is small entries such as the following written by Varro that truly provide insight into Roman farming and the knowledge of the

³⁴ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 8

³⁵ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 169

³⁶ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 172-173

different trees the Roman civilians had. Varo writes that an elm is best for planting because it yields the largest baskets of grapes, provides the best food for sheep and cattle and is excellent for other household needs such as firewood.³⁷ From writings such as these, Harris concludes that although Roman estate-owners cut down many trees for timber, they also realized the benefit of trees and therefore often re-planted and took care of their land for profit.³⁸ While it can be dangerous to rely on larger pieces of text that are potentially fiction, small writings such as these, can provide a great amount of helpful information. Along with scientific evidence they can be used to piece together if and why the landscape has changed.

Ancient works of art can also assist scholars in determining the landscape of the classical Mediterranean. Although ancient works of art do not suffer from the linguistic issues that are linked to ancient literature, they do often depict inaccurate landscapes. Lack of ability to travel coupled with prior idealized visions of the lands often cause painters to produce unreliable works of art.³⁹ The following instance illustrates a possible issue with the painter exaggerating what plants were present in his specific area. Joachim Schouw and Orazio Comes both studied ancient wall paintings found in Pompeii to determine the vegetation that was present in ancient Pompeii. They were surprised to find that although many plants depicted in the paintings are currently found in Pompeii, some were either unidentifiable or derived from other regions.⁴⁰ Schouw found at least three plants, including the lotus, the Egyptian bean and the date palm, in these ancient Pompeii

³⁷ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 191

³⁸ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 192

³⁹ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 8

⁴⁰ Jashemski and Meyer, *The Natural History of Pompeii*, 80

paintings. However, these plants were actually grown by the Nile River and not found in Pompeii thus, demonstrating the liberty that ancient artists often took to exaggerate or falsify their paintings.⁴¹ Scholars must also be mindful that often ancient works of art were symbolic. Certain plants were used as symbols to represent certain things such as spirits and thus were painted more frequently in works of art than they really occurred.⁴² Art was also often used as propaganda and depicted an inaccurate scene. For example the emperor Augustus created a grand public building to demonstrate that he was a restorer and not a destroyer.⁴³ Works of art often depicted scenes that were grander than life really was.

Charles Freeman reminds us that “the art of any period is a creation of specific historical and cultural forces in that period, and above all reflects the needs of the audiences.”⁴⁴ It is important that a scholar analyzing these ancient works keeps in mind that some are exaggerated or distorted to attract a larger audience and thus, are a misrepresentation of the actual ancient landscape. In many houses, remains of wall paintings depict scenes of houses with ponds, gardens and different species of trees.⁴⁵ Similar to ancient literature, it is small works of art such as these that are probably not as exaggerated as some of the larger pieces in more prominent households. This art, coupled with scientific evidence, can help scholars discover what certain areas looked like during ancient times and what vegetation has remained over time.

⁴¹ Jashemski and Meyer, *The Natural History of Pompeii*, 81

⁴² Jashemski and Meyer, *The Natural History of Pompeii*, 80

⁴³ Freeman, *Egypt, Greece and Rome: Civilizations of the Ancient Mediterranean*, 12

⁴⁴ Freeman, *Egypt, Greece and Rome: Civilizations of the Ancient Mediterranean*, 12

⁴⁵ Freeman, *Egypt, Greece and Rome: Civilizations of the Ancient Mediterranean*, 90

Now that the reader properly understands how wording, idealized images and inference can alter a scholars view of the ancient Mediterranean I will move on to discuss the more scientific forms of evidence used to re-create the image of the ancient Mediterranean landscape.

Palynology: Pollen Analysis

Palynology, the analysis of pollen samples, is one of the most frequently used forms of evidence to determine the past landscape of the Mediterranean. With the help of radiocarbon dating, samples of preserved pollen are extracted from waterlogged places and examined to help determine prior vegetation patterns in the Mediterranean. Every spring, trees that are pollinated by wind, release their pollen and it falls to the ground. In damp areas, this pollen is integrated into layers of peat and mud.⁴⁶ This natural process ensures the pollen stays moist underground until palynologists drill cores out of the site years or even decades later. Pollen that has been kept wet and contains enough organic matter can then be analyzed under a microscope to determine which specie it derived from. Coupled with radiocarbon dating this allows palynologists to determine the relative quantity of each tree species present at specific sites over a long period of time.⁴⁷

This utilization of pollen cores has allowed palynologists to conclude that during the first half of the Holocene, evergreens were local trees. This is significant because evergreens are perceived today as typical vegetation for the entire Mediterranean region. On the other hand, during the first half of the Holocene the majority of the pollen

⁴⁶ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 151

⁴⁷ Hughes, *Ancient Deforestation Revisited*, 49

originated from deciduous trees. This has also changed as now as deciduous trees are often only found in specific habitats. Trees such as alder, ash and birch that were once commonplace in southern Europe now are generally found only in northern Europe. Information such as this can aid palynologists in deciphering what pre-Neolithic Mediterranean vegetation looked like. As demonstrated by the above case, pollen samples are able to provide evidence as to what trees were once present in a specific area and if they have altered over time. Along with other forms of evidence, pollen samples are occasionally able to determine what human or natural activities caused the disappearance of certain species as well as, what woodland management techniques increased the frequency of others. However, as I will discuss in the following two paragraphs, palynology does have issues with reliability and extrapolation.⁴⁸

To begin, there are quite a few issues pertaining to finding enough useable pollen cores. Very few sites in the Mediterranean contain reliable and well-preserved pollen cores due to the fact that the Mediterranean, similar to other semi-arid environments, is deficient in the acidic soils, bogs and lakes that are necessary for pollen preservation.⁴⁹ The sites that *do* contain useable pollen cores are generally areas of less importance and are widely strewn across the Mediterranean and especially northern Europe, making it almost impossible to generalize findings upon a larger area.⁵⁰ This lack of examinable

⁴⁸ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 144

⁴⁹ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 151

⁵⁰ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 183

pollen samples often leads palynologists and others to believe that vegetation in the ancient Mediterranean was less than it really was.⁵¹

Another issue with finding enough pollen samples to analyze and is that Mediterranean trees are generally pollinated differently. This creates a problem when looking for pollen samples because trees and shrubs that are pollinated by insects (as much of the Mediterranean tree species are) are more precise in their pollination.⁵² Tree species that are pollinated through wind are more likely to leave excess pollen on the ground to turn into pollen cores later. Also different wind speed, strength and occurrence can affect how far the pollen traveled to reach its present resting ground.⁵³ Insect pollination as well as wind dissimilarity creates an issue for palynologists because finding an area that holds mostly grass pollen does not mean that the whole area was grassy, rather it means the pollen sample could have been from a grassy wet-land area but the surrounding area was forest.⁵⁴ An example that displays this is in a forest containing 80 percent oak and 20 percent asphodel steppe, the steppe would not be correctly accounted for because the shrubs lack of height restricts its pollen from traveling far distances as well as it is insect pollinated, thus leaving little excess pollen behind.⁵⁵ In addition, trees were most likely rooted near the damper areas where pollen is found. These factors may lead palynologists to believe that there was more forest and less open ground or areas

⁵¹ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 151

⁵² Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 151

⁵³ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 183

⁵⁴ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 153

⁵⁵ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 157

filled with steppe.⁵⁶ In the Mediterranean where much of the land is presumably made up of steppe this could create a largely incorrect pollen record.

The second group of issues is dependent upon the palynologists that analyze the cores themselves. The Mediterranean is comprised of many different plant populations; it houses forest, maquis, phrygana (under shrubs), steppe (herbs), a multitude of grasses and more. For palynologists this poses a challenge because often pollen samples are indistinguishable between similar species.⁵⁷ Trees and shrubs also occasionally emit indistinguishable pollen, which makes it difficult to determine whether the site was filled with a tall forest or a series of small shrubs.⁵⁸ It is important that palynologists account for this lack of distinction rather than interpreting the data to match their prior views. This can be especially dangerous when dealing with an unfinished pollen record because palynologists risk creating a false image based on their views, even if they do not mean to. For instance, a palynologist from North America might assume that the pollen was derived from a large forest rather than an area with only small shrubs and bushes because that is what he is used to seeing on a daily basis.⁵⁹ Although this may be unintentional, it nevertheless creates a false form of evidence.

Harris states that in late antiquity, Spain and places along the Catalan coast suffered a sharp decline in the amount of total tree pollen present. From this collected

⁵⁶ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 157

⁵⁷ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 153

⁵⁸ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 151

⁵⁹ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 152

pollen information he concludes that during the period of 500-700 CE erosion occurred.⁶⁰ The loss of woodland (demonstrated by the decline of pollen samples) created erosion in the area. The question however, is what caused the decline of tree pollen? Based upon the research of other colleagues Harris states that it could be connected to an increase in animal grazing.⁶¹ Animals such as goats are harmful to vegetation because when trees are only saplings and still small they feed on them, thus stunting the trees' growth and often inhibiting them from growing. A sudden increase in the amount of goats present or a new lack of monitored grazing could have extreme consequences on young forests.⁶² He also discusses pollen evidence that reveals it could also be associated with farming changes. In Puglia, along the South Italian coast, pollen cores have provided evidence that during this time period olive tree abundance increased while other tree pollen decreased implying that farmers were planting olive trees and cutting down other trees.⁶³

Like many palynological case studies, this case is beneficial because it provides evidence as to what trees were once present in the area and how that changed over time. It demonstrates that from 500-700 CE total tree pollen deposition was reduced in Spain and in places along the Catalan coast. It also provides evidence that there was an increase in olive trees in Puglia.⁶⁴ This is important information to know and can aid in determining prior Mediterranean landscape. But as with many palynology cases, the conclusion drawn from the case has been extrapolated in the following ways. To begin, the only facts are that tree pollen was reduced in the area and that erosion also occurred

⁶⁰ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 185

⁶¹ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 185

⁶² Hughes, *Ancient Deforestation Revisited*, 52

⁶³ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 185

⁶⁴ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 185

in the same area. Harris, along with other scholars, assumes that the decline in tree pollen was caused by human actions such as a lack of monitored grazing by goats.⁶⁵ There is no decisive evidence that the lack of pollen was caused intentionally (or unintentionally) by humans. The lack of evidence proving why tree pollen decreased creates an ambiguous question, nevertheless it is critical that Harris does not fill this gap with fictitious information, like he did. It is also important not to rely on information from other places around the Mediterranean because the Mediterranean is extremely diverse and often things that occur in one area do not occur in another.⁶⁶ In addition, it is important not to build an argument based on assumptions; it is uncertain whether goats and other herbivores truly were harmful to vegetation growth. While it is generally assumed by most that herbivores limited forest regeneration, some scholars still dispute the harmful label they have been given especially in a place as distinct as the Mediterranean, due to their ability to control forest growth and reduce the risk of wildfires.⁶⁷ One scholar even states that “Indigenous fauna of large herbivores is essential for the regeneration of the characteristic trees and shrubs of Europe.”⁶⁸ Second, Harris states that the lack of tree pollen is associated with the erosion that occurred.⁶⁹ This is most likely due to the fact that vegetation holds soil in place and a lack of vegetation therefore promotes more intense erosion. But what Harris assumes is that a lack of tree pollen signifies a lack of vegetation at the site. This assumption is hazardous because a lack of pollen does not

⁶⁵ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 185

⁶⁶ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 11

⁶⁷ Hughes, *Capitalism, Nature, Socialism*, 146

⁶⁸ Mitchell, *How Open Were European Primeval Forests? Hypothesis Testing Using Palaeoecological Data*, 169

⁶⁹ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 185

necessarily indicate a lack of trees rather there could be other vegetation present at the site as well as a lot of pollen could have easily disintegrated over time or was declared unusable due to its poor condition.⁷⁰ The erosion could have been caused by a natural incident such as a flood.

This case demonstrates perfectly why palynological evidence is often looked upon as unreliable. It is critical that palynologists and others simply use the pollen cores they excavate simply as statistics to determine tree abundance and specie locale. With the correct pieces of information it is possible to use palynological evidence and other sources to determine why certain vegetation patterns have changed but it is essential that further research be done in this area as well as others to determine these associations as well as information should not be generalized across places where no pollen samples are available.

Anthracology: Charcoal analysis

Anthracology is another form of evidence, similar to palynology, used to improve re-creation theories about past Mediterranean vegetation patterns. It is the examination of charcoal fragments found at ancient archeological site. Charcoal analysis is conducted by analyzing charred wood under a microscope to conclude what species the charcoal sample derived from.⁷¹ This is valuable information as it can help clarify which trees and

⁷⁰ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 169

⁷¹ Hughes, *Ancient Deforestation Revisited*, 47

shrubs were present at the site during certain times and how they have potentially changed over time.⁷²

As the following case will demonstrate, the application of charcoal samples to determine the ancient Mediterranean landscape is very similar to the application of pollen samples discussed in the previous paragraphs. Through the examination of charcoal samples, scientists have been able to conclude how the vegetation in the south of France dramatically changed throughout the Neolithic era. Charcoal samples provide evidence that the once lush forests began to decline during this period, being replaced by coppice-woods or savanna. It is clear that by the third millennium BC most of the forest was gone and steppe, phrygana and savanna became the new norm. A decline in charcoal samples originating from oak indicate that this species lessened while an increase in charcoal samples deriving from evergreen oak provide evidence that this specie became much more abundant in the area.⁷³ This case exhibits the importance of anthracology and how it is applied to determine vegetation variations over time in the Mediterranean. Often charcoal samples come from the same cores as pollen samples but in the arid Mediterranean charcoal samples are much more abundant than pollen samples because they do not need to be kept wet. This consequently reduces the amount of extrapolation that occurs when using them as a source of evidence.⁷⁴ They also reflect more areas of

⁷² Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 154

⁷³ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 162

⁷⁴ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 154

the Mediterranean because cores can be drilled from many more common places.⁷⁵ And charcoal will be found in virtually any human occupation because wood was used as fuel. Carbon sample analysis provides evidence that reveals past vegetation patterns, climate and fires.⁷⁶ Anthracology can also bring to light past woodland management techniques and human activities that potentially altered the landscape.⁷⁷ Similar to employing pollen analysis though, it is imperative that scientists and scholars do not extrapolate when relying on charcoal samples as evidence. The following case study will reveal how when used correctly charcoal analysis can provide wonderful evidence in the ancient Mediterranean landscape puzzle but why it is not okay to generate conclusions based on assumptions.

In one of his articles Hughes cites a case study conducted by Lucie Chabal and Fanette Laubenheimer that examines charcoal samples found at a site near Narbonne during the Roman Empire. The site was close to the water, and had plenty of wood and clay that was used to produce pottery during this time. So far, charcoal samples from 25 different tree species have been discovered at the site.⁷⁸ Charcoal analysis provides evidence that at this site there were three periods in which certain tree species were burnt more than others. During the first period, deciduous white oak, alder ash and elm were burned the most, decreasing the abundance of these species. The second period favored deciduous oaks and third period favored holm, holly oak and evergreen. Using this information, Chabal and Laubenheimer conclude that certain trees were favored over

⁷⁵ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 154

⁷⁶ Whitlock and Larsen, *Tracking Environmental Change Using Lake Sediments*, 1

⁷⁷ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 154

⁷⁸ Hughes, *Ancient Deforestation Revisited*, 48

shrubs and more specifically certain trees were favored over others. They also conclude that during the first period “the destruction of the low-lying forest along the riversides” occurred because that is where the preferred trees were from.⁷⁹ In the second period “the potters exploited a deciduous oak forest beyond the plains, where the removal of that dominant species favored its replacement by evergreen oak”⁸⁰ For the third period they conclude “...where evidence shows replacement of deciduous oaks by evergreen oaks, it is reasonable to suspect anthropogenic disturbance of the local forest ecosystem.”⁸¹ They then go on to explain how a case from southern Syria shows that over time evergreen oak took over and pushed out deciduous oak, which can now only be found in confined places in Syria.⁸²

Studies such as these that utilize charcoal samples are essential to determine what the ancient Mediterranean used to look like. This case study illustrated how a multitude of tree species were present at the site near Narbonne and additionally it provided evidence as to what tree species remained in the area and which declined over time. Without charcoal evidence the ancient vegetation at this site would still be unknown. With that being said, Chabal and Laubenheimer construct their final conclusions based upon broad assumptions. To begin they state that in period one there was “destruction” and in period two “exploitation” occurred.⁸³ One of the most common mistakes that haunts authors is excessive enthusiasm in wanting to fill in the missing gaps that explain

⁷⁹ Hughes, *Ancient Deforestation Revisited*, 48

⁸⁰ Hughes, *Ancient Deforestation Revisited*, 49

⁸¹ Hughes, *Ancient Deforestation Revisited*, 49

⁸² Hughes, *Ancient Deforestation Revisited*, 49

⁸³ Hughes, *Ancient Deforestation Revisited*, 48-49

the decline of certain charcoal deposits rather than simply reporting statistics.⁸⁴ Although the forests near Narbonne could have been destroyed or exploited during this time period there is no evidence to prove that this transpired. It is most likely that the authors associated the decline in charcoal deposits from certain species as deforestation or exploitation because today the burning wood is often linked with these words. It is also important to recall that “scarcity of charcoal does not prove lack of trees.”⁸⁵ This decline of charred wood from certain species could simply be due to a change in wood preference over time. Chabal and Laubenheimer assume that the potters irresponsibly burned each species until it disappeared and then moved on to a different one. It is not implausible however, that preference changed over time or that woodland management techniques, similar to ones employed in Greece, were used to preserve species once they reached certain numbers.⁸⁶ Therefore careful planning and preservation strategies rather than a depletion of trees explains the lack of charred remains. And if this decline in forest did happen, nature has not been ruled out. Natural events such as a change in the climate, rainfall variation or even flooding could greatly alter a species’ abundance. Finally to conclude their study, Chabal and Laubenheimer draw on another case study conducted in Syria to defend their conclusion that anthropogenic disturbances caused the change from deciduous oak to evergreen oak. They state that in Syria evergreen oak seized the area deciduous oak once occupied due to anthropogenic disturbances but they do not provide

⁸⁴ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 169

⁸⁵ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 169

⁸⁶ Hughes, *Ancient Deforestation Revisited*, 48-49

evidence as to how they know this.⁸⁷ Without evidence that the prior statement is true, they then continue to use it to explain why the same must have happened at this particular site near Narbonne. To generalize across the Mediterranean like this becomes very dangerous. The Mediterranean is exceptionally diverse and frequently plants are local to distinct areas with special climates making it difficult to utilize a case study from Syria to explain something that has happened in southern France.⁸⁸ Also the anthropogenic activities that happen in the Mediterranean may very well be confined to those areas and therefore cannot be imposed onto other areas. As Grove and Rackham state, “Human tribes and cultures of extraordinary diversity have created different cultural landscapes out of apparently similar environments.”⁸⁹

As demonstrated by the preceding case study anthracology is not a perfect form of evidence. Certain trees are more likely to provide charcoal evidence based on their ability to carbonize better. Furthermore, certain species grow more frequently and certain species were used more frequently therefore creating an illusion that certain tree species were more prevalent than reality. Charcoal samples are also often found in unidentifiable pieces and similar to pollen samples it is difficult to determine whether the samples came from a forested area or a maquis.⁹⁰ But anthracology if applied correctly can be a wonderful form of evidence that provides scientists and scholars with new information each time more cores are analyzed.

⁸⁷ Hughes, *Ancient Deforestation Revisited*, 49

⁸⁸ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 11

⁸⁹ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 11

⁹⁰ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 154

Erosion:

On the southern coast of Crete resides an exposed limestone plateau called Sphakia. The once flourishing area, 600-700 meters in altitude, is now vacant of all vegetation. It is believed that after the inhabitants ploughed the soil for agricultural reasons, climatic conditions stripped the surface leaving the limestone beneath uncovered. "Crete, which was once one of the most fertile and prosperous islands in the Mediterranean, is now one of the rockiest and most barren."⁹¹ Examples such as these, illustrating fertile Mediterranean areas turned inhospitable by means of erosion, are used to defend archeologists' and scholars' arguments that the Mediterranean has been transformed through human induced erosion from a previously lush forested region to a bare wasteland. However, archeologists and scholars should be cautious when establishing a universal Mediterranean theory of desertification on a small number of erosion examples, such as this one.⁹²

To begin this section on erosion as tool of evidence, it must first be established that erosion is a natural process that occurs around the world. It transpired prior to humans settling on earth, and still occurs today in places that are not accessible to humans and have not been altered by mankind.⁹³ Therefore it must be remembered during this section that similar to a lack of charcoal or pollen samples, proof that erosion has occurred in a region does not necessarily mean it was either harmful or the affect of

⁹¹ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 241

⁹² Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 261

⁹³ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 288-289

human activity. This distinction allows archeologists and scholars to determine whether erosion in the Mediterranean has altered the landscape and moved the region towards a more “deserted” version of itself, as is true in the example illustrated by Crete, or whether the lack of forested areas in the Mediterranean is natural. One of the larger dangers of exaggerating artificial erosion in the Mediterranean is implementing incorrect woodland management techniques today. If civilians of the past are blamed for destroying a lush forested region that never existed, or was changed by natural forces, it will be impossible for forest management to put into practice rules that will allow the Mediterranean vegetation to prosper in the present day. Thus, the Ruined Landscape theory employed by Grove and Rackham splits erosion into two categories; natural erosion, which is created through natural processes, and accelerated erosion, which is caused by human activity. They argue that natural erosion, often caused by weather, soil consistency or tectonics, is not harmful to the environment, and does not require trees to retain the soil during these events. Any form of vegetation, including maquis, grassland, felled forest and even moss, protects against wind erosion as it provides a barrier. What *is* harmful, are human activities, such as ploughing, that eradicate all vegetation and leave the land bare and exposed.⁹⁴ This allows wind and rain to remove the soil easily. Scholars that simply believe all erosion in the Mediterranean originated from human activities also often assume that all the sedimentation in the Mediterranean region is from the Neolithic period on without any accurate scientific evidence.⁹⁵ They over exaggerate the amount of land cleared by humans and determine that areas with no trees have been eroded.

⁹⁴ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 288-289

⁹⁵ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 186

As a result, it is essential that archeologists work to find this proof so they are able to support their theories. There are a few different methods archeologists can use to determine if an area has been eroded. They are often able to work backwards utilizing dateable ancient objects to determine how much erosion has occurred since the object was originally built and comparing it to where the soil level currently is. However, the most popular and widely used source of evidence to determine if erosion occurred is sediment. Archeologists study sediment at the bottom of slopes or valley floors to determine the amount of eroded sediment that was deposited to the site. To determine rates of erosion today, scientists often study plots in which they adjust treatments to mimic past events, such as ploughing with no vegetation, terracing, et cetera. While all of these methods provide insight into the past Mediterranean landscape, it is important to detect their flaws as well.⁹⁶

As with all forms of scientific evidence though, there are issues. There are quite a few problems with using sedimentation as a kind of evidence. For one, as I mentioned above, the chronology of sedimentation from the Mediterranean is deficient yet it is still used as solid evidence by many to defend theories of erosion.⁹⁷ Another problem with sedimentation is that erosion types such as gullying, sidecutting, marine and karst generally do not remove the essential layer of topsoil yet geologists often measure the total deposited sediment and label it all as topsoil lost.⁹⁸ Deluges, which are frequent in the region, are generally thought of as the main source of Mediterranean erosion as

⁹⁶ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 288-289

⁹⁷ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 186

⁹⁸ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 254

shown by the following example in Italy. A geologist measured erosion rates on a small hilly area in Italy from 1981-1988. During this time there was little difference in erosion observed between the plots that were cultivated at three different depths and the one that had no tillage. Generally the erosion rates were between 0.04 and 0.08 mm but when a deluge occurred all the erosion rates increased. This is demonstrated by the years 1984-1985 when an excess amount of rain fell and erosion rates increased by two and a half times the normal rain years. Although it is most likely safe to conclude that when deluges were coupled with cleared agricultural land erosion occurred, it is difficult to determine whether pure natural events caused the erosion in a certain area during the Neolithic era due to a lack of chronological climate information. This creates a problem in places where it is clear erosion happened over time but if it was human induced or natural we will not know. This idea of natural erosion also creates an issue with experiments being carried out today that either mimic past erosion or that simply are being used to determine erosion rates for a specific area. Because weather is so unpredictable, these case studies must be examined on a much longer time scale than that currently used. Studying a plot for 10, or even 20 years, is not a long enough period to determine how much erosion has occurred with the fluctuating weather in the Mediterranean; especially if the case study is mimicking past erosion, which has been measured on a timescale of thousands of years.⁹⁹

One of the main forms of evidence used to argue the Mediterranean landscape has shifted towards “desertification” through manmade erosion is a “badland.” Badlands are extremely rare regions of natural bare landscape found dotting the Mediterranean in

⁹⁹ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 261

between the other landscape. As Grove and Rackham explain, “They are held up as land ‘degraded’ by human activities – the end of a sequence of deforestation, browsing and cultivation which has ‘desertified’ a once normal landscape and will intrude further on the ordinary world.”¹⁰⁰ Scholars generally use them as a form of evidence to conclude that human induced erosion has altered the Mediterranean landscape over time. This is rather incorrect though as badlands are unique regions and should be treated this way. They commonly reside in a weak area with an active uplift and were formed through fault movements. Therefore, it is inaccurate to deduce that human activities such as agricultural clearing produced them and they should not be used as a form of evidence for the process of erosion altering the Mediterranean landscape.¹⁰¹

Overall the idea of using erosion as a form of evidence to determine pre-Neolithic Mediterranean landscape sounds alright but in reality it can be quite unreliable and can create many false conclusions. Because this paper is mostly focused on how the Mediterranean landscape has changed since pre-Neolithic times due to anthropogenic activities, it is difficult to determine whether erosion that has occurred would have happened in a normal progression or if it was solely caused by humans. Based on the short timescale of the erosion simulations happening now and the lack of accurate measurements across the Mediterranean it is difficult to utilize erosion as a form of evidence for the ancient Mediterranean landscape.¹⁰² Employed with other forms of evidence such as climate models, literature pieces, et cetera it will be possible to

¹⁰⁰ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 271

¹⁰¹ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 271-274

¹⁰² Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 267

determine what occurred in some regions but should be used with extreme caution to avoid stating a theory rather than a fact.

As the preceding chapter highlights, there are three predominant issues surrounding ancient Mediterranean evidence. The first is that there is simply not enough evidence to draw conclusive arguments. In such a diverse area it is imperative that scholars continue searching for new evidence, especially focusing on novel locations. The second issue is the lack of validity the current technology provides. Technological advancements for evidence forms such as palynology and anthracology would greatly increase the validity of ancient core samples. The third and final issue deals with modern day scholars' interpretations; whether accidentally or purposefully scholars often impose their own biased views onto antiquity creating false theories based upon their own personal interpretations. Often these flawed theories are then accepted and further built upon by other scholars who share similar ideals. In order to reduce this trend, ancient works of art and literature should be analyzed closely for fictitious elements, ambiguous words should be clearly defined prior to being used and empirical evidence should solely be reported rather than interpreted.

CHAPTER THREE: THE EASTERN VERSUS WESTERN MEDITERRANEAN

An Overview of Climate and Geography

It is not uncommon for one to believe that the Mediterranean region has been deforested over time. After all, there is no denying that ancient Mediterranean inhabitants utilized the natural resources surrounding them, especially using large amounts of trees.¹⁰³ It has even been proven that in certain places the inhabitants overexploited these natural resources, leaving nothing behind but bare soil or hard rock. The following statement by Hughes illustrates a common thought held by many regarding the Mediterranean region; “My research, with observations made during residence in Greece and travels in other Mediterranean countries convinced me that in classical times, harmony with nature was achieved in some cases, but violated in all too many others.”¹⁰⁴ Timber was used for shipbuilding and fuel for metalworking and heating, animals were left to graze unattended, and land was ploughed and terraced for crops.¹⁰⁵ Scholars have even discovered ancient accounts describing deforested areas as a result of warfare.¹⁰⁶ The demand for timber under the Roman Empire was especially remarkable, due to the fact that wood supplied virtually all of their belongings and that they used it as their main source of fuel.¹⁰⁷ These anthropogenic processes however affected the Eastern and Western regions of the ancient Mediterranean differently though. Although these two regions share the same general Mediterranean climate, (cool dry summers and warm wet

¹⁰³ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 173

¹⁰⁴ Hughes, *Ancient Deforestation Revisited*, 45

¹⁰⁵ Hughes, *Ancient Deforestation Revisited*, 45

¹⁰⁶ Hughes, *How the Ancients Viewed Deforestation*, 437

¹⁰⁷ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 173

winters,) they have distinct climatic patterns of their own as well as different flora and fauna. Therefore, I have chosen to create two separate chapters, one for the eastern Mediterranean region and one for the western Mediterranean region, (as divided during the Roman Empire) in order to better understand the effects of human activities on a more localized level.

The Eastern region, situated on the Mediterranean Sea, is characterized by “strong seasonal precipitation” and “rugged terrain.”¹⁰⁸ In general, this region is more arid than its Western counterpart due to strong and dry offshore winds, which create extremely dry conditions in the summer. The Eastern region also has a much more diverse and localized climate than the West, as illustrated by the mixture of maquis, phrygana and steppe all found in a single area. This mixture creates different vegetation patterns that are distinct in each area across the entire Eastern region. This localized and distinct climate is a result of the different mountain ranges found in the region, including the Mount Carmel range, the Golan Heights range and the Taurus Mountains. These ranges create a rain shadow effect that brings seasonal rains to the area.¹⁰⁹ The varied weather that occurs in the eastern Mediterranean region is produced by these large mountain ranges as they create different climatic conditions on either side of the mountain; generally excess rain is present on the windward side and rain-shadows are found on the lee side.¹¹⁰ This is perhaps demonstrated most clearly in Crete where the northern side of the region receives

¹⁰⁸ Bottenberg, et al. *The Mediterranean Climate*, 3

¹⁰⁹ Bottenberg, et al. *The Mediterranean Climate*, 3-4

¹¹⁰ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 26

a great deal of rainfall and is lush in vegetation while the southern side, only a short distance away, has a much more arid climate and is home to less vegetation.¹¹¹

On the other hand, the Western region of the Mediterranean is characterized by a more stable and wetter climate.¹¹² The two air masses that hover over the region are both of tropical descent (the continental tropical and the maritime tropical) and create a stable, subtropical high over the West, especially during the summer months.¹¹³ Although the West maintains a more stable climate, the deserts in the area still inhibit considerable crop growth. Unlike the Eastern region, the Western Mediterranean is much more uniform with large areas of land belonging only to maquis, phrygana or steppe, not a mixture of the three.¹¹⁴ Some parts, such as Spain, are extremely fertile and produce many crops and wine.¹¹⁵ Due to increased wetness of the region however, deluges are much more common in the Western region.¹¹⁶ They typically occur in places such as Spain and Italy along their coasts but have also been found to occur often in Corsica along the east side of the mountains and in France.¹¹⁷ Although somewhat rare events, it is important to keep in mind that deluges typically cause mass erosion of an area.¹¹⁸

¹¹¹ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 25

¹¹² Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 25

¹¹³ Bottenberg, et al. *The Mediterranean Climate*, 4-5

¹¹⁴ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 57

¹¹⁵ Bottenberg, et al. *The Mediterranean Climate*, 4-5

¹¹⁶ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 30

¹¹⁷ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 32-35

¹¹⁸ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 36

Differences in climate, soil composition, vegetation patterns and more are likely to have caused these regions to respond differently to anthropogenic events that occurred during antiquity. Therefore, keeping this information in mind, it is clear that these two regions should be examined separately in order to reduce the amount of false conclusions drawn by generalizing across the Mediterranean as a whole.

CHAPTER FOUR: EASTERN MEDITERRANEAN DEFORESTATION

The Eastern region of the Mediterranean, as divided by the Roman Empire, was home to places such as Greece, Macedonia, Thrace, Egypt, Syria, Turkey, Mesopotamia and the islands of Crete and Cyprus. [See image one for entire reference map]. Some of these areas, such as Crete and Attica, are also known as the most eroded and deforested in the Mediterranean. This makes sense as the inhabitants of the Eastern region terraced their land heavily, constructed large naval fleets, produced vast quantities of silver, introduced new animals to the land and much more. The following section is divided based upon different human activities that occurred throughout the Eastern region and which could have created erosion or altered the landscape in some way.

Agricultural Clearing and Land Use:

Inhabitants grew crops in many regions of the Eastern Mediterranean. In places such as Crete and Chaume (a region in Greece,) one is still able to see the remains of the terraces created in antiquity and much of Majorca and Croatia's current vegetation stands atop old terraces.¹¹⁹ The western region of Crete was once home to many special irrigation terraces.¹²⁰ The terraces are built into slopes in order to reduce the gradient of hillsides, rearrange sediment and increase access for water and roots.¹²¹ Almost every

¹¹⁹ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 61, 97, 110

¹²⁰ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 107

¹²¹ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 259-260

region in Crete, including steep cliffs, was used to grow crops or gather wood.¹²² The plane tree, found all across the Mediterranean but heavily identified in Crete and Greece, also lends itself to the idea of agricultural land clearance.¹²³ Many scholars attribute the growth of the plane tree to land that was cleared due to the fact that it is often found to increase while other tree pollen decreases. Thus, scholars believe that the clearance of forests for cultivation left many eroded, pebbly regions that were no longer suitable for crops in which the plane tree was then able to grow and thrive.¹²⁴

Wood/Timber Use:

Vast amounts of timber and wood were used in the eastern Mediterranean region for things such as shipbuilding and fuel. This exploitation of timber is said to have drastically decreased the amount of forest that was once present in the region. To illustrate, several scholars believe the island of Crete has been largely deforested due to the exploitation of timber used to build ships. Accounts from antiquity indicate that the Cretans maintained a large fleet of ships. For that reason (as well as others,) it is said that Crete must have been very heavily wooded in order to supply all the timber needed to support their large fleet. Some scholars believe that the excessive use of timber to create this naval fleet was what led to the reduction of trees on the island.¹²⁵ Around the 5th century, if not much earlier, Athens began to run out of timber suitable for building

¹²² Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 59

¹²³ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 163

¹²⁴ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 163-164

¹²⁵ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 167

ships.¹²⁶ Therefore, a similar story can also be examined in Macedonia where large amounts of timber were utilized to build ships for the region of Athens.¹²⁷

Timber was also used as fuel, for processes such as metalworking. In Attica, the silver mines at Laurion, were responsible for a large quantity of the (supposedly) deforested land, as they required one million tons of charcoal and the region eventually began importing wood to be used as fuel for the mines.¹²⁸ It has also been proven that the effects of mining heavily deforested a region in Thrace known as Scape Hyle as well.¹²⁹ Even the islands such as Cyprus were home to mines. So much copper was produced on the island of Cyprus that the island was in fact named after it.¹³⁰

Grazing:

The inhabitants of the eastern Mediterranean region introduced new animals to the land and allowed native species to graze freely upon the vegetation present. This was often an issue because animals such as goats typically reduce vegetation growth since they eat all the edible parts of the vegetation within their reach, creating a ‘browse-line’ and stunting the growth of the vegetation.¹³¹ In one ancient Greek comedy, the plant-based diet of goats is illustrated when Eupolis has the goats list their favorite foods and it

¹²⁶ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 179

¹²⁷ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 171

¹²⁸ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 177-178

¹²⁹ Hughes, *How the Ancients Viewed Deforestation*, 440

¹³⁰ Horden and Purcell, *The Corrupting Sea: A Study of Mediterranean History*, 348

¹³¹ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 191

“sounds like a botanist’s list of a typical Mediterranean plant community.”¹³² This comedy pokes fun at the diet of the goats and demonstrates how harmful the writer thinks they are to the region. Although most vegetation is adapted to a certain level of browsing, it is clear that introduced animals such as elephants, hippopotamuses, deer and badgers altered the landscape by grazing the lands with a foreign intensity.¹³³ This is especially true for islands that were not accustomed to these animals, demonstrated by the following quote from Grove and Rackham describing Crete. “It is no accident that island floras, especially in Crete, are rich in endemic plants that live on cliffs or have extraordinary adaptations to resist browsing.”¹³⁴ It is possible today, to determine the level of browsing that occurred in ancient Greece by examining the prickly-oaks in the region.¹³⁵

Many scholars use the preceding events to validate a theory of mass deforestation in the eastern Mediterranean produced by anthropogenic activities. However, it is often too difficult to determine the amount of degradation these activities caused in antiquity and the lasting effects that they had. The following evidence contradicts this theory of widespread exploitation and rather focuses on deforestation as a more intense, localized occurrence.

To begin, I will discuss the effects of clearing land for agriculture as this occurred throughout the Eastern region. Terracing, a common practice due to the mountainous terrain of the region, has in fact been proven to *reduce* erosion rather than promote it.

¹³² Hughes, *How the Ancients Viewed Deforestation*, 438

¹³³ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 69

¹³⁴ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 163

¹³⁵ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 71

Scholars typically associate cultivating crops on a sloped hill with erosion but there have been very few, if any, accounts of erosion occurring from terraced land. Rather, erosion occurs when the terrace has been abandoned but this abandonment would have happened long after the classical era. The act of building and maintaining terraces may have greatly helped to stabilize the land and reduce the amount of erosion that occurred in the area. If no erosion has taken place, the vegetation that was removed from the area is able to re-grow following the removal of the crops. Therefore, it can be concluded that cultivating the land through terracing may have actually enhanced the landscape by stabilizing it. Acknowledging this information ought to reduce the amount of scholars that incorrectly believe terraced land is an indication of erosion and will hopefully encourage more scholars to rely on empirical data rather than preconceived notions.¹³⁶

As I mentioned above, scholars use the growth of the plane tree to suggest deforestation of the land for agricultural reasons. However, it has yet to be proved that the plane tree actually does only grow in areas that have been cleared. The species is typically found in areas where the water table travels into the mountains and is found among vegetation that responds to fire. In Crete, the species dates back well before the Neolithic era, thus posing the question of whether human land clearance truly did encourage the growth of plane. Grove and Rackham believe that the increase of plane during the decrease of other vegetation is merely a coincidence in timing and the growth of plane cannot determine that the clearance of land occurred in areas. Until further information about this species and its preferable habitat is acquired, scholars should not use it as a source of evidence for agricultural clearing since other factors can also

¹³⁶ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 259-260

encourage its growth.¹³⁷ A study conducted by Richard Yerkes and Ran Barkai uses tools from antiquity to determine that certain sites in the early Neolithic period suffered little land clearance and only small amounts of tree felling. The study was based on the examination of 206 ancient bifaces from over seven sites in the southern Levant made during the Neolithic and Chalcolithic times. It concluded that during the early Neolithic period polished axes were actually made for symbolic purposes rather than as tools for land clearance, as once believed.¹³⁸ This is illustrated by the fact that the axes were made from polished green stone which is thought to have had special significance during antiquity.¹³⁹ Yerkes and Barkai conclude that later, towards the end of the Neolithic, a greater number of tree-felling and land clearance axes were found as they imagine demand for timber and fuel increased but they note that up until that point very “stable forest management practices were practiced.”¹⁴⁰ This demonstrates that although land clearance began to occur more heavily towards the end of the Neolithic in the southern Levant, for the most part land clearance was small scale and axes were used as sacred symbols rather than harmful tools. This preceding example illustrates that ancient Mediterranean citizens were able to maintain sustainable relationships with the land. Even with the invention of more effective tools later on, it should not be assumed that all citizens partook in unsustainable relationships.

¹³⁷ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 163-164

¹³⁸ Yerkes and Barkai, *Tree-Felling, Woodworking, and Changing Perceptions of the Landscape during the Neolithic and Chalcolithic Periods in the Southern Levant*, 230

¹³⁹ Yerkes and Barkai, *Tree-Felling, Woodworking, and Changing Perceptions of the Landscape during the Neolithic and Chalcolithic Periods in the Southern Levant*, 226

¹⁴⁰ Yerkes and Barkai, *Tree-Felling, Woodworking, and Changing Perceptions of the Landscape during the Neolithic and Chalcolithic Periods in the Southern Levant*, 230

The second most significant human activity was the use of timber for building and wood for fuel. Exploitation of trees occurred in many areas but there is only a clear distinction between tree capacity in a few, localized areas. This is often due to the fact that different tree species respond differently to use; certain tree species in one area are likely to react differently from certain tree species in another area.¹⁴¹ Also, it is important to note that ancient people typically did not chop down trees as it is done today. Instead they applied techniques such as felling to produce timber and coppicing, pollarding and shredding to produce wood.¹⁴² These methods often encouraged trees to grow back more quickly.¹⁴³ In Cyprus there is evidence that the kings restricted inhabitants from cutting down trees completely and rather encouraged them to handle them with care.¹⁴⁴ Processes that used wood as fuel generally were able to re-grow their supplies during their time of business as most were open a century or longer. For that reason, if the industry moved to a different area, it was not necessarily based on dwindling supplies; it could just as well have been in order to expand production or because markets moved. It must also be remembered that many inhabitants relied on these mines for food and such and therefore had a special interest in ensuring that the wood supply did not disappear.¹⁴⁵ In Greece,

¹⁴¹ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 45

¹⁴² Coppicing is a technique in which the tree is cut down every few years and then allowed to re-grow again from the permanent base known as the stool. Pollarding is similar to coppicing but the tree is cut 3-4m above ground level. Shredding is a technique in which the tree grows into a tall tree and then only the side branches are ever cut. Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 48

¹⁴³ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 55

¹⁴⁴ Hughes, *How the Ancients Viewed Deforestation*, 442

¹⁴⁵ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 168-169

archeologists have found tablets that display woodland management laws indicating the inhabitants' awareness of the natural resources surrounding them.¹⁴⁶ Most of the tall trees were used by 310 BC in Greece but they saved enough coppiced trees and shrubs to provide fuel and eventually let the tall trees grow back.¹⁴⁷ For these reasons it can be concluded that a small level of tree reduction occurred in many Eastern regions but intense deforestation most likely only occurred in areas such as Attica where metallurgy was extreme.¹⁴⁸

A similar pattern is observed in terms of timber use as well. Most regions were able to maintain their pre-Neolithic landscape but some rare, localized areas show signs of heavy deforestation. It is often written that many places started to import timber for the construction of ships and, therefore, deforestation of the area is automatically assumed. However, scholars generally fail to point out that certain timbers were favored over other for shipbuilding. Thus, a region importing timber does not necessarily indicate that the region had become totally deforested.¹⁴⁹ It could suggest the species was beginning to decline and the civilians, understanding how valuable it was, wanted to allow it time to grow back. In addition, it could suggest that the region never grew the specie to begin with; as a result, they needed to import this particular specie even if the region was rich with other species. This is demonstrated clearly in Athens where the region never had the correct timber for shipbuilding and thus was forced to import it instead since early

¹⁴⁶ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 169

¹⁴⁷ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 180

¹⁴⁸ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 194

¹⁴⁹ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 178

times.¹⁵⁰ Many scholars exaggerate the decline of trees in the Eastern region based upon the construction of ships but again; the deforestation is more localized and rare. In Macedonia, there is no evidence proving that the use of timber altered the landscape.¹⁵¹ Even in Crete, an area heavily deforested by the construction of ships, the deforestation is localized. Sphakia, Tersana and Ayia Galini, were all heavily exploited during Roman occupation and were clearly deforested but other areas of Crete maintained their pre-Neolithic surroundings despite the anthropogenic events.¹⁵² Without proper evidence to determine how much timber and wood was actually necessary for these activities in antiquity, it is merely a guess how much deforestation occurred and how widespread it was.¹⁵³ There is little evidence to validate the idea that timber and wood use significantly altered the Eastern pre-Neolithic landscape.

As with timber and wood use, it is extremely difficult to determine currently whether an unsustainable amount of grazing occurred in antiquity. Today, carrying capacity is used to determine how many animals can be sustained on a certain amount of land but there are many issues with this technique. To begin, it is almost impossible to quantify the number of animals present on the lands during antiquity. Second, it is critical to know the amount of vegetation present, how much each animal ate, (based upon a “proper use” number) and the extent of the browsing time period. Although many scholars have tried to replicate these numbers, they are extremely difficult to verify and

¹⁵⁰ Hughes, *How the Ancients Viewed Deforestation*, 441

¹⁵¹ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 178

¹⁵² Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 246

¹⁵³ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 176

are based mostly off of current day speculation, thus leaving us with little information on how grazing altered ancient Mediterranean landscape.¹⁵⁴ Furthermore, the evidence that has been established is often generalized across the entire Mediterranean region. However, an archeobotanical analysis conducted by Soultana Valamoti in northern Greece demonstrates the issues with this approach. He examined dung-derived charcoal from ancient plant remains to conclude “Neolithic northern Greece has both tell sites and extended flat sites with an implication that people lived differently and may have managed their animals differently on each type of site.”¹⁵⁵ At the tell site of Mandalo animals grazed stubble and fallow fields while at the tell site of Makri charcoal analysis proves the animals consumed many different species indicating that they grazed freely upon a range of different lands.¹⁵⁶ On the other hand, the charcoal evidence from the flat sites at Apsalos and Makriyalos, imply that grazing in pastures or wooded areas only took place during the summer months.¹⁵⁷ With this information it is clear that vegetation present at the flat sites would respond differently compared to the vegetation at the tell sites which endured unrestricted grazing. This issue of differing response is true when comparing islands to the mainland as well. As I mentioned above, scholars often assume

¹⁵⁴ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 70

¹⁵⁵ Tell site is characterized by mud-brick buildings erected and renewed on the same spot to form a mound; the flat sites are characterized by ‘negative’ features (i.e. pits and ditches) and by structures that drift horizontally over time, leaving broad spaces amongst them. Fields and grazing areas are thought to surround tell sites, while at flat sites they are assumed to be located among the structures settlement.

Valamoti, *Detecting seasonal movement from animal dung: an investigation in Neolithic northern Greece*, 1053

¹⁵⁶ Valamoti, *Detecting seasonal movement from animal dung: an investigation in Neolithic northern Greece*, 1058

¹⁵⁷ Valamoti, *Detecting seasonal movement from animal dung: an investigation in Neolithic northern Greece*, 1058

that islands are more prone to grazing due to the introduction of new animals as well as the disappearance of old animals. However, as Valamoti's case study demonstrates, they must be careful to examine each area separately, even lumping areas of similar landscape such as islands into a group can be disastrous. For example, evidence found on Crete suggests there was no more browsing occurring on the island than there was on the mainland of the Eastern region. One final important piece of information is that contrary to popular belief, browsing often did not occur in forested areas because grasses and herbs that grow in forests are either poisonous, unpleasant tasting or offer poor nutrition. As a result, it can be concluded that grazing in the eastern Mediterranean probably did not change forested lands into un-forested lands; instead, it may simply have reduced the amount of vegetation in previously established savannas. It is important to note, however that grazing is often required in savannas in order to allow the smaller, under-shrubbery to gain access to sunlight and water. Grazing by goats can also reduce the risk of fire in savannas by reducing the amount of flammable vegetation that is present.¹⁵⁸ Thus, in conclusion, there are two main things that must occur in order to determine the effect grazing once had on ancient eastern Mediterranean landscapes. First, it is imperative that each region is examined separately in order to reduce false accusations. Secondly, more empirical evidence must be found in order to create clearer numbers in terms of how many animals were present and the amount they ate. Then scholars can begin to determine what effect this grazing had. For example, in Valamoti's case study there was no indication that grazing had a harmful affect on either the forest or savannas present, but more information is needed to confirm this. Scholars often imply that grazing heavily

¹⁵⁸ Papanastasis, et al. *Environmental conservation in ancient Greece*, 130

deforested the eastern Mediterranean but the previous evidence indicates that scholars often speculate and use ambiguous information to draw these conclusions thus making the claims unreliable and useless when determining grazing as a main source of deforestation.¹⁵⁹

On the one hand, the information presented at the beginning of this section clearly demonstrates the fact that ancient eastern Mediterranean inhabitants utilized the natural resources surrounding them. On the other hand however, there is extremely little evidence that supports the theory of lasting degradation on the land.¹⁶⁰ Rather, regions that were affected by small declines in vegetation were most likely able to re-grow, because heavy deforestation was infrequent and relatively localized to areas where major tree use occurred.¹⁶¹ Therefore I conclude that mass deforestation of the eastern Mediterranean did not occur and that only small areas of intense localized deforestation continued to exist following the Neolithic.

¹⁵⁹ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 69-72, 163, 194

¹⁶⁰ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 193-194

¹⁶¹ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 193-194

CHAPTER FIVE: WESTERN MEDITERRANEAN DEFORESTATION

Natural resources were heavily utilized in the western Mediterranean region during the classical era. The western Mediterranean is home to places such as Spain, Rome, Gaul, and many more, all of which contained large populations and extensive trade networks. For this reason, it is often speculated that the Western region of the Mediterranean has been heavily deforested. Today, scholars demonstrate the erosion that occurred during the Neolithic era by citing the heavily eroded areas of Italy and Spain. The vast quantity of inhabitants that lived within Turkey and Rome during this time also present scholars with evidence that parts of these regions were heavily exploited for their natural resources, although today these regions present minimal signs of erosion compared to Spain and Italy. In the following section, I will demonstrate the anthropogenic effects of this large numbers of inhabitants that altered the Western region's pre-Neolithic landscape.¹⁶²

Agricultural Clearing and Land Use:

As mentioned above, the western Mediterranean climate was better for growing crops, with just the right amount of rain occurring almost everywhere. Combined with the large amount of people present in the western Mediterranean, it can be speculated that vast amounts of land were cleared simply for cultivating crops to eat and sell in the markets. In the northern region of Portugal there is evidence that the region was once

¹⁶² Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 69, 246, 345

covered with terraces that aided farmers in growing crops on sloped hills.¹⁶³ “Subtraction savannas” in Sardinia provide scholars today with evidence that residents would remove certain trees from their land in order to create small areas for agriculture to grow.¹⁶⁴ It is also often stated that civilians (in Sardinia and Spain) would clear land through fire, thus creating wide-open land.¹⁶⁵ Some scholars, such as Daniele Colombaroli and his associates, even venture further to hypothesize that “Modern Mediterranean ecosystems are mostly the result of long-term human activity through the centuries, in which human-induced alterations of the fire regime play an important role.”¹⁶⁶ Therefore, they speculate that without these human induced land-clearing fires, it is possible that the Mediterranean landscape would be more forested.¹⁶⁷

Wood/Timber Use:

The Romans required a considerable amount of wood and timber for their everyday functions. As illustrated by the following quote, they perhaps used more trees than any other region in the entire Mediterranean. “Romans were lavish users of building timber; they indulged vastly in bricks, mortars, baths, iron, glass, funerary pyres, pottery [and more] all of which required fuel to make.”¹⁶⁸ Not to mention that the exceptionally

¹⁶³ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 110

¹⁶⁴ Removing trees from previously forested land, forms subtraction Savannas. Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 207

¹⁶⁵ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 229, 235

¹⁶⁶ Colombaroli, et al. *Fire-vegetation interactions during the Mesolithic-Neolithic transition at Lago dell'Accesa, Tuscany, Italy*, 679

¹⁶⁷ Colombaroli, et al. *Fire-vegetation interactions during the Mesolithic-Neolithic transition at Lago dell'Accesa, Tuscany, Italy*, 679

¹⁶⁸ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 173

large Roman population needed to be fed. Because Roman land was occupied with the large number of civilians, Rome imported the majority of its food from Africa and Sardinia. This required a considerable number of ships and each one was generally bigger than other ships built in antiquity in order to import enough food for all the citizens. One passage of work by Lucian gives the measurements for a grain ship at 180 feet long and 44 feet in depth, so large that it was capable of carrying enough corn to feed Attica's inhabitants for a full year.¹⁶⁹ The timber to build this naval fleet generally came from Italy and is believed to have greatly reduced the number of trees there. Furthermore, Hughes relies on accounts from ancient authors to conclude that Rome ran out of the desired shipbuilding timber and that "good forests were generally limited to mountains."¹⁷⁰ Today, scholars believe that the demand for wood and timber put in place by Rome greatly deforested some regions of the western Mediterranean and in general left the entire region with less trees.¹⁷¹

Grazing:

Ancient accounts state that pastoralism was one of the main forces of deforestation. Animals that were left to browse unattended on the land were harmful, cropping all the vegetation present and often restricting tree growth.¹⁷² There are accounts from antiquity that reveal that farmers would either cut tree branches or create small wildfires in order to increase the amount of food available for the animals to graze

¹⁶⁹ Lucian, *The Ship*, 5-6

¹⁷⁰ Hughes, *How the Ancients Viewed Deforestation*, 437

¹⁷¹ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 173

¹⁷² Hughes, *How the Ancients Viewed Deforestation*, 438

on.¹⁷³ Hughes goes on to make the claim that, “Wherever trees were planted, measures had to be taken to protect them against goats...”¹⁷⁴ This is demonstrated in Italy where “large-scale [and] long-distance” pastoralism is recognized by many scholars today as one of the most harmful environmental effects of the region.¹⁷⁵ It has also been determined that ancient inhabitants of Spain enjoyed feasting on vast amounts of wild pig. Thus, it can be speculated that vast amounts of pigs were left to roam and devour the vegetation present in Spain at the time.¹⁷⁶

Although the preceding examples outline all the harm that human activity can cause a region, they need to be examined more closely. Many of the conclusions mentioned above are based on scholars’ assumptions instead of empirical evidence. Often scholars assume that the landscape of regions such as Rome must have been altered during the classical period as a result of the large quantity of inhabitants present in the area. It is understandable that scholars today would hold this thought, but without evidence it simply cannot be concluded that the ancient inhabitants of the western Mediterranean exploited their resources to the point of change. In fact, in many areas, even large city centers, a level of sustainable use was maintained and deforestation was primarily a localized phenomenon.

One of the largest issues at hand in terms of agricultural land is the fact that farmers would have transformed savanna into farmland. This is difficult to observe in palynology evidence because the farmland will generally maintain a few trees and

¹⁷³ Hughes, *How the Ancients Viewed Deforestation*, 438

¹⁷⁴ Hughes, *How the Ancients Viewed Deforestation*, 438

¹⁷⁵ Horden and Purcell, *The Corrupting Sea: A Study of Mediterranean History*, 550

¹⁷⁶ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 195

therefore can seem like a savanna. Although in Sardinia, farmers often removed certain trees in order to cultivate the land, this was a rather localized phenomenon.¹⁷⁷ Around the rest of the Western region, farmers lived peacefully with trees and bushes on their lands and often left sections of their land forested.¹⁷⁸ This is best displayed in Rome and in Turkey where farmers worked around the trees and bushes planting crops rather than removing them.¹⁷⁹ Native bushes and trees could even be used by farmers to create protection for crops that were sensitive to sunlight and wind while trees could lend support to limp vines in their early stages.¹⁸⁰ Even within Sardinia, cultivating land was localized instead of widespread. This is demonstrated by the distinct terracing that occurs in some areas of the region but not others. Scholars speculate that terracing only occurs in certain areas due to land possession laws that give little rights to the owners. Localized terracing is also observed in Portugal where the northern area near the Douro valley is highly terraced but southern Portugal is not.¹⁸¹ This localized terracing implies that some regions in the western Mediterranean relied heavily on the land while the majority did not. Even within regions that were heavily cleared for agricultural purposes, vegetation is able to grow back after the human activity subsides. In southwestern Turkey, the land was heavily degraded through human activity but in several areas the forest was able to

¹⁷⁷ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 163

¹⁷⁸ Hughes, *How the Ancients Viewed Deforestation*, 442

¹⁷⁹ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 163

¹⁸⁰ Hughes, *How the Ancients Viewed Deforestation*, 442

¹⁸¹ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 110

re-grow.¹⁸² Human induced fire is often utilized by scholars to determine that deforestation of the Mediterranean must have occurred due to the fact that large amounts of land were cleared for agriculture. However, there are very few studies linking anthropogenic activities and fire in the classical era.¹⁸³ A study conducted by Damien Ruis and his colleagues utilizes macroscopic charcoal and pollen samples to determine fire frequency during four different time periods in northwestern France. Evidence from these samples show that the area was often burned and then used for agricultural purposes. However, they discovered that during the Neolithic “anthropogenic pollen indicators are scarce but more frequent towards the end of the zone.”¹⁸⁴ They conclude their study by stating that frequency, amplitude and large fraction contribution were all much greater during times of intensive land use (such as the Iron Age) compared to the Neolithic.¹⁸⁵ This indicates that during the Neolithic era, human induced fires were often localized and burning was “sporadic.” A separate study conducted by Colombaroli and his associates at Lago dell’Accesa in Italy also finds a similar conclusion. The scholars examined pollen and charcoal records found at the site to determine connections between climate, anthropogenic activities and fire regimes.¹⁸⁶ The evidence determined that macroscopic charcoal and microscopic charcoal levels were not identical thus, indicating that fire

¹⁸² Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 166

¹⁸³ Ruis, et al. *Fire frequency and landscape management in the northwestern Pyrenean piedmont, France, since the early Neolithic*, 847

¹⁸⁴ Ruis, et al. *Fire frequency and landscape management in the northwestern Pyrenean piedmont, France, since the early Neolithic*, 854

¹⁸⁵ Ruis, et al. *Fire frequency and landscape management in the northwestern Pyrenean piedmont, France, since the early Neolithic*, 857

¹⁸⁶ Colombaroli, et al. *Fire-vegetation interactions during the Mesolithic-Neolithic transition at Lago dell’Accesa, Tuscany, Italy*, 679

regimes were different on a local scale compared to a regional scale.¹⁸⁷ These two studies provide evidence that fire as a tool for land clearance in the western Mediterranean was actually much more localized and less frequent than often believed by scholars today. In addition, although it has not been formally confirmed one way or the other, it is speculated that ancient inhabitants used burning as a sustainable approach to prevent larger forest fires in a region filled with flammable species.¹⁸⁸ All of this evidence helps current scholars determine not only that more empirical evidence is needed, but also that presuming deforestation occurred based on the fact that inhabitants cultivated the land is not an acceptable theory anymore.

Scholars often nominate Spain as a region that was heavily deforested and now severely eroded by anthropogenic events. It is difficult to determine whether this belief is valid because Spain does not have as much scientific evidence on which to rely. On the one hand, some scholars believe that Spain has been heavily altered by human activity; other scholars, however, believe that Spain was in fact drier during antiquity and therefore never had enough moisture to grow much vegetation. Current tree structure in Spain (and Portugal) provides evidence that the region has been covered with savanna and not forest for as long as the present trees have been there. Although this information demonstrates that Spain has been covered with savanna for an extended period of time it still does not answer the question, was Spain ever forested? To answer that more palynological and anthracology information will be necessary. Grove and Rackham also bring up a current issue: “In vast areas of Spain it is a matter of opinion whether trees are

¹⁸⁷ Colombaroli, et al. *Fire-vegetation interactions during the Mesolithic-Neolithic transition at Lago dell’Accesa, Tuscany, Italy*, 679

¹⁸⁸ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 238

big enough (in maquis) or close enough (in savanna) to constitute forest.”¹⁸⁹ This can be an issue if scholars are comparing current day Spain to pre-Neolithic Spain in terms of definition of forest.¹⁹⁰

As I mentioned above, the Romans used massive amounts of wood and timber to enrich their daily lives. Many scholars believe that the sheer number of inhabitants alone is evidence enough for deforestation. Yet Grove and Rackham refute this idea: “If ever an ancient people ran out of timber or wood through over-use the Romans should have done so but the evidence points in the opposite direction. The Romans were practical people and wrote learned accounts of coppicing.”¹⁹¹ This quote illustrates the most important thing to remember when determining whether the Western region was deforested through wood and timber use that is, the idea of sustainable practice. It is easy to assume the Romans and other inhabitants of the western Mediterranean simply cut down all the trees they could in order to meet the demand for it but it should not be forgotten that wood workers in antiquity could work in sustainable ways. In Italy, trees were almost always “shredded,” implying that the side branches were cut and used yet the trees were not cut down, thus allowing the branches to grow back and be used again. It has also been proved that Italian forests are able to re-generate quickly and effectively. Thus, removing large amounts of wood and timber from Italy may not have had such an adverse effect compared to another region with a less resilient forest. In Sardinia, there were also charters that controlled the amount of wood and timber that could be utilized. Thus,

¹⁸⁹ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 214

¹⁹⁰ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 175, 214

¹⁹¹ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 174

indicating that sustainable use could be detected across many regions ranging from islands to the mainland in the western Mediterranean region.¹⁹²

Based on the fact that the western Mediterranean region has multiple islands, as well as the fact that the Roman Empire required a lot of food, many scholars believe that large amounts of grazing must have occurred in the Western region altering the pre-Neolithic landscape. This is not necessarily the case however. A study examining classical transhumance in the Aude valley of southern France, conducted by David Geddes, illustrates that during the early Neolithic, grazing by domesticated animals at this site had little effect on vegetation. By examining archaeological material as well as macrobotanic and faunal remains, he determines that “This early pastoral use of upland pastures had no detectable impact on the environment.”¹⁹³ A large deal of his study focuses on a domesticated versus wild animal ratio, stating that for most of the Neolithic there are the same number of domesticated sheep and goat as there are wild boar.¹⁹⁴ Thus demonstrating that the domesticated animals were not out-grazing the wild animals and taking over their habitats like scholars often assume they did. Although Geddes never denies the fact that domesticated animals grazed the vegetation present, he makes sure to point out that the Neolithic domesticated animals “exploited the indigenous fauna in the same manner as the Mesolithic occupants of the site.” Therefore, indicating that their grazing presence was no more harmful than previous animals that roamed the site.¹⁹⁵

Another issue with animal grazing in antiquity is that scholars often do not understand the

¹⁹² Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 174, 177, 210

¹⁹³ Geddes, *Neolithic Transhumance in the Mediterranean Pyrenees*, 58

¹⁹⁴ Geddes, *Neolithic Transhumance in the Mediterranean Pyrenees*, 59

¹⁹⁵ Geddes, *Neolithic Transhumance in the Mediterranean Pyrenees*, 61

habitats that these animals lived in. Often they believe that animals enjoy forests best but in Gedde's article he states that the Aude valley would not have been a great place for sheep and goats to graze prior to the land clearing that occurred late in the Neolithic because it was more forested and these animals enjoy grazing in open pastures.¹⁹⁶ This lack of ancient habitat knowledge is also clearly demonstrated by many modern day scholars' views of the pig. Often these scholars associate pigs with forest because they feed on acorns. However, it has been determined that in Sardinia, pigs enjoy living in maquis rather than forests and in Spain pigs prefer to reside in savannas, living amongst grasses and under-shrubs. This is due to the fact that pigs often require more than just acorns to survive. The fattest pigs are found in savannas where there are trees to provide acorns as well as grasses to provide the pigs with the extra protein they need. Thus, scholars who assume certain areas were forested based solely on the fact that many pigs were present are often completely incorrect. The pigs of Sardinia and Spain demonstrate the importance of understanding the variety of habitats in which the animals of antiquity thrived. Misinterpreting the landscape of a certain region based on preconceived notions of the habitat that must be present for a certain animal to live there could create major issues with the validity of suggested changes from a pre-Neolithic to post-Neolithic landscape.¹⁹⁷

Another issue facing the western region of the Mediterranean is the idea that human inhabitants have a negative effect on islands after settlement. Because the western region of the Mediterranean has a few prominent islands including Corsica, Sardinia and

¹⁹⁶ Geddes, *Neolithic Transhumance in the Mediterranean Pyrenees*, 58

¹⁹⁷ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 167, 195

Carthage, scholars often assume that these places must have been deforested through the introduction of new species and agricultural practices. Yet, there is very little evidence to prove that the introduction of novel species and the decline of native species drastically reduced the islands' tree cover from the pre-Neolithic time period. In fact, evidence in Sardinia illustrates that human settlers managed to co-exist peacefully with the native animals on the island until after the Bronze Age. This natural co-existence allows us to speculate that the grazing would not have altered significantly during this time. If a large change in grazing were to occur it would most likely happen when the biodiversity of the island was significantly altered. It is also important to note that cork, a notable savanna tree species, found on the islands of Sardinia and Corsica (as well as in Spain and Portugal) is transformed into cork oak forest following a decline in grazing, thus implying that if a large amount of grazing did occur, the cork species would be able to regrow following a decline in animal grazing. Even though scholars often treat islands, as more at risk of intensive grazing because of the introduction of new animals and the decline of native species, there is no evidence that this occurred in Sardinia or Corsica. In fact, on the island of Corsica, there is no evidence that the landscape was altered in a different way than the mainland was.¹⁹⁸

Thus, in conclusion, evidence suggesting heavy deforestation in the Western region during the classical era is actually quite sparse. Scholars should focus on finding more empirical evidence to determine what truly happened during antiquity rather than building theories on preconceived notions of what humans do to landscapes. It is rather apparent *why* current scholars often assume the western Mediterranean region has been

¹⁹⁸ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 163

deforested but there is little proof to back up these theories. Thus, I conclude that similar to the Eastern region, heavy deforestation was actually quite rare and localized to areas that were under immense pressure to provide wood and timber. Although it is clear that many inhabitants utilized natural resources, the use was sustainable and the region was resilient enough to re-grow, especially following the succession of human activities.

CHAPTER SIX: CONCLUSION

In conclusion, I have determined that the ancient Mediterranean vegetation was utilized by inhabitants but not to the extent that a major alteration of the landscape occurred. In a world of climate change and global warming, modern scholars are often too quick to determine that the current Mediterranean landscape has been deforested. The lack of similar landscapes often leaves modern scholars concluding that it must have originally looked similar to more forested landscapes. However, my research has led me to believe that the landscape of the Mediterranean is simply distinctive. In both the eastern and western regions of the Mediterranean, anthropogenic activities such as fire, woodcutting, metallurgy, pastoralism, et cetera, changed certain aspects of the landscape but these activities did not cause large-scale deforestation. The Mediterranean is extremely diverse and certain areas respond in different ways than others. Findings from other ancient regions should not, and simply cannot, be applied to describe changes that occurred in the Mediterranean.

The Mediterranean has proved to be an extremely resilient ecosystem.¹⁹⁹ The Roman Empire used vast amounts of wood yet widespread deforestation across the region has not been detected. Grove and Rackham have found that following cessation of human activities, maquis is able to revert to woodland, shrubs grow into trees and abandoned farmland transforms into steppe or phrygana. Tablets found in Greece and archeological remains found in the Southern Levant have provided modern day scholars with evidence that ancient Mediterranean inhabitants' were aware of sustainable land-use practices.

¹⁹⁹ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 60

Under-shrubs living in savannas may have even required an appropriate amount of grazing, indicating that the Mediterranean landscape was more resilient than modern day scholars often portray it as. As Grove and Rackham state, “Evidence amply rebuts the belief that the Mediterranean ecosystems are fragile and cannot recover. Quite the contrary: they recover more quickly than in England.”²⁰⁰

Along with the resilience of the Mediterranean ecosystem, evidence that the ancient region was deforested through anthropogenic activities is simply lacking. Many scholars base deforestation hypotheses off of incorrect or interpreted data rather empirical evidence. It is in fact quite difficult to find empirical evidence dating back to the classical era that suggests deforestation of the Mediterranean landscape.²⁰¹ Scholars that blame terracing in places such as Crete or Greece, for erosion lack the empirical evidence needed to determine whether this is true; the effects of terracing still remain largely unknown at this time and therefore should not be used as evidence for erosion.²⁰² The theory of over-grazing is also often based upon speculation and modern day models.²⁰³ Perhaps lack of evidence is best demonstrated in terms of wood and timber use. Modern scholars who attribute the importation of timber or wood to forest shortages in those places often are incorrect. The importation of wood could be caused by a multitude of things: the lack of the necessary species, the lack of any tree species, sustainable forest management laws and more could require certain regions to import their timber and

²⁰⁰ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 65

²⁰¹ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 80

²⁰² Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 259-260

²⁰³ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 70

wood. Grove and Rackham assume modern day scholars find it easier to blame erosion that has occurred since the Neolithic on human activity because it is less work than finding evidence and determining what truly happened.²⁰⁴

Finding evidence for this ancient landscape puzzle has however proven to be quite difficult. There is still a large amount of research that needs to be conducted on this topic. It is difficult to determine whether deforestation of the Mediterranean truly occurred based upon the evidence available at this time. As mentioned in chapter two, advances in palynology and anthracology would allow scholars to be more confident when relying on these forms of evidence. Although it may be impossible to increase the amount or the quality of the charcoal and pollen samples available in the area, steps can be taken to create better technology to analyze the samples so there is less of a question when it comes to species that emit extremely similar pollen or where the charcoal derived from.²⁰⁵ Advances in this technology would hopefully aid scientists in creating a better pollen or charcoal record upon which most hypotheses are constructed.²⁰⁶ It is important as well that all scholars use consistent definitions for ancient words and determine the validity of ancient art before utilizing it as a piece of evidence.²⁰⁷ Possibly most important though, is that scholars do not impose their own modern day views onto antiquity. Scholars who fill in the gaps of charcoal studies based upon what they think (or want to believe) happened results in a false interpretation rather than a set of trusted

²⁰⁴ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 307

²⁰⁵ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 153

²⁰⁶ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 152

²⁰⁷ Harris, *Defining and Detecting Mediterranean Deforestation, 800 BCE to 700 CE*, 175

statistical facts.²⁰⁸ A similar situation is often observed with palynological records when North American scholars determine the pollen evidence derived from a large forest rather than brush covered area because it is what they are akin to.²⁰⁹ Although modern day scholars often have varying viewpoints on ancient Mediterranean deforestation, they all agree that the field is constantly changing based upon the emergence of new evidence. With every new piece of information, it is easier to determine what truly occurred and further research in this area would decrease the assumptions and false hypotheses, replacing them with secure evidence. It is also extremely important that modern day scholars and scientists work together to determine what occurred in order to reduce the gap between empirical evidence and invalidated theories.²¹⁰ With the evidence that is currently available, I conclude that large-scale deforestation and alteration of the Mediterranean landscape did not occur. It can be determined that everyday use of the land would have slightly altered the landscape from pre-Neolithic times but in no way was it drastically altered or deforested. This is due to the fact that ancient Mediterranean inhabitants practiced their land clearing, woodcutting and animal grazing on a much smaller scale than is seen today. Mediterranean vegetation was also resilient enough to endure this use, often growing back after these activities ended. Heavy deforestation was rare and only occurred in places such as Attica, Crete and Macedonia where intense human activity was present over long periods of time. Even within these regions, the deforestation was localized rather than all encompassing.

²⁰⁸ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 169

²⁰⁹ Grove and Rackham, *The Nature of the Mediterranean Europe: An Ecological History*, 152

²¹⁰ Hughes, *Ancient Deforestation Revisited*, 45

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Image 1. Map of Mediterranean region divided by East and West