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Pauline Boerma

Assessing Forest Cover Change in Eritrea—A Historical Perspective

The present article uses historical, archival, and photographic evidence to examine the process of deforestation in the central highlands of Eritrea since the late 19th century. It finds that the extent of deterioration has been far less than generally believed by both policy-makers and rural people themselves, and by no means uniform in time and space. Furthermore, the factors that are assumed to have contributed to deforestation in this region have largely been exaggerated, while rural communities have been more adept at handling scarce wood resources than generally believed. The case of Eritrea provides evidence in support of a growing body of literature that seeks to challenge prevailing orthodoxies about the scale and pattern of deforestation in Africa and popular policies of large-scale tree planting that have been devised as a response to such perceptions.

Keywords: *Deforestation; population; environment; history; Italian colonialism; Eritrea.*

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Introduction

In Eritrea it is widely believed by both rural and urban people that forests have decreased from 30% of the overall area to less than 1% today. Deforestation is assumed to have been caused by a combination of population pressure, unsound resource use practices, civil war, and the destructive practices of colonial exploiters. Removal of forests, in turn, is seen by policy-makers to have been at the root of a variety of ills, including increasing desertification of the landscape, declining agricultural productivity, and recurrent famine.

Such popular perceptions, though never properly substantiated, are in line with much of the prevailing orthodoxy on the subject of Africa's forests, which supports the general hypothesis that there has been a rapid and detrimental process of deforestation during the past century (FAO 2001). However, a growing body of literature has been questioning the assumptions that underlie much of the current mainstream thinking on this issue and suggests that past rates and levels of deforestation in Africa have in many instances been overestimated (Hoben 1995; McCann 1997; Crummey 1998; Fairhead and Leach 1998; Ritler 2003). Based on studies involving multiple historical sources, such work throws doubt on whether processes of deforestation have been properly understood, in terms of both the extent and the pattern of change in tree cover and the underlying factors causing change.

Following in the vein of such longitudinal studies, the present article presents the findings of a study undertaken in the central highlands of Eritrea aimed at investigating the extent, pattern, and causes of change in forest cover since the end of the 19th century (Boerma 1999). The methods used and the results obtained are presented and then analyzed in terms of their implications for other countries in the region and for future forestry policy in these countries.

Study area

The study was carried out in the former regions of Hamasien, Akele Guzay, and Serae, which together form the nucleus of the central highland area of Eritrea. Since 1996, the greater part of these 3 regions has been consolidated into one administrative zone—Zoba Debub. This new zone, which has traditionally been the most densely populated area of the country, covers approximately 6000 km^2 and has an estimated population of just over 500,000. It consists largely of a high plateau characterized by both undulating plains and rugged elevations reaching up to 3013 m. Precambrian crystalline basement rock predominates on the plateau but there are sharply differing soil types with variable fertility. In the former region of Akele Guzay, the predominant soils are Chromic, Eutric, and Calcic Cambisols. Much of this soil occurs on slopes and is of restricted agricultural value since it is usually shallow, has poor moisture retention, and contains many stones and rock outcrops. However, in some valleys and depressions, these soils are deeper and the agricultural potential is relatively good. In the upper plains of Serae, soils are generally of better quality than in most other areas of the highlands, consisting of Vertic Cambisols and Luvisols. These have traditionally been areas of intensive cultivation over the centuries, and today continue to be among the most agriculturally productive areas of the highlands (Fiori 1912; FAO 1994).

The climate is cool and dry throughout much of the year, with average precipitation of between 500 and 600 mm in a good year. However, rain is generally unreliable in amount and distribution, and drought is frequent in the area. Some areas of the eastern escarpment of the plateau benefit from 2 rainy seasons resulting in annual rainfall of up to 1400 mm.

The vegetation of most of the central highland plateau is characteristic of a semi-arid temperate climate, with scrubby examples of *Acacia, Euphorbia,* and *Dodonea* predominating. Towards the edge of the east-

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ern escarpment, however, groves of olive and juniper can also be found, which tend to be particularly abundant in areas with higher rainfall. Trees are often grown in household compounds, while many villages also have small plantations of eucalyptus. Larger plantations of eucalyptus still exist on the land of former Italian concessionaires and in the vicinity of towns, where they were originally planted by the Italian colonial government. In 1997, the Food and Agriculture Organization (FAO) estimated that medium and closed woodland comprised 7.3% of the land area in Zoba Debub and open forest and woodland a further 18.6% (FAO 1997).

The rural population consists mostly of sedentary farmers engaged in growing staple crops for local consumption. However, many households still migrate seasonally with their animals to additional pastures and agricultural land in the eastern lowlands, and in the southern and western plains. Livestock constitutes an important part of rural families' incomes. Rural people continue to this day to live in communities of mostly commonly owned lands, the boundaries of which have largely remained unchanged for centuries (Taddia 1986; IAO 1932). This structure of tenure and traditional community management is in the process of being dismantled by the present government.

Methodology

The methodology was determined by 2 objectives. One was to try and establish what the landscape had actually looked like at different stages of the country's history. The other was to compile empirical information on resource use practices of the local population as well as of successive government administrations in order to throw light on the underlying causes of the changes that have occurred. In order to meet the first objective, a variety of Italian, British, and Eritrean public and government archival sources were consulted with a view to obtaining actual recorded observations and descriptions of the landscape as they appeared in journals and reports of travelers, administrators, technical advisors, and other commentators of the period under study. These were complemented by photographic material, most of which was grouped in 2 periods, the first from 1920 to 1930, and the second from 1966 to 1972. Photographs from the 1st period were obtained from the photographic archive of the Istituto Agronomico per l'Oltremare, Florence. Those for the 2nd period were provided from the private collections of Professor Paul Huntsberger of the University of New Mexico, and Professor Marco Guadagni of the University of Trento, respectively. The photographs, which included both sweeping landscape views and more specific site locations, were compared with photographs taken in the same spots, and as far as possible in the same seasons in 1997/1998, in order to ascertain changes in vegetation and land use patterns. In addition to the above, oral testimonies of past changes were collected, though these proved inconsistent and unreliable, particularly when juxtaposed with photographic evidence. Maps, satellite images, and aerial photos were also consulted but did not, on the whole, prove to be useful due to lack of detail or the ambiguity of the images available.

In order to gather information on resource use practices over time, the archival research was broadened to obtain more analytical accounts of forestry issues in journal articles and various government reports. In addition, information was collected on related issues such as land policy, agriculture and livestock production, demography, and local and international trade, particularly with regard to timber-related products, construction, and industrialization. Field research in 23 communities of the central highland area was also undertaken, involving a combination of in-depth study of 2 communities and more general investigation in the remaining communities. The object was to obtain first-hand accounts of changes in individual resource use practices including cultivation, grazing, and timber management. Individual interviews were conducted in the form of open-ended conversations, as well as group discussions and informal interactions with men and women as they undertook their work.

Throughout the study the different sources of information were compared and cross-checked for consistency and credibility. Attention was also paid to clarifying definitions of forests to ensure consistency in comparisons.

Results

While very little concrete information exists on the Eritrean landscape prior to colonization by Italy in 1890, the available evidence suggests that forest resources were already scarce in the years leading up to conquest by Italy and in the early years of colonial rule. We know this in part from travel reports and accounts of military expeditions of the period, all of which indicate that while the vegetation of the eastern escarpment of the central highlands was rather rich, probably more so than today, judging from the visual descriptions available, the plateau itself contained very little woodland of any kind (Matteucci 1880; Vigoni 1881; Munzinger 1890; Schweinfurth 1894; Martini 1925). In addition, government correspondence of the period reveals serious concerns about the fragile status of the colony's existing forests, and particularly the lack of usable timber on the highland plateau (Archivio Eritrea 1893–1897). Not only did the government begin, at a relatively early stage, to introduce legislation restricting the cutting of timber for domestic purposes, but records from the period also show that the administra-

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tion was importing timber from Europe to meet construction and carpentry requirements (Martini 1900).

A more formal confirmation of the scarcity of timber resources can be obtained from a study undertaken between 1905 and 1907 by Signor L Senni, a forestry inspector, in which he estimated that only about 7.5% of the country's land area could be considered as forested (Senni 1915). In 1912, a further and more comprehensive study was made by Adriano Fiori on the state of Eritrea's forests and woodlands (Fiori 1912, 1913). This study, while not attempting to quantify tree cover, categorized the type of vegetation found in each micro-climate. Its usefulness derives from the fact that it verifies the dominant perception of the relative abundance of vegetation on the eastern escarpment as opposed to the lack of woodland on the high plateau. For instance, Fiori writes: "While the escarpment is in most places generally wooded the highland plateau instead is completely bare or almost so … . Just here or there stunted solitary trees or in groups break the monotony of the landscape" (Fiori 1913, p 366).

Unfortunately there was no further attempt by the colonial administration to evaluate the state of Eritrea's forests and woodlands after Fiori's study; thus it is difficult to ascertain with any accuracy what the impact of Italian colonial rule may have been on the landscape. Estimates of tree cover in the 1940s made under the auspices of the British Military Administration after the departure of the Italian colonial administration suggest that there was little significant change in forest cover (see below). This would be largely consistent with archival evidence regarding Italian forestry policy and actions. Firstly, with an eye to long-term development of the colony into an agriculturally prosperous entity, legislation to protect the existing tree population of the highlands was taken seriously and became increasingly restrictive over time. Secondly, the colonial government continued to import large quantities of timber from Europe throughout its administration of the colony (UEE 1928, 1934). In contrast, timber exports were virtually non-existent. Thirdly, tree planting was widely pursued. Both Italian settlers and local communities were coerced or cajoled to plant trees, while the government itself established large tree plantations, mostly of eucalyptus, in areas immediately surrounding major towns of the highland plateau (Guidotti 1934). Lastly, contrary to popular belief, there was limited clearing of forests to make room for colonial settlers. Agricultural settlers were few in number during the Italian colonial period and tended to settle on existing agricultural land. The amount of land that was effectively settled and alienated by colonialists under the Italians never surpassed 10,000 ha (Tekeste Negash 1987).

Despite the evident concern for sustaining forest cover in Eritrea, there were 2 periods of fairly intense timber exploitation under the Italian colonial administration. One was in the 1st decade of colonial rule when large quantities of local timber were used for firing bricks, making railway sleepers, and servicing various military garrisons. However, Senni, who consulted precolonial maps of the highlands and who was otherwise critical of the Government's ability to manage its forest resources, did not believe that this exploitation was sufficiently important to have significantly diminished overall forest cover (Senni 1915). The 2nd period occurred in the mid 1930s prior to the Italian invasion of Ethiopia, when large quantities of timber were used to construct shelters and provide fuel for the military. The impact of this exploitation, however, may have been more localized than general, as most of the wood exploited was along the main roads between Asmara and the Ethiopian border.

It would also appear to have been short-term rather than permanent. Apart from the fact that—as mentioned above—we have estimates of tree cover from the 1940s that suggest minimal change in overall forestry resources since the 1st decade of the 20th century, this latter assertion is reinforced by a set of 28 landscape photographs taken in 1930 along the main road network of the central highlands by the then director of the Colonial Agricultural Institute, Dr Maugini. The roads along which the photos were taken were heavily used by the colonial army, with garrisons established at regular points along the road network. When compared with photos of the same landscapes taken in 1997/98, the photos appear to indicate that, despite reportedly heavy exploitation of wood along the main roads in the mid and late 1930s, the overall quantity of vegetation changed rather minimally in the intervening 60 years. Figure 1A shows one representative sample of the collection, displayed in conjunction with a 2nd photo taken in the same location and season of the year in 1997 (Figure 1B).

The photos show a landscape located about 10 km north of Adi Caieh in the former region of Akele Guzay. One can see that the difference between the 2 photos is quite subtle. The landscapes reveal both loss and gain in vegetation in different locations, though the overall quantity of vegetation is not greatly altered. On the top left of the 1930s photograph, one can note a collection of olive trees that have largely disappeared in the 1997 photograph. On the other hand, there appears to be a greater proliferation of acacia trees in the foreground of the 1997 photograph as compared to the 1930s photograph. This indicates a qualitative deterioration in vegetation, as olive trees are generally more valued by the Eritrean population than acacias. Other photographs in the collection reveal a similar pattern, though in several one can note the addition of many planted trees, including exotic species such as eucalyptus.

In 1941, Eritrea came under the stewardship of a British Military Administration (BMA) after the surren-

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FIGURE 1A April 1930, near Adi Caieh. (Photo by Armando Maugini)



FIGURE 1B January 1997, near Adi Caieh. (Photo by Pauline Boerma)

der of the Italian commander to the Allies. A major source of information for this period is a series of BMA files containing detailed correspondence on matters relating to forestry issues. These files indicate that the British, like the Italians, were greatly concerned about the paucity of wood resources in the country. In an initial broad estimate of tree cover in the country in 1945, it was calculated that roughly 5% of the country as a whole was wooded (RDCE 1943). However, this estimate was revised upwards 2 years later in a more comprehensive survey of tree cover by province undertaken by the head of the Forest and Wildlife Department (Infante 1947). The findings indicated that 10% of the 3 central highland provinces consisted of wooded areas. This estimate is higher than that of Senni in 1905 but seems likely to have included a broader definition of forests. The accompanying text of the report, on the other hand, is very similar in its descriptions of the landscape to that of Fiori made some 35 years earlier.

Unlike the Italians, the British had no permanent interest in Eritrea and were concerned to defray the costs of their occupation of the colony (RDCE 1943). Despite the evident paucity of its forest resources, concessions were granted for the exploitation of timber in the few areas where extensive forests and woodlands still existed, such as on the eastern escarpment and in pockets of the highland plateau. The timber was then exported as logs or in the form of charcoal to other colonial territories, mostly in the Mediterranean (RDCE 1943). Once again, there is insufficient information to make an

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accurate estimate of how much forest cover might have been permanently affected by this exploitation. Most areas of the central highlands remained untouched by concessions, but the evidence suggests that in areas of the central highlands where substantial forest resources had existed prior to the arrival of the British, severe damage was inflicted. In particular, there was heavy exploitation of the forests of Mataten and Coatit on the edge of the eastern escarpment. This is indicated in the archives and the physical remnants of once extensive forests can be seen today in these locations.

Following the transformation of Eritrea into a federal administration under the Ethiopia government in 1951, archival sources on forestry become scarce. Two attempts were made at estimating forestry cover in 1974 by the Eritrean administration (DAEP 1974) and in 1984 under the auspices of the United Nations Development Programme (UNDP)/ FAO Highlands Reclamation Study of Ethiopia (FAO 1984). However the results of neither of these would appear to be reliable due to technical and logistical difficulties caused in part by an escalating war situation. The 40 years prior to Eritrean independence in 1992 were marked by increasing political turmoil, droughts and, eventually, civil war, all of which served to disrupt the exercise of government and the retaining of records on agricultural and resource management activities. In this context, 2 sources of information became particularly useful for the study, namely oral testimonies regarding changes in natural resource use, and photographic information.

Oral accounts of changes in natural resource use practices were largely consistent across communities, and by juxtaposing them with information on land use, demography, and livestock production available in the Italian colonial archives, it was possible to build up a reasonably coherent picture of the changing role of trees and woodlands in people's lives. The main points that emerged were as follows:

1. Despite a 400% growth in population since the late 19th century (Ciampi 1994), the amount of land under cultivation has not generally increased by more than 50%, the tendency being to reduce individual plots of land and decrease fallow periods. Additional land appropriated for cultivation has tended to be marginal, and grazing lands rather than woodlands.
2. While pressure on scarce timber resources grew with the increasing population, most communities were able to institute systems for rationing access to timber, allowing for the regeneration of trees. In addition, timber was obtained more and more from other timber-rich areas such as the eastern escarpment, and from eucalyptus plantations in individual communities. Also, there was a progressive move towards building houses of stone rather than timber.
3. More problematic for communities was the increase in livestock population up to the early 1970s. As wooded areas around communities also serve as grazing land, it became increasingly difficult to ensure the regeneration of young trees. However, the civil war, which escalated in the 1970s and 1980s, resulted in a huge reduction in the number of livestock, with an inadvertently positive impact on vegetation.
4. The civil war did not damage the central highlands to the same extent as other areas of the country. Fear of the Ethiopian military and the proliferation of land mines resulted in limited use of distant pasture and woodlands, allowing for the regeneration of these areas. In contrast, areas in close proximity to dwellings suffered from overexploitation of local timber sources. Many of the former large Italian plantations were plundered, as were local community plantations, but the effect of this was to return the landscape to what it had been prior to the 1920s and 1930s when most of the tree planting took place.

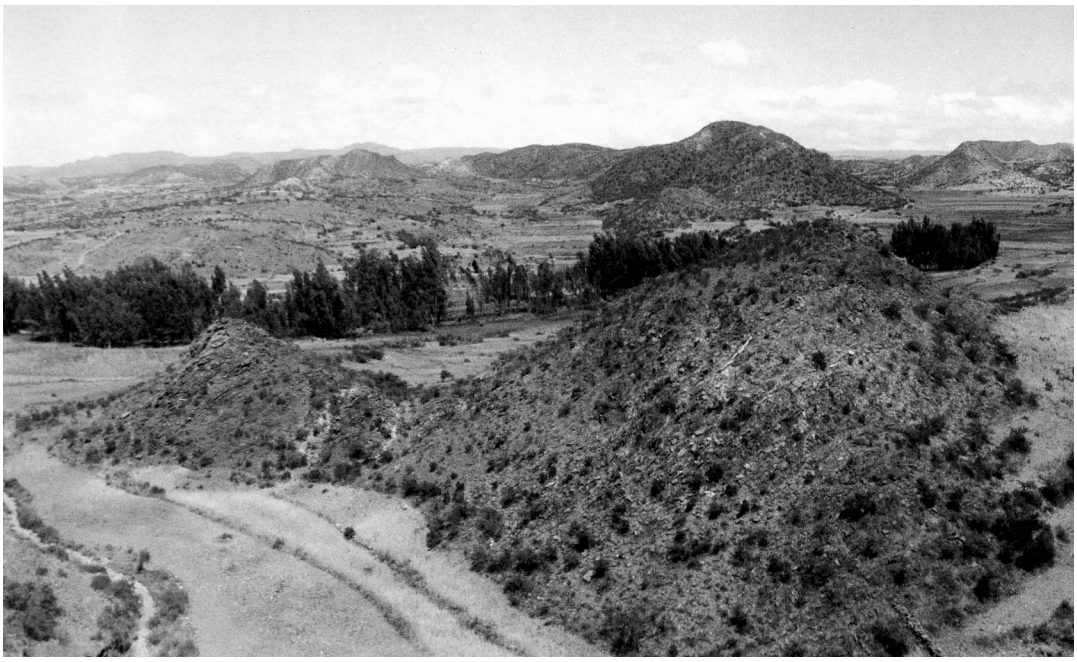
Photographic information from the 1960s and 1970s appears to support these conclusions. One group of photos that support this research date from 1966 and were taken in the vicinity of Saganieti, in the former region of Akele Guzay. A 2nd group of photos were taken in 1971 and 1972 in and around Ma'araba in Akele Guzay, and Adi Cubollo in what was formerly the region of Serae. When juxtaposed with photographs taken in 1998, these photographs, as in the case of Maugini's earlier photographs, indicate little change in the overall quantity of vegetation and in land use patterns, though they do point to the destruction of tree plantations, most of which were planted by the Italians or local community people since the 1930s. Figures 2A and 2B show a landscape in the community of Adi Cubollo, where the overall landscape as depicted in Figure 2B seems largely unchanged as compared to the one in Figure 2A, except for the disappearance of a substantial plantation of eucalyptus trees. These trees, which were planted in the 1950s, were destroyed in stages during the war of liberation.

Conclusions

While overall forestry loss in Eritrea cannot be assessed with great accuracy, 4 general conclusions can be drawn. Firstly, other than on areas of the eastern escarpment, the central highlands were not densely forested at the end of the 19th century. Secondly, the extent of deforestation that has occurred since that time has been considerably less than generally believed, though there is evidence that some areas of the eastern

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FIGURE 2A March 1971, Adi Cubollo. (Photo by Marco Guadagni)



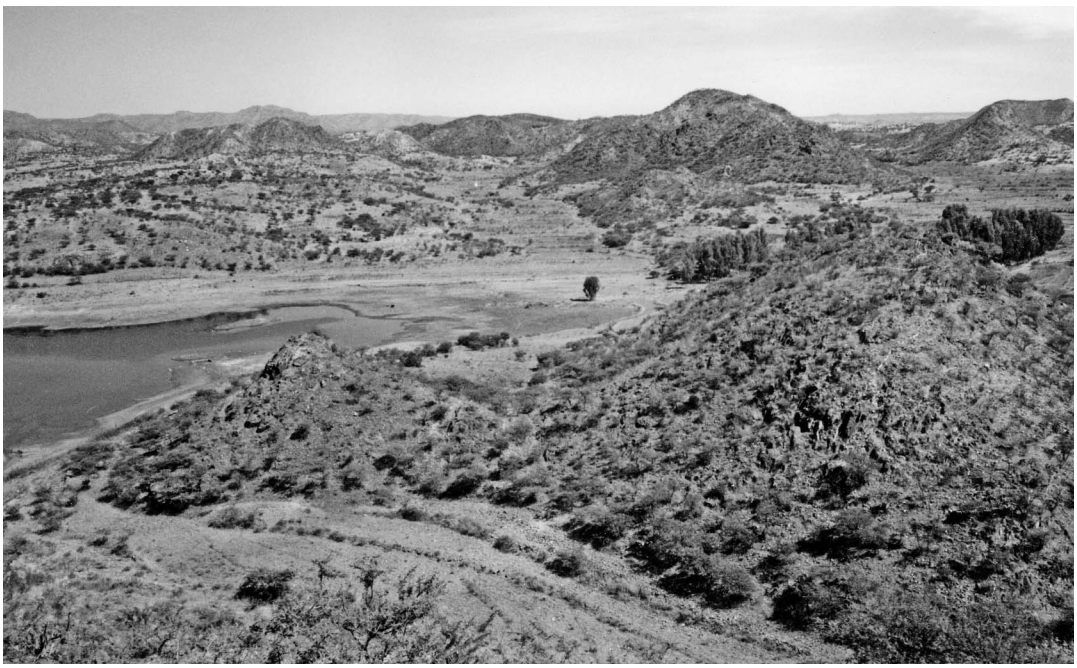


FIGURE 2B February 1998, Adi Cubollo. (Photo by Pauline Boerma)

escarpment experienced severe losses. Also, there has been some qualitative deterioration in the type of vegetation available. In particular, economically useful trees such as olives, euphorbia, and juniper trees have been replaced in many instances by the far less versatile acacia, and by increasing numbers of small eucalyptus plantations on communal land. Thirdly, change in tree cover has by no means been unilinear or uniform, but rather a kaleidoscope of different processes both in time and space, with both loss and gain in tree cover being experienced at different points in Eritrea's recent history. Lastly, the evidence suggests that colonial exploitation of wood resources, though at times intense, had a localized rather than a general impact on tree resources in the central highlands. Furthermore, despite a 400% increase in population growth, community systems of tree management appear to have been more effective in regulating local wood exploitation than generally acknowledged, while the effect of war on vegetation cover has been ambiguous.

There are some important implications of these findings for other countries of the region. The tendency when viewing a landscape devoid of trees in much of sub-Sahara Africa is to assume that it must once have

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been forested and that over-exploitation has been the cause of the disappearance of trees. But the example of Eritrea shows that this may not necessarily be the case, at least not in the recordable past. It is significant to note that traditionally there have been areas—mostly for pastoral use—where trees are known to regenerate naturally and, in the past, these would be periodically closed off by communities to allow the tree stock to replenish itself. But in most areas of the Eritrean highlands, and particularly on the plateau itself, when land is left unused, regeneration results in the growth of grass and shrubs with some scattered trees, but not woodland and certainly not dense forests. This in itself should provide some clue as to what the landscape might have contained in the past.

Furthermore, and particularly where a strong tradition of community cooperation exists, the case of Eritrea is a good illustration of how people may be able to adapt quite well to relatively limited forest and woodland resources, even in a situation of a rapidly increasing population. This is not to say that problems may not arise in terms of tree loss in localized areas or in the qualitative deterioration of tree stocks. This latter point is important not only because it may be economically costly, to farming families in particular, who rely on a variety of woods and tree products for tools, ploughs, and household uses but also because it often leads to substitution with ecologically inappropriate exotic species such as eucalyptus, generally at the encouragement of government authorities. But the response of policy-makers needs to be a more measured analysis of *how* the landscape has changed over time and *why*, rather than a rush into costly and often unsustainable campaigns to 'reforest' areas where trees may never have existed in the first place. Furthermore, a better understanding of how management of wood resources has historically been integrated into people's day-to-day coping strategies would facilitate the devising of appropriate measures and incentives to address existing potential problems of wood availability or quality.

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REFERENCES

Archivio Eritrea. 1893–1897. *Pacco 273* and *Pacco 173*. Rome, Italy: Ministry of Foreign Affairs.
Boerma P. 1999. *Seeing the Wood for the Trees: Deforestation in the Central Highlands of Eritrea Since 1890* [PhD dissertation]. Oxford, United Kingdom: University of Oxford.
Ciampi G. 1994. La popolazione dell'Eritrea. *Bollettino della Societa Geografica Italiana Seria XI* 7:487–524.
Crummey D. 1998. Deforestation in Wallo: Process or illusion? *Journal of Ethiopian Studies* 26(1):1–41.
DAEP [Department of Agriculture of Eritrea Province]. 1974. *Forestry Development in Eritrea.* Asmara, Eritrea: Department of Agriculture of Eritrea Province.
Fairhead J, Leach M. 1998. *Reframing Deforestation: Global Analyses and Local Realities. Studies in West Africa.* London, United Kingdom: Routledge.
FAO [Food and Agriculture Organization]. 1984. *Assistance to Land-Use Planning Ethiopia: Report.* Rome, Italy: FAO.
FAO [Food and Agriculture Organization]. 1994. *Eritrea. Agriculture Sector Review and Project Identification Report: Annex 3.* Rome, Italy: FAO.
FAO [Food and Agriculture Organization]. 1997. *Eritrea. Support to Forestry and Wildlife Sub-Sector: Pre-Investment Study.* Rome, Italy: FAO.
FAO [Food and Agriculture Organization]. 2001. *Global Forest Resources Assessment 2000: Main Report*. Rome, Italy: FAO.
Fiori A. 1912. *Boschi e piante legnose dell'Eritrea.* Florence, Italy: Istituto Agricolo Coloniale Italiano.
Fiori A. 1913. Boschi ed ordinamento forestale nell'Eritrea. *In:* Martini F, editor. *L'Eritrea economica: Prima serie di conferenze tenute in Firenze sotto gli auspici della Societa di Studi Geografici e Coloniali*. Novara, Italy: De Agostini, pp 353–373.
Guidotti R. 1934. Boschi e servizio forestale in Eritrea. *L'Agricoltura Coloniale* 28(3):113–124.
Hoben A. 1995. Paradigms and politics: The cultural construction of environmental policy in Ethiopia. *World Development* 23(6):1007–1021.
IAO [Istituto Agronomico per l'Oltremare]. 1932. *Fascicolo 1092: Il problema fondiario in Eritrea.* Florence, Italy: Istituto Agronomico per l'Oltremare.
Infante E. 1947. *Rassegna Tecnica delle Industrie Eritree.* Asmara, Eritrea.
Martini F. 1900. *Relazione sulla Colonia Eritrea 1899–1900.* Rome, Italy.
Martini F. 1925. *Nell'Affrica Italiana: Impressioni e Ricordi.* Milan, Italy: Treves.
Matteucci P. 1880. *In Abissinia.* Milan, Italy: Treves.
McCann J. 1997. The plow and the forest: Narratives of deforestation in Ethiopia 1840–1992. *Environmental History* 2(2):138–159.
Munzinger W. 1890. *Studi sull'Africa Orientale.* Rome, Italy: Voghera.
RDCE [Research and Development Centre of Eritrea]. 1943. *Box 118, file 30/A/1*, volumes 1 and 2. Asmara, Eritrea: Research and Development Centre of Eritrea.
Ritler A. 2003. *Forests, Land Use and Landscape in the Central and Northern Ethiopian Highlands, 1865 to 1930.* Berne, Switzerland: Geographica Bernensia.
Schweinfurth G. 1894. *Il presente e l'avvenire della Colonia Eritrea*. Milan, Italy: Bellini.
Senni L. 1915. Note sulla legislazione forestale Eritrea. *L'Agricoltura Coloniale* 9(2):65–86/148–166.
Taddia I. 1986. *L'Eritrea—Colonia: 1890–1952.* Milan, Italy: Franco Angeli.
Tekeste Negash T. 1987. *Italian Colonialism in Eritrea.* Uppsala, Sweden: Scandinavian Institute of African Studies.
UEE [Ufficio eritreo dell'economia]. 1928. *Statistica del movimento commerciale marittimo e carrovaniero dell'Eritrea nel quinquennio 1923–1927.* Rome, Italy: UEE.
UEE [Ufficio eritreo dell'economia]. 1934. *Statistica del movimento commerciale marittimo e carrovaniero dell'Eritrea nel quinquennio 1928–1933.* Rome, Italy: UEE.
Vigoni P. 1881. *Abissinia: Giornale di un viaggio*. Milan, Italy: Hoepli.

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