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Part III.

Islands of Experimentation

11. Lost Eden:

An Environmental History of the Plantation System on the Island of La Réunion (1638–1960)

Philippe Holstein, Jehanne-Emmanuelle Monnier and Pablo Corral-Broto

How is an island different from a continent? This question was asked at a key moment in the development of a project. The answers were very varied and familiar: the distance from the mainland, sometimes the ultra-periphery; being surrounded by the sea; the micro-society that is created... But on the island of La Réunion, we realised a cruel answer related to the past of slavery: you can't run far away. An island is also a closed place for animal and especially plant species. This explains the high rate of endemism found there. Today this island is a tourist destination where many people want to go. The island's paradigm shift is another sign of the success of social and environmental change and the improvement of the quality of life of the inhabitants of La Réunion.

I do not know whether coffee and sugar are necessary for the happiness of Europe, but I do know that these two plants have been the bane of two parts of the world. America has been depopulated in order to have land to plant them in: Africa is being depopulated in order to have a nation to cultivate them.
On the Isle of Bourbon ... there are more vegetables growing than can be consumed.¹

Introduction

East of Madagascar lies the Mascarene archipelago, composed of three islands: Rodrigues, Mauritius and Réunion. Réunion formed two million years ago, making it the youngest landmass created by the Deccan volcanic hotspot. Dominated by the 'Piton des Neiges', its peak reaching 3,069 metres, Réunion presents a mountainous profile. More than forty per cent of its 2,500 square kilometres have an elevation of more than 1,000 metres and much of the island is dominated by steep slopes. Because of its topography, its lack of natural harbours and its remote position in the Southwest Indian Ocean, the island has remained for millennia only loosely connected to the Afro-Asian world that has shaped this basin. Though it appeared on Arabian maps in the tenth century as *Dina Morgabini* (see Figure 1), no permanent human settlement occurred until the seventeenth century. Such isolation allowed for the development of unique and diversified ecosystems, adapted to the varied humidity and temperature gradients. Before human colonisation, 88 per cent of the island was covered with forests, home of many endemic and iconic species such as *solitaire* – the Réunion ibis, parrots, and giant tortoises. Ninety per cent of the flora was considered endemic to the Southwest Indian Ocean.²

Taken over by the French *Compagnie de l'Orient* in 1638, Réunion progressively became a plantation economy that relied on the labour of slaves and indentured workers. Its economy specialised in the production of tropical commodities – coffee, spices, sugar and essential oils. Due to the absence

- 1 H. Bernardin de Saint-Pierre, *Voyage à l'Isle de France, à l'Isle de Bourbon, au Cap de Bonne-Espérance, etc. avec des observations nouvelles sur la nature et sur les hommes, par un officier du Roi*, Tome 1 (Paris: 1773), pp. 201 and 308.
- 2 Anthony Cheke and Julian Hume, *Lost Land of the Dodo. An Ecological History of Mauritius, Réunion & Rodrigues* (London: T. & A.D. Poyser, 2008).

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Figure 1. Cantino planisphere (1502) with the Arabian name Dina Morgabini (La Réunion).
Source: Bibliothèque nationale de France (<https://gallica.bnf.fr/ark:/12148/btv1b8440984z>).



Figure 2. Historical map of La Réunion Island.
Source: Bibliothèque nationale de France (<https://gallica.bnf.fr/ark:/12148/btv1b531194760>).

of an indigenous population, Réunion constitutes one of the first societies to be literally shaped by an economic imperative that organised and guided human settlement. In this chapter, we analyse the institutionalisation and expansion of a specific variant of the island plantation system, from diversified coffee and spice cultivation to a sugar monopoly. We then describe how ecological feedbacks and the island's unique characteristics gradually compromised the prosperity and sustainability of the plantations, plunging the island into a period marked by structural land-use pressure, food vulnerability and health crisis.

The institutionalisation of the plantation system

Initiated by the Portuguese in the sixteenth century, European penetration into the Southwest Indian Ocean triggered the integration of the Mascarenes into the modern world-system. The Dutch East India Company took possession of Mauritius in 1638, while the French *Compagnie de l'Orient* conquered the island of Bourbon – later named Réunion – in 1642. On the new southern routes to India, Malacca and the Moluccas, these islands were first used as stopovers. The testimonials and travel stories compiled by the historian Albert Lougnon depict Bourbon as a 'Garden of Eden', whose fresh air and water could heal the sickest sailors.³ They also reveal a distant, utilitarian relationship to the island's ecosystems that treated them as a reservoir offering bountiful wellsprings of fresh water, lumber and easy prey. Several narratives describe hunting orgies that targeted the giant tortoises as well as various bird species.⁴

The first permanent colonisation of Bourbon occurred in 1654 by French colonists and slaves from Madagascar. In 1665, the island was sold to the French East India Company, which enjoyed a fifty-year monopoly on all commercial activities in the Indian Ocean. Botanists and surgeons employed by the Company were rapidly mobilised to conduct exhaustive surveys of the island ecosystems, identify valuable resources and experiment with the cultivation of potential commodities.⁵ Meanwhile, the Company recruited

3 A. Lougnon and D. Vaxelaire, *Sous le signe de la tortue: voyages anciens à l'île Bourbon 1611–1725* (La Réunion: Orphie, 2006), pp. 27–28.

4 Ibid.

5 A. Lougnon, *L'île Bourbon pendant la Régence. Desforges Boucher. Les débuts du café* (Paris: Editions Larose, 1956), pp. 90–96.

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indentured workers from mainland France to exploit and develop these resources. These workers were granted large land plots called *habitation* through five-year contracts. The Company also organised the 'import' of women from Madagascar and India.⁶ The initial population of Bourbon was thus highly mixed.

Surrounded by the island's rich resources, the first inhabitants rapidly failed the expectations of the Company. Instead of following the productive imperative, they developed a subsistence economy based on hunting. To counteract this trend and the settlers' so-called 'idleness', Governor Jacob Blanquet de la Haye enacted an order in 1674 that banned hunting and imposed production objectives.⁷ Agriculture gradually became the economic foundation of the colony. In the 1711 census, 97 of the 103 family heads on the island were labelled as cultivators. The most cultivated crops at the time were vegetables, bananas, maize, rice and wheat, grown both for the settlers' own consumption and to supply vessels. Sugarcane also occupied a large number of plots to produce cane wine – *fangourin* – and distilled alcohol – *arack*. These products were notably served in a large number of taverns to pirates chased from the Caribbean. These pirates exerted a critical influence on the island: they accounted for forty of the 121 family heads in 1714 and brought to the island the initial capital that would later serve the development of its economy.⁸ With them, they also brought slaves: in 1709, the population was composed of 384 slaves and 116 free settlers.

Though the population remained limited, the first fifty years of colonisation had a severe ecological impact on the island. Due to overhunting, giant land tortoises, considered rare in 1667, were extinct by 1735. The introduction of invasive species such as dogs, goats, pigs and rats also accelerated the decline of native birds which were incapable of competing and adapting to such pressures. Even before sugar plantation, the need for wood for construction, ship repair and commercial activities led to the destruction of the semi-dry forest that had covered the west coast from St Paul to Ste Suzanne. Like on Mauritius, such deforestation rapidly altered the water cycle and many

6 P. Eve, *Variations sur le thème de l'amour à Bourbon à l'époque de l'esclavage* (Saint André: Océan Editions, 1998), p. 245.

7 F. Lautret-Staub, 'Trois moments de protestation populaire à Bourbon (XVII-XIXe siècle). Conte, haut lieu et légende comme conservatoire de mémoire', Thèse de doctorat (Université de La Réunion, 2001), p. 27.

8 J. Barrassin, *La vie quotidienne des colons à l'île Bourbon à la fin du règne de Louis XIV: 1700–1715* (St Denis: Académie de La Réunion, 1989), p. 33.

testimonials pointed out that the reduction in rainfall, and more severe desiccation, caused a marked erosion rate and a loss of soil fertility.⁹

The coffee revolution (1715–1820)

The history of Bourbon changed in 1710 with the discovery of an indigenous coffee plant – *Coffea mauritiana*. At that time, the global production of coffee was concentrated on the Arabian Peninsula and the Dutch enjoyed a quasi-monopoly on the supply to Europe. As a consequence, France suffered a commercial deficit with the Netherlands. The French East India Company seized this opportunity to increase its turnover by importing and then cultivating coffee. In 1718, the Company introduced coffee from Moka in Yemen and made its cultivation mandatory for all inhabitants of the island. In 1724, an ordinance introduced the option to take over the *habitation*¹⁰ of any settler cultivating less than 200 coffee plants per slave, and to sentence to death anyone caught destroying the plants. To stimulate coffee production, the Company offered financial incentives and sold on credit luxury goods imported from China. It also legalised the slave trade in 1718, as coffee production required intensive manpower.¹¹

As a consequence, Bourbon entered what Donna Haraway has referred to as the ‘plantationocene’, a period of large-scale agricultural production relying on environmental extraction and exploitation of human labour.¹² Commonly associated with sugar, the socioeconomic institution of the plantation also characterised coffee cultivation. Philip Curtin has defined the plantation system by five criteria:¹³ the mobilisation of colonies, politically controlled by a distant country; export-oriented economies producing cash crops; the prevalence of large-scale capitalist plantations; reliance on

9 K. Payet, ‘Les prélèvements de la faune et la flore à la Réunion’, *Mémoire de maîtrise d’ethnologie* (Université de La Réunion, 1997).

10 Initially the term ‘habitation’ referred to the land concession awarded to the Company employees. It was progressively applied to any plot that cumulated housing and productive purpose.

11 P. Eve, *Histoire d’une renommée. L’aventure du caféier à Bourbon. La Réunion des années 1710 à nos jours* (Saint Denis: Océan Editions, 2006).

12 D. Haraway et al., ‘Anthropologists Are Talking – About the Anthropocene’, *Ethnos* 81 (3) (2016): 535–64; M. Ferdinand, *Une écologie décoloniale. Penser l’écologie depuis le monde caribéen* (Paris: Seuil, 2019).

13 P.D. Curtin, *The Rise and Fall of the Plantation Complex. Essays in Atlantic History* (Cambridge: Cambridge University Press, 1990).

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forced labour and imported population; and this population's subjection to discipline and surveillance mechanisms. All these phenomena occurred on Bourbon from 1711.

On Bourbon, the expansion of the plantation system relied on two complementary processes. The first of them was the rapid growth of the slave population needed to produce coffee. Up to 1728, 5,000 slaves were imported to Bourbon from Madagascar, Mozambique and Western Africa. Between 1729 and 1768, this number rose to 40,000 and grew again to more than 80,000 between 1768 and 1793.¹⁴ The population thus grew from 1,171 inhabitants in 1713 to 67,800 in 1810. Seventy-six per cent of these people were slaves.¹⁵

The second process concerned ecological, economic and social simplification. Though coffee grew in the shade, the extension of plantations led to the destruction of indigenous ecosystems. This deforestation also stemmed from the need of cultivating food crops, such as rice, maize or grains, to support a growing servile population. As a consequence, the wooded areas shrank from 162,462 hectares in 1753 to 125,000 hectares in 1804. The simplification process also took place in economic terms: once diversified activities gradually gave way to coffee production which in 1804 represented 75 per cent of the revenue generated by the island's agriculture.¹⁶ Such growth relied on a highly dualistic and hierarchical society in which a limited number of free white subjects controlled a large slave population. The slaves were legally considered as chattel property and subjected to oppressive living conditions. Even among the white landowners, pauperisation grew exponentially in the coffee era: in 1792, 25,000 of the 40,000 free inhabitants lived in a precarious situation, while ten per cent of the settlers controlled ninety per cent of the slave population.¹⁷

Although Bourbon shared many similarities with the plantation systems introduced in the Mediterranean and the Caribbean, such as deforestation and food crop reduction, the island possessed unique characteristics. Though

14 J.M. Filliot, *La traite des esclaves vers les Mascareignes au XVIIIe siècle* (Paris: ORS-TROM, 1974), p. 54.

15 Agence d'urbanisme de La Réunion, *La Réunion: Enquête monographique régionale* (Saint-Denis: 1965).

16 D. Lefèvre, 'L'organisation de l'espace à Maurice et à La Réunion : étude de géographie comparée', Thèse de doctorat (Nice: 1986).

17 C. Wanquet, *Histoire d'une révolution, La Réunion 1789–1803* (Marseille: Jeanne Laffitte, 1980), p. 64.

coffee represented the largest share of the exports and value produced on the island, it was never exclusive or even dominant in terms of volume. As stated by Bernardin de Saint-Pierre, a writer and French botanist, the islanders 'lived on rice and coffee, hardly needing anything from Europe'. The island produced and exported 20,000 quintals (one quintal equals 100 kilograms) of wheat and 20,000 quintals of coffee a year.¹⁸ The production of food crops to meet the needs of the inhabitants remained the dominant activity. In the early eighteenth century, Bourbon also fed the population of Mauritius, which the French took over after the Dutch had abandoned the island. In the design of the Company, Mauritius acted as an emporium, a commercial and shipping centre, while Bourbon served as a breadbasket. Moreover, colonial administrators were aware of the risks induced by an economic dependency on coffee. They thus encouraged economic diversification, notably through the cultivation of nutmeg and clove trees, introduced by Governor Pierre Poivre (1767–1772) from the Moluccas, breaking the Dutch surveillance and monopoly established on the spice trees. Under Poivre's supervision, a local autodidact named Joseph Hubert acclimatised many tree species and fine-tuned the agroforestry plantation techniques.

The paradox of abolition: a new sugar plantation system (1815–1946)

At the beginning of the nineteenth century the coffee economy, weakened by decades of structural crisis, collapsed following two series of devastating cyclones in 1802 and 1806. Meanwhile, a major opportunity arose. In 1804, France definitively lost its Caribbean colony of Saint-Domingue, the world's leading sugar producer at the time. Mauritius and Réunion were also captured by England during the Napoleonic Wars. As a consequence, sugar prices rose rapidly and some of Réunion's settlers reoriented their *habitations* to sugarcane cultivation. In 1817, Réunion landowner Charles Desbassayns introduced the first steam-powered sugar mill.¹⁹

The conversion to sugar relied on the same massification and simplification processes described earlier. Compared to coffee, the production of sugar

18 H. Bernardin de Saint-Pierre, *Voyage à l'Isle de France*, Tome 2, pp. 19–22.

19 J.F. Geraud, 'Des habitations-sucreries aux usines sucrières : la 'mise en sucre' de l'île Bourbon, 1783–1848', Thèse de doctorat (Saint-Denis: Université de La Réunion, 2002), p. 18.

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required an even larger workforce to grow and process the cane.²⁰ According to Sudel Fuma, more than 200,000 slaves arrived to work on the island's plantations throughout its history.²¹ The abolition of slavery in 1848 offered a new economic opportunity to the main landowners: instead of slaves, they now used indentured labourers called coolies or *engagés*. These *engagés* were formally free but suffered slave-like conditions on the plantations during their five-year contracts.²² Between 1818 and 1882, 117,813 *engagés* were imported from Africa and Asia. As a consequence, the population of Réunion grew from 68,400 in 1815 to 241,677 people in 1941. The simplification of the ecological systems also accelerated. In 1820, 4,265 hectares of land were dedicated to sugarcane and this number rose to 48,000 hectares in 1864. This expansion occurred through removal of previous crops as well as through the extension of the agricultural frontier at the expense of native ecosystems.

The abolition of slavery paradoxically gave rise to a new simplified plantation system of sugar monoculture, with no more coffee or spice trees, which disappeared within four decades. In 1860, sugar accounted for 94 per cent of the island's revenue. If we examine the first steps of the plantation simplification process, we observe that in the early 1850s sugarcane did not replace food crops.²³ This means that the planters cultivated sugar on newly cleared plots or on the former coffee or spice plantations. Xavier Le Terrier has shown that the explosion of sugarcane cultivation was seen as a danger by contemporary press 'because of the deforestation it induces'.²⁴

An essential witness to this transition was the engineer Louis Maillard, who described the sugar rush as follows: 'The ease with which sugarcane

20 J. Barrassin, *La vie quotidienne des colons à l'île Bourbon à la fin du règne de Louis XIV: 1700–1715* (St Denis: Académie de La Réunion, 1989), p. 101.

21 S. Fuma, *L'abolition de l'esclavage à La Réunion. Histoire de l'insertion des 62 000 affranchis de 1848 dans la société réunionnaise* (Saint Denis: Océan Editions, 1998), p. 98.

22 H. Gerbeau, 'Engagés and Coolies on Réunion Island. Slavery's Masks and Freedom's Constraints', in *Colonialism and Migration; Indentured Labour Before and After Slavery*, ed. by P.C. Emmer (Dordrecht: Springer Netherlands, 1986), pp. 209–36; A. Stanziani, *Sailors, Slaves, and Immigrants. Bondage in the Indian Ocean World, 1750–1914* (New York: Palgrave MacMillan, 2014); G. Campbell (ed.), *Bondage and the Environment in the Indian Ocean world* (London: Palgrave, 2018).

23 S. Fuma, *Une colonie île à sucre: l'économie de la Réunion au XIX^e siècle*, (Saint-Denis: Océan Editions, 1989), p. 11; X. Le Terrier, 'L'agriculture cannière et l'industrie sucrière à La Réunion au cours de la seconde moitié du XIX^e siècle, 1848–1914 : entre croissance et crise', Thèse de doctorat (Saint-Denis: Université de La Réunion, 2008), p. 58.

24 Le Terrier, 'L'agriculture cannière', p. 238.

growers could take out loans with the sugar companies, on the condition, of course, that they pledge their crops to them, led many small farmers to destroy everything in order to take up the new crop.²⁵ He also claimed that 'on Bourbon, with very few exceptions, the forests no longer exist' and advised that 'further clearing should be resisted'.²⁶ Still Maillard believed sugar plantations would not last long and the island would return to food crops.

The new plantation system also gradually reduced the areas dedicated to subsistence farming, which accounted for seventy per cent of the cultivated areas in 1820 and less than eighteen per cent in 1885. Maize went from more than half of the crops in 1820 to twenty per cent in 1860. Some cultures, like rice and wheat, completely disappeared within a century. In 1862, Maillard stated 'at the present time, sugar cane and gardening are the only crops in the country'.²⁷ Many small landowners went bankrupt during the sugar crisis of 1867, due to the drop in prices because of increased competition with other sugar islands and sugar beet improvements. Ruined settlers were forced to abandon their land and many of them moved to the uninhabited highlands once occupied by fugitive slaves.

In these relegated spaces, former slaves and ruined landowners developed a subsistence economy, based on the rainwater cultivation of maize, pulses and vegetables along with the use of natural fibres. Though autonomous and dedicated to a freedom ethos, this neo-peasantry remained highly connected to the plantation system. Many worked part-time in the sugar plantations during the harvest period or occupied marginal lands that belonged to the main landowners. Such occupation was regulated by a kind of sharecropping, the *colonat partiaire*, established in 1882 to counteract the declining number of coolies and the shortage of a labour force. The *colonat* allowed landless peasants to live on land in exchange for a third of the harvest. This institution proved decisive not only for controlling a stigmatised social group, but also for expanding the cultivated areas and diversifying the economy through new export crops. Vanilla plantations on the east coast and in the south of the island made Réunion the leading producer in the nineteenth century, ahead of Madagascar and the Seychelles. Vanilla cultivation helped to preserve remnants of the primary forest, because the crop needed an underwood to grow. By the end of the nineteenth century, many *colons* from the

25 L. Maillard, *Notes sur l'île de la Réunion (Bourbon)* (Paris: Dentu Editeur, 1862), p. 215.

26 Ibid., pp. 195–96 and 207.

27 Ibid., p. 150.

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south and southwest part of the island also produced essential oils, including geranium, vetiver and ylang-ylang. In 1920, Réunion became the world's largest producer of geranium essence. These activities, however, also led to a new period of deforestation on the island's west coast.

The ecological vulnerabilities of the plantation system

The destruction of native habitats

Clearing the land for construction and agricultural purposes led to a sharp decline in the primary forests, created by two million years of coevolution. By 1945, half the area of these original ecosystems was destroyed. Only those areas located above the altitude of 1,800 metres or on inaccessible slopes remained intact. The destruction of habitats, combined with direct predation and the introduction of invasive species such as rats, goats, Indian laurel, ginger lily or the giant bramble (*Rubus alceifolius*) exacted a heavy toll on the endemic species that had populated the island: sixty per cent of the indigenous mammals, 58 per cent of birds, and sixty per cent of reptiles went extinct.²⁸

Even before the institutionalisation of the plantation system, the impacts of human activities on endemic ecosystems and species prompted the authorities to react. In 1701, the Governor introduced the '*50 pas du Roi*' legislation that banned all clearing along the shorelines.²⁹ In February 1715, death penalty was introduced for the destruction of plantations and trees. Faced with the rapid decline of the turtle population, in 1710 Governor Villers prohibited the hunting of all land tortoises and limited the hunting of sea turtles to two per week to prevent their extinction and preserve food resources.³⁰

Plantation owners and colonial administrators also tried to limit deforestation by issuing laws to prevent land clearings. However, many of these decrees and the forest code itself did not give forest policing powers to any municipality. Certain landowners also took issue with these regulations, as they were forced to obtain permissions in order to cut trees on their own properties. Though the deforestation was directly caused by the planta-

28 C. Doumenge and Y. Renard, *La conservation des écosystèmes forestiers de l'île de La Réunion* (Saint Denis: Bibliothèque de la Conservation de L'UICN, 1989).

29 P. Holstein, 'La soutenabilité des économies insulaires coloniales et postcoloniales', Thèse de Doctorat (Paris: Institut d'Études Politiques de Paris, Science-Po, 2014).

30 Barrassin, *La vie quotidienne*, p. 33.

tion system, colonial authorities blamed the ecological degradation on the former slaves and poor white creoles who refused to submit to the colonial plantation regime, and their clearings in the highlands.³¹ A struggle ensued to limit the access of former slaves and poor white creoles to resources.³² A cascade of forestry regulations after 1848 also demonstrated this battle for forest resources. According to Varga,³³ between 1769 and 1894 the colonial administration issued no fewer than eight legal measures aimed at preventing land clearings.

In the 1860s, the engineer Louis Maillard recognised that ‘in spite of its numerous decrees, the administration has never managed to plant’.³⁴ He also shed light upon the island’s social system, blaming not only the creoles of the highlands but also the sugar landowners and their ‘sylvophagy’ spirit:

Many colonists do not seem to feel the importance of shade and greenery; we will not speak only of the little creoles who never hesitate, when they go through the forests, to cut down a lemon tree to collect one or two fruits; nor of the sugar growers who mercilessly cut down the last tree in the middle of their fields: some have at least the pretext of thirst, and others that of a few more kilograms of sugar to produce. But what can we say about a city dweller who, when he buys a house surrounded by trees, begins by cutting down all the plantings under the pretext of a new arrangement or another more futile one? What to say especially of the one who, going to settle in the middle of a forest, starts by cutting down, up to a great distance and without exception, all the trees that cover the ground.³⁵

This debate about deforestation on Réunion can serve as evidence for environmental injustice theories that link social to environmental conflicts. According to the well-known studies by Joan Martinez-Alier and Ramachandra Guha,³⁶ deforestation practised by the poor cannot be judged

31 A. Du Peyrat, ‘Situation de l’agriculture à l’Île de La Réunion en 1868’, *Revue maritime et coloniale* **53** (1870): 763.

32 D. Varga, ‘Gérer la forêt à Bourbon, une priorité pour la colonie à sucre au XIX^e siècle’, *Revue historique de l’Océan Indien* **11** (2014): 331–32.

33 Varga, ‘Gérer la forêt’, 320–33.

34 Maillard, *Notes sur l’île*, p. 208.

35 Ibid., p. 207.

36 M. Gadgil and R. Guha, *Ecology and Equity. The Use and Abuse of Nature in Contemporary India* (London: Routledge, 1995); R. Guha, *Environmentalism. A Global History* (New York: Longman, 2000) and ‘Environmentalism of the Poor’, *Economic and Political Weekly* **37** (3) (2002): 204–07; R. Guha and J. Martínez-Alier, *Varieties of Environ-*

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by the same standards as that carried out by the rich. This has essentially two reasons. First, land and forest access is caused by an unequal system of land distribution and inheritance transmission. On Réunion, the European system of inheritance aimed at concentrating the ownership of land and preventing its fragmentation. This transmission of property rights created a growing population of poor white settlers. Secondly, the plantation society refused to increase wages to improve the living conditions of the plantation workers, and avoid violence and miserable conditions on the plantations. The socio-environmental cost of maintaining the profit margin on the plantations was high and jeopardised the social reproduction of the poor islanders. The capitalist plantation system forced poor whites and landless freed slaves to settle in the highlands.

Considering the major ecological impacts of the sugarcane revolution, reforestation became a priority for the colonial administration in the last decades of the nineteenth century.³⁷ Between 1886 and 1900, 200,000 trees were planted to preserve the soil's stability and regenerate the water cycle. However, these efforts relied mostly on exotic species from Australia, such as eucalyptus and quinine, at the expense of native habitats. During the 1930s, the colony restored the forests with filao trees, maritime pines, thuyas and *cinchona* plants.³⁸ The last exotic introduction occurred in the 1950s, when the new Forest Service introduced *cryptomeria*, a coniferous species from the southern islands of Japan in order to develop the local timber industry.³⁹ This confirms Richard Tucker's observation that the most dramatic transformations of sugar societies and landscapes occurred in the biotically fragile environments of islands, with a high degree of endemism but vulnerable to alien species.⁴⁰

mentalism: Essays North and South (London: Earthscan, 1997); J. Martínez-Alier, *The Environmentalism of the Poor, A Study of Ecological Conflicts and Valuation* (Cheltenham: Edward Elgar Publishing, 2002).

37 Varga, 'Gérer la forêt', 320–33.

38 Archives Nationales d'Outre-Mer (ANOM), FM/300/7, 1936.

39 Varga, 'Gérer la forêt', 322.

40 R.P. Tucker, *Insatiable Appetite: The U.S. and the Ecological Degradation of the Tropical World* (Berkeley: University of California Press, 2000), p. 20.

Erosion, pollution, devastation and food insecurity in the island socio-ecosystem

As a young volcanic island, Réunion only has a thin soil cover that is particularly sensitive to erosion and climate change. The volcanic island socio-ecosystem suffers erosion accelerated by the island's mountainous profile and its exposure to heavy rainfall. The elimination of the native vegetation destabilised the soil's structure and contributed to major landslides during cyclones. Through the reduction of evapotranspiration, deforestation also altered the local climate, reducing rainfall and increasing the recurrence and duration of drought episodes. Pierre Poivre had observed these consequences on Mauritius already in 1767, and he blamed the settlers for the destruction of the native forests, for drying-up rivers and making the climate drier and more hostile. He also warned the settlers that such practices would make the island inhabitable.⁴¹

In addition to causing erosion and climate change, the plantation system also altered the soil's fertility. In tropical forests, nutrients are concentrated in the tree cover and not in the soil. As a consequence, the substitution of native habitats with sugarcane monoculture upset the ecological cycles that conditioned soil fertility. The shift toward an intensive agricultural model impeded soil regeneration and caused dependence on larger quantities of fertilisers. The end of the diversified agriculture and crop rotation system that once characterised the *habitations* led to a greater dependence on animal manure and an increase in guano imports from the Seychelles and the Galápagos.⁴² Starting in 1830, chemical fertilisation became widespread and planters were among the world's first users of synthetic fertilisers based on nitrogen, sodium and potassium. In 1898, the soils of *Crédit Foncier Colonial* received an average of 430 kilograms of sodium nitrate, 500 kilograms of superphosphate, 40 kilograms of chloride and potassium and 30 tons of manure per hectare.⁴³

The introduction of pests also impacted the sugar monocultures. One of the most adverse species was the borer, a sugar pest that emerged on Réunion during the 1850s. Contemporary sources blamed the abandonment of

41 R.H. Grove, *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism, 1600–1860*, First Edition (Cambridge; New York: Cambridge University Press, 1995) pp. 168–263.

42 Le Terrier, 'L'agriculture cannière', 58.

43 Holstein, 'La soutenabilité des économies insulaires', p. 335.

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crop rotation and the deforestation of the island for its spread.⁴⁴ During the 1850s, plantation owners tried to defend their crops using phenol, a chemical insecticide. However, the acid polluted the soil and caused harm to human health; in addition, its high cost prevented its large-scale use.⁴⁵ Due to soil depletion, droughts, cyclones, and proliferation of parasites, sugarcane yields collapsed from 1,569 tons per hectare in 1860 to 519 in 1870.⁴⁶

Like deforestation, debates about food dependency played a major role in Réunion's administrative and political agenda. As early as 1730, governor Mahé de Labourdonnais introduced initiatives to stimulate the production of staple foods such as cassava, corn, wheat and rice to complement coffee production, feed the inhabitants and also meet the needs of the neighbouring island of Mauritius, which was under French rule between 1715 to 1810.⁴⁷ Once self-sufficient and a net exporter to Mauritius, Réunion began to rely on imports after the 1850s sugar boom. Crops other than sugarcane were now only grown for the inhabitants' own consumption or abandoned altogether. Moreover, the development of the plantation monoculture led to the decline of the pre-industrial rotation system which combined sugar with cereals, root vegetables and pulses that guaranteed the conservation of soil quality and food self-sufficiency.

The debate about food insecurity intensified during the twentieth century. As historian Daniel Varga has shown, it became an urgency after World War One. In 1917, the colonial government offered premiums for planting corn, potatoes, beans and manioc. These crops were cultivated on domanial lands granted free of charge by the colony. At the same time, there were no plans to cut back on sugarcane production. The following years were crucial. The embargo imposed by some of the governors of Réunion on the export of corn and onions prevented many cultivators from planting food crops, since they could now only sell them on the domestic market. Despite fears of food insecurity, evidenced also by the creation of gardens in all schools in the 1920s, landowners preferred an export crop like sugarcane.⁴⁸ In the 1930s, colonial

44 Du Peyrat, 'Situation de l'agriculture à l'Île', pp. 770–71.

45 Ibid., pp. 772.

46 J. M. Chastel, 'Le rôle des institutions dans l'évolution de la filière canne à sucre à la Réunion', Thèse d'agro-économie (Montpellier: Ecole Supérieure Agronomique de Montpellier, 1995).

47 Eve, *Histoire d'une renommée*, p. 100.

48 D. Varga, 'La question de l'autosuffisance alimentaire à La Réunion: une préoccupation ancienne. Etude à partir de la situation de La Réunion dans la première moitié du XXe siècle', in *Alimentation, pratiques culinaires et rites de repas dans les pays du sud-ouest de*

administration again created 'a system of bonuses for secondary crops that would allow a return to reasonable polyculture'.⁴⁹ This hardly produced any results, as later evidenced by widespread food shortages when the island was forced into self-sufficiency by a British blockade during World War Two.

Epidemics and environmental health conditions

The dire conditions on Réunion stood in stark contrast with the island's former salubrious reputation: it had been praised by Etienne de Flacourt for its 'benign air',⁵⁰ in contrast to the 'unhealthy air' and 'bad season' of Madagascar.⁵¹ Though epidemics were present on the Mascarene archipelago already in the seventeenth century,⁵² the sugar-boom era shed light on the degradation of environmental health, induced by the plantation system and its internal vulnerabilities. The need for cheap and disciplined labour led to the import of coolies from Africa and Asia. Yet, despite a quarantine protocol imposed on all migrants, cholera broke out on Réunion twice, in 1820 and in 1859.⁵³ The guilt felt for reintroducing diseases was atoned by religious processions and Catholic worship. Catholic fervour grew, almost at the same pace as monoculture and malarial fevers. The same process led to the outbreak of malaria on Mauritius, which caused the death of more than 50,000 of its 310,000 inhabitants between 1865 and 1867.⁵⁴ The epidemic reached Réunion during the same period and became endemic. It was soon complemented by dengue fever (1873), influenza (1890) and plague in 1864 and 1899.⁵⁵

l'océan Indien (XVIIe à nos jours), Vol. DVD 3, (Saint-Denis: Association Réunionnaise Communication et Culture, 2012).

49 ANOM, FM/300/7, 1936.

50 Holstein, 'La soutenabilité des économies insulaires', p. 4.

51 Bernardin de Saint-Pierre, *Voyage à l'Isle de France*, p. 220.

52 J. Julvez and G. Larrouy, *Anthropisation et paludisme: éco-épidémiologie historique du paludisme dans les archipels du sud-ouest de l'Océan Indien* (Toulouse: Université Toulouse 3 Paul Sabatier, 1993), p. 191.

53 Y. Pérotin, *Chroniques de Bourbon* (Nérac: Couderc, 1957); J.E. Monnier et C. Ramsamy-Giancone, *Soigner, prier, s'adapter: La Réunion face au choléra de 1859* (Saint-Denis: Presses Universitaires Indianocéaniques, 2021).

54 Holstein, 'La soutenabilité des économies insulaires', p. 395.

55 A. Lopez, 'La santé en transition à la Réunion de 1946 à 1986: bouleversements et limites des conquêtes de la santé dans un département d'Outre-Mer', *Annales de Géographie* 98 (546) (1989): 152–78.

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Once again, many blamed poor creoles and freedmen for the spread of the diseases. Yet, Dr Mac-Auliffe, one of the first Réunionese doctors to write about malaria and other tropical diseases, denounced such prejudices and pointed out the indentured labour as a factor.⁵⁶ According to the doctor, malaria spread along the entire coast of Réunion until 1880. Scientific and medical networks were widespread among the Indian Ocean empires in the following years, facilitating knowledge circulation especially on malaria and the use of cinchona cures between the African West Coast, the Indian Ocean islands and British India.⁵⁷ In 1912, Jules Auber, the director of the Health and Public Hygiene Service, declared to the Governor that ‘the malaria epidemic continues to rage with intensity and is decimating the population, in spite of the free distribution of preventive quinine to school children and the poor’.⁵⁸ In 1937, the health and hygiene department stated that labour conditions were one of the most important factors responsible for the epidemic:

We wish to point out [that] because the poorly housed, poorly clothed and poorly fed individual is the designated prey of the haematozoa, of which he is, along with the child, the most dangerous reservoir ... the improvement of living conditions is ... a preliminary necessity ... Labour in swampy regions, deep earth movements, stay in humid plantations, and generally exaggerated fatigue are the favourite causes of malaria.⁵⁹

In the 1940s, however, World War Two demonstrated the inherent instability of the sugar economy. The island’s governor remained loyal to Marshal Pétain and his pro-Nazi policy. In consequence, the island was blockaded by the British naval force for almost two years. Petroleum was almost completely replaced by a biofuel based on sugarcane alcohol.⁶⁰ Two thirds of the agricultural area was ploughed for food crops, particularly

56 J.M. Mac-Auliffe, *Cilaos pittoresque et thermal: Guide médicale des eaux thermales* (Saint Denis: Azalées Editions & Grand Océan, 1996, 1902), pp. 199–200.

57 R.D. Roy, *Malarial Subjects: Empire, Medicine and Nonhumans in British India, 1820–1909* (Cambridge: Cambridge University Press, 2017); J.E. Monnier, ‘La médecine comme vecteur des recompositions de l’océan Indien au XIXe siècle’, *Outre-Mers* **402–403** (1) (2019): 41–59.

58 Archives Départementales de La Réunion (ADR), 5M41, Lutte contre le paludisme 1868–1937.

59 ADR, 5M41, 1937.

60 *Bulletin Mensuel de Statistiques Coloniales*, 1946, 9.

corn and cassava. Following the shortage of quinine pills, medicinal plants were planted to replace it, such as cinchona trees. Finally, in the building sector, 'sugar mortar', a cement made with sugar, was substituted for usual building materials.⁶¹ Between 1949 to 1952, some letters that reached the Prefect described Réunion's population as 'a people who groan and starve'.⁶² In 1954, the island was still considered 'a country of monoculture with an almost exclusively industrial character' by the CFTC Trade Union.⁶³ An official report from the Prefecture in 1954 confirmed 'insufficient food production for its needs ... Réunion depends on its imports for almost all of its supplies'. The texts stated that 'the Réunionese people make rice that they do not cultivate and do not know how to cultivate, the basis of their diet'.⁶⁴ To avoid hunger, since 1955 'expatriation [was] the only future open to Réunion Islanders'.⁶⁵

Conclusions

The brief history of Réunion highlights the interdependence and coevolution of ecological and social systems.⁶⁶ Created by a volcanic hotspot two million years ago, the island is characterised by its physical remoteness, 3,000 kilometres from the African mainland. Such isolation was magnified by the concentration of the main trade routes in the northern part of the Indian Ocean, which induced a very late human settlement. As a consequence, endemic species and singular ecosystems were able to evolve and thrive without human intervention, making the island one of the few places on earth that still host primary forests today. From the sixteenth century on, physical isolation became an asset for the European powers that established new Southern routes to India and Indonesia, using Réunion as a stopover. It also played a critical role in the later development of the plantation system: the absence of native population combined with the impossibility of fleeing

61 E. Rouse, *Combat des Réunionnais pour la liberté I* (Saint Denis: Editions CNH, 1993), pp. 32–41.

62 ADR, 41W2, 1949 and 1952.

63 ADR, 41W2, 1954.

64 ADR, 41W5, *Ile de la Réunion en 1954*.

65 Ibid.

66 R. Noorgard, *Development Betrayed, the End of Progress and a Coevolutionary Revisioning of the Future* (New York: Routledge, 1994).

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to a neighbouring land (the closest island Mauritius being 260 kilometres away) turned the island into a custodial factory, specialising in tropical speculative commodities such as coffee, spices, sugar and vanilla. The isolation supported the progressive 'radical monopoly' of the plantation system on the island natural and human resources. This monopoly was itself supported by economic, political and legal mechanisms that inhibited the emergence of alternative, rival, organisations, such as maroon societies in the highlands.

The island's characteristics thus allowed for a continuous extension of the plantation system, that relied on the growing import of manpower (slaves and later indentured workers) and the destruction of native habitats. Such extraverted growth soon encountered the physical and ecological limits on the 2,500-square-kilometre island and engendered feedbacks that threatened the very sustainability of the plantation system: loss of ecosystem services, reduction of agricultural productivity, growing food insecurity and dependence on imports, introduction of epidemic diseases, and overt and hidden resistance among the population. These feedbacks generated major vulnerabilities that still plague the island today.

The environmental health history of Réunion demonstrates the importance of examining environmental and human health together in order to understand the historical development of the sugar islands and empires.⁶⁷ The introduction of sugarcane monoculture increased not only the ecological vulnerability of the island, but also the social vulnerability of marginalised populations. The reduction of food crop cultivation to less than a third of the available area fostered the spread of diseases linked to malnutrition, such as tuberculosis and malaria. Cholera and mosquito-borne diseases also increased as a consequence of the influx of new indentured labour force.

Yet, on a small island, these highly visible impacts and shared anxieties also stimulated the development of a reflexive agenda. The colonial administration and the inhabitants understood the social and ecological contradictions of the plantation system and attempted to counteract them in order to improve the colonial governance and preserve the island's productive capital through the implementation of reforestation and public health policies. Such reforms played an essential role in the relative stability of the plantation system which maintained its monopoly for three centuries, despite regular and major crises caused by the vulnerabilities it fostered.

67 J.R. McNeill, *Mosquito Empires. Ecology and War in the Greater Caribbean, 1620–1914* (New York: Cambridge University Press, 2010).

Finally, an environmental history of Réunion shows that the transformation of the plantation system into a sugar monoculture brought about environmental injustices. Poor white creoles and freed slaves were excluded from access to land and the newly indentured workers from Asia and Africa suffered from environmental conditions that favoured the spread of diseases such as cholera and malaria. The loss of food self-sufficiency resulted in food insecurity in times of crises and world wars, which worsened environmental injustices concerning land, food and health. The crop diversification incentives of the interwar period, the reforestation plans, the improvement of nutrition and the eradication of malaria in 1960 all addressed the symptoms and consequences, but did not question the radical plantation monopoly. A post-colonial environmental history of Réunion must address the questions of environmental health, food autonomy and biodiversity conservation in order to understand the consequences of the island's identity as a profitable 'Eden' of sugar production.

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