

Transnational Evolution of *Myristica fragrans* from the Banda Islands to Global Spice Markets

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ABSTRACT

This study investigates the transnational evolution of *Myristica fragrans* (nutmeg and mace) from its origin in the Banda Islands of Indonesia's Maluku to its establishment as a globally cultivated commodity. For centuries, Indigenous Bandanese farmers managed nutmeg through ecologically sustainable and spiritually rooted practices that sustained biodiversity and cultural identity. European imperial expansion disrupted these systems. The Portuguese initiated overseas trade, while the Dutch East India Company (VOC) intensified imperial control by deploying military campaigns, forcing labor, and sterilizing seeds. Using a comparative historical-ecological approach, the study integrates archival documents and peer-reviewed literature (1970–2024), and GIS mapping of VOC maritime routes and present-day production regions. Thematic analysis focused on five dimensions: Indigenous agroecology, VOC monopoly mechanisms, British and French botanical transfers, postcolonial production landscapes, and ecological impacts. Findings reveal that the VOC embedded nutmeg within global commodity chains linking the Banda Islands to Amsterdam. Later British and French interventions, particularly seed transfers to Grenada, Mauritius, and Zanzibar, broke Dutch dominance and diffused nutmeg across tropical regions. Today, nutmeg cultivation supports livelihoods in Asia, Africa, and the Caribbean but faces ecological threats from soil depletion, monoculture dependency, and climate change. The study concludes that imperial ambition and ecological exploitation profoundly restructured tropical agriculture. Understanding this intertwined history highlights the enduring legacies of colonial trade and underscores the need for sustainable, equitable, and historically informed agricultural systems.

Keywords: Banda Islands, transnational commodity chains, *Nutmeg trade*, Maluku province

INTRODUCTION

Myristica fragrans, commonly known as nutmeg, belongs to the family Myristicaceae (Ashokkumar *et al.*, 2022). This botanical family comprises 19 genera and includes over 400 species, with a rich presence in Indonesia and Papua New Guinea. Nutmeg, the seed of *Myristica fragrans*, originates from the evergreen spice tree native to the Moluccas, or Maluku Islands, in Indonesia (Kusuma *et al.*, 2023). This perennial tree yields two highly valued spices, nutmeg and mace, from a single fruit (Sujianto *et al.*, 2024). The yellow fruit, measuring approximately 5 centimeters in diameter, splits upon ripening to reveal a crimson aril known as mace that encases a brown kernel identified as nutmeg (Moripi and Peki, 2015).

The spice tree matures after seven years and can reach heights up to 65 feet. It continues to bear fruit for as long as ninety years (Ducène, 2024; Ravindran, 2017). The simultaneous production of two distinct spices, mace, and nutmeg, makes *Myristica fragrans* unique among tropical spice trees (Sasikumar, 2021; Nair and Nair, 2021). Originally confined to the Banda Islands, nutmeg eventually reached diverse tropical and subtropical regions, including India, Grenada, Sri Lanka, Réunion, Guatemala, the Solomon Islands, Mauritius, Malaysia, Seychelles, Tanzania (Zanzibar), and Vietnam (Gordon, 2020).

Nutmeg's transnational journey reflects centuries of maritime navigation, mercantile ambition, and colonial conquest. The spice's high market value made it a focal point of early modern imperial economies. Portuguese, Dutch, British, and French traders competed to control nutmeg production and exportation. These rivalries shaped the political and economic architecture of the colonial spice trade (Sasikumar, 2021; Kusuma *et al.*, 2023). Pirates, chartered companies, and monarchs all contributed to moving nutmeg from the Banda Islands to plantations across continents. The Dutch East India Company (VOC) implemented ruthless measures to secure monopoly control, including the violent suppression of local populations and the forced relocation of nutmeg trees.

The economic value of *Myristica fragrans* extends beyond culinary use. Nutmeg supports multiple industries, including perfumery, timber, medicine, beverages, oils, and cosmetics (Moripi and Peki, 2015; Ulfah, 2020; Sujianto *et al.*, 2024). This versatility accounts for its reputation as green gold. It remains a staple in households worldwide, enhancing both sweet and savory dishes and serving as a component in traditional remedies and contemporary health products.

Human agency has played a central role in the dispersal and domestication of nutmeg. Species do not migrate uniformly across forests or bioregions. Instead, environmental forces such as wind and water, combined with human cultivation and commerce, drive the spread of plant life. The movement of *Myristica fragrans* involved several such forces, including ecological adaptation, political ambition, and economic interest (Schluter and Pennell, 2017). As a result, nutmeg established itself in soils and climates far removed from its place of origin.

This paper investigates the historical drivers behind nutmeg's geographic dispersion and commercial prominence. The research focuses on the political economies and ecological consequences of colonial spice networks that altered the botanical and human landscape of entire regions. As colonial powers moved nutmeg beyond the Banda Islands, they restructured agricultural systems, transformed land tenure, and introduced monoculture plantations. These changes generated long-term environmental pressures and social dislocations still observable in modern spice economies.

Despite nutmeg's cultural and commercial relevance, much of the existing literature remains fragmented across disciplines such as botany, history, and economics. Few studies adopt an integrative lens that connects plant distribution, imperial politics, labor exploitation, and ecological adaptation. This paper addresses that gap by synthesizing insights from historical and scientific sources to present a comprehensive account of *Myristica fragrans* as both a botanical subject and a geopolitical asset.

The relevance of this study lies in its interdisciplinary approach to understanding how a single plant species became embedded in the global economy through systems of exploitation and resilience. In tracing nutmeg's trajectory from the Banda Islands to distant plantations, this paper offers a lens into how natural resources become contested commodities. It also invites reflection on the colonial legacies embedded in contemporary agricultural practices and global supply chains. By uncovering the complex history of nutmeg's movement, cultivation, and commodification, the study advances conversations about historical accountability, environmental justice, and the socioecological consequences of colonial trade systems.

Methodological Framework

This study employed a comparative historical–ecological research design to trace the transnational diffusion and ecological transformation of *Myristica fragrans* from the Banda Islands into a globally cultivated commodity. The methodology combined archival research, bibliographic review, and spatial analysis to reconstruct the historical, economic, and ecological trajectory of nutmeg cultivation.

Sources of Data

The study reviewed literature published between 1970 and 2024 to establish a robust historical and ecological foundation. The research team collected peer-reviewed journal articles, archival documents, VOC shipping logs, colonial administrative records, and historical monographs from Google Scholar, Web of Science, JSTOR, EBSCOhost, and ERIC. The reviewed works spanned from seventeenth-century accounts to contemporary analyses, focusing on sources addressing the Banda Islands, the Dutch East India Company (VOC), British and French colonial expansion, and postcolonial agricultural systems. The literature search employed targeted keywords, such as *Myristica fragrans*, VOC spice monopoly, Banda Islands agriculture, Dutch colonial plantations, British and French botanical transfers, nutmeg biogeography, and postcolonial spice economies.

Spatial and Visual Analysis

The study reconstructed historical trade routes and mapped present-day nutmeg production using GIS tools. The research team digitized VOC maritime routes linking the Banda Islands to Amsterdam and overlaid them with port locations and resupply points such as Batavia and Cape Town. The mapping process used coastline shapefiles and integrated FAOSTAT (2023) production data to highlight current nutmeg-producing regions. Figures 6 and 7 visualize these historical circuits and contemporary geographies.

All materials were selected based on their relevance to the study objectives and their capacity to provide historical and ecological evidence that contributes to reconstructing the global diffusion of nutmeg.

Analytical Method

A qualitative analytical framework was used to organize and interpret the data. The information extracted from the reviewed materials was grouped thematically to highlight key aspects such as: Indigenous cultivation and ecological practices in the Banda Islands; The Dutch East India Company's monopoly mechanisms and colonial strategies; British and French interventions and botanical transfers; The postcolonial redistribution of nutmeg production; The ecological and socio-economic impacts of these transitions.

The analysis compared historical and modern contexts to identify continuities and transformations in nutmeg cultivation and trade. This thematic organization allowed the study to trace both spatial and temporal dimensions of nutmeg's evolution as a global commodity.

Limitations

The study relied on digitized archives and published literature that often amplify colonial perspectives and minimize Indigenous voices. The English-language focus limited engagement with Dutch-, French-, and Malay-language research that might offer additional nuance. The study did not include field surveys, soil testing, or genetic sequencing, which could further verify patterns of diffusion and ecological adaptation.

Even with these constraints, the research team combined documentary evidence, thematic coding, and GIS mapping to produce a rigorous, interdisciplinary methodology. This approach illuminates both the historical depth and geographic reach of nutmeg's global

trajectory and situates *Myristica fragrans* within the broader context of imperial trade, colonial extraction, and postcolonial agricultural economies.

FINDINGS

Traits of *Myristica Fragrans*

The *Myristica fragrans* tree grows up to 65 feet or 20 m in height. The tree matures to bear fruit at the prime age of 25 years and continues to yield fruit for a further 60 years in a favorable condition (Swaminathan *et al.*, 2019). Nutmegs have evolved in a transnational pendulum that has classified *Myristica fragrans* into a diverse family of fruits and seeds. Table 1 illustrates the scientific classification of *Myristica fragrans*.

Table 1. *Myristica fragrans* taxonomy

Kingdom	Phylum	Class	Order	Family	Genus	Species
Plantae	Tracheophyta	Magnoliopsida	Magnoliales	Myristicaceae	Myristica	Myristica Fragrans

Note: Priyanka *et al.* (2016)

The *Myristica fragrans* grows successfully in a humid tropical area (Adharsh, 2021). The tree thrives in volcanic soils with rich nutrient deposition, which made the Banda Islands fertile for nutmeg cultivation (Wattimena *et al.*, 2021). In general, flowers are dioecious and unisexual. However, there are also bisexual flowers with different sexual compositions. The plantations also occasionally have trees with both male and female blooms (Kharde, 2022). The plant grows in equatorial belts with stable temperatures between 25 and 30 degrees Celsius. Figures 2 and 3 illustrate the various stages of nutmeg before and after harvest. The evergreen plant fruit matures and splits into two, revealing the mace (aril) that covers the kernel (Figure 2). The indigenes consumed the pulp of the fruit (pericarp) locally.



Figure 2. Stages of Nutmeg Harvesting

Note: Gordon (2020)



Figure 3. Production stages of Nutmeg

Note: Gordon (2020). The harvester removes the mace (C) from the kernel (A). The mace (D) dries separately from the seed for up to eight weeks in the sun. It will require patience to harvest quality nutmeg because the kernel demands turning under the sun approximately twice daily (Figure 3). The kernel shell cracks to get the nutmeg seed, which makes the seed ready for consumption and exportation (F).

***Myristica fragrans* Indigenous Cultivation.**

The Banda Islands within the enclave of Maluku archipelago in the 15th Century represented an iconic source of nutmeg (*Myristica fragrans*). The indigenes from Southeast Asia, Indonesia's spice island, cultivated nutmeg for economic value, cultural, culinary, and medicinal purposes (Dhont, 2022). The tree grows well in Humid climatic zones in volcanic-induced soils under a tropical canopy. Birds' seed dispersal has played a significant role in the sustainability and spread of the *Myristica fragrans* on Banda Island. The Banda Islanders' ancestral connection to nutmeg goes beyond economic and medicinal (Kuete, 2017) utilization boundaries. The natives of the Island held nutmeg in high esteem with strong ritual and spiritual value, which deepened their cultural identity and spirituality (Welly *et al.*, 2012; Neswati *et al.*, 2019). Figure 4 illustrates the Moluccas (Maluku province) or Banda Islands.



Figure 4. Topographic map of the Banda Islands, showing the major islands (Neira, Banda Besar, Ai, Run, Hatta) and their location in the Banda Sea.
Note: Adapted from Welly et al. (2012)

The Banda Islands are a volcanic archipelago located in the Banda Sea, comprising 11 small islands, seven of which are inhabited. The principal islands include Banda Besar (Lonthoir), Banda Neira, Banda Api, and Pulau Run.

Historically significant, Run was ceded by the British to the Dutch in exchange for Manhattan Island in the 17th century. Banda Api, an active volcano, has erupted 20 times in the past 400 years, most recently on May 9, 1988 (Neswati *et al.*, 2019). Its volcanic soils are highly fertile and ideal for cultivating *Myristica fragrans* (nutmeg) (Wattimena *et al.*, 2021).

The convergence of the Eurasian, Pacific, and Indo-Australian tectonic plates makes the Banda Sea prone to frequent seismic activity (Hengesh, 2019).

According to the 2023 population census, the islands cover approximately 172 km² and are home to about 21,902 inhabitants, primarily Bandanese and Javanese immigrants (Ali and Heaney, 2021).

Despite the colonial dominance, brutality, and massacres of the 17th century, the Banda Islands remain the world's leading producers and exporters of nutmeg (Mini Raj *et al.*, 2023).

Today, the islands account for approximately 85% of global nutmeg production, with net exports estimated at around 142,000 tons (Figure 5).

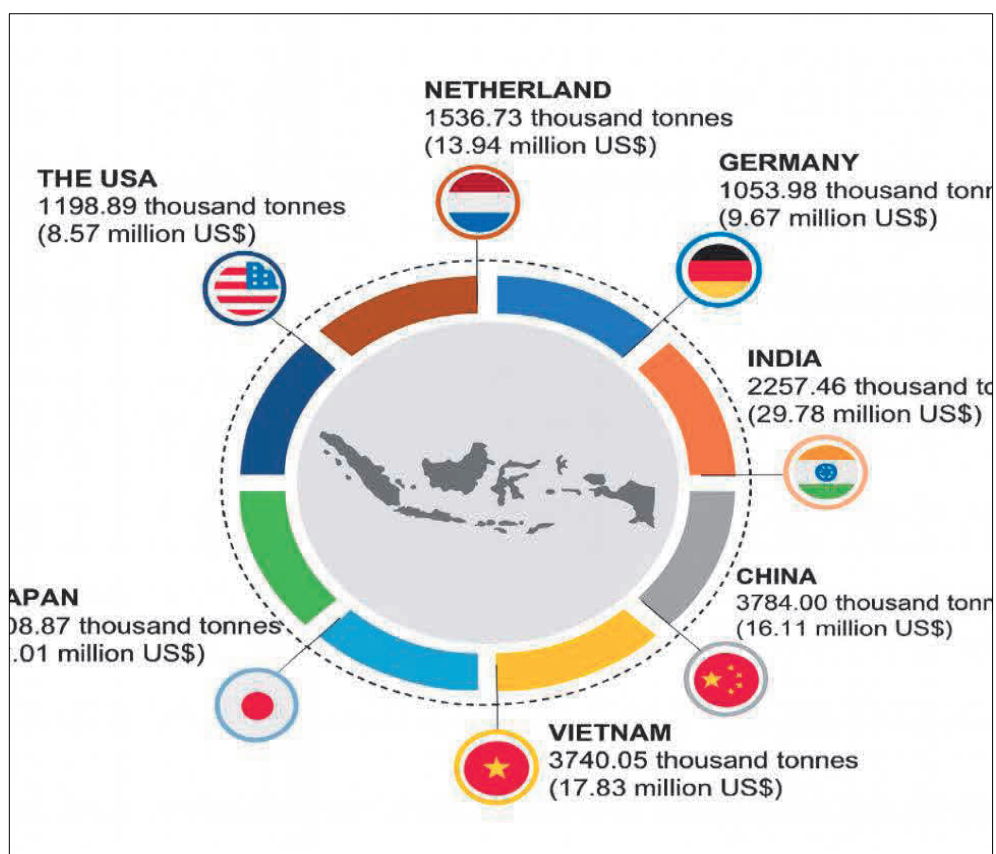


Figure 5. Economic Implications of Nutmeg Exportation from the Banda Islands

Note: Adapted from Statistik Perkebunan Indonesia: Pala 2018–2020 (Directorate General of Estate Crops, 2020) and Statistik Perkebunan Unggulan Nasional 2019–2021 (Directorate General of Estate Crops, 2021).

The Banda Islands continue to maintain global dominance of the spice trade, running into millions of US dollars. The Indonesian government has kept an upbeat global outlook, boosting trade partnerships with seven major economies (the USA, Germany, India, China, Japan, Vietnam, and the Netherlands). In 2019, the Island recorded a net export of 1536.73 thousand tons of nutmeg to the Netherlands (figure 4).

***Myristica fragrans* Colonial Monopolies and Distribution**

Historical evidence shows that the spice trade began centuries ago, predating organized civilization. During the early stages of global exchange, only a limited number of goods traversed long distances. Among the most widely traded spices in the ancient world were cinnamon, clove, pepper, nutmeg, and mace. The acquisition and control of these spices became a marker of political power and global influence.

The intercontinental spice trade originated with the movement of cinnamon and pepper from India and Indonesia to Egypt. Historical accounts suggest that Arab merchants served as the central intermediaries connecting Southeast Asia and the Red Sea port. Functioning as the primary conveyor of spices, Arab traders delivered goods at exorbitant prices to their trade partners. They transported nutmeg to the European market through Mediterranean routes while deliberately concealing the spice's true geographic origin (Hancock, 2021; Micklos Jr., 2017).

Hancock (2021) asserts that nutmeg from Southeast Asia entered the global market through multiple waves of colonial and imperialist intervention. Arab and Indian traders dominated the broader Moluccan spice trade until European interests intensified. Nutmeg's unique

aroma and preservative properties enticed European traders to pursue the plant's origin directly. The collapse of the Arab spice monopoly occurred around 120 BC, when Egyptian Greeks failed to reach the Banda Islands. However, in 30 BC, the Romans assumed control of Egypt and began shipping 120 consignments of Indian spices annually from the Red Sea to various parts of the world (Micklos Jr., 2017).

In 1512, the Portuguese reached the Banda Islands to establish direct trading partnerships. Their fleets, led by Vasco da Gama and Alfonso de Albuquerque, aggressively pursued nutmeg for export to the European market. The Portuguese negotiated unfair deals, acquiring nutmeg, mace, and cloves from the Bandanese at suppressed prices. This development disrupted the existing Arab trade dominance and reduced the market value of their spices. To protect their economic interests, the Portuguese constructed forts across the Banda Islands (Thomaz, 2020). Their dominance persisted until the local population, supported by Dutch conspirators, staged a revolt. Following the uprising, the Portuguese relied on Moluccan intermediaries to access spices, but their influence declined sharply after the Dutch East India Company (VOC) invalidated their trade agreements in the seventeenth century (Landwehr, 2024).

Ghosh (2021) documents that the Dutch invaded and seized control of the Banda Islands, employing brutal tactics against the indigenous population. In a violent assertion of control, they massacred over 15,000 Bandanese people and decimated the local community. The Dutch enslaved survivors and imported laborers from other parts of Asia to cultivate nutmeg plantations. Their strategy included manipulating global market prices and controlling supply by sterilizing seeds. To prevent rival nations from growing nutmeg, the Dutch treated the seeds with lime. They transported the spices through Cape Town enroute to the Netherlands, as illustrated in Figure 6.

The Dutch monopoly exemplified a calculated and violent attempt to dominate global spice routes. Their systematic control over cultivation, labor, pricing, and trade routes elevated nutmeg into a high-value commodity while transforming its native Banda Islands into a site of suffering and resistance. The enduring impact of these colonial monopolies continues to shape the global distribution and economic significance of *Myristica fragrans*.



Figure 6. Nutmeg and Mace Colonial spice trade route connecting Amsterdam, Cape Town, Jakarta, and the Banda Islands.

Note: Adapted from Mappingrecipes (n.d.)

Dutch and British Imperial Rivalries and the Global Spread of *Myristica fragrans*

For over a century, the Dutch East India Company (VOC) maintained a dominant position in the global spice trade. As illustrated in Figure 6, Dutch spice fleets transported substantial quantities of nutmeg and other high-value commodities to Amsterdam via long-distance maritime routes spanning approximately 25,481 kilometers (15,833 miles). The Dutch partitioned the Banda Islands into plantation plots known as *perken*, placing them under the management of VOC-appointed planters to ensure complete control of spice production.

In 1621, the Dutch invaded and destroyed the city of Jakarta.

They established a new administrative and commercial hub, which they named Batavia, now Jakarta. Batavia became the central point for stocking spices from the Banda Islands for onward shipment to the European market. To support their extensive maritime voyages, the Dutch established a strategic resupply station in Cape Town in 1652.

Cape Town provided fresh water, a favorable climate, and a midway point for VOC vessels enroute to the Netherlands. Over the centuries, Amsterdam emerged as a major commercial hub, receiving goods from Asia, Africa, and the Americas for redistribution across Europe (Van der Linde, 2020; Landwehr, 2024).

British imperial forces challenged Dutch dominance in the early 19th century. In 1810, the British navy captured the Moluccas and gained control of nutmeg cultivation and trade. British administrators transported nutmeg trees from the Banda Islands to colonies with similar tropical climates, including Zanzibar and several Caribbean territories. Grenada became a significant producer of nutmeg, a position it retains in today's global market. This strategic transplantation of nutmeg trees undermined the Dutch monopoly and contributed to the worldwide diffusion of *Myristica fragrans* (Callister, 2017; Moore and Van Nierop, 2017; Mini Raj *et al.*, 2023).

Sasikumar (2021) argues that British control of the Moluccas ended with the Treaty of Paris in 1814, which restored the islands to Dutch rule. However, the Dutch could not reestablish their former monopoly. A combination of colonial rivalry, international redistribution, and seed smuggling permanently disrupted their dominance.

French naturalist Pierre Poivre played a critical role in this transformation. In 1770, Poivre smuggled 32 fertile nutmeg seeds and established successful plantations on the island of Mauritius. The success of these plantations led to the spread of nutmeg cultivation to the Maldives, Seychelles, and Madagascar, further diluting Dutch control over the global spice trade (Spence, 2024).

These overlapping imperial interventions, including Dutch colonization, British transplantation, and French botanical smuggling, collectively transformed nutmeg from a locally grown commodity into a transnational crop embedded within global economic systems. Each colonial power exploited the spice's high market value while contributing to the redistribution of nutmeg beyond its native habitat.

Figure 7 presents a contemporary map of nutmeg production zones, illustrating the enduring legacy of colonial redistribution and commercial expansion.

This map highlights the principal nutmeg-producing countries and major tropical regions in the Americas, Asia, and Africa where *Myristica fragrans* is cultivated. Native to the Moluccas of Indonesia, nutmeg spread globally through colonial trade networks and is now commercially grown in Guatemala, India, Indonesia, Laos, Nepal, Sri Lanka, Bhutan, Tanzania, Honduras, and Grenada.

The historical trade of *Myristica fragrans* (nutmeg and mace) demonstrates how imperial ambition, ecological exploitation, and maritime logistics shaped global commodity networks. Archival records and spatial analyses of maritime routes reveal that the Dutch East India Company (VOC) engineered an efficient yet extractive monopoly. As Figure 7 illustrates, VOC ships traveled approximately 25,500 km (15,833 mi) from the Banda Islands to Amsterdam, embedding nutmeg within a worldwide network of supply and demand (Landwehr, 2024;

Van der Linde, 2020; Knaap and Firman, 2017). This transformation elevated nutmeg from a locally cultivated seed to a globally traded commodity and highlighted the VOC's mastery over geography, logistics, and coerced labor.

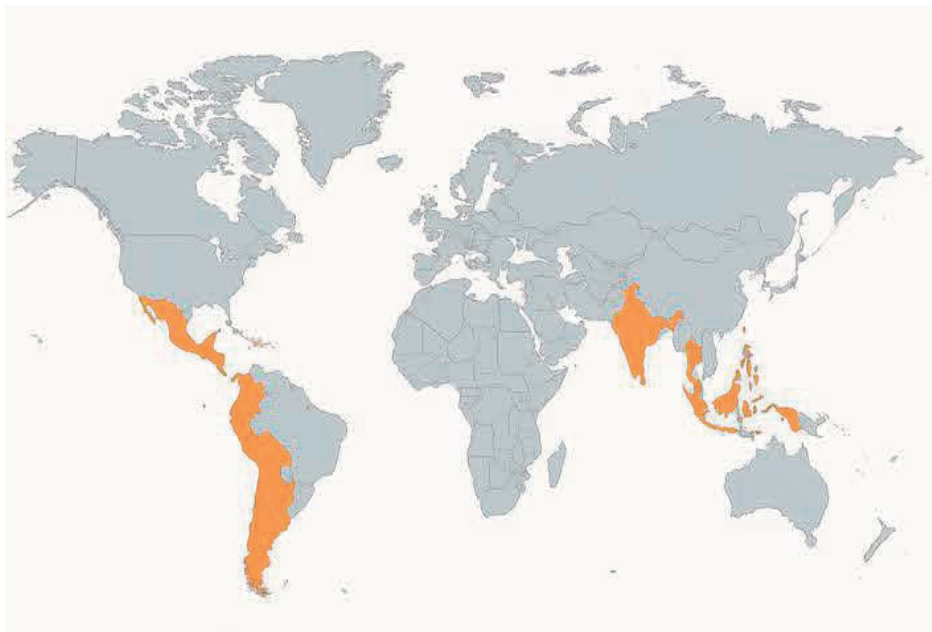


Figure 7. Global distribution of highlighted countries across Latin America, South Asia, and Southeast Asia.

Note: Map created by the author

Nutmeg's historical exclusivity has diminished as its cultivation expanded across multiple biogeographical realms, including the Indo-Malay, Afrotropical, and Neotropical zones. Production has also taken root in Malaysia, the Pacific Islands, and several Caribbean nations. This global distribution has increased supply, lowered prices, and transformed nutmeg from a rare luxury commodity into a widely accessible spice—reshaping its economic and cultural significance.

DISCUSSION

Colonial Expansion and Globalization of *Myristica fragrans*

Monopoly, Violence, and Ecological Control

To consolidate its control, the VOC divided the Banda Islands into *perken* (spice plantations) and installed Dutch planters who depended on enslaved labor imported from across Asia. The founding of Batavia (modern-day Jakarta) in 1621 created a central hub for processing and shipping spices, connecting Southeast Asian production zones to European markets. The 1652 establishment of Cape Town as a resupply port further optimized shipping, reduced voyage times, and increased volumes reaching Amsterdam, soon Europe's primary spice redistribution center (Van der Linde, 2020).

This logistical success carried a human and ecological cost. More than 15,000 Bandanese islanders were massacred for resisting Dutch rule (Ghosh, 2021). The VOC also sterilized nutmeg seeds with lime to prevent rival cultivation, creating a vertically integrated system of monoculture and extraction that set a precedent for later colonial agricultural regimes (Ricklefs, 2020).

Post-Monopoly Diffusion and British Expansion

VOC dominance fractured under geopolitical pressure. British forces seized the Moluccas in 1810, breaking the monopoly and transplanting nutmeg seedlings to colonies with similar climates, including Zanzibar, Sri Lanka, and Grenada (Callister, 2017). Grenada's volcanic soils and rainfall patterns proved ideal for nutmeg cultivation, and its production soon rivaled that of the Moluccas. By diversifying supply, the British diluted Dutch price control and democratized access to nutmeg (Moore & Van Nierop, 2017; Mini Raj *et al.*, 2023).

French naturalist Pierre Poivre further undermined monopolistic control by smuggling 32 nutmeg seeds to Mauritius in 1770, establishing plantations that thrived in the Indian Ocean basin. His efforts catalyzed additional plantings in Madagascar, the Maldives, and Seychelles, embedding *Myristica fragrans* in new agroecological zones and decentralizing global production (Spence, 2024; Cribb and Kahin, 2019). Although the Treaty of Paris (1814) restored Dutch sovereignty over the Moluccas, colonial rivalries and ecological diffusion had permanently transformed nutmeg into a multipolar commodity (Sasikumar, 2021).

Contemporary Production and Global Distribution

The present-day geography of nutmeg production, reflecting the enduring ecological legacy of colonial diffusion (Figure 7). Commercial cultivation now concentrates in Guatemala, India, Indonesia, Laos, Nepal, Sri Lanka, Bhutan, Tanzania, Honduras, and Grenada (FAO, 2023). Smaller but significant production also persists in Malaysia, parts of the Pacific Islands, and select Caribbean nations. This global spread increased supply, lowered prices, and shifted nutmeg from an elite luxury to an accessible household spice, altering centuries-old consumption patterns.

Current Challenges and Sustainability Implications

Modern nutmeg production continues to support livelihoods and regional economies, but also faces ecological and economic vulnerabilities. Monoculture cultivation reduces biodiversity, depletes soil nutrients, and leaves production systems susceptible to pests, diseases, and extreme climate events. These risks mirror the overexploitation concerns of the colonial era and emphasize the need for sustainable agricultural models. Agroforestry integration, crop diversification, and climate-resilient practices can mitigate these threats and ensure long-term production viability (Patra *et al.*, 2022).

Contribution

The historical and contemporary trajectories of *Myristica fragrans* reveal how human agency extends plant dispersal beyond natural boundaries, reshaping ecological and economic landscapes. Nutmeg's journey from a closely guarded island resource to a widely available commodity underscores the intertwined roles of imperialism, forced labor, scientific transfer, and global trade in shaping agricultural systems. This discussion provides a critical framework for understanding the colonial roots of today's spice economy and invites further inquiry into the socio-political histories embedded within everyday agricultural goods.

CONCLUSIONS

This study traced the evolution of *Myristica fragrans* from its origins in the ecological traditions of the Banda Islands to its emergence as a globally cultivated commodity embedded in colonial and postcolonial trade systems. The analysis shows that colonial powers, particularly the Dutch East India Company, used military power, economic leverage, and botanical manipulation to monopolize the nutmeg trade. Dutch forces replaced

biodiverse, community-based cultivation with forced labor regimes and export-oriented plantations, severing the ecological and cultural ties that once defined nutmeg production. Indigenous farmers cultivated nutmeg in ways that preserved biodiversity and sustained ecosystems. Dutch colonizers disrupted these systems, sterilized seeds, fortified trade posts, and suppressed local resistance to secure their monopoly. These actions turned nutmeg into a symbol of imperial ambition and economic dominance while reshaping tropical landscapes.

British and French actors disrupted Dutch control through seed transfers and deliberate introductions of nutmeg to Grenada, Mauritius, and Zanzibar. These interventions broke the monopoly, spread cultivation to new ecological zones, and increased global supply. While these moves widened access to nutmeg and diversified production, they also commodified traditional knowledge and placed new pressures on local environments.

These findings highlight the importance of examining globally traded crops to understand colonial disruption, environmental exploitation, and cross-continental economic entanglement. Nutmeg's transformation from an island-bound spice to a global staple shows how imperial strategies continue to shape agricultural systems, trade flows, and biodiversity today.

The transnational story of *Myristica fragrans* urges researchers, policymakers, and growers to build food systems rooted in equity, sustainability, and cultural preservation. Stakeholders must integrate social and ecological histories into trade and agricultural policy, reclaim indigenous knowledge, protect biodiversity, and redress historical injustice to cultivate inclusive, resilient, and ethically grounded futures.

Future Directions

Researchers should analyze the genetic diversity of *Myristica fragrans* cultivars across producing regions to strengthen resilience against pests, disease, and climate change. Scholars can compare postcolonial nutmeg economies to reveal how plantation-era structures influence today's labor practices and land governance. Interdisciplinary studies that link environmental history, agroecology, and trade policy can generate practical strategies for fairer and more sustainable spice supply chains

Data Availability Statement

This study is based entirely on publicly available secondary data from previously published sources. No new datasets were generated or analyzed during the current study. All data referenced are cited appropriately within the manuscript, and no data are deposited in a public repository.

Declaration of conflicting interest

There is no conflict of interest.

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