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Forest management in Mozambique from 1920 to 1974: surveying, uses, protection and dune stabilization

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This paper links issues of forestry and colonialism in Mozambique during Portuguese rule, from 1920 to 1974. It analyses the role of Portuguese foresters in building Mozambique's Forest Services by looking at their concerns, priorities, application of technical knowledge, challenges and limitations. The article describes how these experts acted in remote areas to survey and catalogue the existing forest as well as introduce European forest management methods. The work also shows how foresters promoted the creation of new forest areas and examines the little-known case of coastal dune afforestation. Emphasis is given to the importance of knowledge and species transfers in these interventions. The authors argue that, alongside to 'grey' infrastructures such as railroads, ports, and dams, forests served as 'green infrastructures' in Mozambique: human-made landscapes used as colonial tools of power, penetration, and state control.

La gestión forestal en Mozambique entre 1920 y 1974: Reconocimiento, aprovechamiento, protección y estabilización de las dunas

PALABRAS CLAVE: **dunas, Mozambique, siglo xx, historia forestal.**

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Este artículo vincula las cuestiones de la selvicultura y el colonialismo en Mozambique durante el dominio portugués de 1920 a 1974. Analiza el papel de los ingenieros de montes portugueses en la construcción de los Servicios Forestales de Mozambique, estudiando sus preocupaciones y prioridades, cómo aplicaron sus conocimientos técnicos, los desafíos que enfrentaron y las limitaciones de su trabajo. Se explica cómo actuaron estos expertos en zonas remotas, inspeccionando y catalogando el bosque existente e introduciendo métodos europeos de gestión forestal. También muestra cómo estos forestales promovieron la creación de nuevas áreas boscosas y analiza el caso poco conocido de la forestación de dunas costeras. El artículo destaca la relevancia de la transferencia de conocimientos y especies para estas intervenciones. En última instancia, este trabajo sostiene que estos bosques son «infraestructuras verdes», paisajes instrumentales creados por el hombre, que se utilizan como herramientas coloniales de poder, penetración y control estatal, al igual que las infraestructuras grises, como los ferrocarriles, los puertos y las presas.

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1. INTRODUCTION

Mozambique inherited from the Portuguese a weak, neglected, and fragmented forestry administration. Jaime Toha, a Chilean forester working in Mozambique in the 1980s, wrote that in 1975 there was no idea of the country's forest potential, no reforestation programs in place, and not a single Mozambican trained forester (Toha, 1985). Despite this poor legacy, the more than 50 years of forestry history, between the arrival of the first Portuguese forester and Mozambique's independence in 1975, were characterized by a complex set of knowledge transfers, scientific and technological developments, service organization and countless activities. And not all was lost with the transition: when the Food and Agriculture Organization (FAO) arrived to Mozambique after its independence and tried to organize the Forest National Administration and the forestry sector, FAO technicians found some of the Portuguese work valuable and tried to continue it (Mansur & Cuco, 2002: 18-22).

To understand what was done in Mozambique during the last phase of the colonial period, it's necessary to go back to the last decades of the 19th century, when public debate on forestry issues was particularly active in Portugal and its colonies. The lack of wood, soil erosion, and frequent floods in the metropolitan territory raised the concerns of the Parliament and other high-level intellectual institutions such as scientific societies (Ferreira, 2018; García-Pereda, 2018). Administrative, political, military and academic elites were called upon to contribute to the discussions on how the State could solve these problems by increasing forest cover, while at the same time having a more effective knowledge of the African forests in order to explore its resources. Among these elites were foresters trained at the Lisbon Institute of Agriculture (ISA), whose contributions were often translated into national laws and policies. After the First World War, Mozambique's colonial administration, directly under the metropolitan government and not dependent on commercial companies[1], implemented the first forestry projects set up by Portuguese foresters trained in Lisbon. This initiative marked the transition between an earlier stage of granting concessions to join stock enterprises, like the Companhia de Moçambique, to a national administration of the colonial resources. The development of the Portuguese territories in East Africa between 1920 and 1974 was based on an ideology of economic growth coupled with cultural transformation. This dual purpose, which colonial theory called the "civilizing mission" of the overseas empires (Conklin, 1997), said much about the attitude of experts and administrators in acknowledging, developing, and controlling local

1. About the colonial intervention in rural Mozambique of these companies, see Direito (2013).

natural resources. An appropriation that was framed within a bureaucratic apparatus built in the image of the modern European states (Berman, 1984). However, due to the limited number of civil servants, the dependence from central authorities in the metropolis, the complex relations with different economic groups in Lisbon and in the colony, and the heterogeneous local presence, the colonial administration was far from being uniform in its functioning.

This article aims to contribute to the history of Mozambique during the Portuguese rule, by analyzing the local forestry policy and its long-term legacies, and to expand knowledge on a subject that is relatively absent from the historiography of Portuguese empire-building in Africa. Scholars working on Mozambique have taken for granted the forestry services as an instrument of colonial dominance (Affentranger, 2010), but they have not examined its origins and functions, staff and administrative difficulties, and its wider implications for people and territories. The paper begins with the establishment of the Forest Services within the Agriculture Department, its aims and organization, and shows how economic and environmental concerns determined the exploitation and management of forest resources according to a techno-scientific European imperial rationale. The paper highlights the mechanisms used to control the landscape and the context in which such policies were formulated. It follows the first Portuguese foresters in Mozambique, focusing on their training, priorities and practices, as well as the expectations generated by their presence and what they represented to the colonial authorities. The work also looks at the particularities of the intercultural encounters, the people and institutions involved, and the nature of the forestry practices that emerged from these experiences.

This paper seeks to build bridges between history of science and environmental history. Scholars, such as Carse (2012) and Kreike (2013), have turned their attention to the analysis of the built environment as infrastructure. In this line, historical literature has examined how infrastructure acts as a carrier of politics, and how the properties and operations of materials and technologies affect political processes. Antina von Schnitzler, for example, highlights the importance of technical devices as conduits of state political visions, saying that many physical networks, such as forests, trains and water supply, enable social life and forms of governance. Schnitzler's work and others have opened up new perspectives on the relationship between materiality and culture (Anand, 2017; Schnitzler, 2016). Building from this idea, this article argues that the Portuguese civilizing mission in Mozambique included not only the construction of the traditional grey infrastructure, such as railways, dams, ports and cities –which were the anchors of imperial strategies for controlling territories, structuring economic zones and imposing European models (Pereira, 2023)– but also green infrastructure,

like cash crops, monoculture tree plantations and stabilized dunes[2]. The definitions of green infrastructure are diverse, depending on how they are seen and approached. Benedict and McMahon (2002), for example, defined "green infrastructure" as an "interconnected network of green space that conserves natural ecosystem values and functions and provides associated benefits to human populations". The concept blurs the line between engineering and nature. It can also hide the fact that the benefits may not extended to all, since the use of green infrastructure as tools have different consequences for different populations and ecosystems. In this paper the term *green infrastructure* stresses the utilitarian value ascribe to the forest and the role of this hybrid ecosystem –which allows room for human and non-human agency– in shaping the territory according to colonial thinking and purposes. The concept of green infrastructure is also used here to explore "exchange" or "transfer", as defined by Beinart and Middleton (2004), on a very particular environmental dimension of the Portuguese colonialism in Mozambique: dune afforestation in coastal areas. Since the 1970s, the circulation of organisms (humans, plants, animals and microbes) has been regarded as a key factor in certifying the achievement of colonial policies (Crosby, 1989). For the "encounters of plants, animals, humans and soils express the social context of the eras in which they occur and represent relevant actors in land management processes" (Biasillo, 2021; Kull & Rangan, 2008). In accordance, the Mozambican coastal sand dunes are good *loci* to observe the role that science and plant transfer played in the building of a new colonial landscape.

Finally, this paper draws on a range of historical material relating to the Portuguese activities in Africa, from the general features of colonial administration, economic development, and ecological concerns to land reclamation and resource exploitation. The Arquivo Histórico Ultramarino in Lisbon, the Arquivo e Biblioteca do Instituto Nacional da Conservação da Natureza e Florestas, in Lisbon, the Arquivo Nacional de Moçambique, in Maputo, and the Arquivo Nacional de Cabo Verde, Praia, provided most of the information used. The article is divided in three sections: the first examines the development of the Forest Service and its staff between 1920 and 1940; the second deals with forest resources and management; and the last one analyses the particular case of the afforestation of the dunes of the Limpopo River mouth and along the Mozambican coast for the protection of the lighthouses.

2. The terms *grey* and *green infrastructure* have been broadly used in history of technology, environmental history and urban history. See, for example, Beja Da Costa and Mazzolini (2021). For the construction of the techno-scientific rationale by engineers, see Saraiva (2016) and Pereira (2023).

2. THE SETTING OF THE FOREST SERVICE IN MOZAMBIQUE

The Department of Agriculture (Repartição de Agricultura) of Mozambique was created in 1906[3], when Freire de Andrade was the General Governor, with the help of foreign experts, namely the Scottish botanist Thomas Robertson Sim, forester in South Africa (Sim, 1907), and Otis Warren Barrett, who had worked for the US Department of Agriculture[4]. The diversity of backgrounds and expertise of the Department's first technicians reflected the blurred boundaries between botanists, agronomists and foresters at the time, especially in the colonial context. Nevertheless, they shared a science-based approach to their work. A Forest section, later called the Forest Service (FS), was established in 1920 within the Department of Agriculture. The first Portuguese foresters to arrive in Mozambique found an almost complete lack of organized services and infrastructure (Grilo, 1946: 49). Trained in the metropolis, these foresters had only been in contact with the environmental conditions of Eastern Africa through the Colonial Garden of Lisbon, created in 1906 (Nunes & Abelha, 2014). It was not much, but its establishment was "important in providing some impetus for the exploration and classification of the forest resources of the colony" (Cleary, 2005).

In a work about the Agriculture Department of Angola, Maria do Mar Gago (2018) explains that the interwar period of 1918-39 represents a new phase of European imperialism. European concerns about promoting the development of overseas territories led to an increase in the recruitment of technical personnel in several colonial departments. The first forester to work directly for the Mozambican colonial administration, Fernando Almeida Bello (1887-1927), arrived in the colony in 1920. He returned to Portugal, in 1923, seriously ill, and was unable to come back (Bello, 1914)[5]. Bello was replaced by Raúl Augusto da Silva Guardado (1894-1942), who started in 1926, after having worked at the Angola Department of Agriculture (Guardado, 1926, 1928a, 1928b). There was a close link between the administrative services of the two colonies, as colonial experts often circulated between them. Júlio Gardé Alfaro Cardoso succeeded Raúl Guardado

3. Decreto de 18 de janeiro de 1906, que organiza a criação dos serviços agronómicos das colónias (Miller, 1908). In 1908 it was also created the Department of Agriculture of Nyasaland (Malawi since 1964), British protectorate sharing a border with Mozambique (Green, 2009).

4. Otis Warren Barrett (1872-1950) was an American agriculturalist. He spent his early career collecting insects in Mexico, where he became a museum curator. In 1901 Barrett went to Puerto Rico as a US Department of Agriculture entomologist and botanist and afterwards worked with the department's Office of Seed and Plant Introduction. In 1908 he was appointed director of Agriculture of Mozambique. Barrett returned to the US Department of Agriculture in 1910 as chief of their Experimental Stations and Horticultural divisions in the Philippines.

5. Arquivo Nacional de Moçambique, *Revista Agrícola,* Lourenço Marques, 1967, p. 89.

in Mozambique around 1928 (Cardoso, 1948). Unlike his predecessors, Cardoso had both the time and stability to carry out his duties, having toiled in the Mozambican forests for some three decades (Cardoso, 1964). He is credited with initiating systematic forest management in Mozambique.

Working for the colonial services was not an easy task. African colonies were considered unhealthy. Deaths and illness among European staff, caused by diseases, were common. The lack of facilities for scientific work was also well known and remained almost as bad as when, at the second half of the 19th century, the German botanist Friedrich Welwitsch (1806-72) decided to take his *herbarium* of Angolan plants to London, convinced that it was impossible to study them thoroughly in Luanda or Lisbon. Gomes e Sousa, the first botanist at the Department of Agriculture of Mozambique, described that, on his first mission, in 1930, he had done everything "alone, without assistants, acting as driver, collector, draftsman and microscope technician" (Gomes e Sousa, 1940)[6]. So, when the Department of Agriculture advertised for two forester positions in 1930, no one applied[7]. Earning a living in Africa was not appealing for the men trained in ISA: Portuguese experts preferred to stay in Europe or emigrate to Brazil[8]. With this in mind, Luís Carriço (1928), a botanist, wrote that Africa should no longer be regarded "as a kind of terrestrial hell to which the unfortunate who have unfinished business with justice are consigned". He advocated the adoption of a new mindset that would end the perception of Africa as a dangerous territory. The problem was that the situation, services and infrastructure took time to change. Twenty years later, António Barreto, a forestry student, found the same lack of resources. He had to complete his final year project without the help of technicians: *European* or *Indigenous*. He only overcame his difficulties with the support of two logging industrialists (Barreto, 1954). A photograph taken by Barreto during his fieldwork shows that Mozambique's main road was an impassable mud pit during the rainy season.

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6. For the recognition of some of the plants, Sousa thanked the help of Arthur William Hill (Kew botanical gardens) and Gottfried Mildbraed (Berlin botanical gardens). They exchanged seeds and knowledge, building a learned community of tropical botanists that was diverse in national background, but united in common aspirations. Sousa became a mediator of seeds, plants, and information. The Lourenço Marques municipal garden was central to the exchange of knowledge and plants in the name of imperial economic development (Gomes e Sousa, 1951). A range of Mediterranean crops were imported, such as wheat (Boleo, 1966; Mota, 1970). Aesthetics and landscape architecture also played some part in colonial conservation strategies (Beinart, 2000; Saraiva, 2009).

7. Arquivo Ultramarino, 446, 2g-s1.

8. Africa "has been an authentic bonfire for agronomists" (Câmara, 1945: 3).

The reduced autonomy of the Forest Services and the scarcity of resources were the chief complaints of these early staff. In 1929, the Forest Services were still a section under the Department of Agriculture and had a colossal mission given their lack of human and financial resources. They were responsible, for instance, for the forestation of the dunes, mountains and arid plains that should have a forest cover; for the conservation and exploration of all the state forests, and for issuing forest use permits[9]. Despite such an immense agenda, the Services were not effectively supported as the colonial government was more concerned with short-term political and financial considerations. Cardoso, for example, found his budget for 1932 too small, especially considering that Mozambique's forest area was eight times that of the metropolis[10]. Moreover, the Forest Services in Lisbon employed more than twenty foresters and dozens of guards, while the services in Lourenço Marques had only a forester and three guards. The comparison with South Africa was also troublesome: the British colony had more than fifty foresters and a hundred forest guards for an area smaller than that controlled by Portugal in East Africa (Grilo, 1946)[11]. In several personal communications, Cardoso expressed his divergences with the colonial ministry on matters relating to forestry. They disagreed, for instance, on the size of staff needed. While Cardoso believed that increasing the number of experts was necessary for the progress of forest conservation in Mozambique, the colonial government saw them as an additional financial burden. As a result, valuable suggestions from foresters, which could have made important contributions to resource management, were not implemented simply because the staff was small and inadequately trained.

3. ASSESSING AND MANAGING FOREST WEALTH AND LIMITS

One of the main obstacles to colonial development was the lack of information about the geography and ecological characteristics of much of Mozambique. Otis Warren

9. Arquivo Histórico de Moçambique, Governo Geral, Direcção dos Serviços de Agricultura em Lourenço Marques, Organização dos Serviços de Agricultura, folder 295, 1929.

10. Arquivo Histórico Ultramarino de Lisboa (AHU). Cardoso, Júlio, "Considerações sobre o problema florestal na Colónia de Moçambique e Relatório dos trabalhos efectuados pela Secção Florestal no ano de 1939", [typewritten], 1940.

11. In 1948 and 1960 Cardoso travelled to South Africa, to participate in the Annual Congress of the South African Association for the Advancement of Science (Cardoso, 1951, 1960). Cardoso's first article was a triumphant account of the success of the casuarina plantations in the dunes. The will to improve cooperation among colonial governments engendered numerous conferences and surveys. In 1950, about one hundred South African visitors attended the Congress, in addition to a number of Rhodesians, as well as representatives from the Sociedade de Estudos of Moçambique and the Suid-Afrikaanse Akademie vir Wetenskap.

Barrett, encouraged the Portuguese government to invest in this forgotten land (Barrett, 1908):

> A country as big as the Atlantic states from Florida to New York with half a dozen small towns scattered along the coast; more than 3.000.000 inhabitants, of which only 1% are whites; one of the oldest of all European possessions and one of the richest in agricultural possibilities, at least, but one of the least known countries in the world. Such is Mozambique […] Millions of acres of the finest alluvial soil fairly aching to show the farmer what big crops may be grown […] No deserts, no salt sinks, no large swamps, no mountainous wastes, no impenetrable jungles; out of some twenty only one or two tribes that object seriously to paying taxes to the government (Barrett, 1910: 807).

Barrett wanted to remove the aura of mystery surrounding Mozambique by presenting it as an agricultural paradise. This idea was part of the "El Dorado myth", the general belief in the wealth of the African colonies (Alexandre, 1995). The North American also believed that international propaganda could change the image of the colony. So, in 1909, he undertook a scientific exploration of the lesser-known regions of Mozambique, later publishing his findings in the *National Geographic Magazine*.

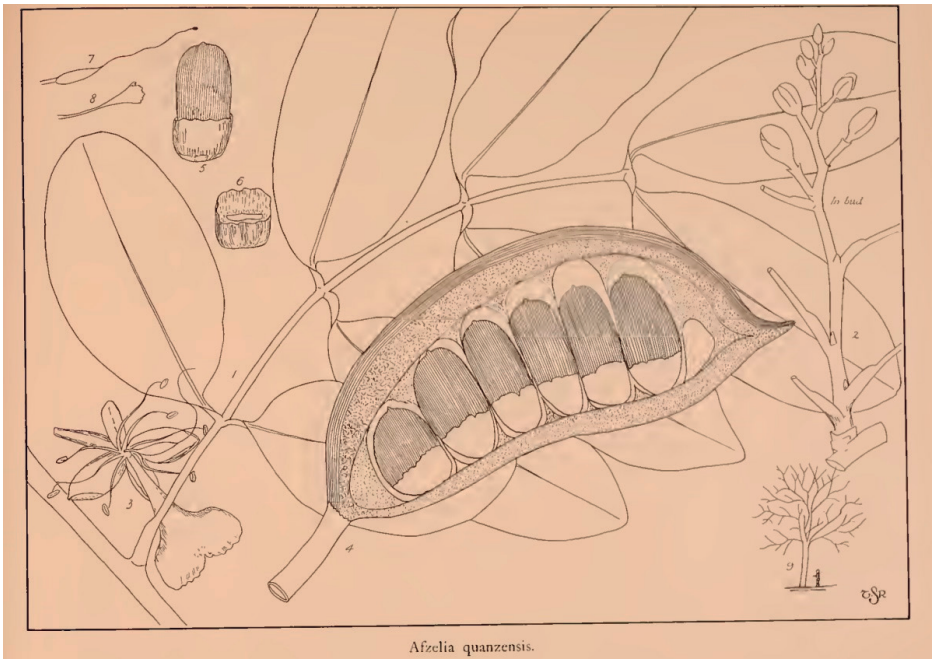
To know the territory and its forest resources better was also one of the main concerns of Fernando Bello when arriving in 1920, since this information was crucial to the development of the action program of the Forest Services (Grilo, 1946). The first challenge was to carry out a survey, following on Thomas Sim's work (1909) (Fig. 1) on the identification of local flora, to assess the characteristics, potential uses and conservation needs of the Mozambican forest (Grilo, 1946: 49). But more than a book of taxonomic flora as Sim had produced, it was necessary a map of natural vegetation as Barros Gomes, the first Portuguese forestry engineer, had drawn in the 1860s to Portugal[12]. Without such knowledge some tasks, like overseeing forest concessions, were impossible. According to Alfaro Cardoso, the best forest areas had to be evaluated in the same way as the metropolitan public forests: Their areas and species distribution zones had to be identified, inventories of wood material had to be made, maps, action plans and methods of rational forest management had to be drawn up[13]. Luís Carriço,

12. Portugal turned to Germany for expertise in forestry. Barros Gomes was convinced of the superiority of forestry practice in Germany and advocated its application, with some modifications. The chief aim of forest management was to steadily improve the conditions of forests and never to cut more than the annual production. See García-Pereda (2018).

13. AHU. Cardoso, Júlio, "Considerações sobre o problema florestal na Colónia de Moçambique e Relatório dos trabalhos efectuados pela Secção Florestal no ano de 1939", [typewritten], 1940.

the director of the botanical garden of Coimbra (Portugal), said in 1928 that a quarter of a century had passed without a Portuguese naturalist setting foot in Mozambique (Carriço, 1928). With this in mind, Gomes and Sousa was hired in 1930 to get an idea of the colony's plant wealth. António de Figueiredo Gomes e Sousa was a botanist from the University of Coimbra, who had already made some recognitions in Angola and Guinea. From the outset, he was aware that he would be in charge of mapping the part of the continent where the tropical flora was less known. Given the size and complexity of the mission, Mozambique's first vegetation map would only be completed three decades later, with the financial support of the Cotton Board. Gomes e Sousa (1950) synthesized his work in a treatise, on the arboreal flora of the colony, titled *Dendrocronologia de Moçambique* (Dendrochronology of Mozambique).

FIGURE 1
Drawing of the Afzelia tree, 1909



Source: Sim (1909).

The raw materials that could be extracted from Mozambique's forests were also unknown. There was plenty of wood, just not the kind familiar to Europeans. They were unaware of these species or their technological properties. And there were also not enough trained staff to determine this in a short period of time. Studies on Mozanbican

woods did not begin until 1948, and they began in Lisbon, not in Lourenço Marques. The researchers of the Laboratory of Wood Histology and Technology in the metropolis were then struck by the lack of bibliographic data and study materials (Ferreirinha, 1955; Mateus, 1973). In the same decade, a Department of Agriculture report concluded that although the Forest Services' core mission was forest inventory, a lack of personnel made impossible to carry out this mission. Existing staff were primarily devoted to other tasks, such as forest concessions and state forest management (Grilo, 1946: 50).

Forestry is intimately bound to two prominent structures of modern power and knowledge –the market and the State (Lanz, 2000). In British colonies, forest policies were connected to the nationalization of forest land, anchored on the legitimacy of scientific forest, with the purpose of setting the stage for commercial logging activities (Enuoh & Bisong, 2015). In line with this, Gomes e Sousa and Cardoso were bio-prospectors, to use a term currently in vogue (Crouch *et al.*, 2008), who sought to make the most of the riches of Mozambique's forests. From their early days in the colony, their main objective was to redesign African forests according to European standards and priorities, such as combating soil erosion or implementing extension services (Green, 2009). To achieve this, Portuguese foresters developed a series of laws to control and manage the forest. One of the main functions of the FS of Lourenço Marques was to oversee forest concessions and govern certain regions of the colony with a relative freedom, but under the watchful eye of Lisbon (Direito, 2013)[14]. In 1920, under the political rule of the General Governor of the Province Brito Camacho (1862-1934) (Roberts, 1986; Smith, 1991), a series of norms were published to guide the operations of the forest concessions and resource exploitation, which later (1926, 1927, 1928, 1939, 1942) would be reviewed due to difficulties in their application and to better fit the practice (Grilo, 1946: 51). In theory, the concession requirements had to be addressed to the General Governor of the Province and the Forest Service had to recognize the requested area and approve the exploitation plan designed by the applicant (Brito-Camacho, 1936; Grilo, 1946; Rollo & Pires, 2015). The concessionaire paid an annual tax per hectare, depending on the nature and location of the land. The extraction operations had to begin in the first six months of the concession and, reforestation, according to the indications of the FS, was mandatory. Drawing a perimeter survey map was also indispensable, as well as having a management plan with the definition of the reserves per hectare. The concessions were granted for 5 years for forest areas of less than 5,000 hectares and 10 years for larger areas. This regulation, however, was not applied until 1955 (Pinto, 1961).

14. In 1967, there were in Mozambique 152 forest concessions, for a total surface of 1,074,466 hectares (Boleo, 1967: 123).

Mozambique does not seem to have experienced the growing requests for concessions in the more thinly forested areas, as has happened in other places, as in the Spanish Guinea with Teck wood, due to increasing market demand (García-Pereda, 2016; Guerra, 2018). The mentioned lack of knowledge about the territory and its resources may have contributed to this diminished commercial interest. In 1932, in part due to the economic crisis, there were only four concessions in operation, which involved the logging of less than 24,000 hectares. There were at least five sawmills operating for the transformation of the wood[15]. Although the wood was considered of good quality, it worth almost nothing on the metropolitan market compared to the Brazilian wood, which was imported in quantities fifty times greater. But the crisis, internal and external, was gradually overcome: 1936 was the first year in which timber exports from Mozambique exceeded the imports[16]. By then, at least five varieties of tropical timber, such as African ebony, had been identified, which could interest the European markets[17]. In the 1920s and 30s, Transvaal was the only region close to Mozambique that was a major buyer of its timber, since the mining operations in South Africa required large quantities of wood. Often, transportation costs were considered excessive and many forest areas were simply cleared for agricultural use (Harrison, 1926). In the 1930s and 1940s, signs of overexploitation began to emerge, and there were initial concerns about the destructiveness of colonial society (Grove, 1996). The depletion of the forests reached serious proportions. The lack of a real valuation of the forest's wealth by the Forest Services and the shortage of staff to monitor the concessions caused lasting damage. The practice of taking only the best tree specimens left the poorer forest stands "with no possibility of rehabilitation" (Pedro, 1949). For Alfaro Cardoso it was the combination of the felling of mature trees by loggers, leaving open terrains, and the fires set by the indigenous people to create *machambas* (small agricultural fields) (Fig. 2) that caused the gradual disappearance of the forests (Cardoso, 1951).

Cardoso (1951) considered that the damage caused by slash-and-burn agricultural practices was greater than previously thought. In the Portuguese colonies, like in British ones, "Africans came under scrutiny for practicing slash-and burn agriculture and destroying the forest" (Bennet & Kruger, 2015: 236). In the European forester narra-

15. AHU. Cardoso, Júlio, "Considerações sobre o problema florestal na Colónia de Moçambique e Relatório dos trabalhos efectuados pela Secção Florestal no ano de 1939", [typewritten], 1940.

16. 814 tons in 13,952. AHU. Cardoso, Júlio, "Considerações sobre o problema florestal na Colónia de Moçambique e Relatório dos trabalhos efectuados pela Secção Florestal no ano de 1939", [typewritten], 1940.

17. AHU. Cardoso, Júlio, "Considerações sobre o problema florestal na Colónia de Moçambique e Relatório dos trabalhos efectuados pela Secção Florestal no ano de 1939", [typewritten], 1940.

tive, fire was the primary tool of deforestation and biological impoverishment, and an evocative symbol of destruction. No distinction was made between forest fires set for the purposes of creating agricultural fields and those intended to rejuvenate pasture. On the other hand, the role of Portuguese farmers in deforestation was rarely mentioned, despite the fact that they cleared the forests to make way for vast expanses of coffee and cotton plantations, as well as other cash crops (Quintanilha, 1948)[18].

FIGURE 2
***Machamba* in Save region, Mozambique**

Source: photo by Joana Gaspar de Freitas, 2022.

Attempts to create a modern forest programme did not go without consequences, especially for the local population. Some experts did not overlook this. In 1954, Cape Verdean agronomist and future pro-independence politician Amílcar Cabral, described how traditional practices conflicted with European forest policy:

18. At the same time, the spread of malaria and the tsetse fly disease, which posed a threat to the human population, seemed to be connected to the expansion of flat areas resulting from the cut of large forested regions (Simões Vaz, 1951). In these early periods, health and environmental concerns walked side by side to a colonial administration.

> The cultural system redolent of Black Africa is an itinerant system […] a portion of forest or savannah is chosen for cultivation; the natural vegetation is thinned and then burned; the earth is exploited for a short period and then abandoned; the forest or the savannah then reclaims the land […] The itinerant system (nomadic agriculture) demands a high level of settlement instability. The people don't attach themselves to the land (César, 2018: 263).

Cabral (1959) believed that Africans were unfairly characterized as abusing natural resources, when in fact they were very adaptive in their approach. For example, he recognized the important role of African women as the primary cultivators and at the forefront of agricultural management. Cabral defended that a good colonial agronomist should work flexibly with local knowledge and techniques. In Mozambique, however, some foresters and landowners promoted a virulent anti-indigenous rhetoric, attributing deforestation to pastoralism and the use of fire by local people. By regulating or eliminating traditional activities such as slash-and-burn, colonial foresters sought to put an end to what was not "rational" or "economic" in the eyes of the colonial government. They advocated the sedentarization of indigenous pastoralists and the punishment of communities. The 1962 forest code detailed the penalties for offenders and organized of the forest police into forest rangers and forest masters, some of whom were from local communities[19]. The African forest rangers, for example, were responsible for controlling grazing rights and limiting the number of animals.

For years the FS were just a section within the Department of Agriculture –a situation its staff viewed as a limitation to their work, due to functional boundaries and different goals of the department. In 1957, however, forestry appears to have gain a status similar to that of agriculture with the creation of the Department of Agriculture and Forest[20]. The structure and organization of these services were reviewed and improved in 1965, as it was considered by that they needed a better coordination and resources to provide their technicians with more means to execute their duties[21]. It was also during this period that the forest has its first specific regulation. With the Forestry Regulation of 1962[22], the authorities recognized that increasing exploitation had to be balanced with better control over forest access and use. The immediate reason for forest conser-

19. Regulamento florestal das províncias de Angola, Moçambique e Guiné, Decreto 44531 de 1962. https://dre.tretas.org/dre/264452/decreto-44531-de-21-de-agosto

20. Decreto 41482, de 28 de dezembro de 1957.

21. Decreto 48198, de 11 de janeiro de 1968. https://dre.tretas.org/dre/253333/decreto-48198-de-11-de-janeiro

22. Regulamento florestal das províncias de Angola, Moçambique e Guiné, 1962.

vation was economic: ensuring a consistent timber supply to satisfy industrial demand. However, there was also a sustainability rationale for conservation: maintaining the integrity of tropical ecosystems (Guerreiro, 1966). The constitution of colonial forest reserves (*reservas florestais*) –article 24 of the 1962 forest code–, was an important step for the preservation of natural local resources (Frade, 1956; Gomes e Sousa, 1966). Such classification following scientific and cultural principles was crucial for controlling certain practices within delimited areas (Guerreiro, 1963; Teixeira, 1967). Brett Bennett and Frederick Kruger wrote that historical interpretations of forestry in South Africa have tended to emphasize how foresters technically colonized forests once used by Africans. Even though this is "undoubtedly true", they say: "from the perspective of foresters, the actions of extractive capitalists and poor Africans alike had to be regulated" (Bennett & Kruger, 2015: 239). Alfaro Cardoso, for instance, considered utopian to think that industrialists were going to save the future of the forests by sacrificing their immediate profits: they almost always wanted to return to Europe shortly, with the highest possible benefit. Cardoso (1951) believed that only the foresters of the colonial administration could put an end to this destruction, if given the resources and power to do so. However, it is also undoubtedly true that the colonial forest regulation aligned firstly with commercial interests, excluding traditional practices and largely alienated the indigenous populations from their prior rights and uses. Local communities, living from forest resources for their daily consumption and handicraft production, were left out from decision-making and governance of these ecosystems[23]. As Everisto Mapedza (2007) explains regarding Zimbabwe, colonial forestry policy tended to be paternalistic. It did not accommodate indigenous knowledge, which was considered unscientific. Similarly, it disregarded any non-commercial uses of the forest, overlooking the religious significance of some groves to local communities, for example.

In this period, scientific institutions, such as the Sociedade de Estudos de Moçambique (Society for the Study of Mozambique, SEM), also played an important role in shaping conservation thinking in Mozambique and establishing a dialogue between the colonial government, industry, and local interests (Pimenta, 2016). The work of this society and others, like the Sociedade de Geografia de Lisboa, represented the "paradigmatic colonial science" (Osborne, 2000). SEM members gathered useful knowledge and disseminated it through a bulletin for subscribing members and government officials, as well as through organized meetings. They served as "access points" between local communities and broader global circuits of knowledge production. Through their networks, these men of science and commerce collaborated within and across imperial borders to transform colonial territories to make them more suitable according to

23. Decreto 44531 de 1962.

European standards and purposes. The "improvement" paradigm, coupled with serious concerns about the relationship between health and nature, enlivened the social and political activities of the increasingly powerful elites. The success of this group relied on familiarity, shared social identity, and a consciousness of reciprocal benefit. The SEM gave an institutional form and civic life to the intellectual exchanges that were already taking place, informing government officials of the concerns of the local elites[24]. As Michael Osborne (2000: 104) has observed, this was a "epistemic community" that developed scientific expertise for colonial rule. This occurred alongside with the professionalization of science within the colonial government with the establishment of the Centro de Investigação Científica do Algodão, Junta de Exportação de Algodão Colonial in 1944 (Câmara, 1945; Guimarães, 2021), the Instituto de Investigação Científica de Moçambique in 1955 (Ministério de Ultramar, 1961), the Estudos Gerais Universitários de Moçambique in 1963 (Pinto Lopes, 1964), and the agriculture school of Vila Pery in 1968[25].

4. "PLANTING THE SANDS": DUNES AND CASUARINAS

The first foresters laboring in Mozambique were particularly concerned with assessing existing natural resources, but they also began some extensive planting work. Planting trees was then seen as a solution to solve environmental problems, such as draining wetlands, improving climate and stabilizing riverbanks and sandy coasts. As in the metropolis (Freitas *et al.,* 2023), foresters in Mozambique focused on the fight against the drifting sands. Over centuries, in Europe, coastal sand dunes moving inland blown by the strong maritime winds caused severe problems to local populations, covering hamlets, agricultural fields and silting the mouth of rivers. Fixing the dunes, through

24. Foresters Alfaro Cardoso and Gomes Guerreiro and the agronomist Gomes e Sousa were members of the board of the Sociedade (*Boletim da Sociedade de Estudos de Moçambique,* n.º 131, p. 1, 1962). These were manifestations of their levels of social capital.

25. Since the 1940s, in Vila Pery (Trindade experimental station), there was a plant breeding department (Ascenso, 1967; Santos, 1952). The agronomists' narrative with experimentation, in Mozambique, was more concerned with breeding and production of stable hybrid lines, like the ones made with cotton and wheat plants (García-Pereda, 2024). The colonial administration lacked detailed local surveys and hence had only imprecise ideas about local environments, which vetoed any clear strategy for agriculture development. FAO first years had an intense reflection on how to develop rural communities (Ribi Forclaz, 2018). The Portuguese government signed a commitment in 1947 with FAO to participate in a world agricultural survey, with quantitative data on a few basic items: areas of cultivation and respective crops, general characteristics of the population, farm animals, and productivity of main crops. This was the origin, in 1953, of the request made by the governor of Guinea-Bissau to Amilcar Cabral to organize an agricultural survey (Cabral, 1959). There is no information about a similar attempt in Mozambique.

afforestation, to prevent such destruction had been a state policy in several European countries, including Portugal, since the beginning of the 19th century (Freitas, 2024).

By the 1920s, dunes planting methods were well known. They were the product of scientific networks, European practices, and imperial expansion. They had been thoroughly developed by experimentation, in Portugal and other European and non-European countries, for more than a century. Dune afforestation schemes were at the center of forestry discourses and practices in the Iberian Peninsula after 1870, flourishing in both Portugal and Spain until the 1950s. These projects aimed to stabilize thousands of hectares of dunes, improve these sandy areas and bring them under timber and resin production. In both countries, the method used for dune afforestation was based in the experiences of Nicolas Brémontier (1738-1809), a French engineer of the Ponts et Chaussées Services, in the region of Gascogne, from 1787 onwards[26]. In France, Spain and Portugal, the *Pinus pinaster* proved to be the most suitable and profitable tree for the task. It was able to grow in poor sandy soils and provided timber of moderate quality (*e.g.* for railway sleepers), as well as firewood and resin. It was also effective in the desiccation of wetlands often associated with dunes and tidal areas. Moreover, at the end of the 19th century, the beaches of the Bay of Biscay, Ampurias (Catalonia), Guardamar (Alicante), in Spain, and Furadouro, Caparica, and others in Portugal were becoming attractive places for sea bathing. Their value was increasing, and, according to contemporary views, afforestation contributed to the improvement of these areas.

The Mozambican coastal region running south from the Save River to South Africa is characterized by extensive transgressive dune fields, with high rates of dune migration occurring during the dry season, causing intensive burial processes in the local back lacustrine-lagoon systems (Miguel & Castro, 2018). In the first half of the 20th century most of these dunes –some more than 200 meters high– were vegetated and therefore immobilized, representing no danger. But others, such as those at the mouth of the Limpopo River, caused problems; their constant shifting posed a hazard to navigation, affected the water flow and led to flooding in the river basin. The moving sands also affected the lighthouses erected along the coast to aid navigation, which was crucial to the economy of the colony. Many of these infrastructures had been constructed on the dunes and their instability threatened the foundations of the buildings (Cardoso, 1948). Therefore, the FS concentrated their efforts on fixing the dunes at the mouth of the Limpopo River and near the lighthouses (figures 3 and 4).

26. Bremontier, an officer in the government department of the administration of public works in France, conceived the idea of erecting wattle hurdles and boards near the sea, so as to break the storms (Freitas, 2024).

FIGURE 3
Map of Mozambique showing the locations of dune afforestation

Source: figure by Joana Gaspar de Freitas & D. M. R Sampath.

In Mozambique, the first enterprise against the drifting sands was related to an irrigation project and agricultural settlement presented by the English engineer, John Aylmer Balfour, to the provincial government in 1920. Balfour (1920) proposed the creation of a 20,000-hectares irrigated area to be built 15 km from the village of Guijá, in the valley of the Limpopo River. The region had the right conditions for the settlement of Portuguese families. An initiative fostered by the authorities to increase the European colonization of Mozambique and promote social control and new patterns of land use. The project was later continued and encouraged by the "proactive developmental agenda of the *Estado Novo*" (the Portuguese Dictatorship, 1933-74) (Castelo, 2016). The plan was to control the indigenous population and local resources, and to modernize agriculture with the financial and logistical support of the State. Hundreds of houses and public buildings were then constructed[27]. In 1955, 327 rural workers and their families were transferred to these new villages to live alongside 318 indigenous fami-

27. The first families, from the Portuguese regions of Alentejo and Madeira, were installed in 1954. In 1958 the new agricultural colony had more than 5,000 individuals (Castelo, 2016).

lies (Trigo de Morais, 1956). The modernization of the Limpopo Valley also involved non-human transfers, namely the introduction of Portuguese livestock and agricultural machinery and equipment[28].

FIGURE 4
Limpopo River Mouth, by the Comissão da Cartografia, 1894

Source: Biblioteca Nacional de Portugal, http://purl.pt/3621.

In order to colonize the Limpopo River Valley, it was necessary to fix the mobile dunes at its mouth to improve the water regime and prevent the occurrence of frequent floods (Fig. 5). The task was accomplished before the beginning of the agricultural part of the project in the 1950s. It was a challenge for Fernando Bello, who had just arrived at Mozambique and was the first forester to work on such matters in that colony (Gomes e Sousa, 1967). The procedures, which began in 1920, involved the creation of foredunes to act as barriers against the prevailing winds, through the planting

28. To reduce the possibility of failure, the State prepared training programs for both Indigenous and European workers. Each family unit, consisting of 4 irrigated and 24 non-irrigated hectares, included a precise number of local and non-native animals, plants and people. This was clearly a colonialist project, within a framework of domination, but the inclusion of indigenous families indicates that they were needed and played an active role in the making of such new territory.

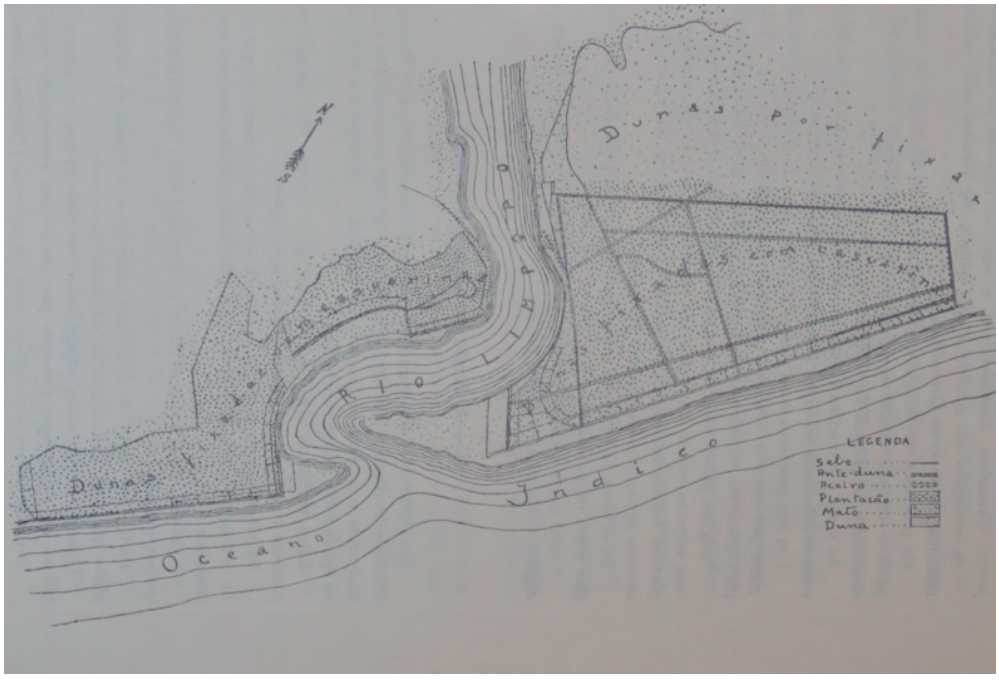
of various sand-binding species (*e.g. Ipomea biloba*, *Eragrostis* sps., *Canavalia rosca*, *Cyperus maritimus*). The development of a vegetation cover was important for stabilizing the sand and protecting seeds and young trees. As mentioned earlier, in Portugal, *Pinus pinaster* was considered the ideal tree to plant on the Atlantic coastal dunes. But in Mozambique, after some experiments with some exotic and local species, the casuarina (*Casuarina equisetifolia*), native to Australia[29], proved to be the best choice for the climate of the East African coast. Other exotic species, such as Eucalyptus and Grevillea, were tried, but failed (Cardoso, 1954). The casuarina, on the other hand, thrived on those sandy, poor, dry soils, and resisted to the salty winds, grew quickly and produced wood, preparing the soil for the introduction of other slower-growing species with higher-quality wood, such as *Afzelia quanzensis* (*chanfuta*) and *Trichilia emetica*. In 1953, 1,268 hectares had been planted with more than one million trees. In the process many died due to storms or extreme dryness and had to be replaced. These trees, which were used to control the river's natural regime for colonial purposes, as well as the stabilized dunes that protect lighthouses from sand drifting and coastal erosion, are examples of green infrastructure. As Ashely Carse puts it, they are natural elements modified by human labor to provide critical services for communities and economies. Building and maintaining these infrastructures required a set of professional skills and organizational techniques, such as knowledge, planning and resources. However, they were also dependent on nature for their reproduction and survival. This reveals the fragility of human dominance (Kreike, 2013). Like technical systems, these infrastructures change over time, age, become damaged, and require regular maintenance (Carse & Kneas, 2019).

The casuarinas were also used to stabilize the dunes around the lighthouses of Ponta do Ouro, Inhaca, Monte Belo, Boa Paz, Závora, Barra do Inhambane, Barra Falsa, Bazaruto, Timbué, Ponta Caldeira e Uifundo (Freitas *et al.,* 2023). Starting in the 1920s, several requests were made to the colonial authorities to protect these infrastructures, forcing the government to take action. In some places, moving sands threatened to cover constructions. In others, the buildings' foundations were at risk due to the unstable sandy ground on which they had been implanted. Interventions began at Inhaca in 1929 and continued at other lighthouses until 1948. The work consisted in the installations of fences to break the wind and create a foredune, sowing sand-binding vegetation and planting casuarina. In some places, like the Barra de Inhambane

29. *Casuarina* sp. has been introduced to many continents and islands. The species *Casuarina equisetifolia* was introduced in Mexico before 1890 (Guadarrama, 2025), and in Florida during the 1890s as windbreaks and shade trees (Wheeler *et al.,* 2011). It is an invasive species in the United States, including southern Florida, Hawaii, and throughout the Caribbean.

and Bilene, casuarinas or acacias and eucalyptus were planted to enhance the region's beauty and please frequent visitors (figures 6 and 7), similarly to what had been done in some beaches in Portugal (Palma *et al.*, 2021). Local people and forced laborers, mostly indebted prisoners, did the fencing, sowing, and planting. They were paid a small amount of money and provided with food, but the work was hard, and the conditions were terrible. Many escaped, and those who volunteered often gave up[30]. The use of prisoners for dune stabilization was not unique to Mozambique. In Australia, in the first decades of the 20th century, convicts were also employed in tree plantation to control the unruly sands. According to Benedict Taylor, forced labor practices at Tuncurry Afforestation Camp were directly connected to the rehabilitation of the men involved (Taylor, 2008). In the case of Mozambique, however, foresters' reports do not establish such a relationship.

FIGURE 5
Mouth of the Limpopo River and a sowing scheme



Source: Cardoso (1948).

30. AHU. Cardoso, Júlio, "Considerações sobre o problema florestal na Colónia de Moçambique e Relatório dos trabalhos efectuados pela Secção Florestal no ano de 1939", [typewritten], 1940.

FIGURE 6
Macuti Lighthouse, Beira

Source: photo by Joana Gaspar de Freitas, 2022.

The reports produced by the FS's staff show that the foresters, trained in the metropolis, adapted their knowledge to local conditions, testing and introducing improvements to achieve their goal. Cardoso, for instance, referred to the use of mud (the *matope*) in the transplanting process to protect and hydrate the young seedlings in the dry sands (Cardoso, 1948). This was not a practice in Portugal. The forester's narratives are filled with the deliberate use of words like "experiment" and "testing". The persistent experimentation with the casuarina genus reveals the material mechanism of the new "green infrastructure (Fig. 7). In this sense, the Limpopo River mouth and coastal dunes acted as a "living laboratory", to use Helen Tilley's (2011) expression. Linked to other institutional and bureaucratic services and policies, forestry left a legacy in Mozambique's coastal and irrigated rural areas, with the Forest Service representing an extended arm of state penetration with direct influence in remote areas. Dune and forest management in Mozambique, as in other Portuguese colonies and within the British Empire, as evidenced by Bennett and Kruger's (2015) chapter on forestry in South Africa, also clearly demonstrate transcontinental exchanges between at least three continents. Knowledge of seeds and plants came from colonial gardens in Lisbon, Kew and Berlin, and, in the case of the casuarinas, directly or indirectly from Australia. Cardoso's texts reveal the influence of German and French forestry science and reference practices in Portugal, Spain and France. Foresters' petitions to the State for more resources –expertise and

seeds– depended on the efforts various actors, including agronomy professors in Lisbon, diplomats in South Africa and gardeners in Berlin.

FIGURE 7
Casuarinas in Praia do Bilene. The legacy of the Portuguese dune afforestation

Source: photo by Joana Gaspar de Freitas, 2022.

5. CONCLUDING REMARKS

Combining history of science and environmental history approaches, this paper presents evidence of a particular strand of official colonial thinking during the 20th century: the belief that the use of rational knowledge and methods could overcome and subdue different social and ecological conditions, and adapt the African landscapes to European standards contributing to the improvement of the overseas territories. This period was characterized by debates and considerable exchange of scientific knowledge, techniques and resources that were integrated into agricultural and forestry programs throughout the Portuguese empire. Despite the fact that the tropical forests are very different from those of the Atlantic and Mediterranean ecosystems, with a bewildering vastness and a huge variety of tree species, in fifty years the FS contributed to the cataloguing and scientific knowledge of Mozambique's botany,

and searched to apply the principles of forestry developed within the European tradition. The objectives of forest management were to ensure effective protection of forests against natural and human destruction, to devise a system to guarantee forest regeneration and to increase timber production. Implicit in this mandate was the basic principle of German forestry, based on sustainable production and harvesting according to the long-term needs of the market economy. Between 1920 and 1974, Cardoso and his colleagues did surveys and inventories of forest areas and species across Mozambique, designed working plans and ran forestry operations in the entire overseas territory. The process of delimitation and classification of forests led to the development of state forests and reserves, important categories for both nature conservation and state power. The cultural role of the new forest service was rooted in the idea of scientific forestry, which emphasized the botanical, economic and social performance of the "modern" forest. Such view and measures deeply impacted people and environments, provoked tensions and resistance.

This article examines also lesser-known aspect of Portugal's efforts to modernize Mozambique: the use of green infrastructure. Much has been written about how cities, railways and dams were used as colonial tools to dominate African territories. But these were not the only means of effectively controlling land, people and resources. Green infrastructure, namely forests and dunes, also had that ability. Additionally, reaching inland and coastal areas far from urban centers where most of the colonization efforts were concentrated. Dune fixing in Mozambique benefited from the knowledge acquired through practice in Portugal and based in the European methods developed by Brémontier and others. Many of the foresters trained at ISA in Lisbon started their careers working on dunes afforestation in the littoral of Portugal, and from 1920, in the colonies. Forest science in Mozambique far from representing a mere transfer of European science, was shaped by the African context. Bello, Cardoso and others, when arriving to Mozambique, had to adapt their knowledge to the local conditions, studying the ecological context, finding and experimenting with new plants species, using mud for the protection of the seedlings, and depending on the labor of indigenous populations. Their interaction with the Mozambican environment introduced a high level of hybridity into their working practices. It's interesting to see how these foresters developed "place-based knowledge" through long stays in the field. The casuarina and *chanfuta* introduced in the Limpopo dunes were not used in the European sands. Not denying the "powerful binding of science and empire", Sujit Sivasundaram (2010: 155) states that "to understand colonial science, it is necessary to think beyond categories of colonized and colonial" and view it as a rich tapestry. In the case of dunes afforestation, European scientific knowledge was intermingled with African and Australasian species and practices that were adapted to the East African climate and soils.

This paper is not a celebration of European knowledge or of the great achievements of the Portuguese Forest Service in Mozambique in the 20th century. But it's far from the apocalyptic vision of imperial environmental history based on destructive colonial encounters (Beattie, 2012). Some of the Portuguese agronomists and foresters were concerned with regulating forests to increase their yield. At the same time, they wanted to ensure the forests were used widely, controlling capitalist initiatives and indigenous uses. As Emmanuel Kreike (2008: 141) notes, the record of environmental change is often multi-trajectory and full of contradictions and ambiguities occurring simultaneously in different directions. Foresters supported forest clearing for timber exploitation in some places and promoted afforestation in others, like coastal areas. The aim of this paper was not to engage with the dominant historiography on colonial forestry in Africa and on the history of conservation. It did not intent to focus on the tensions and conflicts between the different human agents involved (foresters, loggers, African populations) because of official forestry policies in colonial territories. Its purpose was to bring the overlooked history of the professional networks and practices that shaped the FS in Mozambique and their relatively unknown initiative of dune afforestation in this territory. As Bennett and Kruger (2025: 226-27) point out, imperial visions often falter in the face of colonial realities. Grand plans for capitalist expansion and imperial integration were easily hindered by bureaucratic procedures, local politics, budgetary constraint and personnel issues. This paper clearly demonstrates that. The first Portuguese foresters, who created the FS in Mozambique, were constantly dealing with bureaucratic constrains, technical weakness, and the lack of human and financial resources. The Portuguese colonial state was "weak and brutal at the same time" (Isaacman, 1996: 9), relying on intimation and periodic acts of terror to try to accomplish what they could not do through supervision.

Within the framework of colonial domination, the afforestation of the dunes was a major attempt to transform coastal areas into stable landscapes that better served development purposes. This included the colonization of the Limpopo Valley and the maintenance of lighthouses to safeguard navigation and commercial interests. However, green infrastructure easily deteriorates without continuous investment of labor, money, technology and knowledge. Budgets evaporate, political regimes end, trends fall out of fashion (Chandran, 1998). Trees die or are cut down in storms and wars, dunes are washed away by the sea or destroyed by people. The history of the FS in Mozambique can be examined through the lens of the modernization paradigm or described as a declinist narrative. However, both perspectives would be reductionist. As Emmanuel Kreike (2008: 145) proposes, human and non-human history, particularly when dealing with environmental change, occurs "across various scales of analysis involving multiple

strands, trajectories, and sub-processes that may converge and diverge, intertwine and unwind in dissynchronous asymmetry".

A final consideration brings the findings of this paper into the contemporary arena. As in other countries, such as Nigeria and Zimbabwe, some colonial forest policies continued in the post-independence (Enuoh & Bisong, 2015; Mapedza, 2007). After 1975, Mozambican authorities maintained the planting of casuarinas in the dunes. In the 1980s, these artificial plantings were appraised as a success, protecting inland areas from the wind and the sea, safeguarding coastal lagoon systems from being silted by the sand (Costa, 1985). The parallels between the debates in forestry circles during the *Estado Novo* and today are striking. It can be argued that the policies and discourses articulated in the past in many ways prefigured the current debates on the governance of Mozambique's forests (Sitoe, 2008). Fighting deforestation, protecting the existing forests and planting new ones are the priorities to achieve sustainable development goals. The assertion of a scientific body of work derived from European forestry began in the first half of the 20th century, but did not end in 1974. Today, Mozambique's forest managers and scientists are working to restore ecosystems, the afforestation of dunes is included in the law of nature conservation and is part of forest management programs with the aim of protecting coastal environments[31]. However, those involved in these initiatives often ignore the previous ad hoc trial-and-error attempts, feedback and "the serendipity of previous interventions" (Freitas, 2020: 5).

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31. Ministério da Terra, Ambiente e Desenvolvimento Rural, *Agenda Estratégica 2019-2035 e Programa Nacional de Florestas, Moçambique*, June 2019. Some of these new ecological ideas did not come from Lisbon, but rather from South Africa (Antunes, 2016; Ferreira & Ferreira, 1952). The discipline of ecology owed a good deal to the global imperial context and the idea of conservation spread from the United States to Africa already in the 1920s (Beinart, 2000).

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