Middle States Geographer, 2007, 40:150-157

NEAR EASTERN POLLEN DIAGRAMS AND "DEFORESTATION"

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ABSTRACT: *Currently, there is considerable controversy over the degree to which traditional societies degrade the environment. In Africa and the Himalayas, especially, more and more scholars are arguing that degradation has been greatly overstated. In contrast, most scholars still believe that massive degradation including deforestation has occurred in the Mediterranean and Near East. I examine the pollen evidence for Near Eastern deforestation, using a data set from 13 sites. The pollen diagrams show an increase in arboreal pollen in the early Holocene, as woody cover returns with the re-establishment of modern climate; but arboreal pollen does not show any tendency to decline subsequently, as agropastoralism and other human impacts increase. That is, there is no clear pollen evidence for deforestation in the Near East. This does not mean that deforestation did not occur, but it does mean that the matter needs re-examination. I suggest some possible reasons for the discrepancy between the pollen record and the widespread belief that extensive deforestation has occurred.*

Keywords*: Deforestation, Near East, Environment*

INTRODUCTION

In recent decades, divergent views have developed over the degree to which traditional societies degrade the environment (Blaikie and Brookfield, 1987). The long-standing consensus was that the poor countries of the world, especially those that were ancient centers of civilization, have undergone and are still undergoing significant land degradation (Marsh, 1864). A critique of this belief has taken hold recently, especially in sub-Saharan Africa and the Himalayas (Coughenor et al., 1985; Brower, 1993; Fairhead and Leach, 1996; Leach and Mearns, 1996; Bassett and Bi Zueli, 2000; Blumler, 2002; Blumler, 2006; Blaikie and Muldavin, 2004). Some argue that reports of degradation or deforestation embedded in the scientific literature are mere "degradation narratives" because they lack empirical support (McCann, 1997; Davis, 2007). Others assert that the traditional belief is now completely replaced at the higher levels of academe (Blaikie and Muldavin, 2004), if not yet at the governmental or policy-making level. But with respect to the Mediterranean and adjacent Near East, most scholars still believe that massive degradation including deforestation has occurred, though some may blame empire more than traditional agropastoralism (Zohary, 1973; McNeil, 1992; Hughes, 1994; Brandt and Thornes, 1996). The few dissenters are mostly geographers (Blumler, 1992; Blumler, 1993; Blumler, 1998; Blumler, 2000; Butzer and Butzer, 1995; Bencherifa, 1996; Johnson, 1996; Grove and Rackham, 2001; Davis, 2005, 2007), and like the critics elsewhere, can be loosely categorized as either a) scientists, whose empirical data do not support the degradation thesis, or b) political ecologists, whose main concern is to protect the poor and traditional societies from what they view as "neo-colonialist" enterprises.

This is not merely an academic issue. International environmental policy rests upon the degradation thesis. International aid organizations that have a "green" component, such as World Bank, now typically require "reforestation" as a condition of assistance to poor countries. One result may be the spread of species-poor, plantation forests, grown on land taken from peasants, who are displaced to the already overcrowded cities (Maddox, 1999; Bassett and Bi Zueli, 2000). Similarly, sedentarization of nomadic pastoralists is often justified by claims that they have overgrazed their territories (Bencherifa, 1996; Johnson, 1996; Blaikie and Muldavin, 2004; Davis, 2007).

Ideally, in such a situation one would see a dispassionate debate that would ultimately resolve the matter. Unfortunately, today, there tends to be more heat than light. What is needed is a comprehensive re-examination of the empirical evidence. One line of empirical evidence that could shed light on the degradation question is the pollen

record. This is particularly likely to be informative for the Near East, given that agropastoralism's footprints go back about ten millennia, long before documentary and other sorts of evidence. In the Mediterranean and Near East, the pollen record is generally interpreted as indicating deforestation and other degradational impacts. But what does the empirical record actually show? In this paper, I perform a preliminary analysis of the Near Eastern pollen evidence, and demonstrate that it does not support the traditional interpretation. Reasons why this is so are then discussed, as are some policy implications.

PRIOR WORK

Bottema (1982[1985]) stated that Greek pollen diagrams characteristically show a return of the forest (increase in arboreal pollen) during the early Holocene, and a subsequent retreat (decrease in arboreal pollen) as agropastoralism and civilization progressively impact their environment. He illustrated this pattern with a schematic diagram (Figure 1). This figure captures the traditional understanding of what has happened to the vegetation, not only in Greece, but throughout the region. It is well-accepted that steppic conditions prevailed over much of the Mediterranean and Near East during the Late Glacial, with minimal forest cover (Van Zeist and Bottema, 1982; Roberts, 1998). It has also been established that arboreal species spread during the first half of the Holocene, though at different dates and rates in different places (Huntley and Birks, 1983). Most believe that the forest has subsequently retreated (Roberts, 1998; Grove and Rackham, 2001).

THE POLLEN RECORD

Because of the scarcity of suitable coring sites, there are only a small number of pollen diagrams from the Near East, and perhaps half of these are Greek. Conveniently, Bottema (1991) collected the important diagrams (though including only three from Greece) in a single paper. The diagrams that he did not include tend to have short records, and thus are less informative. Bottema calculated the trends in arboreal pollen (AP) and non-arboreal pollen (NAP), employing the simplifying assumption, NAP = *Artemisia* + *Chenopodiaceae*. This had the general effect of smoothing the curves (reducing the amount of fluctuation in AP from one time period to the next).

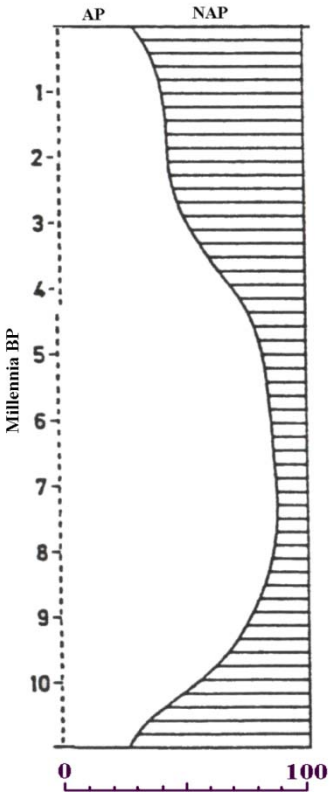

Figure 1. Schematic depiction of the increase and subsequent decrease in arboreal pollen that purportedly occurred at most Greek sites during the Holocene (after Bottema, 1982[1985]). Arboreal pollen % is shown in white; non-arboreal pollen % is the remainder (lined). Y-axis shows time in millennia BP.

Bottema (1991) did not state why he adopted this procedure. One likely explanation is that he wished to remove aquatic taxa. A well-known source of error in pollen diagrams comes from the aquatic plants, growing in and around the lake or marsh from which the core was taken, which can fluctuate for reasons having nothing to do with climate or the surrounding, terrestrial vegetation. Some taxa, such as the Poaceae (grasses), can be either aquatic or terrestrial, making estimation of the proportion of aquatics in the record problematic. If removal of aquatics is the primary reason for the smoothing effect, then Bottema's curves may be more accurate indicators of regional arboreal cover than the original diagrams.

The locations of these pollen cores are shown in Figure 2, and Bottema's (1991) curves are reproduced in Figures 3 and 4. The diagrams span

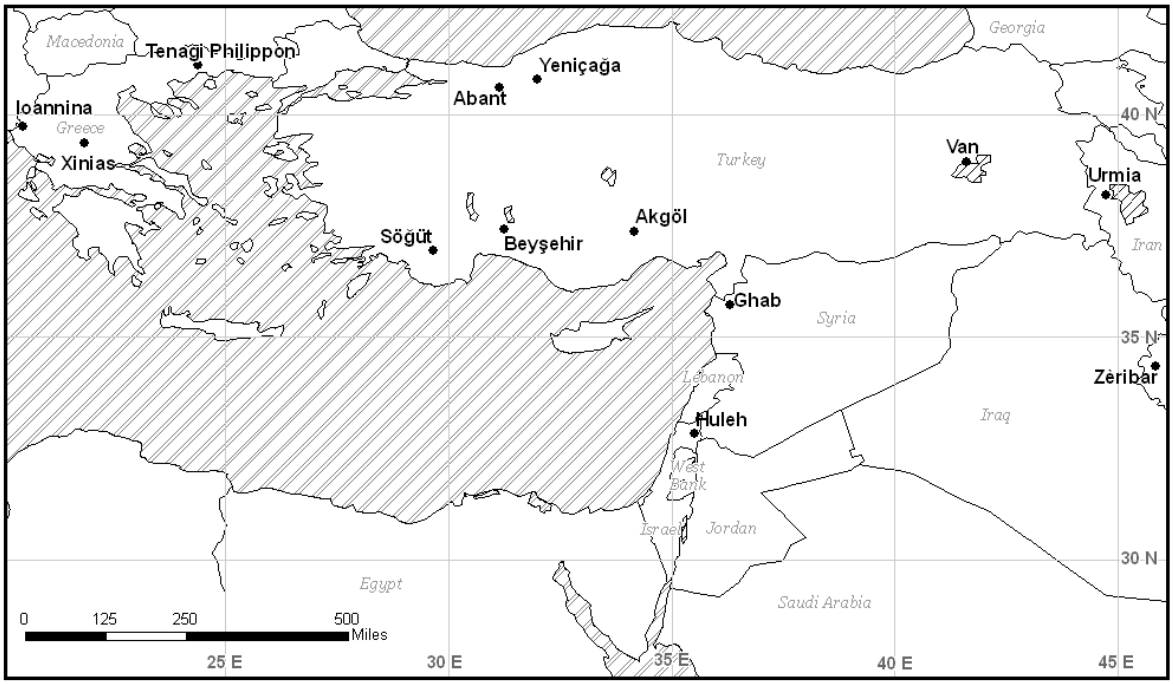

Figure 2. Location map showing the cores from which the diagrams in Figures 3 and 4 were made.

the Near East from western Iran to Israel, and north. All diagrams show an increase in AP in the early Holocene, though the increase is less pronounced in the Levant where forest cover apparently persisted through the glacial periods; but the diagrams do not show the posited subsequent decline. Rather, they are remarkably flat once forest cover is established. At the 13 sites, most show too little change to enable one to pick out a trend; a few, such as Beyşehir, Akgöl, and Ioannina appear to increase gradually right up to the present; and two (Van and the Ghab) show some decrease in AP. But even the latter do not provide supporting evidence for the sort of drastic decline depicted in Bottema's (1982[1985]) schematic diagram (Figure 1). Moreover, the Ghab is a composite of three cores (separated by all-white in Figure 4) taken from different parts of the marsh. The middle core is undated, leaving its chronological alignment with respect to the other two open to question. Note that there is little decline in AP within each Ghab core, while there are significant decreases between cores. The latter could be spurious, since they depend on proper alignment of the cores.

As discussed, the original diagrams show more fluctuation in AP than do Bottema's (1991) curves. This makes it more difficult to determine whether AP is increasing or decreasing. Where variation due to sampling or other error is considerable, it is highly problematic to assume that the level with the greatest AP truly represents the time period of maximum arboreal cover. Each pollen count, graphed in a pollen diagram, is a sample from a given level of the core, and as such, cannot be presumed to be entirely accurate. Consider a fluctuating pollen diagram with ten samples: if the fluctuations are entirely due to chance, the uppermost sample has only a one in ten chance of having the highest AP. AP would appear to decrease in 90% of all diagrams, due to the error term. To properly interpret fluctuating diagrams, then, one must look at the general trend rather than picking out the maximum AP value and assuming it is real. When one examines the original diagrams in this manner, six (Ioannina, Xinias, Söğüt, Akgöl, Urmia, and Zeribar) show an increase in AP towards the present, five (Tenagi Philippon, Yeniçağa, Beyşehir, Van, and Ghab) show a decrease, and two (Abant and Huleh) show no real change (data not shown). As with the curves in Figures 3 and 4, none show a decline as drastic as that of Figure 1. The closest is Tenagi Philippon, which between about 8 K BP and the present declined from about 90% to just fewer than 60% AP. In contrast, the schematic diagram depicts a decline from about 90% to 30% AP over the same time span.

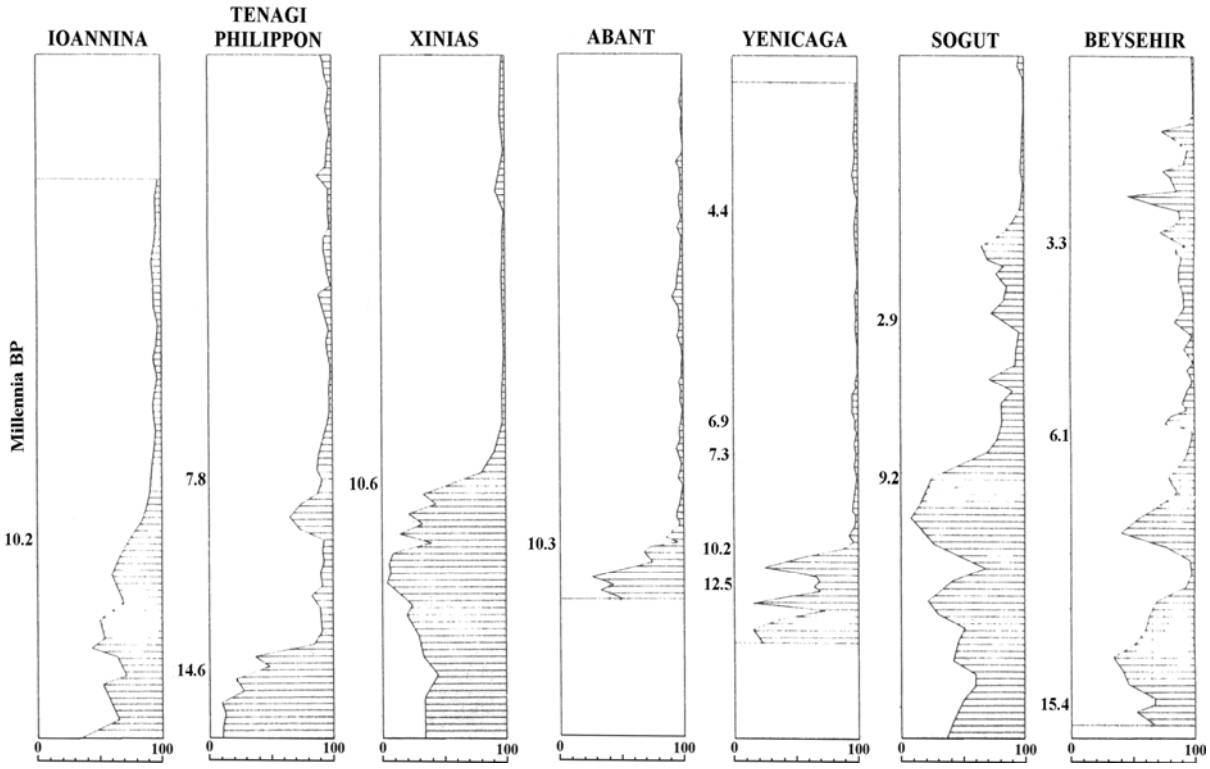

Figure 3. Trends in AP and NAP in diagrams selected for analysis by Bottema (1991). AP and NAP are represented as in Figure 1. Radiocarbon dates are given in millennia BP.

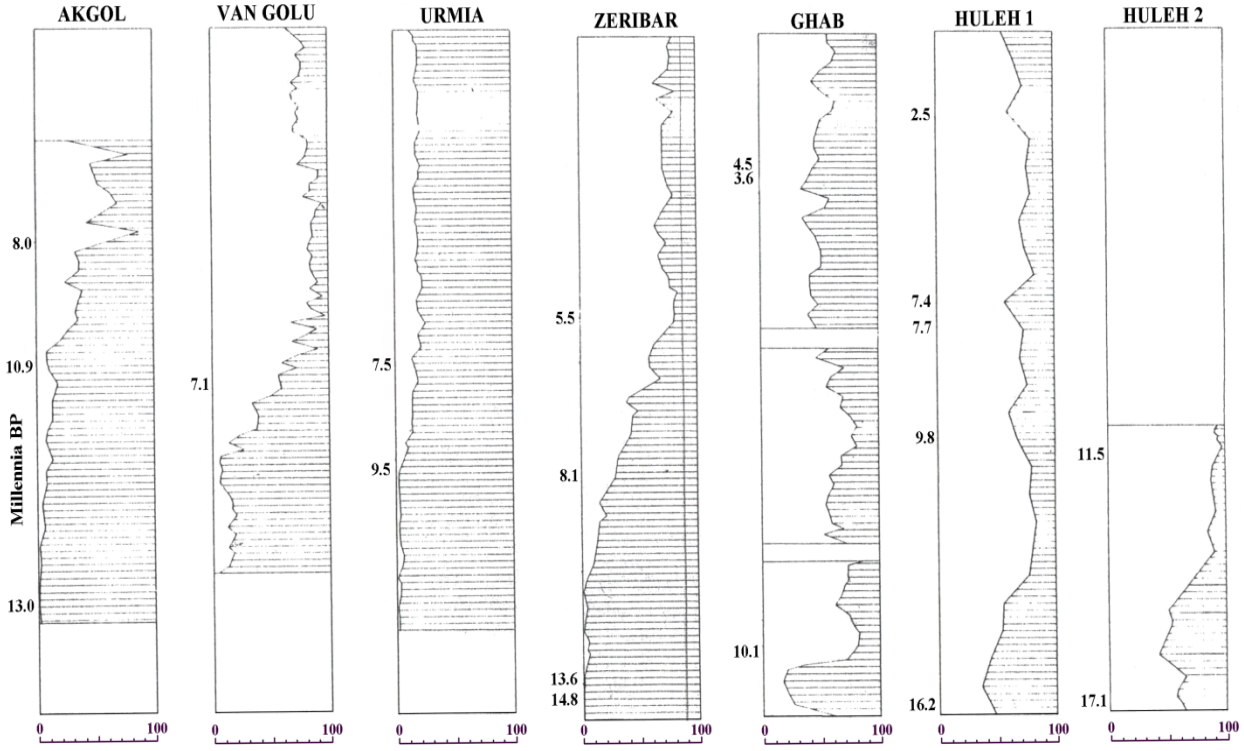

Figure 4. Trends in AP and NAP in additional diagrams selected for analysis by Bottema (1991). AP and NAP are represented as in Figures 1 and 3. Radiocarbon dates in millennia BP.

DISCUSSION

In sum, these pollen diagrams do not provide evidence for an overall pattern of deforestation in the Near East. One or two sites such as Tenagi Philippon may possibly have suffered deforestation, but others seem still to be increasing in forest cover. On the other hand, given that the pollen record is subject to numerous sources of error, other interpretations are possible. For instance, Van Zeist (1969) argued that the top of the core from Lake Zèribar must be missing, and that it would show deforestation. In other words, the destruction of the forest must have happened recently. Note, however, that in this case the interpretation was based on the presumption of deforestation, not on any evidence for it. Writing at about the same time, Guest (1966) went through travelers' descriptions of the Iraqi Zagros, just over the border from Zèribar, and reported that vegetation today is at least as forested as it was in the early 1800's. Therefore, according to Guest, deforestation must have occurred before 1800. This begins to narrow the window of deforestation to a very limited time period, one that is not thought to have been notably more degradational than others (*cf.* Christensen, 1993).

Also, palynologists commonly argue that shifts in tree species dominance, such as from oak to pine, result from human abuse of environment. While this is possible, one would think the converse would be equally plausible. In particular, deciduous oaks are more likely to occur in open, park-like stands than pines (Blumler, 1991; Blumler, 2005), and the latter tend to be taller. So a shift from oak to pine is likely to correspond to an increase in woody biomass. How does that equal environmental degradation? I do not mean to dismiss all such arguments, but rather to point out that there is a need today, given the existence of an alternative viewpoint, to adopt a hypothesis-testing approach.

There are additional complexities in the interpretation of Near Eastern pollen diagrams. For instance, the annual vegetation that dominates huge areas today is mostly self-pollinated. Since self-pollinated species release very little pollen, they typically are under-represented in pollen diagrams. A shift from perennial grass dominance of the herb cover, to annual cereal dominance, therefore, could reduce NAP, without any change in the actual arboreal cover. In contrast, a shift from oak to pistachio could have the opposite effect. Only a rigorous, detailed study of the available pollen diagrams, combined with field studies of vegetation dynamics today, could begin to sort out whether such complexities significantly change the apparent result of this study, of little long-term deforestation in the Near East.

Since Bottema's (1982[1985]) schematic diagram refers only to Greece, another possibility is that the rest of the Near East shows a different pattern than Greece does, assuming also that the three Greek diagrams included in Bottema (1991) are exceptional. But there is no reason to believe that they are exceptional, while the authoritative descriptions of Mediterranean and Near Eastern vegetation do not regard Greece as contrasting in any significant way from the Levant or western Turkey (Braun-Blanquet, 1932; Zohary, 1973). Moreover, as Rackham (1982 and1990; Grove and Rackham, 2001) has repeatedly pointed out with specific reference to Greece, empirical evidence for deforestation and other types of degradation is lacking. Most palynologists and other scholars would be very uncomfortable with the notion that Greece was deforested but the rest of the Near East was not. In short, it appears that Bottema's (1982[1985]) schematic depiction overstated the case, though admittedly a more complete analysis of the Greek diagrams should be carried out and compared with the results presented here. Indeed, such an analysis should be extended to the entire Mediterranean region, since interpretations similar to Bottema's prevail throughout. An exception is Lamb et al. (1989), who pointed out that their Moroccan diagram does not support the widespread belief that the region is deforested.

Some possible reasons for the disconnect between the Near Eastern pollen record and the widespread belief that extensive deforestation has occurred include the following:

1) Human impacts, though great, are conflicting rather than unilinear (Blumler, 1994). For example, in ancient times humans may have removed wild trees, but then replaced them with olives.

2) "Arboreal" vegetation can be very short; in fact, a few species can grow as a mat under the influence of goat browsing, escaping later when the grazing pressure is relaxed (Grove and Rackham, 2001). Thus visual (mis)perception of the landscape may suggest a lack of arboreal cover that really is present.

3) Traditional succession theory (Clements, 1916) is poorly suited to Mediterranean-climate regions (Blumler, 1993; Blumler, 2000). The same sorts of disturbances that shift vegetation from forest to more open communities elsewhere may have the opposite effect in summer-dry climates. Deep, fertile soil may be unfavorable for tree establishment, while eroded or impoverished soil may, paradoxically, support a

higher density of woody vegetation (Blumler, 1992; Blumler, 1993; Blumler, 1998; Blumler, 2000).

POLICY IMPLICATIONS

In the Near East, the perception of degradation is pervasive among scientists and government officials. A scientific evaluation of this thesis is long overdue, and is only initiated here (see also Blumler, 1993; Davis, 2007). Policies such as the planting of pine trees, to "reforest" regions not definitely known to have ever been forested, decrease species-diversity, and normally do not produce any economic benefits (Blumler, 1998). The present study provides one more line of evidence supporting the need to re-think environmental policy with respect to traditional societies, in order to achieve "conservation with development" (Zimmerer and Young, 1998). Currently, a popular paradigm is that policy is best informed if all "stakeholders" in the vicinity of a proposed development project have their say. But in the event, this often amounts to lip service (Grove and Rackham, 2001; Margonelli, 2007). Fewer mistakes might be made if the views of traditional agropastoralists were received with less skepticism and more respect.

CONCLUSIONS

The results of this limited, preliminary investigation do not prove that deforestation did not occur, and they say little about other sorts of land degradation. But they do indicate that the matter needs thorough, critical re-examination. Rather than assuming degradation, the null hypothesis of no degradation needs to be carefully and rigorously tested. The traditional view rests to a large extent upon Clementsian succession theory, which predicts degradation under human impacts while the relatively new "non-equilibrium" paradigm in ecology suggests more nuanced outcomes (Blumler, 1993; Blumler, 1998; Blumler, 2000). Thus, any testing of the degradation thesis also will require more rigorous testing of hypotheses concerning vegetation dynamics.

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