

Brandis the Forgotten Botanist

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Prologue

Among the world's forest scientists, foresters and silviculturalists, Dietrich Brandis (1824-1907) is a well-known person. This is especially true for the South Asian Subcontinent as Brandis was the first Inspector General of Forests in British India from his appointment in 1865 until his retirement in 1883. In the first place he is considered father of tropical forestry, yet he also deeply influenced the forestry movement in the United States of America as well as the forest management in other parts of the British Empire. Several monographs and a large number of articles honoured Brandis' credits as an eminent as well as exceptional forester and forest administrator.¹ In fact, however, Brandis was not a trained forester (responsible for the conservation of forests, felling and reforestation) but a botanist (biological scientist who studies plants) and an eager collector of plants throughout his life. His herbarium, consisting of 19,000 sheets, eventually bought by the Senate of Hamburg in 1908 and presently part of the Herbarium Hamburgense of the University of Hamburg, documents Brandis' professionalism as a gifted botanist.

Quite astonishingly, in the academic discourse Brandis was and still is mainly seen as a forester and hardly ever as a botanist. Therefore this article tries to trace Brandis' role as a botanist who ought to be seen in a line with other eminent botanists in the service of the British colonial state in India like William Roxburgh (1751-1815), a trained surgeon, passionate meteorologist and Superintendent of the Botanical Gardens in Calcutta from 1793 to 1813. His posthumous two volume publication *Flora Indica; or Descriptions of Indian Plants* (1820, 1824) earned him the reputation of being the founding father of Indian botany.² Roxburgh was succeeded by Francis Buchanan (1762-1829) who became fairly famous for

¹ Herbert Hesmer, *Leben und Werk von Dietrich Brandis 1824-1907. Begründer der tropischen Forstwirtschaft, Begründer der forstlichen Entwicklung in den USA, Botaniker und Ökologe*. Opladen: Westdeutscher Verlag, 1975 (Abhandlungen der Rheinisch-Westfälischen Akademie der Wissenschaften, vol. 58); S.S. Negi, *Sir Dietrich Brandis: Father of Tropical Forestry*. Dehra Dun: Bishen Sing Mahendra Pal Singh, 1991; David Prain, revised by Mahesh Rangarajan, "Brandis, Sir Dietrich (1824-1907)", *Oxford National Biography* (1915, online edn 2004). Oxford University Press. doi:10.1093/ref:odnb/32045; Ajay S. Rawat, "Brandis: The Father of Organized Forestry in India", in: *idem*, (ed.), *Indian Forestry: A Perspective*. New Delhi: Indus Publishing Company, 1993, pp. 85-101.

² Tim Robinson, *William Roxburgh. The Founding Father of Indian Botany*. Chichester: Phillimore, 2008.

his *A Journey from Madras through the Countries of Mysore, Canara and Malabar*³ which documented his reputation as a professional surveyor and naturalist in the service of the East India Company rather than being, like Dietrich Brandis, a meticulously working ambitious botanist. Likewise, the Danish surgeon Nathaniel Wallich (1786-1854) is better known as the first superintendent and curator of the Oriental Museum of the Asiatic Society of Bengal, its collections growing rapidly under his guidance and through his personal donations, than as Superintendent of Calcutta's Botanical Gardens from 1817 until 1846.⁴

Although the scientific activities of the superintendents of Calcutta's Botanical Gardens as well as that of the later forest inspectors in British India has been extraordinary as to detecting, collecting, classifying and publishing botanical findings, stately interest in botany was dwindling and public perception rather negligible. This development indicates a discursive shift from scientific knowledge about plants to plants as a natural resource and therefore an economic category at the beginning of the nineteenth century.⁵ During the following decades a specific colonial archive emerged and developed which, in the wake of railway construction in India and growing European demand of tropical wood, turned the flora of British India into valuable timber resources.⁶ This is also the reason why Brandis was not acclaimed as a botanist but as a forester since, from the 1850s onwards, the focus of the colonial state was on securing natural resources and in particular timber. Hence, as Brandis somehow frustrated remarked, according to certain public opinion 'the sole legitimate duty of forestry in India [seems] to provide fuel and timber, and that the forester has no concern with bark, lac, gums, resins, caoutchouc, wax, oil, dyes, fruits ...'.⁷

Botany, in turn, seems to have become the private pleasure of covenanted foresters and ambitious amateurs. Botany, after forestry, was further reduced to a subordinated science within the colonial scientific setting, geography, geology, mineralogy and anthropology

³ Francis Buchanan, *A Journey from Madras through the Countries of Mysore, Canara and Malabar*. In Three Volumes. London: T. Cadell & W. Davies, Black, Parry & Kingsbury, 1807.

⁴ O.P. Kejariwal, *The Asiatic Society of Bengal and the Discovery of India's Past, 1784-1838*. New Delhi: Oxford University Press, 1988, pp. 115-6. Martin Krieger, *Nathaniel Wallich. Ein Botaniker zwischen Kopenhagen und Kalkutta*. Kiel/ Hamburg: Wachholtz-Murmann Publishers, 2017.

⁵ Marika Vicziany, "Imperialism, Botany and Statistics in Early Nineteenth-Century India: The Surveys of Francis Buchanan (1762-1819)", *Modern Asian Studies* 20, 4 (1986), pp. 625-60.

⁶ Rather unintentionally Dietrich Brandis became part of the emerging textual discourse, cf. his, "Memorandum on the Supply of Railway Sleepers of the Himalaya Pines Impregnated in India", *Indian Forester* 4,4 (1879), pp. 365-85. Timber for ship-building was on the colonial state's agenda at the beginning of the nineteenth century, cf. Michael Mann, *Flottenbau und Forstbetrieb in Indien, 1794-1823*. Stuttgart: Franz Steiner Verlag, 1996; *idem*, "Timber Trade on the Malabar Coast, c. 1780-1840" *Environment and History* 7 (2001), pp. 403-25.

⁷ Dietrich Brandis, *Forest Flora of North-West and Central India. A Handbook of the Indigenous Trees and Shrubs of those Countries. Commenced by the late J.L. Steward, continued and completed by D. Brandis. Prepared at the Herbarium of the Royal Gardens, Kew. Published under the Authority of the Secretary of State for India in Council*. London: Wm H. Allen & Company, 1874, p. ix.

gradually taking the lead in the first half of the nineteenth century.⁸ Despite this shift in public attention and state sponsoring, it is important to note that numerous botanists were still at work in British India throughout the century. Dietrich Brandis is a fine example because having a closer look at the sources it becomes clear that Brandis was not only a gifted administrator and surveyor of British India's forests but throughout his life a passionate and professionally working botanist substantially contributing to the growing knowledge of South Asia's flora.⁹

1. Academic Education and Early Activities

Dietrich Brandis was born in Bonn in 1824 as the oldest of four sons of Christian Brandis, Professor of Philosophy at the city's university. Dietrich developed his interest in botany at the age of fifteen when the Brandis family moved to Athens (1836-9). In 1843 Dietrich Brandis started studying in Copenhagen where he stayed in the house of his grandfather, Dietrich Joachim Brandis, Professor of Medicine at the University of Kiel and personal physician to the king of Denmark. From 1844 Brandis studied in Bonn, moving to Göttingen in 1846. Back to Bonn a couple of years later he submitted a doctoral dissertation in chemistry, followed by a Habilitationsschrift (second thesis, German speaking countries' system for qualifying as a professor) on the main components of plant seeds in 1849.¹⁰ Interestingly, Brandis' scientific career as a botanist only started as Privatdozent (senior lecturer) for Botany and Plant-Chemistry at the University of Bonn where he offered various lectures on botanical and closely related subjects between 1849 and 1855. Both, his personal interest and ambition as well as the familial background, deeply influenced Brandis' career as a broadly educated academic which eventually qualified him to work in the administrative service of the government of British India.

In January 1854, Brandis married Rachel Havelock. She was the daughter of the well-known Baptist missionary Joshua Marshman (1768-1837). She was also the younger sister of Major-General Sir Henry Havelock's wife. Dietrich met Rachel during Havelock's two-year home leave from his service in British India when the family stayed in Bonn in 1851. Havelock returned to India in the same year, his wife and their younger children as well as Rachel

⁸ David Arnold, *Science, Technology and Medicine in Colonial India*. (The New Cambridge History of India III.5) Cambridge. Cambridge University Press, 2000, pp. 19-56.

⁹ Parts of the following paragraphs are based on Hesmer, *Leben und Werk von Dietrich Brandis*. From the bibliography and appendices of the book it seems that hardly a single source has slipped through Hesmer's scientific fingers. However, although Hesmer's study is the first comprehensive biography on Brandis it somehow underrates the role of Brandis as botanist since out of 414 pages only 10 deal with his botanical activities.

¹⁰ Hesmer, *Leben und Werk*, pp. 1-5.

remaining in Bonn. Rachel was born in 1804 thus 20 years older than Dietrich, and formerly married to the Danish government surgeon and botanist Joachim Otto Voigt (1798-1843) then based in the Danish settlement Serampore near Calcutta. After the death of her husband, she published his large collection of manuscripts on plants in the Botanical Gardens of Calcutta and Serampore. Her interest in botany and being brought up in a missionary household may have promoted the marriage as Dietrich also stemmed from a protestant household.¹¹

Eventually it was Rachel who asked her brother-in-law Henry Havelock in 1855 to look for a post for her husband in or around Calcutta where Dietrich would be able to continue his botanical studies.¹² Havelock suggested him for the recently vacant post of surveyor of the teak forests of Burma which had been annexed to British India in 1852. The then Governor-General Lord Dalhousie insisted that Brandis would take up his post by the end of the same year. Brandis obtained permission for a three years leave from the University of Bonn and the couple immediately headed for Calcutta where they arrived at the end of December. Eight days later, Dietrich Brandis explained the governor general his idea of forest politics which predated his future plans for the administration of British India's forests, namely, first, to protect and improve the forests for securing their sustainability, second, to make the dwellers of the forests his friends and allies as this would guarantee the success of the first point, and third to achieve an annual net output of teak for supplying timber traders with tropical wood and the government with additional revenues.¹³

By the middle of January 1856 the Brandis reached Rangun where Dietrich took up the post as Superintendent of Forests of the Province of Pegu (Lower Burma). Two years later the provinces of Tenasserim and Martaban were added to his field of responsibility. During the early inspections of Pegu's forests Brandis developed a system of linear valuation surveys (strip survey) and girdling according to age and circumference as a preparatory measure for systematic felling. In addition, he developed measures for afforestation as well as the idea of reserved, protected and village forests, access to forest resources henceforth to be strictly regulated by the government.¹⁴ To implement his ideas, Brandis elaborated principles of a systematic forest administration based on trained personnel, scientific publications and annual reports.¹⁵ Within a couple of years he conceptualised a highly sophisticated and at the same

¹¹ *Ibid.*, pp. 6-7.

¹² It seems that Brandis' university career was, for unknown reasons, somehow stuck. As in plenty of other cases, British India promised a career if patronage was conceded.

¹³ Dietrich Brandis, "Indian Forestry", Rangoon Gazette, reprinted in *Indian Forester* 23 (1897), pp. 176-8.

¹⁴ Report on the Teak Forests of Pegu for 1856. *Selections from the Records of the Government of India (Foreign Department)*, No. 28. Calcutta: Baptist Mission Press, 1860, pp. 2-3.

¹⁵ Hesmer, *Leben und Werk*, pp. 44-7.

time professional forest administration which, to a very large extent, was based on established German scientific forestry. It is against this background that the new forest administration revolutionised existing forms of tropical forest management as from now on forestry in British India rested upon scientific assessment, cartographic survey and economic sustainability.¹⁶

2. Brandis the Botanist

Already on his way to India, Dietrich Brandis collected plants in Aden and Point Galle on Ceylon.¹⁷ Immediately after his arrival in Calcutta, Brandis continued his botanical studies. Until their departure for Rangun, the Brandis couple stayed in Rachel's parental house in Serampore from where Dietrich had easy access to the town's Botanical Garden, the spacious park of the English governor general's palatial Government House in Barrackpore as well as the Botanical Gardens of Calcutta where he collected and classified trees and shrubs. Yet, this first collection was lost because on the way to Burma Brandis' herbarium and library were conveyed on a separate vessel which wrecked on the Rangun River.¹⁸ However, Brandis' travelogue and his later writings remain silent on the bereavement. As Brandis was just about to start his career as a forester and botanist in Burma he may have regarded the loss not as a tragedy worth mentioning. In fact, his botanical publications as well as the herbarium surviving in Hamburg bear testimony of his continued interest in botany.¹⁹

As Dietrich Brandis's duty was to organise the forests of Burma and later on British India there remained hardly any time for botanical studies. Brandis was a very thoroughly working administrator organising a systematic forest management that would be implemented all over British India in 1878. Preparing the 1878 act, Brandis was in the end successfully opposed by Henry B. Baden-Powell, a civil servant-turned-conservator of forests, who was seemingly more interested in appropriating local rights and custom for the central government than

¹⁶ Ravi Rajan, "Imperial Environmentalism or Environmental Imperialism? European Forestry, Colonial Foresters and Agendas of Forest Management in British India, 1800-1900", in: Richard H. Grove, Vinita Damodaran, Satpal Sangwan (eds), *Nature and the Orient. The Environmental History of South and Southeast Asia*. Delhi: Oxford University Press, 1998, pp. 324-71; Michael Mann, "German Expertise in India? Early Forest Management on the Malabar Coast 1792-1805", in: Georg Berkemer et al. (eds) *Explorations in the History of South Asia. Essays in Honour of Dietmar Rothermund*. Delhi: Manohar Publishers, 2001, pp. 9-26.

¹⁷ Dr. Dietrich Brandis' *Reise nach Hinter-Indien, über Aden, Ceylon und Calcutta; Dezember 1855 bis Februar 1857, Mittheilungen aus der Justus Perthes' Geographischer Anstalt über wichtige neue Erforschungen auf dem Gesamtgebiete der Geographie*, (by Dr. A. Petermann). Gotha: Justus Perthes, 1857, pp. 479-84. The article however provides a description of landscapes, people and custom rather than detailed botanical studies.

¹⁸ W.[ilhelm] S.[chlich], "Sir Dietrich Brandis, 1824-1907", *Indian Forester* 33 (1907), pp. 569-74, esp. pp. 569-70.

¹⁹ Wm Schlich suggests that Brandis looked at the event 'almost as a direction to his future line of action' as for some time he abandoned botanical studies mainly concentrating on his administrative works, *ibid.*, p. 570.

seeking cooperation with villagers and forest dwellers as it was the practice of European forestry, especially in German speaking countries, France and northern Italy. This practice Brandis was obviously referring to, not as a botanist but as a non-trained forester who wanted to rely on established and successful European models. Hence, the Forest Act of 1878 was in many ways stricter than contemporary European forest legislation as the emphasis was laid on the colonial state's more or less unlimited access to forests, which were now regarded as a natural resource and a source of revenue.²⁰ Despite the strict forest regulations, Brandis tried to insist on foresters being broadly trained systematically in botany, geography, geology, zoology and chemistry as it was the case with German foresters.²¹

During his stay in Europe to recover from bad health (1865-7), Brandis, after an audience with the Secretary of State for India and correspondence with the Secretary to Government of India, was granted permission to employ two assistants. The workload of surveying, administering and organising the forests of British India had proven to be too heavy for the inspector general who had basically been working on his own. Brandis selected the Hessian Forest Assistant Dr Wilhelm (later William) Schlich and the Hanoverian Forest Assistant Berthold Ribbentrop who were appointed Special Assistant Conservators of Forests.²² Brandis was highly interested in the botanical training of his two future assistants. To promote the preparations for their service in British India, he introduced them to Dr Joseph Hooker, the then prominent Director of the Royal Botanic Gardens at Kew.²³ In a letter Brandis told Hooker that the two Germans were former students of Dr Grisebach, Professor of Plant-Geography at the University of Göttingen whose lectures Brandis had attended as well.²⁴

²⁰ Gregory A. Barton, *Empire Forestry and the Origins of Environmentalism*. Cambridge: Cambridge University Press, 2002, pp. 38-93; Indra Munshi Saldanha, "Colonialism and Professionalism: A German Forester in India", *Environment and History* 2,2 (1996), pp. 195-219; Richard Hölzl, "Der 'deutsche Wald' als Produkt eines transnationalen Wissentransfers? Forstreform in Deutschland im 18. und 19. Jahrhundert.", *discussions* 7 (2012), 29 pp., http://www.perspectivia.net/publikationen/discussions/7-2012/hoelzl_wald (retrieved 10. October 2017); Ramachandra Guha, "An Early Environmental Debate: The Making of the 1878 Forest Act", *Indian Economic and Social History Review* 27, 1 (1990), pp. 65-84. The Institut für Weltforstwirtschaft at the University of Hamburg, Germany, harbours a set of Brandis' correspondence with various contemporaries.

²¹ Barton, *Empire Forestry*, pp. 68-73.

²² Wilhelm/William Schlich (1881-5) and Berthold Ribbentrop (1885-9) succeeded Brandis as Inspector General of Forests to the Government of India.

²³ Hooker was the most eminent British botanist of the nineteenth century. His greatest botanical work was the *Flora of British India*, published in seven volumes starting in 1872 and the final volume came out in 1897. He succeeded his father Sir William Hooker in 1865 (until 1885) as Director of the Royal Botanical Gardens Kew. In contrast to the colonial colleagues, botanists working in Britain are much better remembered. This is, in fact, true for many European scientists working in the colonies, for example, William O'Shaughnessy (1809-89) inventor of the first underwater as well as out-door telegraph line, cf. Michael Mann, *Wiring the Nation. Telecommunication, Newspaper-Reportage, and Nation Building in British India, 1850-1930*. New Delhi: Oxford University Press, 2016, pp. 36-7.

²⁴ Hesmer, *Leben und Werk*, pp. 86-9.

Aside France Germany was then the European region with the largest number of trained foresters and botanists and quite a few of them willing to pursue their career overseas.

From 1856 to 1865 Brandis was completely occupied with the set-up of the forest administration. During that decade Brandis did not publish any article on the botany of South Asia. Nevertheless he was able to collect plants during his extensive tours through the forests of the subcontinent, as he did, for example, between 1858 and 1862 in Burma. Numerous herbarium sheets collected in that period are extant in the Herbarium Hamburgense. Two letters to Dr Hooker dating from 1868 document the difficulties Brandis faced in obtaining botanical data. However, Brandis tried to collect such information in cooperation with his colleagues. During an expedition to the forests of Burma in 1867-8, he was accompanied by Sulpiz Kurz (1843-78), a botanist from Augsburg in southern Germany and since 1863 curator of the herbarium of the Botanical Gardens in Calcutta.²⁵ Brandis asked Kurz to draw a list of trees, specimens of bamboos, liana and other plants. At the same time Conservator Major Beddome worked on a *Flora Sylvatica* of the Madras Presidency, and Conservator Dr J. L. Steward did the same in the Punjab hoping their work would be useful for Brandis own envisaged comprehensive *Flora Sylvatica Indiae Orientalis*. However, Brandis soon had to realise the unsurmountable difficulties he would face in compiling the material even when the burden of workload was distributed on various shoulders.²⁶

Until 1871, when Brandis again left for Europe to recover from bad health, he had travelled extensively throughout the South Asian Subcontinent. Like no other official in British India he was familiar with the country's flora, fauna, climate and geography. In Europe Brandis published a small article "On the Distribution of Forests in India" which included a map on the "Rainfall and Forest Trees in India" delineating climatic zones and forest distribution thus pointing to the connection between rainfall and wood coverage. Whether he borrowed the idea of plant-geography from Alexander von Humboldt (1769-1859) is but likely.²⁷ It was the first map of its kind and remained authoritative until the end of the nineteenth century.²⁸ In the

²⁵ Still the most detailed biographical note on Kurz is Brandis' epitaph published in the *Indian Forester* 4,1 (1878), pp. 1-4. Sulpiz Kurz' two volume *Forest Flora of British Burma*, London 1877, in which he described 2000 plants, became a standard work reprinted in 1974.

²⁶ Hesmer, *Leben und Werk*, pp. 131-3.

²⁷ In fact this was an old debate going on in British India and other parts of the tropical world since the middle of the eighteenth century known as desiccationist theory, Richard H. Grove, *Green Imperialism. Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism, 1600-1800*. Cambridge: Cambridge University Press, 1995, pp. 309-80 *passim* and *idem*, "The Evolution of the Colonial Discourse on Deforestation and Climate Change 1500-1940", in: *idem*, *Ecology, Climate and empire. Colonialism and Global Environmental History, 1400-1940*. Cambridge: The White Horse Press, 1997, pp. 5-36.

²⁸ Dietrich Brandis, "On the Distribution of Forests in India" with a map on the Rainfall and Forest Trees in India", *Ocean Highways* 4 (1872), pp. 200-206. Reprinted in *Transactions of the Scottish Arboricultural Society* 7 (1873), pp. 88-113 and *Indian Forester* 9 (1883), pp. 173-83 and 221-33. Several German versions exist:

same year Brandis was instructed by the Secretary of State for India to complete the “Forest Flora of North-West and Central India” which Dr Steward had commenced a couple of years before. Within two years Brandis completed the book for which, quite interestingly, he used the following botanical materials:

- 1 a manuscript written by Dr Steward consisting of 444 pages
- 2 parts of the botanical material collected by R. Thompson, former employee at the Botanical Gardens in Saharanpur
- 3 at Kew the rich botanical collections, herbariums and library
- 4 his own herbarium sent by Sulpiz Kurz to London
- 5 a small set of plants collected in Gujarat during his tour in 1869-70.²⁹

In fact, the book turned out to be a big volume consisting of XXXI plus 608 pages describing 700 indigenous trees and shrubs as well as 80 introduced specimens. In addition, Walter Fitch published an accompanying illustrated book consisting of 70 drawings.³⁰ Brandis’ *Forest Flora* was, and still is, an impressive testimony of his being a most distinguished forester and at the same time a scholarly botanist. The book established his reputation as an eminent botanist esteemed by his contemporaries. In *Forest Flora* Brandis emphasised the role of climatic zones for forestry and he pointed out the ‘remarkable feature of the arboreous vegetation of North-Western India with a large number of African and Arabian species, many of which find their eastern limit within this Flora.’ He also hinted at the similarities between the forest vegetation of the north-western Himalaya and Europe, in particular that of the Mediterranean. At the same time, Brandis stressed the 80 arboreous species that had been introduced from Burma and Ceylon, western Asia, Africa, America and Australia.³¹ It is this

“Forstliche Verhältnisse aus den britisch-indischen Waldungen”, *Aus dem Walde* 8 (1877), pp. 36-65, “Die Beziehungen zwischen Regenfall und Wald in Indien”, *Verhandlungen des Naturhistorischen Vereins der preußischen Rheinlande und Westfalens* II, 1884, pp. 380-416 and “Regen und Wald in Indien”, *Meteorologische Zeitschrift* 4 (1887), pp. 369-76. See also his “Indirect Influence of Forests”, *Public Works Department, Forest Report*, Calcutta: Government of India Press, 1882. At the end of the nineteenth century, especially cartographical publishing houses and natural science societies asked for geo-botanical maps. However, Alexander von Humboldt had already drawn plenty of geo-botanical maps, *vide* Nils Güttler, *Kosmoskop. Karten und ihre Benutzer in der Pflanzengeographie des 19. Jahrhunderts*. Göttingen: Wallstein Verlag, 2014.

²⁹ Brandis, *Forest Flora*, p. xiv.

³⁰ *Illustrations of the Forest Flora of North-West and Central India. Drawn by Walter Fitch*. London: Wm H. Allen & Co, 1874.

³¹ Brandis, *Forest Flora*, p. viii. See also his article “Progress of Forestry in India”, *Indian Forester* 10,9 (1884), pp. 400-10 in which he describes marketable trees introduced from North America, tropical America, Europe, Japan and Australia, the latter known for Eucalyptus. Interesting also the observations on the “Growth of Grass

global comparison and comparability, which actually highlights the significance of Brandis' forestry, based on a comprehensive understanding and generalising concept of botany.³²

Brandis' *magnum opus* however was his *Indian Trees*. At least eight years he devoted to the collecting and organising of materials and the writing of the manuscript, the book eventually being published in 1906. It covers over 4,400 species of trees, shrubs, woody climbers, bamboos and palms of the subcontinent including the Andaman and Nicobar Islands and Burma. During his work at Bonn and Kew, Brandis received considerable herbarium material from his former colleagues, for example, the data regarding the Andaman and Nicobar Islands collected by Sulpiz Kurz, as well as data from scientific journals, list of plants, botanical works etc.³³ In the introduction, Brandis describes the forest vegetation, geography, climate, soils and water distribution of British India, followed by a synopsis of 115 plant families, keys to genera and species. The information on more than 4400 species includes the correct botanical names, synonyms, popular names, vernacular names, botanical description, associated tree flora and slash characters. In addition Dr R. Anheißer from Cologne drew 201 accurate pictures of selected plants.³⁴

In fact *Indian Trees* was such an important botanical work that it inspired Governor-General Lord Curzon (1898-1905) to establish the Botany Branch at Dehra Dun's Forest Research Institute in the same year the book was published. Suggested by Brandis, the Government of India had founded the Dehra Dun Forest School in 1878 to professionalise the training of indigenous foresters.³⁵ Also in 1878, Brandis attended the Paris International Exhibition where he became the driving force behind the botanical exhibits. The collection was undoubtedly the most complete that has ever been compiled and systematised in India and sent to Europe for exhibition. Brandis also displayed a vast collection of timbers from various regions of the subcontinent, and he personally dictated their captions describing wood structure and the correct botanical names.³⁶ Eventually, duplicates from the vast collection were sent to the Dehra Dun Forest School, and to the various conservators in the provinces of British India, to the Indian Museum and Botanical Gardens in Calcutta, to Kew, the Nancy Forest School and other public institutions in Europe, America and India. The distribution

and Underwood under the Shelter to Trees", *Indian Forester* 10,7 (1884), pp. 314-8, comparing European and Indian climatic and botanical conditions.

³² Dietrich Brandis, *Indian Forestry*. Woking: Oriental University Institute, 1897, decidedly places Indian forests and forestry in a global context.

³³ Brandis, *Indian Trees*, pp. xii-xiv.

³⁴ *Ibid.*, p. vii.

³⁵ Hesmer, *Leben und Werk*, 168-74.

³⁶ Rawat, Brandis, pp. 99.

documented Brandis' and the first generation of European foresters' arboricultural as well as botanical interests.³⁷

Later Brandis entrusted James Sykes Gamble (1847-1925), Conservator of Forests and since 1890 until his retirement in 1899 Director of the Imperial Forest School at Dehra Dun, with the Paris collection which seems to have been a source of inspiration for his standard work *Manual of Indian Timbers* published in 1881.³⁸ Like Brandis' *Indian Trees* for the establishment of the Botany Branch, Gamble's manual was instrumental in establishing the Wood Anatomy Branch at the Dehra Dun institute.³⁹ With his personal plant collection, Gamble founded the Forest School Herbarium in 1890 (renamed the Dehradun Herbarium in 1908). At Dehra Dun he further expanded his collections, adding from the Himalayan regions and also receiving specimens from colleagues. The collection was described as perhaps the largest collection of plants ever owned by an individual in India. After his retirement Gamble helped founding the Forestry School at Oxford and his collection of nearly 50,000 specimens was eventually presented to the Royal Botanical Gardens at Kew.⁴⁰ Actually, Gamble's Indian career as a systematic collector of plants was, again, hardly noticed by the scientific community.

Brandis however found hardly any time for botanical activities. In the above mentioned two letters to Dr Hooker dating from 1868 Brandis complained somehow frustrated that his time was consumed by administrative work. Six years later, in the preface of his *Forest Flora*, Brandis wrote that, owing to continued pressure from official duties, he was never able to devote much time on botanical studies.⁴¹ And in a letter to Hooker dating from the same year, Brandis complained about the load of administrative paperwork as well as the amount of evaluation and publication of his findings which deters him from any kind of botanical work.⁴² These obstacles may have caused Brandis to downgrade his botanical contributions as with his *Forest Flora* as well as *Indian Trees* he simply aimed at a practical guide through the forests of India not to be used as a botanical work. In spite of such humbleness, botanical studies were always on Brandis' mind, since he told Hooker in a letter dating from 1874 that

³⁷ Brandis, *Indian Trees*, p. vii,

³⁸ James Sykes Gamble, *Manual of Indian Timbers. An Account of the Growth, Distribution and Uses of the Trees and Shrubs of India and Ceylon with Description of Their Wood-Structure*. Calcutta : Office of the Superintendent of Government Printing; 1881; London: Sampson, Low, Marston & Company, 1902, 1922.

³⁹ Rawat, Brandis, p. 99.

⁴⁰ "Miscellaneous Notes", *Bulletin of Miscellaneous Information (Royal Botanic Gardens, Kew)*, 1925 (10), pp. 433–40; "The Gamble Herbarium", *Bulletin of Miscellaneous Information (Royal Botanic Gardens, Kew)*, 1926 (1), pp. 12–17.

⁴¹ Brandis, *Forest Flora*, p. xiv.

⁴² Hesmer, *Leben und Werk*, pp. 131-3.

his new herbarium was constantly expanding, and that the plants he had been collecting recently were in much better condition than those of former years.⁴³

Eventually, his herbarium, at the time when he returned to Europe, comprised 19,000 sheets. In addition he presented herbarium materials to globally distributed academic institutions like the Arnold Arboretum of Harvard University, the Botanical Institute of the University of Bonn, the Indian Botanical Garden Calcutta, the Forest Research Institute Dehra Dun, the Royal Botanic Gardens Kew, the National Herbarium of Victoria in Melbourne and the Museum of Natural History in Vienna. Aside he constantly sent living plants and seeds to Kew.⁴⁴ However, even in his *Indian Trees* Brandis finally stated that collecting plants was not part of his official business and that, apart from that fact, during the 28 years of his Indian service he never had enough leisure for collecting systematically or for working out scientific problems.⁴⁵ Therefore it seems that Brandis was, on the one hand, an ambitious and quite successful collector of plants, yet on the other hand, less successful with the botanical work including fully working up his rich herbarium bought by the Senate of Hamburg in 1908.

3. Bamboo: Botany and Economy

Brandis did not only collect plants but he also published widely on botanical and closely related subjects which in some way contradicts his perception of never having enough time for botanical work. One of the journals he regularly published with was the *Indian Forester*.⁴⁶ The first India-wide forest conference held at Lahore in 1872 had commissioned a forest magazine, edited by William Schlich and Henry Baden-Powell after 1875, which would collect and commission information of general interest.⁴⁷ Hence the *Indian Forester* was not conceptualised as a scientific journal but rather as a magazine that aimed at a wider readership. The 900 copies circulated among a learned few and an unknown large number of readers generally interested in the forestry and related subjects of British India. In that sense the *Indian Forester* was part of a public debate on sciences which took place in colonial India as elsewhere. The first 25 years of the magazine coincided with the formative stage in the development of scientific forestry in British India and in other parts of the British Empire as

⁴³ *Ibid.*, p. 257.

⁴⁴ *Ibid.*, pp. 257-8.

⁴⁵ Brandis, *Indian Trees*, p. xii.

⁴⁶ Brandis published altogether 35 articles in the *Indian Forester* between 1876 and 1907, cf. Hesmer, *Leben und Werk*, Appendix "Veröffentlichungen sowie gedruckte Berichte und Briefe von Dietrich Brandis", pp. 421-36 *passim*.

⁴⁷ Barton, *Empire Forestry*, p. 7.

well as the United States of America.⁴⁸ However, the *Indian Forester* also documents the transition from a generation of generalists concerned with forest conservation and sustainable forest management based on experienced knowledge to a new generation of bureaucratic specialists more interested in extraction and engineering, hence the profitability of forestry regarding the value and marketability of timber.⁴⁹

Having a closer look at the publications in the *Indian Forester* two subjects seem to appear regularly namely teak and bamboo as valuable forest products. Brandis' "Memorandum on the Rate of Growth of Teak" (1879) demonstrates the general lack of knowledge on this timber. The only reliable information available so far provided the teak plantation in Sylhet, Bengal, set up in the 1820s and, more recently, the plantation in Nilambur, South India, where British foresters had systematically planted the tree in 1845. Still, in other parts of the subcontinent specifics about the growth of teak was rather unknown. Brandis, referring to his *Forest Flora*, stated that further data on teak has been collected since the book's publication in 1874, and that additional data is now available from Dr William Schlich's report for 1872-3 on the teak forests in Lower Bengal, Captain Van Someren's report on Mysore for 1875-6, and Colonel Beddome's report on the Nilambur Plantation submitted in 1878. Still, 'the data brought together in no way give a complete account of the rate and mode of growth of teak ...'.⁵⁰ This coincides with the information available on other Indian trees, deodar for example, new results, findings and observations permanently adding to the scarce knowledge on that tree.⁵¹

Brandis, the botanist, always pointed at the natural growth of timber which, in the case of teak, is associated with bamboos and a variety of other trees. For that reason he opposed mono-cultural teak plantations.⁵² As to the various kinds of bamboo in different regions of British India knowledge was however as good as that on teak. The first comprehensive book on bamboo was written by William Munro (1818-80), botanist and captain in the British-

⁴⁸ Satpal Sangwan, "Making of a Popular Debate: The Indian Forester and the Emerging Agenda of State Forestry in India, 1875-1904", *Indian Economic and Social History Review* 36,2 (1999), pp. 187-237.

⁴⁹ Benjamin Weil, "Conservation, Exploitation, and Cultural Change in the Indian Forest Service, 1875-1927", *Environmental History* 11 (2006), pp. 319-43. The growing number of subscribers from the Forest Departments documents the strategy of the magazine, as in 1882 only 43 per cent of the officers of the Superior Staff and a very few Forest Rangers subscribed for it whereas in 1895 the number had grown to 62 per cent, Sangwan, Making of a Popular Debate, fn. 192, p. 233.

⁵⁰ Dietrich Brandis, "Memorandum on the Rate of Growth of Teak", *Indian Forester* 4,3 (1879), pp. 215-25, quote p. 216.

⁵¹ Dietrich Brandis, "Ripening of Deodar Seed", *Indian Forester* 8,1 (1882), p. 49. Again Brandis refers to his *Forest Flora* admitting that since his return to British India he had 'found more opportunities than [he] previously had of watching the habits of the deodar' and that he had doubts on the statements he made in the *Forest Flora*.

⁵² Brandis, Memorandum on the Rate of Growth of Teak, p. 224.

Indian army, based on his observations and collections of grasses and especially bamboo conducted during his expeditions in British India between 1834 and 1838.⁵³ Eventually James Sykes Gamble published an authoritative monograph on bamboos in 1896.⁵⁴ Still, despite the useful information both books provided, detailed knowledge on the reproduction, in particular seeding, germination and growth of bamboo, as well as overall distribution was not available. Having a closer look at the various articles on bamboos published in the *Indian Forester* until the end of the nineteenth century, it becomes clear that a very lively debate took place on the botanical behaviour as well as economical use of the plant.

In the closing decades of the nineteenth century, bamboo became to play a fairly prominent role in the production of paper. Since the 1860s the ever growing paper industry desperately looked for a cheap and easy procurable substitute for linen rags. Experiments with different fibres including straw, wood, bark and grass failed as processing was too laborious and hence production costs prohibitive. It was not until the middle of the nineteenth century that paper mills working with new powerful machines were able to economically produce paper from different fibres, the first large scale pulp mill being established in Manayunk near Philadelphia, USA, in 1865, followed by similar pulp mills in England in 1867 and soon afterwards in Germany.⁵⁵ Megasse, the residue of sugar cane, and bamboo seemed the most promising alternative natural resources. However, as megasse was not yet produced and transported in sufficient quantities to Britain, its paper manufacturers began to consider bamboo as an alternative. Yet, further botanical knowledge on the reproduction and growth of the grass was necessary to ensure the long-term availability and economic feasibility of the fibre.

The first long treatise on this subject was published by Thomas Routledge, owner of a paper-mill near Oxford, in 1875.⁵⁶ The book was followed by several articles in the *Indian Forester*. A certain A. Smythies wrote a short “Report on the Preparation of Bamboo Fibre for Paper Making” in which he explicitly referred to Thomas Routledge’s book, however drawing different conclusions as to the net outcome of cut, dried and unbleached bamboo fibre stock. According to his calculation the output was only 12 per cent instead of 15 as calculated by

⁵³ William Munro, *Monograph of the Bambuceae*. Transactions of the Linnaean Society of London, 26, 1868.

⁵⁴ James Sykes Gamble, *The Bambuseae of British India* (= *Annals of the Royal Botanical Garden*. Vol. 7) Calcutta: Bengal Secretariat Press, 1896. The book received highest commendation from Sir Joseph Hooker, *Indian Forester* 23,7 (1897), p. 280.

⁵⁵ Dard Hunter, *Papermaking. The History and Technique of an Ancient Craft*. New York: Dover Publications 2011, pp. 309-403, 74-99.

⁵⁶ Thomas Routledge, *Bamboo Considered as a Paper-Making Material. With Remarks upon its Cultivation and Treatment. Supplemented by a Consideration of the Present Position of the Paper Trade in Relation to the Supply of Raw Material*. London and New York: R. & P. N. Spoon, 1875.

Routledge. However, Smythies' conducted his experiments in the Moharli bamboo forests near Nagpur in Central India, conceding that in different regions and with different bamboos the outcome might be different.⁵⁷ His article triggered a fierce controversy with Thomas Routledge who, to start with, bluntly stated that he is recognised by the 'English paper trade as an authority more especially when drawn fibres are concerned' and regarded 'as pioneer and patentee of this new industry of bamboo paper stock.'⁵⁸ In his factual reply, Smythies stated that he actually considered the growth of bamboo and that his 'chief point was to choose the young shoots at a proper time, neither too young, nor too old.'⁵⁹

Actually the hefty and sometimes fairly emotional debate disclosed the appalling ignorance of its participants regarding the use of bamboo as a cheap and therefore alternative fibre for paper-making. Knowledge about the growth and the best time for cutting was still missing which also hinted at the fact that botanists and foresters were so far not really involved in the debate. Quite interestingly, Thomas Routledge, in an article published in the *Indian Forester* in 1879, lengthily quoted the correspondence between a certain Robert Thomson, who had collected some bamboo specimens in Jamaica, and Sir Joseph Hooker, who had also published an article on bamboo as a source for paper-making. Apparently Routledge tried to mobilise botanical authority for his case. In the concluding paragraph of his article Routledge stressed that the judiciously and economically carried out manufacture of paper based on bamboo fibre will not only well pay but guarantee a good quality of such paper of which samples he sent as well.⁶⁰

The debate continued for years to come. Thomas Routledge seems to be the point of reference as articles on bamboo published in the *Indian Forester* mostly referred to his writings. On the one hand, the debate is determined by botanical aspects and on the other hand, the question of the preparation of pulp from bamboo is also on the agenda. To start with, the botanical discussion was basically on the distribution of various kinds of bamboos within British India, the condition of soils, the climate, growth and best time for cutting. Sulpiz Kurz, in the third issue of the *Indian Forester* (1876), published a long article on these questions including the use of bamboo in British India for different purposes such as a natural resource for pulp production but also as a means for famine relief as bamboo, grown on waste land would provide for additional income for the aggrieved people and, at the same time, supply the paper

⁵⁷ A. Smythies, "Report on the Preparation of Bamboo Fibre for Paper Making", *Indian Forester* 3,1 (1877), pp. 32-8, esp. p. 34

⁵⁸ Thomas Routledge, "Preparation of Bamboo Fibre for Paper-Making", *Indian Forester* 3,4 (1878), pp. 353-6.

⁵⁹ A. Smythies, "Preparation of Bamboo Fibre for Paper-Making", *Indian Forester* 4,1 (1878), pp. 94-5.

⁶⁰ Thomas Routledge, "Bamboo as a Paper-Making Materia", *Indian Forester* 4,3 (1879), pp. 253-60.

mills with additional raw material. Hence, according to Kurz, bamboo reserves as well as bamboo plantations would serve multiple purposes.

Yet, he had to frankly admit that ‘we have, however, much to learn yet of the life-history of these bamboos ...’⁶¹ In fact, knowledge on bamboos was piecemeal and remained so for decades to come. In 1882, the main question was still at what time and at which height bamboo had to be cut for receiving the best results for paper pulp. Various drawings illustrated the germination and growth of bamboo within three years. Likewise the diameter of a single stem, the shape of bamboo clumps and the right height of cutting for ensuring a good shooting was shown. Repeatedly, special emphasis was laid on the location of the plant as to soil, moisture and climate which decisively were to influence the growth of bamboo.⁶² From Travancore, South India, for example it was reported in 1887 that

[a]bout five years ago there was a general seeding of the ordinary bamboo (*B. Arundinaceae*) and the culms died down. Ever since then there has been great difficulty in procuring bamboos of good size.

What I wish now to ask is, if it is possible by cutting out the bamboos before they seed, to avoid this general seeding,* and so have a supply coming on and in full vigour in one place, while in another the bamboos have matured and are dying.

In a footnote the editor commented on the ‘general seeding’ marked by the asterisk: ‘There is probably no way of preventing the general seeding of bamboos, when they become mature.’⁶³ Despite an increasing amount of information, knowledge still was fairly fragmentary because botanists forwarded their reports from different regions of British India using different species of bamboo.⁶⁴ In any case however, the *Indian Forester* contributed to the general discourse on bamboo as well as to the, though slow, growth of information on and knowledge about the plant as the following paragraphs will show.

In a short note on the “Reproduction of Bamboos”, S.E. Peal, in an answer to a note on the “Reproduction of Bamboos” in the December 1887 issue of the *Indian Forester*, reminded of bamboos as a valuable forest produce and the danger of its deterioration and eventually entirely dying out from a want of proper system of treatment and cutting.⁶⁵ Reproduction

⁶¹ Sulpiz Kurz, “Bamboo and Its Use”, *Indian Forester* 1,3 (1876), pp. 219-68, quote p. 361.

⁶² S.E. Peal, “Bamboo for Paper Stock”, *Indian Forester* 8,1 (1882), pp. 50-4.

⁶³ T.F.B., “Seeding of Bamboos”, *Indian Forester* 13,9 (1887), p. 409.

⁶⁴ A.C., “Sowing and Planting Bamboos”, *Indian Forester* 13,4 (1887), pp. 177-8.

⁶⁵ S.E. Peal, “Reproduction of Bamboos”, *Indian Forester* 14,2 (1888)

remained a major topic. J.S. Gamble, meanwhile on leave in Kew, stated that ‘the whole of our present knowledge of the life-history of the Indian specie of bamboo, and of the sylviculture of the Bambuseae, is very small, and we badly want experiment and the record of careful and protracted observation.’⁶⁶ At the end of the 1880s, still no systematic forestry as to the treatment including the propagation, growth and cutting of bamboo existed. The above mentioned G.J. van Someren reported from the Melghat Forests in Berar, Central India, about the manner in which bamboo (*Dendrocalamus strictus*) in that forest has multiplied during the rainy season. However, he was eager to learn whether the same was observed in the close by Khandesh Forests and the forests of the southern and western Central Provinces.⁶⁷

In addition he reported on the destruction of bamboo forests in the Kinwat Forest of southern Berar. From that forest Brandis, visiting the place in 1878, had reported that reproduction may be left to nature. However, as there had been no general seeding of bamboo since then it was almost extinct by the time van Someren visited the forest. From his personal experience in the Melghat Forests he recommended the cutting of bamboo three feet above the ground as too close to the ground would prevent natural seeding.⁶⁸ Indiscriminate cutting of even thin and inferior bamboo stems as well as the complete cutting of a clump had led to a dangerous depletion of bamboo and lack of natural reproduction. Countermeasures seem to work slowly and somewhat frustrated the author concluded that, to prevent prolonged ill-treatment and to close bamboo forests up to two years, ‘... it is a record of such experiences that we are so badly in want of.’⁶⁹ Back in India, J.S. Gamble replied to the above mentioned article with a few remarks on the flowering and maltreatment of bamboos, ending his article with a general appeal to the readers to help him with

... specimens of flowers, leaves, sheaths, &c., of any species they may come across, and with any general or specific information about bamboos. I have been for some time engaged in collecting specimens of, and information about, the Indian Bambuseae, a group of the highest forest importance, and specimens and information will be most gratefully welcomed, and most especially from Burma and the extreme south of India.⁷⁰

⁶⁶ J.S. Gamble, “Treatment of Bamboos”, *Indian Forester* 14,3 (1888), pp. 112-4.

⁶⁷ G.J. van Someren, “Note on Bamboos”, *Indian Forester* 13,2 (1888), pp. 80-2, esp. 81.

⁶⁸ van Someren, Note on Bamboos, pp. 81-2.

⁶⁹ S. E.-W., “On the Treatment of Bamboo Forests”, *Indian Forester* 16,4 (1890), pp. 147-52.

⁷⁰ J.S. Gamble, “The Treatment of Bamboo Forests”, *Indian Forester* 16,10 (1890), pp. 418-9.

Aside the still existing paucity of information on bamboo it is quite obvious that Gamble was in dire need of special as well as general information for his own comprehensive book project on the bamboos of India. Gambles systematic dealing with bamboo is also reflected by his “Note on the Small Bamboos of the Genus *Arundinaria*”, the rather long article addressing a readership thoroughly acquainted with botany and in particular the botany of bamboos for the wording speaks to specialists and scientists.⁷¹ Gambles article is in stark contrast to that of Jasper Nichols, who made rather general observations on the *Bambusa arundinaria*, the thorny bamboo, in various regions of the South Asian subcontinent.⁷² From Bengal a report on the *Bambusa balcooa* growing on rich sandy loam under the dense canopy of tamarind trees⁷³ is another example how piecemeal information on bamboo was generated, collected, distributed and made available for foresters and botanists. This is documented by the order of the government dating from 1893 to procure all information available on bamboos.⁷⁴

Dietrich Brandis published altogether six articles on bamboos, however, long after his return to Europe. Brandis had been working on bamboos during his time as inspector general collecting many specimens of which the Herbarium Brandis bare testimony. Yet, he only started publishing on bamboos in 1887 with an article written in German on the bamboos of Burma.⁷⁵ This was followed by an article, also in German, on the geographical distribution of bamboo in India.⁷⁶ It seems that Brandis intended to make a German readership and in particular a readership with colonial aspirations familiar with bamboo as a tropical grass whose systematic cultivation would be as useful as any timber plantation. Another article published in German actually recommended the combined plantation of bamboo and teak, as it naturally grew in British India and particularly in Burma, for the economic improvement of the German Reich’s colony in East-Africa, teak improving colonial commerce and export trade, bamboo the everyday life of the local population.⁷⁷

⁷¹ J.S. Gamble, “Note on the Small Bamboos of the Genus *Arundinaria*”, *Indian Forester* 14,7 (1888), pp. 307-14.

⁷² Jasper Nichols, “The Flowering of the Thorny Bamboo”, *Indian Forester* 21,3 (1895), pp. 90-5.

⁷³ Upendranath Kanjilal, “The Bhalkua Bans (*Bambusa balcooa*) of Bengal”, *Indian Forester* 17,1 (1891), pp. 53-5.

⁷⁴ H.B. Bryant, “Flowering of the Bamboo”, *Indian Forester* 20,9 (1894), p. 332.

⁷⁵ Dietrich Brandis, “Über die Bambusen von Birma”, *Verhandlungen des Naturhistorischen Vereins der preussischen Rheinlande und Westfalens*, 44 II, 1887, pp. 113-4.

⁷⁶ Dietrich Brandis, “Die geographische Verbreitung der Bambusen in Ostindien”, *Sitzungsberichte der Niederrheinischen Gesellschaft für Natur- und Heilkunde* I, 1897, pp. A 68-76.

⁷⁷ Dietrich Brandis, “Anbau der großen Bambusen in Deutsch-Ostafrika”, *Der Tropenpflanzer* 3 (1899), pp. 438-42.

Until his death Brandis published three more articles on bamboos in the *Indian Forester*, however with a rather scientific–botanical impetus.⁷⁸ Eventually, *Indian Trees* was to contain 26 pages of thorough knowledge on bamboos Brandis had generated during the preceding – and his final – twenty years of botanical research dealing with 14 bamboo genera and 102 species.⁷⁹

4. History and Content of the Brandis Herbarium

Irrespective of its large size, Brandis' collection might have been considered to be only one among many others existing from former British India. Nonetheless, one wonders why Brandis did not give his herbarium to Kew? Here, in one of the leading institutions of the world, it would have been available for study by generations of botanists. However, a substantial set of 1,000 sheets is today preserved in Kew.⁸⁰ Very likely, Brandis deposited duplicates of his collections in Kew while he was working there on his *Indian Trees*. Another option for him would have been giving his private collections to the herbarium of the University of Bonn, his hometown in Germany. He maintained lasting connections with Bonn which is obvious from, for example, many specimens of plants cultivated in the Bonn botanical garden preserved in Brandis' herbarium. The fact that his herbarium eventually was purchased by the Hamburg Botanical Museum is somewhat surprising. In Hamburg it was most welcome mainly as a substantial addition to the still rapidly growing collections of the Herbarium Hamburgense. At the same time, it allows to conclude that his herbarium was simply not known or valued high enough to attract attention from leading institutions in Kew, London, Edinburgh, Paris, Berlin, Munich or even from major herbaria in India.

The private herbarium of Dietrich Brandis was acquired by the Botanical Museum Hamburg in 1908. The purchase was facilitated through extra funds granted by the Hamburg Senate to the botanical state institutes. Brandis' herbarium comprised 19,000 sheets of dried plant specimens, four cabinets of wood samples, three cabinets with plant material preserved in alcohol as well as a few thousand sheets of unmounted herbarium samples, mostly

⁷⁸ Dietrich Brandis, "Notes on Indian Bamboos", *Indian Forester* 25 (1899), pp. 1-25, Dietrich Brandis, "Doubtful Burmese Bamboos", *Indian Forester* 26 (1900), pp. 87-90, Dietrich Brandis, "On some Bamboos in Martaban South of Toungoo between the Salwin and Sitang Rivers", *Indian Forester* 32 (1906), pp. 179-86, 237-44, 289-96.

⁷⁹ Brandis, *Indian Trees*, pp. 9, 14, 593, 653, 661-83.

⁸⁰ J. Lanjouw, J. F. A. Stafleu, *Index Herbariorum*, Part II(1) 1954, Collectors. First installment A–D. Regnum Vegetabile 2, pp. 1–174, *vide* p. 93.

duplicates.⁸¹ The material was found in such a good condition that it was rapidly incorporated into the general herbarium of the Botanical Museum.⁸² When in 1912 the Hamburg botanical state institutes were rearranged into the Institut für Allgemeine Botanik (institute of general botany) and the Institut für Angewandte Botanik (institute of applied botany), the herbarium became part of the former, whereas the herbarium's wood collections – including Brandis' wood samples – were given to the collections of the Botanical Museum as part of the latter. Later on, the entire wood collections of the Botanical Museum were moved to Lohbrügge (Hamburg) and are today housed in the collections of the Institut für Holzwissenschaften (institute of wood sciences) of the University of Hamburg.

Due to the large number of sheets, the comprehensive taxonomic scope and the very large geographic area covered the Brandis herbarium was welcomed as a major acquisition for widening and completing the already existing collections from southern Asia and the tropics in general.⁸³ Unfortunately, there seems to be no list or index or any others detailed written documentation on the specific content of the Brandis herbarium. Perhaps because of the sheer number of skilfully mounted herbarium sheets and possibly also because of lack of sufficient funding and man power at the Hamburg Botanical Museum no such list has been prepared by the herbarium staff, as normally has been done for smaller acquisitions. Once the sheets of the Brandis collection had been fully incorporated into the Herbarium Hamburgense general collection it became impossible to produce such a list retrospectively. As there is no index to Brandis' herbarium, statements about the specific content are difficult to make.

Those Brandis herbarium specimens that could be identified to species level, became part of the general collection and are currently filed under their corresponding names. Therefore, access to his collection in the Hamburg Herbarium is currently possible only via searching for his specimens under a plant species name. This is a daunting task in a large institutional herbarium like the Herbarium Hamburgense (HBG) that currently preserves 1.8 million specimens, approximately one million being flowering plants classified into c. 120,000 species. Brandis also did not employ a fully consistent numbering system for his collections (which would have been desirable given the large size of his herbarium). Whereas his early

⁸¹ Zacharias, E. Botanische Staatsinstitute. (Botanischer Garten, Botanisches Museum und Laboratorium für Warenkunde, Abteilungen für Samenkontrolle und Pflanzenschutz.) Bericht für das Jahr 1908. *Jahrbuch der Hamburgischen Wissenschaftlichen Anstalten. XXVI. Jahrgang. 1908*, (1909), pp. 387-410, esp. p. 396.

⁸² Zacharias, E. Botanische Staatsinstitute. (Botanischer Garten, Botanisches Museum und Laboratorium für Warenkunde, Abteilungen für Samenkontrolle und Pflanzenschutz.) Bericht für das Jahr 1910. *Jahrbuch der Hamburgischen Wissenschaftlichen Anstalten. XXVIII. Jahrgang. 1910*, (1911), pp. 225-50, esp. p. 232.

⁸³ Zacharias, Botanische Staatsinstitute, Bericht für das Jahr 1908, p. 396.

gatherings from Myanmar 1858-1862 usually have a collection number, such numbers are sometimes missing in his later collections from India.

On the other hand, he did provide numbers to special parts of his collection such as the bamboos that he was intensively working on. In the absence of a written (or electronic) collection index it is at present impossible to provide exact figures for the overall number of plant species collected by Brandis, the number of genera, plant families etc. The species number, however, may range from 5,000-10,000. The vast majority are vascular plants: phanerogams (flowering plants) and pteridophytes (ferns). Cryptogamic plants (mosses, algae, lichens, fungi) are rather rare. Zacharias mentions that Brandis' herbarium contained a somewhat incomplete set of marine algae (R.F. Hohenacker: "Algae marinae exsiccatae").⁸⁴ There is only a small number of Brandis specimens in the Herbarium Hamburgense lichens, bryophyte (mosses) and fungal collections.

Recent efforts towards digitising the most valuable parts of the Herbarium Hamburgense, i.e. the type specimens, revealed so far only limited information on the overall content of the Brandis herbarium and the species therein. As already mentioned, there is no species list and there is virtually no published information containing more detailed information on the content. Therefore, the data provided here are new, but should be considered very preliminary. Data have been compiled from two sources: 1) an electronic register of that part of the Brandis collection that is still kept separately and that perhaps includes the unmounted material mentioned by Zacharias,⁸⁵ and 2) those herbarium sheets from the Brandis collections that have been recently digitised and identified to represent valuable type material or otherwise historically and taxonomically important specimens (e.g. rarely collected plants, expert annotated material, samples collected at the type locality etc.).

The first source comprises 2013 sheets covering c. 150 families of flowering plants and ferns, representing c. 600 genera, and c. 1100 species, sometimes in duplicates. Approximately 500 sheets remain not yet identified to species, genus or even family level. This material, not yet incorporated into the HBG main collection, roughly represents 10 per cent of the total Brandis collection at HBG. The separate material is certainly not a representative sample of the whole collection though. Reasons for the still pending incorporation of the separate collections were or still are: specimens identified but not yet mounted, identified but separation of duplicate material for exchange with other herbaria still required, material so far only identified to family or genus level, material state insufficient for proper identification, last but not least

⁸⁴ *Ibid.*, p. 397.

⁸⁵ *Ibid.*, p. 396.

lack of man power to further proceed with treatment. On the other hand, because that material is still kept separately it is easily accessible for analyses and may become one of the first targets for the planned initiative to uncover and register the Brandis collections at HBG.

The second source of information on the Brandis herbarium are specimen data entered into the HBG database with emphasis on valuable type and otherwise historically important material. There are currently 350 datasets of fully digitised sheets from the Brandis herbarium. This material represents 241 species of flowering plants belonging to 164 genera and 69 families respectively, plus some not yet fully identified samples likely representing type material.⁸⁶ The most important plant families are Gramineae (including the bamboos), Leguminosae, Rubiaceae, Dipterocarpaceae and Orchidaceae. The high number of types of bamboos and dipterocarp trees is not surprising since Brandis conducted intensive fieldwork and research in both plant groups.⁸⁷ Brandis himself collected 106 of the databased specimens, the rest was collected by other botanists including R.H. Beddome, W. Griffith, J.D. Hooker & T. Thomson, S.H. Koorders, J.W. Oliver, R. Pantling, G.H.K. Thwaites, N. Wallich, G. Watt, R. Wight to name only some. Because the digitisation efforts at the Herbarium Hamburgense still focus on type material, specimens collected by Brandis are certainly underrepresented in this dataset. Also, screening for type material is still incomplete for many plant families. Yet, the current number of 63 identified type specimens collected by him already provides impressive evidence of his scientific work in the field of plant taxonomy. Thus, an exhaustive search for all types preserved in the Brandis herbarium, either collected by him or by others, is one of the main goals for future work on his collections. An effective search strategy is currently developed at the Herbarium Hamburgense.

Based on the available, but still very preliminary and much biased figures it is estimated that the Brandis herbarium contains about 21,000 specimens. Brandis collected approximately two thirds (14,000 specimens), while the remaining one third (7,000 specimens) was collected by others. So far, more than 50 collectors have been documented. Among these are many well-known plant collectors and botanists who worked and travelled in former British India (see above). The number of species represented in the Brandis herbarium is estimated to 5,000-10,000. The number of valuable type specimens may range from 500 to 1000.

The geographic origin of the Brandis collections largely coincides with his own travelling activities throughout British India. Indeed Brandis travelled a lot in India as this was part of his duties for the colonial service. The prefaces of his *Forest Flora* and *Indian Trees* provide

⁸⁶ www.herbariumhamburgense.de (accessed 15 Oct 2018)

⁸⁷ Hesmer, *Leben und Werk*, pp. 290-4.

impressive information about these travels and thus the origin of his collections. A summary of the travels undertaken by Brandis is provided by Hesmer. Although only a very small number of his sheets has been fully digitised so far (see above), the wide geographic scope of his collections becomes already evident.⁸⁸ However, Brandis continued to incorporate dried plant material into his herbarium even after he had finally left for Europe in 1883. There are, for example, specimens collected in the Swiss Alps, many specimens cultivated in the Botanical Garden Bonn, but also samples collected by H.H. Haines 1900 in Duars, West Bengal or specimens of bamboos collected 1905 and preserved in the herbarium of the Dehra Dun Forest School. Brandis continued to maintain and expand his herbarium even in the very last years of his life.

Brandis regularly indicated the vernacular (common) names of a given plant species on his herbarium labels. Examples are *Milettia brandisiana* Kurz, vern. Thitpagan and *Dalbergia kurzii* Prain, vern. Thitponk, both woody species of the Leguminosae, the bean family. The vernacular names are usually written in Latin characters and seldom in indigenous dialects. Deciphering such names is certainly an interesting task linked to the field of ethnobotany. The indication of common names on the labels of herbarium sheets is certainly desirable and a useful information at least in the local region where the common name of a given plant is used.⁸⁹ Brandis indicated very consistently the vernacular plant names he most certainly was provided with by local informants on his herbarium sheets, and Hesmer reports that he requested and received lists of vernacular names of woody plant species when he worked on his *Indian Trees*.⁹⁰

However, Brandis' interest for common names was perhaps also linked to his duties in the training of forest servants. The latter would need to use both scientific and common names at least to a certain degree for communication with scientists, authorities, landowners, local people and other stakeholders. While the scientific names of plants mainly serve for a stable and unequivocal communication among scientists in the fields of plant taxonomy and ecology worldwide, vernacular names constitute an important linkage between scientific investigations, administrative regulations, trade and the regional knowledge of the local

⁸⁸ Specimens have been digitised that originate from Myanmar ("Burma", Mar 1858-Apr 1862, "Pegu" Dec 1875, "Burmah" Feb-Mar 1880), Indian regions and provinces Kerala ("Malabar" 1868), Madhya Pradesh (Pachmarhi Apr 1868, Apr 1877), Maharashtra ("Sattara" Apr 1870), Himachal Pradesh ("Narkunda" 1874, 1877, Kullu Oct 1876, "Simla" Oct 1880), Assam (Ambari Nov 1874, Makum Pant Apr 1879, Maldang Jun 1881), Mherwara (Dec 1878), Golaghat (Mar 1879), Darjeeling (Kurseong Apr 1879), Uttar Pradesh ("Oudh" Feb 1881), Sikkim (Apr 1881), "Mahellankoor" (Oct 1881), Madras (Feb-Dec 1882).

⁸⁹ D. Bridson, D., L. Forman, *The Herbarium Handbook*. 3rd ed., Royal Botanic Gardens, Kew, 2013, pp. 2, 47.

⁹⁰ Hesmer, *Leben und Werk*, pp. 313-14.

people on the traditional or modern usage of plants as food, medicinal or ritual herbs, resins, oils, timber, fibres etc., and their communication. Vernacular names are therefore often provided in comprehensive floras – Brandis' *Indian Trees* is just one example.

Brandis was a trained botanist who studied under early botanical authorities and pioneers in plant geography. In addition, he was also familiar with the principles and techniques of plant taxonomy and its major tool, the herbarium. A herbarium serves not only as a taxonomic reference collection. It is an archive accumulating taxonomic as well as environmental information, which can be analysed under various aspects. This is also the case with the Brandis herbarium. Brandis build up a very large reference collection containing not only his own gatherings, but also many duplicates of friends, colleagues and botanical experts to make his herbarium as complete as possible. Evidence for his intense work with the herbarium are numerous pencil or ink written descriptions of leaf, floral or fruit structures, references and synonyms.

Sometimes there are even hand coloured illustrations of floral or anatomical details usually made directly on the herbarium sheet. Occasionally, there are letters attached to herbarium sheets with expert opinions on critical plant specimens provided by colleagues such as J.S. Gamble. Brandis' collection of bamboos contains not only the rarely formed inflorescences, but also series of juvenile plants preserved at different stages of development in order to document the growth steps from the germination of the seeds to the younger plants. Of course, Brandis would make use of other herbaria. For example, he visited the herbarium of the Royal Botanic Gardens Kew and the Natural History Museum London during his first leave from India to Europe when he worked on his *Forest Flora* and later when he worked on *Indian Trees* after his retirement and final return to Europe.⁹¹

5. The Fate and Current Recognition of the Brandis Herbarium

The purchase of the Brandis herbarium by the Hamburg Botanical Museum in 1908 was timely communicated by Zacharias,⁹² but probably not widely recognised despite the fact that the *Jahrbuch der Hamburgischen Wissenschaftlichen Anstalten* was a long-lived series combining reports of the various scientific Hamburg State institutes and original research papers published in numerous supplement volumes. Therefore, the missing or incomplete information in some prime resources on the holdings of the herbaria of the world seems strange. For example, Lanjouw and Stafleu report that Brandis collected 1872-1906 in India

⁹¹ *Ibid.*, pp. 293, 313.

⁹² Zacharias, *Botanische Staatsinstitute*, Bericht für das Jahr 1908, p. 396.

and Burma omitting his early Burmese collections (1858-1862) and disregarding that he had ultimately left for Europe in 1883. The specimens are said to be deposited in several places such as the herbaria of the Arnold Arboretum of the Harvard University in Cambridge, Massachusetts, the University of Bonn, Germany, the Botanical Survey of India in Howrah, the Forest Research Institute in Dehra Dun, the Royal Botanic Gardens in Kew, and the Royal Botanic Gardens Victoria in Melbourne – but not in the Herbarium Hamburgense (HBG).⁹³ Stafleu and Cowan provide updated data listing correctly HBG as the place of the Brandis herbarium with additional material deposited in Cambridge, Bonn and Kew.⁹⁴ Yet there is no information on the number of specimens, taxonomic scope etc. as is normally provided (if available). An update to this information appeared in Stafleu and Mennega, but still without data on the size of the herbarium and particularly relevant parts of the collection.⁹⁵ Obviously, Brandis' work as a plant taxonomist and his herbarium fell into oblivion, at least in comparison with his widely acknowledged achievements in forest administration. Interestingly, Hesmer states in the preface of his Brandis biography that Brandis' botanical achievements alone are a life's work. This conclusion is certain true. Although Hesmer provides a detailed summary of Brandis numerous scientific papers on various plant groups, there is only a very short chapter on Brandis botanical collecting activities and his herbarium, and the last part of that chapter mainly deals with S. Kurz with whom Brandis collaborated on the flora of Myanmar.⁹⁶

Epilogue

Brandis' herbarium should be considered an integral part of his botanical work and legacy. In the absence of an adequate index or registry and comprehensive analysis of the Brandis botanical collections, the still very poor knowledge on and minimal use of its materials in recent time is regrettable and certainly not justified, but not surprising. As a consequence there are very few examples of how Brandis' collections have been used. One is Deutschmann who published results of wood anatomical studies of various dipterocarp trees.⁹⁷ For his investigations he took wood samples from herbarium material collected by Brandis and

⁹³ Lanjouw and Stafleu, *Index Herbariorum*, Part II(1), p. 93.

⁹⁴ Stafleu, F.A. & Cowan, R.S., *Taxonomic Literature. A selective guide to botanical publications and collections with dates, commentaries and types*. Volume I: A–G. 2nd ed. Utrecht: Bohn, Scheltema & Holkema, 1976, p. 304.

⁹⁵ Stafleu, F.A. & Mennega, E.A., *Taxonomic Literature. A selective guide to botanical publications and collections with dates, commentaries and types*. Supplement III: Br–Ca. Königstein: Koeltz, 1995, pp. 13-14.

⁹⁶ Hesmer, *Leben und Werk*, pp. 290-298, 257-261.

⁹⁷ F Deutschmann, F., Anatomische Untersuchungen über die Harzgänge einiger Dipterocarpaceae. *Berichte der Deutschen Botanischen Gesellschaft* 67 (1954), pp. 381–4.

others. Such destructive sampling is granted only if restricted to an absolute minimum and if accurately indicated on the herbarium sheets.

There have been very few requests addressed to the Herbarium Hamburgense regarding the Brandis herbarium. For example, a request for type material of *Bauhinia monandra* Kurz has been received. The type sheet was located at its appropriate place in the HBG collection. It has been databased and a high resolution scan was provided. A corresponding paper with a clarification of the taxonomy of the species has already been published.⁹⁸ This is an example of routine herbarium requests and how digitisation efforts can expedite taxonomic research. Meanwhile, the high resolution scan and metadata have been made publicly available online through the HBG database, the type specimen database JStor Global Plants (plants.jstor.org) as well as the global biodiversity data portal GBIG (www.gbif.org). The uncovering of the botanical treasures preserved among Brandis' plants will doubtlessly benefit from future digitization efforts. Finally, selected specimens from the Brandis herbarium have been displayed publicly as part of an exhibition placed in the side programme of the bi-annual meeting of the German Historical Society held 2016 in Hamburg and featuring India as its "guest land".

To conclude, Brandis lasting achievements in tropical forest botany and legislation are well studied and have been acknowledged widely. His similarly important contributions as a taxonomic botanist appear less known, but would have been impossible without his herbarium. The large herbarium of Sir Dietrich Brandis today preserved in the Herbarium Hamburgense provides both, an example of a skilfully built and maintained resource and tool for the study of tropical plant taxonomy, and a most valuable source of information on the occurrence, distribution, ecology – or simply the plant diversity of India and Myanmar. It is hoped that intensified taxonomic studies, digitisation and public outreach activities will help to increase the visibility, awareness and recognition of one of the most valuable botanical collections from the Indian subcontinent, and place Brandis in the first line of nineteenth century botanists in India.

⁹⁸ S Bandyopadhyay, S., Lectotypification of *Bauhinia monandra* (Fabaceae: Caesalpinioideae). *Phytotaxa* 261 (2016), pp. 295–7.