THE COMPLEX WAYS in which degradation narratives inform and affect environmental policies in Africa and other regions have received growing scholarly attention over the last decade. Researchers are increasingly questioning the received wisdom of conventional environmental narratives, many of which were written during the colonial period. Much of this work points out exaggerations and errors in the data or the interpretations of data upon which these environmental narratives, and many environmental histories, are based. A substantial portion of this recent research highlights the political and economic purposes to which these questionable environmental narratives were, and are, frequently put.¹

To date, an astonishingly small amount of this kind of research has been conducted on environmental narratives that concern the Middle East and North Africa. This is even more surprising given that the arid landscapes of this region often are described and defined as deforested and overgrazed environments that have been subjected to centuries of abuse by local peoples. This article examines how the dominant environmental history of North Africa informed the development of environmental policy in Morocco during the colonial period, 1912-1956, and analyzes some of the major effects of these policies. The conventional environmental history of North Africa, still ubiquitous today, was conceived primarily during the French colonial occupation of Algeria, dating from 1830. It
is an environmental narrative of decline, of the ruin of a previously fertile landscape by centuries of deforestation and overgrazing by Arab nomads and their livestock herds. Recent paleoecological studies, however, have questioned rates of deforestation described in this narrative as well as the extent of historical forest cover in North Africa, particularly in Morocco. Contemporary research in arid lands ecology and pastoral studies likewise has questioned the destructiveness of traditional land uses assumed in this declensionist narrative.

Most environmental policy in colonial Morocco outside of urban and agricultural areas was developed in or strongly influenced by a single key sector: forestry. That is, most land not under cultivation or built upon came under the purview of the forestry department (Service des Eaux et Forêts) or was strongly affected by this department. The forestry department was developed by one man who directed it for decades. The influence of this man, Paul Boudy (1874-1957), and his conviction that Morocco was severely deforested, cannot be overestimated. Boudy, deeply imbued with the conventional environmental narrative of North Africa, identified traditional livestock grazing as the most significant cause of deforestation and environmental degradation in the protectorate. He presided over the creation of the Moroccan forest code and several amendments to it, as well as the development of new laws and policies, all of which restricted and regulated grazing in forested areas. Under his leadership, even non-arboreal areas, such as the immense alfalfa grass pastures in eastern Morocco, were brought under the control of the forestry department.

The forestry department worked closely with the livestock and range management department (Service de l'Élevage). Forest laws and policies greatly affected the work of the livestock department which likewise was staffed by men trained in the conventional environmental narrative of North Africa. Thus much of their work, too, focused on restoring what they saw as a degraded environment by intensifying livestock raising for commodity production and by promoting sedentarization. Because unforested land not under cultivation or built up in cities and villages was used largely for grazing, the policies of the livestock department extended the use and impact of this declensionist environmental narrative to most of the rest of Morocco. In helping to shape so many policies, the environmental narrative favored imperial interests over indigenous interests. Further, it facilitated the dispossession of Moroccans from their lands and the destruction of their traditional livelihoods.

The conventional environmental history of Morocco, based on this declensionist colonial environmental narrative, was well-established by the nation’s independence in 1956. What had begun as a largely literary narrative before Morocco was even colonized had been transformed into a scientific story of deforestation and environmental degradation “proven” by vegetation maps and voluminous ecological statistics and calculations. These statistics, calculations, and maps were provided by those working in the young science of plant ecology during the 1920s and 1930s. The development of potential vegetation maps—maps of what the natural vegetation could and should be—was particularly influential in providing scientific authority for forestry and other environmental policies.
In Morocco, the most influential plant ecologist was Louis Emberger (1897-1969). Trained as a phytosociologist (plant ecologist) in France, he wrote much of the definitive scientific literature on Morocco’s vegetation.

Emberger, though, like most phytosociological researchers, relied on certain types of relict vegetation and other subjective measures—which were assumed to be indicative of the original, natural vegetation—to formulate his calculations and conclusions. As Emberger also had been brought up with the conventional environmental narrative of North Africa, his belief that Morocco was severely deforested informed his research. The statistics, articles, and maps that he produced quantified, rationalized, and institutionalized much of the dominant environmental narrative in the science of plant ecology for Morocco. Emberger’s research was used as scientific proof of severe deforestation by Boudy to justify forestry policies that severely restricted traditional uses of the forest by local Moroccans. Boudy further strengthened and institutionalized the colonial environmental narrative in a four-volume treatise on North African forests. His treatise still is cited today as an authoritative source of information on forests in Morocco, Algeria, and Tunisia.

This article elucidates how an inaccurate nineteenth-century narrative based largely on classical literary sources shaped environmental policy formulation in Morocco during the colonial period. It is the first work to detail how such a narrative was itself refined and quantified during the colonial period. The essay explains how the narrative both informed, and later was justified by, developments in plant ecology and the construction of potential vegetation maps, to become institutionalized as the dominant environmental history of Morocco. In doing so, it argues that this environmental narrative formed a fundamentally important part of the context in which many environmental laws and policies were developed and thus challenges much previous scholarship on environmental history and environmental policy in Morocco.

NORTH AFRICA IN THE FRENCH COLONIAL IMAGINARY

LONG BEFORE FRENCH colonial administration, North Africa held a special place in the imaginations of most Europeans, as a region of legendary natural fertility. Within the first two decades of the French occupation of the Maghreb, beginning with the invasion of Algeria in 1830, an environmental narrative developed from this imaginary which would have a profound impact on colonization efforts in Algeria, Tunisia and Morocco. This narrative, which later would become the most common environmental history of North Africa, was composed of two primary parts. Informed largely by familiar French readings of classical texts such as Pliny, Strabo, Herodotus, and Ptolemy, North Africa was interpreted as formerly being “the most fertile region in the world.” Not limited to romantic writers, journalists, or historians, this long-standing interpretation was formalized by the official, government-sponsored, Exploration Scientifique de l’Algérie of the 1830s and 1840s. One of its authors proclaimed in 1847 that “this land, once the object of intense cultivation, was neither deforested nor depopulated as today, ... it was
the abundant granary of Rome." This particular quote reveals the new, colonial half of the narrative, that of decline. Based mostly on the writings of medieval Arab historians such as Ibn Khaldoun, the second half of the narrative claimed that the North African environment had been deforested, overgrazed and desertified by hordes of Arab nomads and their voracious herds of livestock. A popular quote used in a variety of permutations from the 1860s on, for example, expressed the sentiment well: "when the Arabs invaded the North of Africa ... cities were annihilated, fire destroyed the harvests, the plantations, the forests, and a society newly established on this land was devastated." Once created, this narrative had tenacious staying power. Nearly three quarters of a century later, slightly different versions of it remained in official use. One version, for example, described "the profound convulsions which since the Roman era have upset the country: the passage of the Arab armies and later the Hillalian tribal invasion ... have made of this country a desert strewn with ruins which however attest to its ancient prosperity." The story thus claimed that since the Arab invasions of the seventh and eleventh centuries, the descendants of the Arab nomads had perpetuated, with their destructive land-use practices (burning and grazing), the decline and ruin of the North African environment. The part of the indigenous population defined as Berber, by contrast, was portrayed as mostly sedentary and agricultural, and therefore good (or at least better) stewards of the environment. In combination with the prevailing sentiment that, in North Africa, France was "the legitimate successor of Rome," this created a powerful rationale for sedentarization as the colonial powers claimed it was their duty to restore the former fertility and glory of ancient Rome. The impact of this environmental narrative on colonial policy in Algeria, and later Tunisia and Morocco, was wide ranging. It justified the appropriation of forests by the state, the expropriation of large amounts of agricultural and pasture land, the development of elaborate agricultural policies, and the control of pastoral nomadic and transhumant populations in the name of environmental protection. Morocco was an integral part of this environmental narrative from its inception in the nineteenth century. A typical book on North Africa, although written just a few years after the capture of Algeria, reiterated the ancient Greek geographer Strabo's observation that "all of the [land] between Carthage and the Pillars of Hercules [from Tunis to the Atlantic ocean] is of an extreme fertility." The pillars of Hercules are, according to classical mythology, the mountains on either side of the Straits of Gibraltar which, when pushed apart by Hercules, created the Straits. Thus this exalted area of assumed extreme fertility stretched from contemporary Tunisia well into Morocco. From at least the mid-nineteenth century on, Morocco was often singled out as "one of the most beautiful and fertile countries of the earth." It, like Algeria and Tunisia, was frequently described as "one of the granaries of Rome." In the decade or so leading up to the conquest of Morocco in 1912, descriptions of Morocco's ancient fertility and its lush vegetation became more common and more detailed.
Although little actually was known about Morocco at the turn of the century, lengthy descriptions of Roman Morocco as far south as the Draa river on the Atlantic coast extolled its marvelous fertility (see map). One author in particular, Maurice Besnier, did that in authoritative and extensive tracts for the Scientific Mission of Morocco (Mission Scientifique du Maroc), a research group commissioned by the French government. Based on his readings of the ancient texts of Strabo, Pliny, Pomponius Mela, and others, he proclaimed that in the past, “except for a few deserts of small extent, Mauretania [Morocco] [had] only fertile land and [was] well supplied with streams. It [was] very forested and the trees [attained] there a prodigious height.” This environmental narrative became
enshrined in the series of volumes begun by the Mission Scientifique du Maroc, Les Archives Marocaines, from approximately 1903 into the 1930s.9

The idea that Morocco had been the granary of Rome, and also the location of the mythical garden of the Hesperides, was used to formulate and to justify extensive agricultural policies during the colonial period in Morocco. Those agricultural polices have received considerable scholarly attention. What has been less well explored is how the idea that Morocco had been significantly more forested during the classical and pre-Islamic periods influenced colonial policy, especially environmental policies outside of the agricultural sector. Yet descriptions of North African forests during antiquity attracted as much attention as did the granary-of-Rome myth during the French colonial period, since they were interpreted as indicators of the region’s innate natural fertility and environmental salubrity. As early as 1846 ancient sources like Pliny were being used as evidence that “grand forests” once covered the sides of the Atlas mountains and that neighboring forests were “full of elephants, other wild animals and huge serpents.” This same description by Pliny is repeated often
during the colonial period in Morocco. Besnier’s articles in the *Archives Marocaines*, for example, claimed that “the Atlas were covered in dense forests.”

Contemporary paleoecological evidence, however, has convinced many that Morocco has not experienced deforestation of significant portions of its arboreal vegetation. Although there has been a reduction in some species over the last two thousand years, many areas considered severely deforested—such as the Middle Atlas mountain region—appear not to have experienced significant changes in vegetation, especially of most tree species, during this time. It also has been demonstrated that many traditional forms of resource use such as extensive herding and even the use of fire in the Mediterranean basin are not necessarily harmful, since much of the vegetation has adapted to grazing and fire over thousands of years. The scientists and administrators in the Moroccan protectorate did not, of course, have such evidence concerning these issues. They chose, however, to make comparisons with descriptions from classical sources to draw the conclusion that the Moroccan landscape as the French found it around the turn of the century was egregiously deforested.

When the protectorate was established, though, the amount and severity of deforestation were not yet quantified. As in Algeria and Tunisia, the Moroccan narrative nonetheless primarily blamed the Arab nomad invasion of the eleventh century for the general destruction of a formerly lush landscape, and especially for the assumed deforestation. This culpability was extended to the Arab pastoral nomad populations living in the region since that time. It was frequently lamented, from the early days of the protectorate, that in the Moroccan countryside, “as everywhere, the Arab has destroyed the tree.” Such assumptions about the general degraded state of Morocco’s forests, made since before the protectorate was established, provided an imperative to resurrect the forest in Morocco from the earliest days of French control. This historical narrative of deforestation and environmental decline thus underpinned the creation, development, and applied work of the Moroccan forest service.

**RESURRECTING THE FOREST**

In 1954, two years before independence, the honorary inspector general of the Moroccan forestry department, Paul Louis Jules Boudy, presented a historical overview of four decades of triumphal work by the department. His exposé was titled “La Resurrection de la Forêt Marocaine,” and it began, “In 1913, the day after the establishment of the protectorate of France, the Moroccan forest was in a miserable state and its trajectory tended toward absolute zero [sic].” This quote succinctly summarizes the views of Boudy, the man who created the Moroccan forestry department, directed it for three decades, and maintained strong influence in the department until Moroccan independence. Boudy’s views of North African and Moroccan environmental history mirrored the predominant views of the period and are clearly reflected in how he shaped the Moroccan forest code and enacted forestry policies. He believed passionately that Morocco had enjoyed extensive forests in the past and that, if destructive local forest use could be prevented, the protectorate had great potential for extensive forests in the future.
Paul Boudy was born in July 1874 in France. He graduated from the national forestry school at Nancy in 1897. In 1898, he was posted to Algeria and then to Tunisia in 1904. In 1907, he joined the reforestation department back in Algeria, and became director. In March 1912, the official beginning of the Moroccan protectorate, Boudy volunteered to leave Algeria to go to Morocco to help with forestry issues in the new protectorate. By March 1913, he had arrived in Morocco and been appointed director of the newly established forestry department. Boudy ran the forestry department for nearly thirty years, until 1941. He stayed on as an official adviser to the protectorate administration until his death in 1957. The Resident General of Morocco, General Louis-Hubert-Gonçalves Lyautey (1854-1934), ordered the creation of the forestry department in 1913, and it was placed under the general direction of the department of agriculture, commerce, and colonization. The first order of business, by order of Lyautey, was to save the cork forests along the mid-Atlantic coast (Mamora) and to turn them into profit-generating export forests. This interest in cork followed a 1912 harvest that was the largest and most lucrative harvest of cork in Algeria since 1830. The Moroccan cork forests were considered degraded from indigenous abuse but capable of being saved, reconstituted, and made similarly profitable. As in Algeria, the environmental narrative of ruin which blamed the indigenous populations served the interests of some stake holders in Morocco much more than others. The protectorate administration, for example, declared ownership over all forested areas in the name of environmental protection but, importantly, generated
substantial revenue from the sale of cork, timber, and other forest products which was used to finance French administration of the territory. Revenue from forest production grew quickly during the first few years of the protectorate. Between 1915 and 1918, for example, revenue increased over 800 percent.\textsuperscript{14}

When Boudy arrived in Morocco, as a veteran of twelve years in the forestry departments of Algeria and Tunisia, he likely already had an idea of what he would find in Moroccan forests. The forests in Algeria and Tunisia were widely considered to have been destroyed by centuries of abuse by indigenous land-use practices such as grazing and burning. In 1914, Boudy published an article on the forests of Morocco that made clear his opinion that the known forests in the protectorate at that time, especially the cork forests, were badly degraded and deforested. Fire, charcoal making, debarking for tannin production, and abusive grazing—that is most of the indigenous uses of the forests—all were blamed for forest degradation, as they had been by foresters in Algeria and Tunisia. At that time, just two years into protectorate administration, only small areas of northwest and eastern Morocco had been explored and their forests inventoried. It was not until well after World War I that the pacification of Morocco was completed. The process took two decades and was not officially over until the occupation of the deep south in 1934. The process of exploring and inventorying Morocco’s forests likewise took decades.\textsuperscript{15}

Boudy’s predecessor Forest Inspector Dupont had been sent from Algeria in 1911 to evaluate the forests of Morocco and to write an advisory report. Based partly on Dupont’s report, the protectorate government decided in 1912 that the Algerian forest code of 1903 should be applied, though adapted to Morocco’s conditions. Thus the Algerian code was the acting forest code in Morocco for five years as well as the basis for the new Moroccan forest code of 1917. The Algerian forest code of 1903 was itself a much-amended version of the 1827 Napoleonic forest code of France that had been applied at the time of Algerian conquest in 1830. Extensive forest fires in Algeria prompted several changes to the 1827 code during the nineteenth century. (Fire was a common tool for managing the landscape among local Algerians—during the occupation it became a tool of protest as well.) As a result of these modifications, the Algerian forest code of 1903 was much more restrictive and punitive than the 1827 French code. Its application, which criminalized nearly all indigenous forest uses, caused great adversity and protest among local Algerians.\textsuperscript{16}

Lyautey, who had come to Morocco with years of experience in Algeria, Madagascar, and other French colonial territories, strove to avoid what he perceived as the pitfalls of previous French colonial administrations. One of his goals was to pacify by attraction and not by coercion and violence as had occurred so often in Algeria and elsewhere. This meant, in theory, that local custom and use rights were to be more respected and that application of the forest code was to be less harsh than in Algeria. In setting up the forestry department, then, Lyautey determined that “contrary to what happened in Algeria, the Moroccan forestry personnel [would have], in effect, a role exclusively technical.” At this early date, infractions were to be dealt with by the local authorities and not
forestry personnel. Most of the changes made to the Algerian forest code as it was adapted to Morocco thus related to how and where to apply the code and did not modify any of the code’s primary goals or ecological bases. Whereas in Algeria the French had carried out a lengthy and difficult process of defining state forests, communal forests (for local Algerians), and private forests, in Morocco the administration simply appropriated all forested land and defined it as state land to be reserved for the public good and the restricted use of a few local tribes. This was mandated with a government circular in November 1912 that became law on 7 July 1914. This was followed by the law of 3 January 1916 on auditing and delimiting state forests.17

The Moroccan forest code, conceived by Boudy and formalized in October 1917, was based on the Algerian forest code, although it was shorter and had changes in modes and extent of application. This legislation itself carried the conventional French colonial vision of the North African environment to Morocco in many ways. Although the two codes were similar, the Moroccan code contained only 84 articles compared to 190 articles in Algeria’s forest code. Most of the fines for infractions of Moroccan forest laws, though, were less than those in Algeria. The 1917 Forest Law (Dahir) allowed limited use of the forests by Moroccans only, and not by European colonists, which was a significant change from the Algerian code. The Moroccan code severely restricted the use of fire in or near forests by the few local tribes allowed to use portions of the forest, and completely banned it elsewhere. Charcoal production and the collection of traditional forest products such as firewood, foods, and medicinal plants were likewise severely restricted and regulated. As in Algeria, grazing was expressly prohibited for six years in forests that had burned or been harvested for cork or timber. Most traditional uses of the forests, which had previously sustained entire communities, were restricted, regulated, or criminalized.18

Because of the slow progression of pacification in Morocco and the effects of World War I, the new forest code was not widely applied until the 1920s, and more extensively after 1935, with the final pacification of the south. In fact, the Moroccan forest code contained a provision with no precedent in any form in Algeria or Tunisia. This was article two, which stated that the forest code would be applied to different territories successively, by governmental decree, as they were conquered. Areas outside of these decreed territories were covered by separate government rules. In the south near Essaouira and Agadir, for example, the forest service did not establish a presence until 1920. It was not until 1925 that the law was decreed to govern the delimitation and protection of the Argan forests in the region, bringing them under the 1917 Moroccan forest code.19

As pacification progressed in Morocco, more and more of the forested areas were explored, inventoried, and eventually brought under the rules and regulations of the 1917 forest code. The initial estimates of about 2 million hectares of forests in the protectorate were revised during this period of expansion. At the end of the protectorate, the forested areas were said to cover approximately 5 million hectares. Estimates of deforestation also changed over this period, in extent as well as in modes of calculation. Tracing these changes
reveals an interesting history of policy formation at the same time that it illuminates a significant, but overlooked, period in the history of plant ecology. During these formative years of the 1920s and 1930s, as the new science of plant ecology was being developed, the narrative of environmental decline and deforestation was refined, quantified, and institutionalized in Morocco by Boudy and others working in the protectorate. What had been rather vague generalizations about deforestation, overgrazing, and environmental degradation during the nineteenth century came to be portrayed as exact, scientific facts. This affected policy in powerful ways.20

MAPPING THE POTENTIAL

ONE OF THE EARLIEST attempts to quantify Moroccan deforestation was made by forestry director Boudy in 1927 in a lecture to the new recruits of the indigenous affairs department (Service des Affaires Indigènes). This department was tightly allied to the administration and performed a variety of intelligence services for the protectorate. Conferences were held annually for new recruits and the lectures served not only as an introduction to the service but also as indoctrination in correct ways of thinking and acting. Boudy began his lecture by asserting the crucial role that forests played in the climatology and the economy of a country, emphasizing that a “certain proportion of wood is in effect indispensable for a country to actually be inhabitable.” The lecture contained numerous such generalizations, which were common in France, French possessions, and much of Europe during the nineteenth and early twentieth centuries. One idea that Boudy particularly highlighted throughout his career was that pastoralists, especially nomadic pastoralists, destroyed forests and caused desertification. As he explained to the new recruits, “There exists, in effect, a very tight link between Semitic [Arab, not Berber] nomadism and vegetal devastation.” Elsewhere in the lecture he stated that “it is scientifically proven that the formation of sand deserts ... is due to deforestation, the work of ancient nomadic peoples who resort to fire to procure pasture for their beasts.” This reflected, not surprisingly, the dominant environmental narrative of North Africa ubiquitous at the time.21

Following this impassioned introduction, Boudy explained that to be able to support “social organization,” any given country must have 30 percent forest cover. This ratio is referred to as the ratio of woodedness, or the taux de boisement. He then calculated that Morocco had a rate of woodedness of only about 9 or 10 percent. Since he believed it should have, and must have had in the past, a rate of woodedness of 30 percent, he assumed that the country was approximately two-thirds deforested. He blamed that deforestation on burning, grazing, and clearing land for agriculture by the indigenous Moroccans over the previous centuries. If this destruction could be controlled, Boudy believed, Morocco had the potential to have at least 6 million hectares of forest, three times the amount believed to exist at that time.22

By 1934, the year of the final pacification of the south, forest cover in the protectorate was estimated at about 3 million hectares. During the intervening
seven years, Boudy had revised his estimate of deforestation in the protectorate up to about 85 percent. He calculated this amount of deforestation in an article on Moroccan forests that he co-authored with ecologist Louis Emberger for a special volume, La Science au Maroc, written for the fifty-eighth meeting of the French Association for the Advancement of Science, which was held in Morocco that year. This estimate of deforestation is detailed further in an article by Emberger on general Moroccan vegetation in the same volume. Emberger estimated that 17 million hectares of forest had been destroyed. He calculated this based on the 3 million existing forested hectares and the presumed 20 million hectares in Morocco that he thought should be naturally forested. In the introduction to this article Emberger explained that “the traveler who traverses Morocco following the classical paths [itineraries described by ancient writers] comprehends with difficulty the profound physiognomy of Moroccan vegetation ... Nothing but ruins! Man aided by flocks has made war on the forest and brutally exploited it for centuries. Immense areas formerly covered are today bare.” He attributed this massive amount of deforestation, as did Boudy, to centuries of abuse by Moroccans and their flocks. Boudy worked with Emberger for many years and was deeply influenced by his research.

Emberger was born in France in 1897. He obtained his doctorate in the sciences with a dissertation on plant cytology in 1921. In 1923, he was appointed director of botany at the Moroccan Scientific Institute (Institut Scientifique Chérifien) and professor at the Moroccan Institute of Advanced Studies (Institut des Hautes Études Marocaines) in Rabat. Emberger remained in Morocco until 1936,
conducted prodigious research, and quickly became the pre-eminent ecologist in Morocco. In 1936, he returned to France and in 1937 was appointed the chair of Botany at the University of Montpellier, where he later founded the prestigious Institute of Botany and the influential Centre d’Études Phytosociologiques et Écologiques (CEPE). Emberger maintained a strong interest in Morocco and North Africa throughout his career and published on plant ecology in the region until his death in 1969.24

Emberger’s research on Moroccan vegetation coincided with a period of great activity and advancement in the young discipline of plant ecology. Many influential and formative works in plant ecology were written from the 1890s through the 1930s. Concepts of plant associations and formations were developed, many of them based on mapping rainfall and temperature region by region, often following the work of Alphonse de Candolle, Wladimir Koppen and Johannes Warming. Phytosociology (French plant ecology) was growing in prominence in France with the work of Josias Braun-Blanquet, Clementsian succession and climax was gaining ground in American ecological studies (although there were critics of Frederick Clement’s theory such as Henry Gleason), and Arthur Tansley’s ecosystem concepts were being refined in the United Kingdom. It is not uncommonly said of the 1900s that “the first quarter of this century was the age of the great general theories of vegetation.” Emberger’s contribution to these general theories has been mostly overlooked except in studies of Mediterranean ecology. Here he is nearly universally credited with defining and delimiting Mediterranean climate and vegetation zones, called bioclimatic zones. His pluviometric quotient, which takes into account the effects of temperature, rainfall and evaporation on plant associations, has been especially influential.25

Two factors of Emberger’s work are not widely appreciated but are important for both environmental history and environmental policy in Morocco and more widely in the Mediterranean basin. The first is that Emberger defined the Mediterranean bioclimatic zones (étages) on the example of Morocco, which he believed “alone possesses the complete series of these stages [zones].” The second factor is that Emberger defined all of his five zones in Morocco by their trees (or potential trees), drawing on his belief in the declensionist narrative which insisted that Morocco had been vastly more forested in the past. He believed that even the most arid zone (l’étage méditerranéen aride) naturally had forest vegetation, though “the forests there are usually very thin and comparable to savannas.” He explained in his definitive publication on Moroccan vegetation that his work “has been oriented toward researching the primitive [natural or potential] state of the vegetation, the climax.” Emberger looked in places like religious sanctuaries (marabouts) for this relict vegetation, as Marvin Mikesell would do a generation later. Although such sanctuaries are often intensively cared for by humans and not infrequently built near springs, the vegetation in and around such sites was assumed to be natural. This is how Emberger was able to estimate that 20 million hectares in Morocco naturally should be wooded; he inferred from relict vegetation and bioclimatic maps. Such deductions from relict vegetation, though, were and are fraught with serious problems.26
Much has been learned, however, in the field of paleoecology during the last several decades. Research in this field, especially fossil pollen analysis, points to some deforestation in a few areas of Morocco but not in many others. This research firmly contradicts Emberger’s calculations, for it documents no definitive overall pattern of massive deforestation on the order of 60 to 85 percent over the last two millennia. Moreover, plant ecology has recognized disturbances—fire, disease, and erosion for example—as integral parts of the ecosystem. From this point of view, a single ideal or climax vegetation is not the natural culmination for plant succession, because multiple stable states, with very different vegetation, are possible depending on disturbance regimes. Thus grasses, not trees, may form the “climax” vegetation in many arid regions and regions with frequent fires or heavy grazing. Experimental succession studies and paleoecological research, though, were extremely limited in the early twentieth century. It was common, therefore, to use relict vegetation, assumed to indicate the remains of natural vegetation, to reconstruct both past vegetation and potential, or natural, vegetation—in other words, what the vegetation should be. This approach had a strong historical precedent in France and much of Europe.27

Charles Flahault, a professor of botany at the University of Montpellier, was an early proponent of this approach. He was an important figure in the history of French phytosociology, influencing not only Emberger but also the better-known phytosociologist Braun-Blanquet. Flahault worked on French vegetation and especially French forests which, given the existing soil and climatic conditions, he believed were badly degraded. He wrote that “the actual state of the vegetation in our civilized countries no longer represents the primitive [natural] state ... the primitive vegetation has disappeared; in all our mountains, abusive exploitation of wood has modified profoundly the composition and distribution [of the vegetation].” Thus researchers needed to find “some of the normal elements of the primitive associations; thanks to them we can reconstitute [the natural vegetation].” This general approach to deducing what natural vegetation should be has informed plant geography and ecology in general to the present, especially in the form of Braun-Blanquet’s legacy, the relevé method, which relies on the scientist’s selection of what represents the supposedly natural vegetation or ecological dominant. This method, although criticized over the years for being too subjective, remains the most widely used method outside of North America today.28

Emberger studied with Flahault in 1921 and 1922 before going to Morocco, and he used Flahault’s relict approach to vegetation reconstruction. Emberger explained in his work that it is possible “to deduce the primitive [natural] state of vegetation of a site today bare, but where the ecological conditions and, particularly, climate are the same as in the locality with intact vegetation.” Emberger believed, though, that in Morocco “the actual vegetation cover, over immense surfaces, represents degraded states, the ‘miserable remains’ of a past much richer and above all more wooded.” Moreover, he blamed the ruined state of vegetation in the protectorate on the Moroccans and their herds who had made “war on the forest and exploited it brutally for centuries.” This led to authoritative
conclusions such as, “the absence of red juniper on the south slope of the Middle Atlas cannot be due to anything but the complete destruction of this tree.” The environmental narrative of decline so common in Morocco during the period of French occupation clearly informed Emberger’s scientific research. Thus the old and inaccurate environmental narrative was especially important in shaping much of his research, especially his phytogeographic map of Morocco prepared in 1939. This map still is referenced today as the definitive bioclimatic map of Morocco. Given the climatic conditions, soils, and elevation of any given region, this map deduces what the natural or potential vegetation should be, based on subjective interpretations of existing and relict (and sometimes absent) vegetation. Emberger’s work did more than just incorporate the ubiquitous degradation narrative, though; his research and writings refined, quantified, and firmly institutionalized the declensionist narrative in the science of plant ecology in Morocco. His work, in particular his bioclimatic map, very quickly became widely influential and formed the basis for numerous calculations of forest cover and deforestation in the protectorate. Citing Emberger’s 1939 map, an influential botanist wrote in 1941, for example, that “Morocco had, during the Roman epoch possibly 65 to 70% of its surface covered in forests.”

Emberger’s research and especially his exaggerated estimates of naturally (potentially) forested regions of Morocco (and thus deforestation rates), had a profound influence on the director of forestry, Paul Boudy. Those estimates gave him the authority of science to legitimize his pre-existing views on the forests in Morocco. This becomes clear in the first volume of his magisterial four-volume series, 

Économie Forêtérière Nord-Africaine. Although published in 1948, important parts of the volume on the human and physical milieu were completed by 1941, only two years after Emberger’s map of bioclimatic regions appeared. Boudy devoted significant space in this tome to introducing and discussing Emberger’s stages. He lauded their precision, writing that “Emberger’s method provides ... a precise scientific base for classifying diverse types of forests.” Boudy then used the Emberger method and map to calculate the amount of forest that had disappeared since classical times “by pure ecology.” In this section, Boudy calculated that about 9.5 million hectares should naturally/ecologically be covered with forests although only about 4.8 million hectares actually were forested. Thus he concluded that Morocco was approximately fifty percent deforested.

A dozen pages later, Boudy provided a detailed history and description of how this deforestation had proceeded over the last two thousand years, since the time of “Roman Africa.” This section reads like a textbook description of the conventional environmental narrative of North Africa as conceived under French administration—with facts, figures, and maps added. Boudy began by suggesting that, according to ecological science, all of the areas that should be forested naturally were forested during Roman times. Although he conceded some forest destruction in North Africa from about the fifth century, he placed the majority of blame on the eleventh century Arab invaders and their destructive herds, often citing Ibn Khaldoun. This “army of locusts,” “this plundering and anarchic horde,” “had the effect of intensifying the practice of nomadism ... and of transforming
the country into desert.” He highlighted additional causes of deforestation in Morocco, including the construction of great cities such as Fez and Marrakech, the tanning industry, and the presumed destructiveness of the numerous goats. There is little doubt that Boudy believed the conventional environmental narrative of decline for North Africa and Morocco. With Emberger’s new ecological research, he also now was able to justify the old narrative with “scientific facts.” In this way, Boudy was a pivotal actor in refining, institutionalizing, and amplifying the declensionist narrative.31

**RESTORING THE RANGE**

Both Boudy and Emberger were strongly influenced by this dominant environmental narrative, and in turn their scientific stories of deforestation reinforced and rationalized the French colonial vision of the Moroccan environment as deforested, overgrazed, and degraded. What had been largely a literary story of generalized environmental decline became by about 1940 a scientific story complete with ecological statistics and maps that helped to justify policy making. The influence of this narrative reached beyond the realm of forestry, however, to the policies and work of the livestock and range department, which governed most of the non-forested areas of the protectorate. Notably, the forestry department itself played a large role in the environmental policies developed in the livestock and range department.

Boudy’s early conviction of the terrible damage inflicted by livestock grazing in the forest had a strong impact on forest policy but also influenced livestock and range management. This negative view of grazing was held widely in the protectorate by administrative officials and colonists alike. Grazing in the forest, and especially the practice of transhumance/migration, a centuries-old pastoral livelihood tool, was seen as the greatest cause of deforestation in Morocco and therefore as the greatest threat. Under Boudy’s direction, the forest code was amended in 1921 with a new provision regulating the right and usage of pasture within forested areas. The 1921 amendment limited grazing rights to the “traditional users” of the forests, thereby effectively regulating transhumance. The traditional users were defined as members of Moroccan tribes who lived in the territories where the forests were located or who had had use rights to the forest for a very long time. The definition of the traditional users eliminated large numbers of local people and animals who had actually been using the forests, because the French “fossilized” the Moroccan tribes.32

The numbers of livestock were strictly limited by defining the size of the family herd allowed to graze tax-free in the forest. Although the relief from taxes was a benefit, the family herd could, according to the new law, include no more than five cows and fifteen sheep, and no goats or camels. Typical herds in much of Morocco, especially of sheep and goats, were much larger than this. The family’s other animals also could graze, if the annual limits were not exceeded, but they had to pay a fee per head of livestock to be admitted. These annual limits, in turn, depended on the forest service’s annual assessment of the state of the vegetation
in each forested area (*le possibilité en herbe*). Grazing still was limited to areas judged defensible and the routes through which the livestock could travel to get to the permitted sections of forest were strictly delimited and monitored. Furthermore, the users had to reapply each year for the right to graze their herd in their traditional forest. Livestock grazed in the forests were also subject to the *tertib*, the agricultural-production tax. Overall, this resulted in a large reduction in numbers of livestock grazed and diminished rural Moroccans’ abilities to support basic family needs.33

Whereas fire and incendiarism had been the biggest problems facing the forestry administration in Algeria, grazing was considered the biggest problem in Morocco. According to Boudy, grazing was “the nerve center of the forest question in North Africa.” His solution to the problem was to combine repression and technical organization, and “surveillance, and consequently repression, must continue to be exercised in the most active fashion.” During the 1930s the government paid heightened attention to the issue of transhumance, among pastoralists in Morocco and its assumed contribution to overgrazing. In 1934, new regulations officially reduced the territories and rights of usage of mobile pastoralists and reduced the numbers of stock that could migrate in several regions. This followed not only the final pacification of the protectorate—specifically the conquest of the south with its high proportion of nomads—but also increased concern about the migrations of livestock in Algeria and in France. This decade saw the publication of many articles on the subject, almost all of which argued for the diminution if not the elimination of transhumance in Algeria, France, and Morocco, largely for environmental reasons. Where it was thought that migration could not be eliminated quickly, strict surveillance and control over all movements were considered essential. In 1939, the government officially acknowledged “that the goal to attain is the progressive extinction of transhumance.”34

Forestry policies thus overlapped with and influenced policies governing livestock raising and range management in Morocco. The department of livestock raising, *le Service de l’Élévage*, a subsidiary of the agriculture department, was founded in 1913, the same year as the forestry department. Until 1930, it was directed by veterinary colonel Théophile Monod, a good friend of Lyautey’s. Like Boudy, Monod was born and educated in France, had many years of experience in Algeria and elsewhere in greater France, and stayed active in an official advisory capacity after his retirement until his death in Casablanca in 1942. In the early years the department was concerned primarily with infectious livestock diseases and the immense task of trying to transform subsistence production, especially of sheep and cattle, into commodity production. Toward that end, the department worked to intensify and “improve” livestock raising to produce more meat and milk as well as wool of a higher quality, which would appeal to the French consumer. This involved improving nutrition, providing shelter from heat and cold, and reducing physical exertion, especially reducing mobility over long distances. This mode of livestock raising was completely foreign to the majority of Moroccan subsistence producers; it was also much more expensive.35
This sort of intensive livestock production, which could be accomplished in a smaller area with less movement, was thought to be necessary as the protectorate developed its agriculture and forest sectors. Just as large areas of the forests increasingly were being protected from grazing, more and more land was being brought under cultivation, much of which previously had been used as seasonal pasture land. Thus the livestock department worked in cooperation with the forestry and agriculture departments. It also had to adapt to the changes wrought by forest policies that progressively decreased pasture land and transhumance in the forested areas of the country. In 1928, for example, grazing was restricted on two million hectares of prime pasture land when these areas—dominated by alfa grass (*Stipa tenacissima*)—were placed under the control of the forestry department and new legislation regulating their use was promulgated. In the early 1920s the livestock department also became responsible for pasture (range) improvement. As Monod explained, the livestock service was charged with the amelioration of the whole environment in which animals were raised and therefore “also with obtaining the reconstitution of pastures.” Thus the department organized, run, and staffed by veterinarians was responsible for what today we call range management. A vast majority of the land in the protectorate not under cultivation, not in forested areas, and not in urban or village areas, was used for grazing livestock and frequently was subject to the policies of the livestock and range department.

Within a decade of the establishment of the protectorate, the livestock and range department was implementing many policies to reconstitute pastures assumed to be degraded. The conventional environmental narrative is evident in this sector as well with numerous references to the natural fertility of Moroccan pastures that had been degraded by the “improvidence of the natives,” especially transhumants and nomads. Although pasture degradation never was as tightly quantified as the amount of deforestation was in the 1930s and 1940s, it was the target of dire claims made by the department. Techniques to reconstitute and restore the range thus were implemented widely, included delimiting exclosures for forage reserves, seeding pastures with forage species, creating cactus plantations in hyper-arid regions and irrigated alfalfa pastures in areas with access to irrigation networks, and acclimatizing exotic forage species. Later in the protectorate, foreign (presumed better) forage shrubs such as Australian salt-bush (*Atriplex*) were planted to improve pastures. Pastures improved by those means, though, often required paid permits before entry was allowed, and grazing was restricted and regulated. Many attempts at improvement failed when imported plants did not grow well.

Most of these measures discouraged mobility. They required time, money, and/or work spent in a single location; that is, they encouraged, and sometimes enforced, sedentarization. Most of these so-called improvements were in complete opposition to the primary goals of subsistence herders. These goals include high mobility and hardy livestock, which, though often low producers, allow flexibility of resource use in an unpredictable environment. The overriding protectorate goal of security helped to reinforce the transformation from a nomadic/
The livestock and range service worked more closely with the military and intelligence services than did the forestry service. Over the course of the protectorate period, the policies of the forestry and livestock departments greatly curtailed—sometimes brutally—the traditional modes of livestock production, both nomadic and transhumant. As a result, an untold number of local Moroccans lost their livelihoods and many migrated to the shanty towns of the growing cities.38

The delimiting, improving, and policing of pasture lands was not as comprehensive or as detailed as similar activities were in forested areas. The policies and work of the livestock and range department, however, did help to extend the environmental narrative—and many of the goals developed in the forestry department—to much of the rest of the protectorate. And as it had in the forestry sector, the narrative served colonial interests in the livestock sector more than indigenous interests. In this sector, the combination of policies encouraging intensification, veterinary public-health laws, and range-management practices that enforced sedentarization, privileged commodity production by European colonists over the subsistence production of local Moroccans. This had the added benefit, in the eyes of the military and parts of the administration, of controlling the nomads and other mobile herders who were perceived as a threat to the state.

Those in need of labor also benefited. By incrementally depriving Moroccan pastoralists and agro-pastoralists of the ability to support themselves with forest products and livestock, the government’s policies created a vast pool of labor for the expanding export-oriented agricultural venture that defined Moroccan colonialism. Such labor was necessary since, by the end of the protectorate period, an estimated 77 percent of the best agricultural land was in the hands of the Europeans, mostly in large farms requiring many workers. The deforestation/degradation story was invoked here too, with an ironic twist. As Boudy explained in 1927 to the young recruits of the government’s indigenous affairs department, the Argan forest (in southwestern Morocco) must be saved, for “if the argan [tree] disappears, the region will return to its true steppe destination or even to desert; with it will be dried up the great human reservoir of Morocco, which feeds with manpower the rest of the country.”39

CONCLUSION

ALTHOUGH NOT CATEGORIZED as environmental policies during the colonial period, the policies and practices of the forestry and livestock departments developed and applied most of the rules governing Morocco’s environment for more than forty years.40 This article has argued that a questionable nineteenth-century declensionist environmental narrative of North Africa profoundly shaped environmental policies in protectorate Morocco. It favored imperial interests over indigenous interests and helped to dispossess Moroccans from their lands and livelihoods. This environmental narrative and many of its attending environmental policies were retained in the post-colonial period and still affect Morocco to this day. The 1917 Moroccan forest code and most of its amendments
and related policies, for example, remain in effect. There is a similar legacy in the livestock and range management sector where intensification of production, control of grazing, sedentarization, protection of arboreal areas, and pasture reconstitution are still the primary goals. The writings of Boudy and Emberger, in particular, still strongly influence environmental research and policy formulation in Morocco. Their descriptions of the natural or potential vegetation, and their calculations of rates of deforestation (and its causes), are invoked frequently as scientific proof of the state of the Moroccan environment.

Scholars of North Africa and the Middle East have been noticeably silent on these topics, although many of the problems associated with colonial environmental degradation narratives have been exposed for much of sub-Saharan Africa, parts of Asia, and some other regions. False environmental histories, repressive environmental policies, political and economic struggles over resources, and interest-laden narratives are now well-recognized phenomena, particularly in Africa. Although nearly all of this work traces dominant environmental narratives to the beginning of the colonial era, few explore the nineteenth century, since most colonial ventures in sub-Saharan Africa, did not begin until after the turn of the twentieth century. This article highlights some of the benefits of examining the nineteenth-century precedents of colonial environmental narratives, especially for former French African territories. The Maghrebi territories, specifically Algeria, were held up as “models of colonial installation” to be emulated in other French territories. The influence of Maghrebi environmental narratives and environmental policies for French colonial territories outside of North Africa, though, has not been analyzed. Most intellectual histories of environmental thinking trace ideas from French, British, and European precedents to Indian influences and subsequently to sub-Saharan Africa. My research suggests that the influence of Maghrebi environmental narratives and policies for French colonial Africa has been overlooked and should be explored.

The Moroccan case also highlights the importance of analyzing potential vegetation maps and related data sets for their underlying environmental narratives. Although a few authors, namely James Fairhead and Melissa Leach, have mentioned the importance of potential vegetation maps in their discussions of colonial forestry, no one to my knowledge has conducted detailed examinations of how these maps were constructed or by whom. Few of these maps have been studied for their accuracy, based on comparisons with contemporary ecological or paleoecological data. Potential vegetation maps provided authority for draconian environmental policies during the colonial period as they still do in much of the world. Many potential vegetation maps used today were constructed during the colonial period or are based on slightly revised versions of colonial maps. Potential vegetation maps and related environmental data sets often provide baselines for work in environmental remote sensing and geographic information systems (GIS) and thereby influence a large and growing number of environmental projects, some global in scope. By examining these maps and the narratives that often permeate them, we will be better able to expose and
correct outdated assumptions, biases and errors that increasingly lead to environmentally destructive and socially detrimental outcomes around the world.

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NOTES

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2. North Africa is used in this paper to refer to Algeria, Morocco, and Tunisia, collectively also known as the Maghreb. Research for this article, and a related book project,
based on extensive research in Morocco and in the French colonial archives. Translations from the French are mine unless otherwise noted.


6. Both Berber and Arabic belong to the Hamito-Semitic language group, of which the Semitic languages, including Arabic, form a subgroup. Berber is thought to be the oldest language in North Africa, while Arabic was introduced to the Maghreb during the seventh century.


16. For details of the early inspections and decisions regarding Morocco’s forests, see “Service des Forêts,” no date, in Maroc/DAI/Inv. 8/#101, CADN. The 1827 Napoleonic forest code was, in turn, an updated version of the 1669 French forest code written under Jean-Baptiste Colbert, which had the primary purpose of assuring enough wood for the navy. See Georges Plaisance, *La Forêt Française* (Paris: Édition Denoël, 1979); 200-202. Thus the 1669 and 1827 French forest codes were written more for economic and political purposes than for environmental or ecological purposes. Amendments to the 1827 forest code were made in France in the name of environmental protection.


22. Boudy, “L’Arbre et les Forêts,” 21-22. It should be noted that many western experts believed at this time that most of the habitable earth was once and should again be heavily wooded. The concept of the taux de boisement and its importance may be traced back to at least the nineteenth century in France and likely much earlier. A taux de boisement of 30 percent was the widely accepted minimum for civilization in France and much of Europe. It was applied to Algeria to make much the same argument in favor of extensive reforestation during the last half of the nineteenth century. See Gouvernement Général de l’Algérie, *Commission*.


24. For details on Emberger’s life, see Jacques Miège, “In Memorium: Louis Emberger,” *Candollea* (1970): 183-87. Emberger was likely influenced by a French botanist with long experience in Algeria, René Maire. Maire began botanical investigations in Morocco early in the protectorate period and Emberger accompanied him on many of his excursions. While Maire and several other botanists researched and published on Moroccan vegetation, Emberger was the first to quantify and map the potential vegetation and to calculate the extent of presumed deforestation in the Protectorate.


33. Limits on the numbers of livestock in a family herd are detailed in Boudy, *Économie Forestière*, 587. One economist has explained that the *tertib* was “no longer a mere tax, but also a political instrument for breaking down the native and historic method of utilizing the environment.” See Melvin Knight, *Morocco as a French Economic Venture: A Study of Open Door Imperialism* (New York: D. Appleton-Century Co., 1937); 49. This was true of animal as well as plant agriculture in Morocco. As late as 1952, the government still was using this tactic. By raising the *tertib* (tax) on goats, the government sought to discourage goat production and increase sheep production, based on its fears that goats cause deforestation. See Maroc/DAI/#591, CADN.

34. First two quotes are from Boudy, *Économie Forestière*, 1:627-68. For regulations on transhumance, see Commandant Ruet, “La Transhumance dans le Moyen Atlas et la Haute Moulouya” (CHEAM, unpublished report, 1952); 6. For examples of arguments to reduce transhumance, see Léon Lehureaux, “Comment s’Effectue Actuellement la Transhumance,” *L’Union Ovine*, 5 May 1930: 189-91; Antonin Rolet, “La Transhumance en France: Ses Difficultés,” *L’Union Ovine*, 5 September 1930: 386-89; and Maurice Rondet-Saint, “Un Problème à Résoudre en Afrique du Nord: le Nomadisme,” *La Dépêche Coloniale* 18 December 1931: 1. Strict surveillance was advocated by Vétérinaire-Major Gadiou, “La Situation Économique du Sous,” *Revue de Géographie du Maroc* (1927): 137-65; and Lehureaux, “Comment s’Effectue.” See Ruet, “La Transhumance,” 6, for the 1939 government decision on transhumance. Although overgrazing and deforestation were given as the primary reasons that transhumance was a problem and needed to be stopped, the state also was interested in controlling or eliminating transhumance for reasons of security and quelling the rising tide of nationalism in the protectorate.


37. Descriptions of the improvidence of the natives may be found in Service de l’Élevage du Maroc, “Historique du Service de l’Élevage du Maroc: ses Attributions et son Role


40. Even national parks were created under the authority (and therefore the policies) of the forestry departments in Algeria, Morocco, and Tunisia during the colonial period. See Diana K. Davis, “Environmentalism as Social Control? An Exploration of the Transformation of Pastoral Nomadic Societies in French Colonial North Africa,” *The Arab World Geographer* (2000): 182-98.


42. See note 1, above.

