

Fire, Forest, City: A Social Ecology of Fire in British India¹

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ABSTRACT

Of all the elements, fire has been the most neglected in the environmental history of South Asia. This article traces a trajectory of fire and fire-use in British India from the 1840s to the 1930s and from the forest to the city. It considers the destructive role attributed to fire in the forest by colonial foresters but also the ways in which fire became integral to the management and exploitation of state forests. Rather than focussing on ‘big timber’, the discussion then turns to the consumption of firewood as a leading energy source and the extensive trade that brought firewood to the city. Urban lighting, city fires and new energy sources like kerosene are assessed as aspects of a changing urban fire environment. The article concludes with Hindu cremation pyres as an illustration of the economics and culture of Indian fire-use and changing patterns of fire consumption.

KEYWORDS

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India, social ecology, fire, forests, firewood, kerosene, cremation

If we were to regard environmental history as a tale told through the classical elements of earth, air, fire and water, then we could argue for South Asia that some elements in this nature narrative have received more favoured treatment than others. Water has dominated discussion of the South Asian environment. Pre-eminent in accounts of agriculture and irrigation, of floods, droughts and famines, water is viewed as a life-sustaining, if politically and economically contested, resource. A home for animal and aquatic life, it is also in human terms a medium for water-borne diseases like cholera or a host for the malaria-carrying mosquitoes. Hydrology, and belief in water's destructive, civilizing, developmental and pathogenic agency, has been at the heart of innumerable environmental histories of colonial and postcolonial South Asia.² Similarly, one could argue that the earth and all that it sustains has been a vital ingredient in regional historiography—in relation to land rights and usages, revenue systems and cultivation practices, in narratives of forestry, pastoralism and animal

² E.g., Elizabeth Whitcombe, 'The environmental costs of irrigation in British India: Waterlogging, salinity and malaria', in David Arnold and Ramachandra Guha (eds), *Nature, Culture, Imperialism: Essays on the Environmental History of South Asia* (New Delhi: Oxford University Press, 1995), 237-59; David Mosse, *The Rule of Water: Statecraft, Ecology and Collective Action in South India* (New Delhi: Oxford University Press, 2003); Rohan D'Souza, 'Water in British India: The making of a "colonial hydrology"', *History Compass* 4 (2006): 621-8; David Gilmartin, *Blood and Water: The Indus River Basin in Modern History* (Berkeley: University of California Press, 2015); Kathleen D. Morrison, 'Archaeologies of flow: Water and the landscapes of southern India past, present, and future', *Journal of Field Archaeology* 40 (2015): 560-80.

life, and in histories of mineral extraction and soil erosion.³ Air, too, has assumed historical prominence through a growing literature on meteorology and climate change, on hill-station sanatoria and the imperilling tropics, on miasmas, airborne disease and atmospheric pollution.⁴ Indeed, one could go so far as to argue that histories of colonial and postcolonial South Asia, especially those centring on health, disease and environmental dystopia, have remained remarkably loyal to the neo-Hippocratic agenda—attentive to airs, waters and places—but, like James Ranald Martin’s pioneering medical topography of Calcutta (Kolkata), having relatively little to say about fire.⁵

Historians of colonial South Asia have not neglected fire entirely, particularly (as will be seen below) with respect to forest management; but they have created an environmental

³ E.g., David E. Ludden, *An Agrarian History of South Asia* (Cambridge: Cambridge University Press, 1985); Richard H. Grove, Vinita Damodaran and Satpal Sangwan (eds), *Nature and the Orient: The Environmental History of South and Southeast Asia* (Delhi: Oxford University Press, 1998); Gunnel Cederlöf, *Landscapes and the Law: Environmental Politics, Regional Histories, and Contests over Nature* (Ranikhet: Permanent Black, 2008).

⁴ E.g., Dane Kennedy, *The Magic Mountains: Hill Stations and the British Raj* (Berkeley: University of California Press, 1996); Mark Harrison, *Climates and Constitutions: Health, Race, Environment and British Imperialism in India, 1600-1850* (New Delhi: Oxford University Press, 1999); David Arnold, *The Tropics and the Traveling Gaze: India, Landscape, and Science, 1800-1856* (Seattle: University of Washington Press, 2006).

For an interesting discussion of water, land and their intersection, see Debjani Bhattacharyya, *Empire and Ecology in the Bengal Delta: The Making of Calcutta* (Cambridge: Cambridge University Press, 2018).

⁵ James Ranald Martin, *Notes on the Medical Topography of Calcutta* (Calcutta: G. H. Huttman, 1837).

history in which fire has been assigned too restricted a socio-ecological role. This lacuna is arguably less apparent for other regions, like Australia and North America, where fire has occupied a far more prominent place in both natural ecologies and anthropogenic environments.⁶ Following the work of Stephen Pyne, this article is intended as a contribution to the social ecology of fire—that is, nature understood as historically constructed and culturally situated.⁷ The aim is to bring fire in from the ‘fringe’ and to situate it more centrally and connectedly in the environmental history of modern India.⁸ The article focuses on the period from the 1840s to the 1930s because this was an age in which, under colonialism, fire assumed a particularly momentous environmental, social, political and

⁶ Consider the limited space given to fire in India compared to Australia or North America in Stephen J. Pyne, *Vestal Fire: An Environmental History, Told Through Fire, of Europe and Europe’s Encounter with the World* (Seattle: University of Washington Press, 1997), and William Beinart and Lottie Hughes, *Environment and Empire* (Oxford: Oxford University Press, 2007); but as a partial corrective to the first of these, see Stephen J. Pyne, ‘Nataraja: India’s cycle of fire’, *Environmental History Review* 18 (1994): 1-20. For two wide-ranging review essays that pay little heed to fire, see Mahesh Rangarajan, ‘Environmental histories of South Asia: A review essay’, *Environment and History* 2 (1996): 129-43; James Beattie, ‘Recent themes in the environmental history of the British Empire’, *History Compass* 10 (2012): 129-39.

⁷ On the social ecology of fire, see Michael Lewis, ‘And all was light? Science and environmental history’, in Andrew G. Isenberg (ed.), *The Oxford Handbook of Environmental History* (Oxford: Oxford University Press, 2014), 209-10.

⁸ Stephen J. Pyne, ‘Afterword: Fire on the fringe’, in Greg Bankoff, Uwe Lübken and Jordan Sand (eds), *Flammable Cities: Urban Conflagration and the Making of the Modern World* (Madison: University of Wisconsin Press, 2012), 389-96.

economic role and became integral to new forms of rural control and urban governance. The article further seeks to present through fire a mobile environmental history—one that, rather than being fixed in a single location, travels from countryside to city, from forest fires to urban conflagrations, from fire in cultivation to fire in domestic hearths and urban cremation pyres—and in so doing changes not its essence so much as its technical agency and cultural presence. I hope thereby to raise questions about the kind of border-crossing environmental history we might wish to pursue and the kinds of connections—across time, space and culture—we might develop further.

Fire in the Forest

Fire has had a long history as an instrument of anthropogenic environmental modification in South Asia, traceable in myth back to Vedic times (from c. 1,500 BCE) and the burning of the Khandava forest the Hindu epic the *Mahabharata*, but also evident in the archaeological record through an extended history of fire use to clear or adapt to human use forests and savanna.⁹ The trope of the burning forest is one in which fire has most commonly entered the environmental history of South Asia, as of many other extra-European societies.¹⁰ Forest

⁹ Madhav Gadgil and Ramachandra Guha, *This Fissured Land: An Ecological History of India* (Delhi: Oxford University Press, 1992), 79; Pyne, 'Nataraja', 4-6. For the long-term context of India's fire history, see Kathleen D. Morrison, 'Conceiving ecology and stopping the clock: Narratives of balance, loss, and degradation', in Mahesh Rangarajan and K. Sivaramakrishnan (eds), *Shifting Ground: People, animals, and mobility in India's environmental history* (New Delhi: Oxford University Press, 2014), 39-64.

¹⁰ Stephen J. Pyne, 'Frontiers of fire', in Tom Griffiths and Libby Robin (eds), *Ecology and Empire: Environmental History of Settler Societies* (Edinburgh: Keele University Press, 1997), 19-34.

fires, accidental or, more especially, due to deliberate human action, figured centrally in colonial thinking about the Indian forest, and were seen as one of the main dangers, if not the principal danger, to forest conservation. Certain tree species, including those most commercially prized like sandalwood, teak, *sal* (*Shorea robusta*) and Himalayan *chir* pine (*Pinus roxburghii*), were regarded by colonial forest officers as being exceptionally vulnerable to destruction or permanent damage by fire. Given that fires arising from natural causes (such as lightning strikes) were relatively rare, the blame for most fires fell on human populations living in, or on the outskirts of, the forests. Although patches of forest were sometimes torched to facilitate the hunting of game or drive off predatory animals, the main perpetrators were thought to belong to one of two groups. Either they were the practitioners of swidden or shifting cultivation, who axed and burned the tree cover to clear the ground and fertilize the soil for a few seasons' harvest before moving on elsewhere;¹¹ or they were graziers from the forest margins, who each dry season set fire to the old grass in order to encourage fresh growth for their animals after the rains.

The establishment of the Indian Forest Service in 1864 marked an intensification of this colonial hostility to forest fires. At a forest conference convened at Simla (Shimla) in

¹¹ On swidden, see Jacques Pouchepadass, 'British attitudes towards shifting cultivation in colonial South India: A case study of South Canara District, 1800-1920', in Arnold and Guha, *Nature*, 123-51; Archana Prasad, 'The political ecology of swidden cultivation: The survival strategies of the Baigas in the Central Provinces, India, 1860-1890', in Mahesh Rangarajan and K. Sivaramakrishnan (eds), *India's Environmental History: Volume 2: Colonialism, Modernity, and the Nation* (Ranikhet: Permanent Black, 2012), 246-77. For a more favourable view of swidden cultivation and its environmental impact, see Robert A. Voeks, *The Ethnobotany of Eden: Rethinking the Jungle Medicine Narrative* (Chicago: University of Chicago Press, 2018), 38-45.

1875, Dietrich Brandis, India's first inspector-general of forests, put fire control at the top of the agenda and stressed the urgent need to address the issue. 'Fire conservancy', he observed, was 'the most important task of the Forest Department in most provinces of the [Indian] empire'. For 'the improvement of these forests there is no measure which equals fire conservancy in importance', he stressed, adding that it was essential 'to keep out fires from our [sic] forests'.¹² Fire was the foe, alleged causing the loss of valuable timber (and hence of revenue to the state) but also the destruction of ground cover, opening the way to soil erosion, flash floods and desiccation. Unless checked, fires reduced stands of teak, sal and *sissoo* (*Dalbergia sisso*) to barren wastes and unproductive savannah.¹³ To read an early colonial forest narrative, like James Forsyth's account of the Central Provinces in the 1860s, is to enter a world in which fire is abhorred as out of place in the forest, a wanton force unleashed by reckless and 'primitive' cultivators, inimical alike to the natural ecology of the forest and to India's material progress. A single swidden clearing might, in Forsyth's view, ruin three or four acres of 'valuable teak forest', reducing it to 'a heap of ashes, strewn with the charred remains of the large limbs and trunks'. Once the 'virgin forest' had been felled and burnt, it would never fully recover, resulting only in tangled thorn scrub 'impenetrable to man or

¹² D. Brandis and A. Smythies (eds), *Report of the Proceedings of the Forest Conference Held at Simla, October 1875* (Calcutta: Office of the Superintendent of Government Printing, 1876), 4, 12.

¹³ See *ibid.*; B. Ribbentrop, *Forestry in British India* (Calcutta: Office of the Superintendent of Government Printing, India, 1900), 148-60; and, for an overview, Gregory Barton, *Empire Forestry and the Origins of Environmentalism* (Cambridge: Cambridge University Press, 2002), 82-9.

beast'. And so, 'for untold ages', the 'wild tribes' of Central India had been 'devastating the forests', leaving irreversible ruin in their wake.¹⁴

Fire and the means to control it thus became integral to forest policy and the colonial management of Indian woodlands. British measures took a variety of forms—from fining those suspected of lighting fires to outlawing shifting cultivation entirely. Firebreaks, 200 to 300 feet, but as much as 900 feet, in width were laboriously cut through the forests and repeatedly cleared. By 1893, more than 27,000 square miles of state forest were officially protected against fire, and it has been suggested that fire-lines were among the innovative contributions India made to international forestry.¹⁵ There were, however, those who doubted the effectiveness of such measures: despite the prohibitions and fines, grass-burning continued, causing one forestry officer to remark despairingly that fire-protection 'does not meet with any fair measure of success'.¹⁶ The policy was, nonetheless, persisted with.

As British foresters sought to ban swidden cultivation and annual grass-burning, or at least to confine these activities to a few licensed locations, they encountered sustained

¹⁴ [J.] Forsyth, *The Highlands of Central India: Notes on Their Forests and Wild Tribes, Natural History, and Sports* (London: Chapman & Hall, 1871), 96, 98-9. This view of India's 'virgin' forests is now strongly contested: see Kathleen D. Morrison and Mark T. Lycett, 'Constructing nature: Socio-natural histories of an Indian forest', in Susanna B. Hecht, Kathleen D. Morrison and Christine Padoch (eds), *The Social Lives of Forests; Past, Present, and Future of Woodland Resurgence* (Chicago: University of Chicago Press, 2014), 148-60.

¹⁵ Gregory Allen Barton, *Empire Forestry and the Origins of Environmentalism* (Cambridge: Cambridge University Press, 2002), 87; 'Review of forest administration in British India for 1892-93', *Indian Forester* 21 (1894): 25.

¹⁶ 'Forest administration in the northern and central circles of Bombay during 1897-98', *Indian Forester* 25 (1899): 337.

hostility from local communities accustomed to regard forests as their own, largely unrestricted and untaxed, territory.¹⁷ Fees levied on the collection of wood for domestic fuel and other purposes from state forests were keenly resented and occasioned numerous protests. Villagers in Godavari district in the Madras Presidency in 1913, for example, complained that, due to taxation, they could only with difficulty obtain the wood they needed to cremate their dead—a conjunction of wood and fire we will return to later.¹⁸ Aside from complaints and petitions, local protests might erupt into incendiarism. In some years, dozens of dry-season forest fires were started, straining the energies and resources of forest guards and firewatchers.¹⁹ In 1893 the ‘fire season’ was said to be ‘the most trying and anxious time for the majority of forest officers in India’.²⁰ Between 1910 and the early 1930s forest fires were especially numerous and widespread, many apparently lit in angry defiance of official restrictions, and from the early 1920s they coalesced with anti-colonial civil disobedience campaigns. Incendiarism was particularly rife in the Himalayan foothills, the United Provinces and central India, but almost no part of the government’s forest estate was immune. In 1921, at the height of the Gandhian non-cooperation movement, 317 fires were

¹⁷ For the licensing of swidden cultivation in Burma’s teak forests, see Government of India, *A Concise Manual of Sylviculture for the Use of Forestry Students in India* (Calcutta: Office of the Superintendent, Government Printing, India, 1906), 50-2.

¹⁸ *Selections from the Proceedings of the Godavari District Association, 1912-1913* (Cocanada: Godavari District Association, 1914), 93.

¹⁹ As in Coorg in south India in March 1891 when 23 fires ravaged 12,000 acres of government forest: ‘Annual forest administration reports of the N.-W.-Provinces and Oudh, and Coorg for 1890-91’, *Indian Forester* 18 (1892): 318.

²⁰ ‘Review of forest administration in British India for 1892-93’, *Indian Forester* 21 (1894): 25.

burning in the chir forests of Kumaon, threatening 320 square miles of prime timber. In a further phase of nationalist unrest in 1931 more than 52,000 acres in the same region were ‘wantonly’ set ablaze.²¹

However, even while many forestry officers continued to regard fire as inherently destructive, some came to believe either that they were impossible to suppress entirely or had positive benefits for some tree species. There was an extended debate in the pages of the *Indian Forester* in the years leading up to First World War One as to whether forest fires were as preventable as Brandis and an earlier generation of forest officers had assumed and whether it was worth the cost and labour of trying to prevent them. It was also questioned whether fire was as inimical to many trees as had previously been claimed. As forest ecology, botany and entomology grew more nuanced and sophisticated, it became evident that forest fires might helpfully destroy insect pests, eliminate rank undergrowth and help fertilize forest soils. Experimentation showed some species to be relatively fire-tolerant (like the thick-barked chir pine or the regenerative shoots of sal) and might actually profit from periodic exposure to fire, while others (such as teak and sandalwood) were confirmed as particularly vulnerable.²² By the 1890s, at a time when talk of tropicality was at its height, this debate was

²¹ F. C. Ford Robertson, *Our Forests* (Allahabad: Superintendent, Printing and Stationery, United Provinces, 1936), 30-31. For these episodes, see Ramachandra Guha, *The Unquiet Woods: Ecological Change and Peasant Resistance in the Himalaya* (Delhi: Oxford University Press, 1989), 51-5, 107-9; David Baker, “‘A serious time’: Forest satyagraha in Madhya Pradesh, 1930”, *Indian Economic and Social History Review* 21 (1984): 71-90.

²² ‘E. A. S.’, ‘Fire-protection in the tropics’, *Indian Forester* 39 (1913): 24-6; C. E. C. Fischer, ‘The need for fire-protection in the tropics’, *ibid.*, 225-32; C. E. C. Fischer, ‘Damage to teak by fire’, *ibid.*, 434-5; H. C. Walker, ‘Fire-protection in the tropics’, *ibid.*, 532-40; H. M. Glover, ‘Departmental firing in chir forests in the Rawalpindi Division, Punjab’, *ibid.*,

further framed in terms of fire-protection *in the tropics*, thereby spatially and environmentally distancing Indian forests and their inevitable dry-season fires from the climatic and ecological conditions of the temperate world from which most authoritative ideas of scientific forestry derived. Fire might, after all, have a legitimate place in India's forest ecology, one that did not simply equate with the perceived danger of fire to European woodlands.²³

There was also growing, if reluctant, recognition among forest officers that India's vast forest estate could not be dedicated exclusively to the production of 'big timber' and the revenues it generated. As a matter of practical, as well as political, necessity forests had to remain open for use by local communities, in accordance with their perennial need for grazing and fodder for their animals and for small timber to make implements, for housebuilding and as fuel.²⁴ Moreover, while fire continued to be denied a legitimate place in the forest in some respects, it was accorded a remarkable degree of recognition in others.

568-71. On this compromise, see Pyne, 'Nataraja', 9-15; K. Sivaramakrishnan, *Modern Forests: Statemaking and Environmental Change in Colonial Eastern India* (Stanford: Stanford University Press, 1999), ch. 7.

²³ The exceptional vulnerability of Indian forests to fire was highlighted by the additions made to Richard Hess's textbook *Der Forstschutz* (1895) when translated and republished as W. R. Fisher (ed.), *Dr Schlich's Manual of Forestry, Volume IV: Forest Protection* (2nd ed., London: Bradbury, Agnew, 1907), 639-48.

²⁴ As in Assam: Arupjyoti Saikia, 'Making room inside forests: Grazing and agrarian conflicts in Colonial Assam', in Rangarajan and Sivaramakrishnan, *Shifting Ground*, 155-79. The importance of forests as a source of firewood for public consumption was generally recognized by the interwar period: E. A. Smythies, *India's Forest Wealth* (2nd ed., London: Oxford University Press, 1925), 10-11.

Even while fire, as used by the grazier and the shifting cultivator, was being condemned, it was also being celebrated by being repeatedly written into the colonial biography of Indian trees—through the resistance of individual species to fire and the calorific value of their wood, through their suitability for use as firewood and as fuel for iron-smelting and charcoal-making, and even as supplying the raw material for torches and incense.²⁵ Like the medical botany of the period, with which it intersected, this colonial categorization of the fire-generative forest, embodied in forest manuals and silvicultural textbooks, drew both on colonial scientific expertise and on an indigenous knowledge rich in vernacular names, cultural associations and practical usages. And if, as modern archaeology and forest science indicates, human activity had helped, over millennia, to shape the very nature of India's forests, not least by the application of fire, then the gulf between what Forsyth imagined to be 'virgin forest', rarely axed and seldom torched, and the human-built environment of India's cities begins to narrow. Fire helped fashion the forest as it did the city.

As Forsyth's romantic depictions of the woodland scenery of central India further attest, for the colonial observer forests were a rich sensory, as well as economic and ecological, domain. Alongside the negative images of charred forests and smouldering tree-stumps, there reigned a very different fire aesthetic. Fire destroyed but it also, to the human eye, produced visual spectacles. Although the incendiary firing of the forest was condemned, forest fires attracted far more favourable attention when they lit up the night sky or crowned the surrounding hills with a fiery glow.²⁶ Sir Richard Temple, (who, as chief commissioner of

²⁵ E.g., J. S. Gamble, *A Manual of Indian Timbers* (Calcutta: Superintendent of Government Printing, 1881), 38, 48, 154, 230, 345, 382, 397, 410.

²⁶ Forsyth, *Highlands*, 208; Mrs Colin Mackenzie, *Life in the Mission, the Camp, and the Zenana, or Six Years in India* (2 vols, London: Richard Bentley, 1854), 2: 119. See also Pyne, 'Nataraja', 6-7.

the Central Provinces in the 1860s, had been a keen advocate of forest conservation), was one of many western observers who ranked forest fires among India's finest sights. In a lecture in London in 1881 he called these fires were among 'the most magnificent spectacles you can possibly figure to yourselves.'

The way in which the devouring element rushes over the country, travelling sometimes at the rate of several miles an hour—the wild animals fleeing before it in terror, the native inhabitants of the forests sometimes even being caught in the flames and burned to death, poor men, and occasionally even mounted Europeans having to gallop away to escape from the vast rushing conflagration—all these things constitute a wonderful sight ... the burning trunks of the trees form as it were pillars of fire, the clumps of bamboo rattle and crackle just like the roll of musketry, the sound of the falling forest, and the roar of the flames is not unlike the resonances of artillery or the thunder of Heaven.²⁷

Quite how Temple could regard the burning to death of Indians caught up in forest fires as constituting a 'wonderful sight' is hard to fathom: deaths from this cause were real enough.²⁸

Fire from the Forest

Environmental histories of India's forests tend to follow the fortunes of one or a small number of tree species, principally those identified as being of commercial value or of particular utility to the regime and so subject to plantation cultivation or special conservation measures—among them teak, sal, sissoo and chir pine. And, despite calls for a more inclusive

²⁷ Richard Temple, *Oriental Experience: A Selection of Essays and Addresses Delivered on Various Occasions* (London: John Murray, 1883), 261-2.

²⁸ E.g., 'Progress report of forest administration in Jodhpur for 1890-91', *Indian Forester* 18 (1892): 65-6.

environmental history, histories of the forest tend to stay within the forest and not to consider what happened to forest products once they left the forest. However, an environmental history of fire is also a history of consumption. India's forests were more than a source of 'big timber', for they also provided fuel and firewood for village communities and, in the absence of a more extensive use of fossil fuels, met the growing needs of transport, industry, towns and cities. Wood and charcoal made in the forests had long been used in Indian industries—as in the smelting of iron ore.²⁹ By the mid-nineteenth century wood was in huge demand as fuel, notably for railway locomotives and river-steamers, for in India wood was required to meet a burgeoning energy need more efficiently supplied in Britain by coal.³⁰ Since twice as much wood was required to do the work of an equivalent weight of coal the quantities of wood consumed and committed to fire were enormous. Until replaced by coal and coke, railway engines in India devoured between 250 and 300 lbs of wood for every mile travelled: as late as 1891, 340,000 tons of wood were burned in a single year as locomotive fuel.³¹ Others high-consumption uses included brick-firing, lime-burning and such agricultural processes as the boiling of sugarcane.

Anxieties about a continuing and sustainable supply of firewood date back to at least the 1840s. The creation of hill-stations like Simla and Ootacamund, the growth of cities, and the rise of fuel-hungry railroads and river-steamers made many Europeans acutely aware of

²⁹ As in the Punjab hills: Stebbing, *Forests*, 1: 416.

³⁰ Ibid., 489-96; V. Pallavi Das, 'Railway fuel and its impact on forests in colonial India: The case of the Punjab, 1860-1884', *Modern Asian Studies* 47 (2013): 1283-1309; Clive Dewey, *Steamboats on the Indus: The Limits of Western Technological Superiority in South Asia* (New Delhi: Oxford University Press, 2014), 59-64.

³¹ 'Administration report on the railways in India', *Indian Forester* 18 (1892): 229-30; 'Administration report on the railways in India for 1891-92', *ibid.*, 435.

the problem of fuel. Indeed, the provision of firewood was one of the foremost incentives for early measures of forest conservation and the creation of forest reserves in nineteenth century India.³² It was partly in order to increase the rapidly dwindling supply of firewood that Australian exotics were introduced—eucalyptus and acacia in upland tracts like the Nilgiris in south India and casuarina among the dunes of coastal Madras.³³ Fire and the unremitting need for fuel thus impelled fundamental changes in the Indian environment, either in displacing less fuel-productive vegetation or in colonizing previously barren land. The extensive casuarina plantations of the Madras Presidency, dating from the 1850s, are a striking example of the physical transformation of the landscape and the economic opportunities created for state revenues and private speculators.³⁴ A further response was the creation of linear plantations alongside irrigation canals and railway tracks for the supply of

³² E. P. Stebbing, *The Forests of India* (4 vols, London: Bodley Head, 1922-30) 1 (1922): 117, 197, 310, 315-16, 460-78; [W.] Jameson, 'On the physical aspects of the Punjab: Its agriculture and botany', *Journal of the Horticultural Society of London* 8 (1853): 273-313, 287-8.

³³ Brett M. Bennett, 'A global history of Australian trees', *Journal of the History of Biology* 44 (2011): 134-7; Prasannan Parthasarathi, 'Forests and a new energy economy in nineteenth-century south India', in Gareth Austin (ed.), *Economic Development and Environmental History in the Anthropocene: Perspectives on Asia and Africa* (London: Bloomsbury Academic, 2017), 145-58.

³⁴ Campbell Walker, 'Plantations and firewood reserves in the Madras Presidency', in Brandis and Smythies, *Report*, 94-101.

fuel and firewood. These were among the several ways in which colonial forestry gave a place to fire and recognized the legitimate needs of consumers.³⁵

Forests were certainly not the only source of fuel. As well as wood, many Indians burned cow-dung cakes (*bratties*) as fuel for domestic cooking. The dung, collected by women, and mixed with chaff and straw, was hand pressed into flat, round cakes and left to dry in the sun. Unlike firewood, bratties were not traded and had no commercial value, but as a source of biomass fuel they were consumed in enormous numbers, supplying up to a third of all household fuel.³⁶ Without them, the demand for wood would have been even greater than it was, but the relative value of firewood and bratties was much debated. In his 1893 report on the improvement of Indian agriculture, the agricultural chemist J. A. Voelcker argued that the greatest practical benefit to cultivation would come from increasing the supply of firewood, by creating additional forest reserves, so that Indians would burn wood rather than cow-dung as their domestic fuel, leaving dung for use as much-needed manure.³⁷ Not all experts agreed with this analysis. Another agricultural chemist, Robert Wallace, reasoned that Indian cow-dung was so poor in nutrients, and of so little worth as manure, that

³⁵ In the United Provinces in 1888-89 canal plantations covered 30,000 acres and contained 1.85 million trees: 'Report on the canal plantations', *Indian Forester* 18 (1892): 69-70. The importance of maintaining forests as a source of firewood for public consumption was generally recognized by the interwar period: E. A. Smythies, *India's Forest Wealth* (2nd ed., London: Oxford University Press, 1925), 10-11.

³⁶ For Madras, see W. R. Robertson, *Report on the Agricultural Conditions, and Prospects of the Neilgherry and Coimbatore Districts* (Madras: Higginbotham, 1881), 152.

³⁷ John Augustus Voelcker, *Report on the Improvement of Indian Agriculture* (London: Eyre & Spottiswoode, 1893), chs 7 and 8.

it might as well be burned as fuel and the ashes used as fertilizer instead.³⁸ Others offered a cultural rationale for the use of bratties, that, even in cities like Bombay (Mumbai) where firewood was plentiful, householders preferred to cow-dung to wood as fuel because it gave a more constant source of low, steady heat or imparted a better flavour to simmering milk.³⁹

Like the drawing of water and the collection of cow-dung for fuel, gathering firewood for domestic consumption was primarily women's work.⁴⁰ Women resourced the raw materials needed for cooking and heating in the home: in this respect, among others, women's engagement with the environment—and hence with fire—was significantly different from that of men. However, the commercial extraction, transportation and sale of wood for fuel was entirely in the hands of men, from the local or migrant labourers who cut and hauled the wood to the contractors, based in Bombay and Calcutta, who organized and profited from the timber and firewood trade.

The full extent of the trade in firewood and the scale of its consumption is hard to measure, but some local examples are indicative. Thus, Bombay in the 1860s was said to consume 300,000 tons of wood fuel a year. Restrictions on access to the forests of nearby Thana district gave added incentive for the importation of firewood from more distant

³⁸ Robert Wallace, *India in 1887* (Edinburgh: Oliver & Boyd, 1888), 80-3.

³⁹ 'Veteran Forest Officer', 'The forest policy of the Government of India', *Indian Forester* 21 (1894): 145.

⁴⁰ On firewood collection by women, see Bina Agarwal, 'Gender, environment, and poverty interlinks: Regional variations and temporal shifts in rural India, 1971-1991', in Rangarajan and Sivaramakrishnan, *India's Environmental History*, 462-6. However, for an account of firewood collection that emphasizes men's role, see M. N. Srinivas, *The Remembered Village* (Delhi: Oxford University Press, 1976), 106.

locations.⁴¹ Much of the wood came from the tropical rainforests of the Western Ghats, transported along the coast by boat to jetties in Bombay harbour solely dedicated to the importation of firewood and timber.⁴² Other supplies reached the city by road and rail. The means of making fire arrived from all directions. Like Chicago in William Cronon's account of *Nature's Metropolis*, Calcutta and Bombay were the beneficiaries of an enormous ecological hinterland, extending, in the case of Calcutta, deep into the forests of Burma and Assam, the mountains of the eastern Himalaya, the deltaic Sundarbans and the timber-rich Andamans.⁴³ A further indication of the extent of this trade can be gleaned from the fact that in 1882 Bombay municipality (in one of its many fire-related roles) issued 523 licenses for wood sold in bulk (including firewood), 888 for wood sold in bundles, 195 for sandalwood, and 217 for timber in general, worth in total Rs 10,000 in license fees.⁴⁴ Modern Mumbai has been conceived of as a city dominated by water: colonial Bombay might no less be regarded as a city founded on wood and fire.⁴⁵

On the eastern side of India, the main timber harvested was *sundri* (*Heritiera minor*) from the tidal forests of the Sundarbans in the Bengal delta. Yielding a wood prized for

⁴¹ N. A. Dalzell, *Observations on the Influence of Forests, and on the General Principles of Management as Applicable to Bombay* (Bombay: Education Society's Press, 1863), 24; G.P. Millett, 'Thana forests and their working plans', *Indian Forester* 18 (1892): 89-95.

⁴² *Bombay Almanac and Directory, 1867* (no publication data), 268-9.

⁴³ William Cronon, *Nature's Metropolis: Chicago and the Great West* (New York: W. W. Norton, 1991).

⁴⁴ *Annual Report of the Municipal Commissioner of Bombay, 1882* (Bombay: Times of India Steam Press, 1882), 370.

⁴⁵ Mathew Gandy, 'Landscapes of disaster: Water, modernity, and urban fragmentation in Mumbai', *Environment and Planning A* 40 (2008): 108-30.

shipbuilding, furniture-making and construction, the vast *sundri* forests were ‘among the most valuable of the Government forest properties in India’; but they were also, even by the 1870s, being stripped of the largest and most accessible trees.⁴⁶ Inhabiting the watery Sundarbans, *sundri* was not normally susceptible to forest fires (though it was to the periodic devastation caused by cyclones), but once cut and dried it burned well. Small amounts were used locally for fuel with far larger quantities shipped to Calcutta for firewood.⁴⁷ Of the 5.2 million cubic feet of *sundri* extracted from the Sundarbans in 1909-10, 1.5 million cubic feet was for firewood. In 1912-13, of an outturn of 3.2 million cubic feet of *sundri*, 2.7 cubic feet consisted of firewood. In 1915 it sold as firewood for Rs 35 to 40 per 100 *maunds* (a maund being 82 lbs weight, with 28 maunds equivalent to one ton).⁴⁸

The importance of state forests to the supply of wood for fuel, although only part of wider biomass provision, deserves emphasis. In 1892-93 the value of timber from state forests in the whole of British India was Rs 54.3 million, but the value of wood sold as fuel was nearly double that figure—Rs 106.8 million.⁴⁹ Across all state forests in 1907, 4.7 million tons of wood were harvested: of this roughly 84 per cent by volume was for use as

⁴⁶ R. S. Pearson, *Commercial Guide to the Forest Economic Products of India* (Calcutta: Superintendent, Government Printing, India, 1912), 56; W. Schlich, ‘Remarks on the Sunderbans’, *Indian Forester* 1 (1875): 6.

⁴⁷ Richard Temple, *Men and Events of My Time in India* (London: John Murray, 1882), 419. Martin, *Medical Topography*, 57, notes the supply of *sundri* wood to Calcutta in the 1830s.

⁴⁸ R. S. Pearson, ‘Note on *sundri* timber’, *Forest Bulletin* 29 (Calcutta: Superintendent, Government Printing, India, 1915), 5-6.

⁴⁹ ‘Review of Forest Administration’, 27.

fuel.⁵⁰ But in terms of both quantity and value, the wood sold as fuel greatly exceeded the wood designated for use as timber. For a regime anxious to maximize its revenues, the sale of such vast amounts of firewood was an invaluable asset. Paradoxically, the state which sought to control and even banish fire in the forest in order to protect valuable timber trees was also the principal supplier of the wood whose main function was to provide fuel for the fire.

A Light Interlude

In the countryside it was the colonial state, acting through the Indian Forest Service, that took primary responsibility for the regulation of fire as well as providing a large part of the wood required for fuel. In the cities it was principally the municipalities, their executive powers greatly enhanced in the mid-nineteenth century, that were the guardians of the flame.

Although forest and city are often thought of antithetically, the one signifying nature, the other culture, the preceding discussion has indicated some of the ways in which fire-use and the regulation of fire blurred that distinction and showed the two ecologically and economically entwined. But fuel from the forest was not the only aspect of fire pertinent to Indian towns and cities. As Pyne reminds us, cities need fire in order to function: one of those functions was for lighting.⁵¹ Despite the growing scholarly literature on visual sensibility and the cultural history of light, environmental histories of India have rarely engaged with the significance of light or attempted to track its transforming presence. Thinking about fire offers one way to do so.

India has a rich and complex fire culture. Just as the sacred fire is central to many Hindu rituals, so has light enormous cultural resonance, most obviously in Diwali, the

⁵⁰ R. S. Pearson, *Commercial Guide to the Forest Economic Products of India* (Calcutta: Superintendent, Government Printing, India, 1912), 7.

⁵¹ Pyne, 'Afterword', 392.

autumn festival of lights.⁵² But light, natural or artificial, had important connotations, too, for European observers. In a great deal of nineteenth-century colonial writing, India was represented metaphorically as a land of darkness, of concealment and superstition. Conversely, India's brilliant sunlight was seen as dazzling, harsh and oppressive, a supposed cause of eye cataracts, 'tropical neurasthenia' and other disorders. And yet, in the midst of darkness, firelight, lamplight, even wildfires, could be exhilarating and enchanting. As we have seen, forest fires, blazing at night, entered the ambit of India's visual spectacles. Julian Baker has likewise described how European travellers were fascinated by the light cast by torches and campfires, and by the brilliance of moon and stars, so much more luminous against the velvety darkness of a tropical night sky than glimpsed through the cloud-shrouded darkness of northern Europe.⁵³ Firelight dispelled the gloom and obscured the squalor many Europeans associated with India. It made the figures of servants and camp-followers and nocturnal scenes of buildings, tents and trees appear far more romantic and picturesque than in the painful glare of day. Europeans delighted, too, at the glow of the small oil-lamps that Indians used to decorate their homes during Diwali and on other celebratory occasions, or that illuminated evening bazaars with their 'shifting light and wavering shadow'.⁵⁴ Lamplight recreated an Indian fairyland, a place of 'poetical' beauty befitting the *Arabian Nights* to

⁵² Frits Staal, *Agni: The Vedic Ritual of the Fire Altar* (2 vols, Berkeley: Asian Humanities Press, 1983).

⁵³ Julian C. T. Baker, 'Darkness, travel and landscape: India by fire- and starlight, c. 1820-c. 1860', *Environment and Planning D* 33 (2015): 749-65.

⁵⁴ Sidney Low, *A Vision of India* (2nd ed., London: Smith, Elder & Co., 1907), 21-2. On Diwali illuminations in Bombay, see *Times of India*, 3 Nov. 1880, 2; *ibid.*, 20 Nov. 1884, 3.

which it was repeatedly compared.⁵⁵ The flickering of thousands of tiny oil-lamps evoked further delight when used to illuminate the palaces of India's princes. The journalist Sidney Low, in India in 1905 to report on the tour of the Prince of Wales, was one of many Europeans who waxed lyrical over the Indian use of light. In Udaipur, at the heart of what he called 'medieval India', Low observed:

Here there were no electric arcs, with their cold and steel-like beam, no incandescent lamps with hard unwinking stare, no coloured lanterns in garish green and red. Nothing was used but the common Eastern *butty*, the true 'Light of Asia', a mere earthenware saucer, with a shred of cotton-wick and a tiny pool of oil. The humble nightlights were set by the thousand and ten thousand, outlining everything with a tender palpitating glow, as if streams and runlets of lambent flame were slowly trickling along every wall and pinnacle and projection, by the sides of buildings and down the shafts of columns. The islands mirrored themselves in the lake in temples and palaces of softened fire; the forts flickered like giant fireflies on the distant hills. It was Fairyland—with the elfin lamps alight.⁵⁶

⁵⁵ George W. Johnson, *The Stranger in India: Or, Three Years in Calcutta* (2 vols, London: Henry Colburn, 1843), 1: 213-14; Mrs Leopold Paget, *Camp and Cantonment: A Journal of Life in India in 1857-1859* (London: Longman, Green, Longman, Roberts & Green, 1865), 57-8; 'A Lady Pioneer' [E. S. Mazuchelli], *The Indian Alps and How We Crossed Them* (London: Longmans, Green & Co., 1876), 12-13.

⁵⁶ Low, *Vision of India*, 98. For similar sentiments, see Marchioness of Dufferin and Ava, *Our Viceregal Life in India: Selections from My Journal, 1884-1888* (2 vols, London: John Murray, 1889), 1: 250-1; 2: 112. In fact, India's princes were pioneers of electric lighting, as at Baroda: *Times of India*, 27 Aug. 1889, 5.

If light helped make princely India romantic and reassuringly ‘medieval’, so did it also visually and almost magically transform India’s metropolitan cities. In Bombay and Calcutta official buildings, business premises, streets and houses were lit with millions of oil-lamps several times in the late nineteenth century—to celebrate the end of the Mutiny and Rebellion in 1858, during the visit of the Prince of Wales in 1875, and for Queen Victoria’s jubilee in 1887.⁵⁷ Illumination transformed Bombay, according to one report in 1884, into ‘a city of fire by night’.⁵⁸

In reality, though, Indian cities were beginning to be radically transformed, their visual appearance and physical environment reconstituted, by modern lighting. Streets, factories, offices, markets, slaughter-houses, barracks and railway stations were progressively lit by oil, gas and electricity. In place of the candles, once imported in huge quantities, European and middle-class Indian homes were now lit by gas or electricity.⁵⁹ But street-lighting was the most obvious manifestation of the new age of light. Delightful, even magical, when first installed, street-lighting was also highly functional, enabling city-dwellers to move around at night in relative safety—though perhaps not on moonlit nights, when street-lamps were turned off to save money, or for those who lived and worked in the poorer parts of town where modern lighting remained intermittent or even non-existent.⁶⁰ As the demand for ‘light, more light’ grew, street-lighting, paid for through municipal taxation, came less and less to be thought of as a luxury and more and more as an urban necessity. For those denied it, the ‘absence of light’, the state of being ‘left in the dark’, became redolent of

⁵⁷ *Bombay Times*, 3 Nov. 1858, 692; *Times of India*, 10 Nov. 1875, 2.; *ibid.*, 18 Feb. 1887, 5.

⁵⁸ *Times of India*, 20 Oct. 1884, 3.

⁵⁹ On candles, see *Bombay Times*, 23 Oct. 1845, 682; *ibid.*, 19 Oct. 1854, 4484.

⁶⁰ *Times of India*, 16 Dec. 1882, 3; *ibid.*, 12 Feb. 1889, 4.

racial discrimination, urban danger and social deprivation.⁶¹ By contrast, effective street-lighting (where it existed) made a city like Calcutta, in the eyes of eulogists, ‘civilized’ and ‘modern’, the epitome of a new urban orderliness.⁶² In 1880 Bombay had 3,177 gas and 224 kerosene street-lamps; by 1900 the number of gas lamps had risen to 3,945, but there were still 1,741 kerosene lamps, which, though cheaper than gas, produced poor illumination.⁶³ In Calcutta in 1901 oil-lamps were declared an anachronism by the municipal commissioner, and yet, for reasons of economy, there were still more than 2,000 in operation.⁶⁴ India’s pyrotechnology was entering an era of rapid change.

Fire in the City

Kerosene provides an essential link between fire, lighting and fuel. Too often seen in the colonial period as a society averse to technological innovation, India experienced in the late nineteenth century a kerosene revolution. A by-product of the petroleum industry, kerosene was imported into India from the United States and southern Russia. In 1887, 30 million gallons were imported, with a value of over Rs 12 million: six years later, in 1893, imports

⁶¹ *Times of India*, 10 July 1889, 3: cf. Chris Otter, *The Victorian Eye: A Political History of Light and Vision in Britain, 1800-1910* (Chicago: Chicago University Press, 2008), Ch. 2.

⁶² *Times of India*, 26 Sept. 1889, 4; *Report of the Municipal Administration of Calcutta, 1915-16* (Calcutta: Corporation Press, 1916), 1: 16.

⁶³ *Annual Report of the Municipal Commissioner of Bombay, 1880* (Bombay: Times of India Steam Press, 1881), 234; *Annual Report of the Municipal Commissioner for the City of Bombay, 1900-01* (Bombay: Times of India Press, 1901), ix. For the poor quality of kerosene lighting, see *Times of India*, 19 Feb. 1891, 3.

⁶⁴ *Report on the Municipal Administration of Calcutta, 1910-11* (Calcutta: Corporation Press, 1911), xviii.

totalled 64 million gallons. By 1911 this figure had risen to 75 million gallons, with a value in excess of £2 million.⁶⁵ It is indicative of the growing popularity of kerosene for lighting and fuel that in 1882 Bombay municipality, in one of its fire-related roles, issued 23 licenses to wholesale kerosene vendors and 672 to retail outlets.⁶⁶ Imported kerosene—oil from a foreign earth—began to replace local vegetable oils and traditional oil lamps. One visitor remarked in 1888 that kerosene was ‘now almost universally used for lighting by the native population’.⁶⁷ But lighting was only one of several uses: kerosene served as a disinfectant and, by spraying on stagnant pools to kill mosquito larvae, a means of malaria control.⁶⁸ It was used for household cooking stoves, in part supplanting cow-dung cakes and firewood, and so, in theory, easing the pressure on fuelwood. A Bombay newspaper declared in 1897: ‘We seem to be approaching the time when kerosene will displace every other fuel for cooking by sheer force of economy’.⁶⁹ The extent to which India had become kerosene dependent is shown by fact that at the end of the World War One, when it was in short supply, the oil appeared alongside food-grains and cloth as one of the essential commodities city-dwellers lacked or, with soaring prices, could no longer afford.

⁶⁵ *Accounts Relating to the Sea-Borne Trade of British India, 1890* (Calcutta: Superintendent, Government Press, India, 1891), 20-21; *Times of India*, 25 Aug. 1894, 4. *Accounts Relating to the Sea-Borne Trade of British India, 1913* (Calcutta: Superintendent, Government Press, India, 1914), 27.

⁶⁶ *Annual Report of the Municipal Commissioner of Bombay, 1882*, 369.

⁶⁷ Wallace, *India*, 221.

⁶⁸ *Report on the Municipal Administration of Calcutta, 1906-07* (Calcutta: Corporation Press, 1907), 69.

⁶⁹ *Times of India*, 17 July 1897, 4.

However, fire in the city, especially when it involved a volatile substance like kerosene, was hard to control and, like fire in the forest, could threaten devastating consequences.⁷⁰ Fires periodically swept through India's 'flammable cities', as in Bombay in 1803 and again in 1876, prompting urban regeneration but also causing wholesale destruction among slum communities, whose dwellings consisted of wooden shacks and palm-leaf thatch.⁷¹ Fires caused by short-circuiting electricity or overheating generators marred several fairs and exhibitions: the blaze that engulfed the People's Park in Madras in January 1887, described as an 'appalling spectacle', resulted in 118 deaths.⁷² Warehouses stuffed with jute, cotton, timber, firewood and kerosene were highly inflammable: despite a municipal ban on stores of over one thousand maunds of firewood, there were more than 500 warehouse fires in Calcutta alone in 1918-19.⁷³ Like rural incendiarism, some city fires were started

⁷⁰ Fires and accidental deaths caused by burning kerosene date from the early 1870s: see the 'sad accident' at a wedding in Meerut in May 1872, where a case of kerosene left near a burning wick exploded, killing two people and injuring five others: *Times of India*, 9 May 1875, 3. Such deaths were not unique to India: when the *Times of India* remarked on 10 June 1876, 3, that kerosene accidents were 'daily becoming more numerous' it was referring to fatalities in both London and India.

⁷¹ James Douglas, *A Book of Bombay* (2 vols, Bombay: Bombay Gazette Steam Press, 1883) 2: 119; *Times of India*, 26 Feb. 1876, 2. On urban fires in modern Asia, see Greg Bankoff, *Flammable Cities*.

⁷² *Times of India*, 5 Jan. 1887, 5.

⁷³ *Report on the Municipal Administration of Calcutta, 1911-12* (Calcutta: Corporation Press, 1907), 95; *Report and Statistical Tables of the Calcutta Fire Brigade, 1919* (Calcutta: Bengal Secretariat Book Depot, 1919), appendix XV: xiv. Bombay's municipal authorities similarly

deliberately, as during the violent labour confrontation in Madras in July 1921 when, in retaliation for strike-breaking, the huts of 150 untouchable slum-dwellers were torched.⁷⁴ Fire-brigades often found themselves ill-equipped to combat these fierce and fast moving conflagrations: fire-engines might arrive at the scene only to find themselves unable to draw water from defective standpipes.⁷⁵ Fire entered the political vocabulary of the city as it did that of rural protest. The public burning of foreign cloth as an act of what Gandhi saw as gesture of national self-purification during the non-cooperation movement in the early 1920s was one illustration of this. Metaphorically as well as materially, fire gave expression to the ardent fervour of the nationalist cause.⁷⁶

Fires were also domestic events. This was especially so for women, whose distinctive relationship to fire and fire-making has already been noted. In lighting a kerosene stove, women accidentally set fire to their clothing and so suffered serious burns or died from horrific injuries.⁷⁷ Most of these domestic fires were reported as accidental, but many were not. In an urban revival of the long-outlawed practice of self-immolation by *sati*, some Hindu widows committed suicide by dousing their clothes with kerosene and setting fire to themselves. In a few cases, these fire events proved to be wife-murder and the husband or

attempted to restrict the volume of kerosene and other combustible goods held in warehouses or ordered their relocation away from populous areas: *Times of India*, 27 Jan. 1876, 2.

⁷⁴ David Arnold, *The Congress in Tamilnad: Nationalist Politics in South India, 1919-1937* (London: Curzon Press, 1977), 70.

⁷⁵ *Times of India*, 26 Feb. 1876, 2.

⁷⁶ *1921 Movement: Reminiscences* (New Delhi: Publications Division, Ministry of Information and Broadcasting, Government of India, 1971).

⁷⁷ E.g., *Times of India*, 25 Jan. 1892, 3.

other relatives were charged with deliberately causing the wife's death.⁷⁸ In 1906 there were 89 reported deaths from burns in Calcutta, most affecting women. In a more detailed listing in 1918-19 there were 20 recorded cases of death or serious injury due to men, but more especially women, pouring kerosene on their clothes and setting themselves on fire.⁷⁹ Accident, suicide or murder, these fragmentary statistics attest to the far larger and more persistent phenomenon of Hindu women as victims of anthropogenic fire.⁸⁰

On the other hand, like fire in the forest, once regulated fire in the city had its approved uses. Fire was essential to the realization of the 'sanitary city' and modern urban governance.⁸¹ Urban refuse was removed to open spaces outside the metropolitan area to be burned or taken to mechanical incinerators for destruction.⁸² Or, to cite another sanitary

⁷⁸ E.g., *Report and Statistical Tables of the Calcutta Fire Brigade, 1916*, xi. Kerosene has continued to be implicated in female suicides and murders: Mala Sen, *Death by Fire: Sati, Dowry Death and Female Infanticide in Modern India* (London: Weidenfeld and Nicolson, 2001), 54.

⁷⁹ *Report on the Municipal Administration of Calcutta, 1906-07*, Appendix J, 92; *Report and Statistical Tables of the Calcutta Fire Brigade, 1919*, Appendix XII, xii.

⁸⁰ According to a recent report, more than 150,000 women were killed by fire in India in a single year, especially aged between 15 and 34: Prachi Sanghavi, Kavi Bhalla and Veena Das, 'Fire-related deaths in India in 2001: A retrospective analysis of data', *Lancet*, 11 Apr. 2009: 1282-8.

⁸¹ Martin V. Melosi, *The Sanitary City: Urban Infrastructure in America from Colonial Times to the Present* (Baltimore: Johns Hopkins University Press, 2000), 196-203.

⁸² David Arnold, 'Burning issues: Cremation and incineration in modern India', *NTM: Zeitschrift für Geschichte der Wissenschaften, Technik und Medizin* 24 (2016): 393-419, 406-13.

example, in the early stages of the bubonic plague epidemic in Bombay in the 1890s, before the aetiology of the disease was adequately understood, fire was seen as a vital agent in destroying plague ‘germs’. In what was termed ‘disinfection by burning’, household contents were burnt and floors dug up to be purged by fire.⁸³

Cremation

As Pyne observes, ‘Perhaps nowhere else [than in India] have the natural and the cultural parameters of fire converged so closely and so clearly’.⁸⁴ One highly significant use of the wood imported into cities was as fuel for funeral pyres, and here again India’s environmental and social histories intersect. Indeed, cremation could be described as one of the more salient aspects of India’s ‘urban fire regime’.⁸⁵ As in the forest, fire in the city involved negotiation and compromise between rulers and subjects. In the forest, this was generally with poor and low-status communities over their right to swidden cultivation, cattle grazing and firewood gathering. In the city, the compromise, over the right to cremation on open-air funeral pyres, was of a different order, involving some of the most influential and articulate sections of the urban population—merchants, businessmen, industrialists, professionals, politicians, even princes. The fire rights of such prominent Indians could not easily be ignored.

Almost from the start of the British presence, in seventeenth-century Bombay, cremation was recognized as being an incontrovertible right with a legitimate entitlement to

⁸³ *Administration Report of the Municipal Commissioner for the City of Bombay, 1896-97* (Bombay: Times of India Steam Press, 1897), 663, 670, 678; Christos Lynteris, ‘A “suitable soil”: Plague’s urban breeding grounds at the dawn of the third pandemic’, *Medical History* 61 (2017): 343-57, 355-6.

⁸⁴ Pyne, ‘Nataraja’, 1.

⁸⁵ Bankoff et al., *Flammable Cities*, 8-9.

urban space, a position implicitly endorsed by Queen Victoria's promise of religious toleration in her 1858 proclamation.⁸⁶ Colonial officials and municipal authorities might seek ways to constrain and amend the practice of cremation—for instance, by requiring screens to be erected around the cremation ground to make it less visible to the public or by insisting on adequate stocks of fuel to burn bodies efficiently. Or they might (with little success) encourage the relocation of cremation sites away from central, residential districts. But they could not deny the basic right of Hindus to cremate their dead. Indeed, many colonial sanitarians themselves believed that in Indian conditions cremation was preferable to other means of disposing of the dead and a means of breaking the chain of transmission in cholera epidemics. Far from being marginalized and despatched to suburban obscurity, burning *ghats* (cremation sites) were a conspicuous element in the social ecology and spatial geography of the Indian city. Since cremation could not be suppressed, the urban landscape had to adjust to the presence of these sites, even when they lay close to busy roads and residential areas and whose sight and smell drew repeated protests from non-Hindus.

Fig. 1 near here: photography by Samuel Bourne, c. 1865, showing the ghats at Benares (courtesy of the British Library, London).

Given the paucity of statistics, apart from for Calcutta and Bombay, it is impossible to compute the volume of wood used for cremation in British India. However, a recent survey, indicating that 50 to 60 million trees were cut down for cremation every year, releasing 8 million tonnes of carbon dioxide into the atmosphere and 800,000 tonnes of ash into rivers,

⁸⁶ Douglas, *Book of Bombay*, 1: 87; *Proceedings of an Ordinary Meeting of the Municipal Corporation of Calcutta, Held at the Town Hall on Monday, 7th March 1864* (Calcutta: Hindu Patriot Press, 1869), 7.

suggests something of the likely scale of cremation and its environmental impact in colonial times.⁸⁷ Cremation entailed greater consumption of wood than if, as in the West, wooden coffins had been used, and, while cremation in Europe and North America quickly turned from the 1870s to other means of combustion (coal gas and electricity), in India most Hindus, Sikhs and Jains adhered to the traditional practice of outdoor cremation on wood pyres, piled three or four feet high with logs, brushwood and bratties. Nineteenth-century photographs of the city of Benares (Varanasi), like that taken by Samuel Bourne c. 1865 [Figure 1], show boats and landing stages piled high with wood for the almost incessant funeral pyres on Manikarnika Ghat. In Bombay the landing-stages assigned for the unloading of wood lay conveniently close to the main burning-ground at Sonapur on Queen's Road. In Calcutta, the premises of many of the city's leading timber merchants nestled close to the cremation ground at Nimtola Ghat.⁸⁸

Cremation tapped into South Asia's rich bio-diversity, with the wood used for cremation, where possible, selected for the heat it generated, for its costliness and fragrance, or for the obscuring smoke it produced. Thomas Laqueur has referred in the context of European burial practices to the 'necro-botany' of trees like yews and willows chosen for their melancholy associations with graveyards, death and mourning.⁸⁹ Hindu India had its own version of this necro-botany in the selection of the types of wood considered suitable for cremating the honoured dead. In Calcutta, the preferred fuel was sundri wood from the

⁸⁷ Gargi Gupta, 'Saying goodbye, the green way', <http://www.dnaindia.com/india/report-saying-goodbye-the-green-way-226604>, accessed 26 Oct. 2016.

⁸⁸ *Report on the Municipal Administration of Calcutta, 1901-02* (Calcutta: Municipal Press, 1902), appendix K, 89-95.

⁸⁹ Thomas W. Laqueur, *The Work of the Dead: A Cultural History of Mortal Remains* (Princeton: Princeton University Press, 2015), 133-7.

Sundarbans, previously noted for its firewood connection.⁹⁰ In Bombay wood for cremation came from named tree species from the Western Ghats and Goa, further specified according to size and quality.⁹¹ In the countryside, less costly or more readily available woods, such as *babul* (*Acacia arabica*), *dhak* (*Butea frondosa*) or mango, were commonly used. But families who could afford it used logs of Mysore sandalwood, reputedly the world's most expensive wood (selling in the 1890s for Rs 500 a ton), yet one as readily consumed by funeral pyres in the city as by wildfires in the countryside, where 'of all the enemies ... sandal has to contend with, fire is the worst and most dangerous'.⁹² If among Hindus to be cremated on a sandalwood pyre was 'a very high distinction', more pragmatically it was valued because its smoke and fragrance concealed the smell of burning flesh.⁹³

The quantities of wood used in this way varied according to affluence and availability: the rich could afford to burn more wood and of better quality than the poor. According to some estimates between 300 and 400 lbs of wood were needed to cremate a corpse effectively, but figures range as high as 800 lbs. Some cremations involved nearly a third of a ton of wood, and, not surprisingly, wood commonly accounted for more than half

⁹⁰ Birendra Nath Ghosh, *A Treatise on Hygiene and Public Health with Special Reference to the Tropics* (7th ed., Calcutta: Scientific Publishing Co., 1930), 339.

⁹¹ The management committee of the Sonapur burning ghat in Bombay called for the supply of Goan *dukut* and *amlee* wood, dried and cut to the length of a human corpse: *Times of India*, 28 July 1884, 5. I have been unable to identify these vernacular names definitively, but 'amlee' might refer to tamarind.

⁹² M. Rama Rao, 'Notes on sandal', *Indian Forester* 30 (1904): 357-62, 359.

⁹³ Alfred Chatterton, 'The production of sandalwood oil in India', Indian Munitions Board, *Industrial Handbook, 1919* (Calcutta: Superintendent, Government Printing, India, 1919), 410-17, 410. Sandalwood was also used by Bombay's Parsis in their so-called 'fire worship'.

the total cost of cremation.⁹⁴ When Dayananda Saraswati, founder of the Arya Samaj Hindu reform movement, was cremated in 1883 his funeral pyre consisted of two maunds of sandalwood as well as eight maunds of ‘common fuel’—820 lbs of wood in all.⁹⁵ But if we take the more modest figure of 400 lbs as a guide, then just over 4,000 tons of wood would have been required in Bombay for the 22,818 bodies cremated there in 1897-98, or close to 2,800 tons for the 15,489 bodies burned in Calcutta in 1917-18.⁹⁶

Like fire in the forest, cremation had temporalities of its own. The hot, dry season that favoured fire in the forest, to prepare for swidden cultivation or to burn off old grass, likewise favoured cremation. Conversely, open-air funeral pyres were much more difficult to ignite and maintain at full heat during the monsoon months, requiring considerable additional quantities of wood and ghee. Kerosene, a modern, foreign fire source with no ritual standing, was not technically acceptable for this purpose, but it was sometimes used when other means of combustion failed.⁹⁷ Other, less predictable, temporalities were also involved. In adding greatly to the number of bodies for cremation, epidemics of cholera, smallpox, influenza and plague enormously increased the demand for wood, creating at times a worrying scarcity. In Bombay in 1900-01, as plague mortality climbed steeply, the number of bodies burned on funeral pyres rose to 35,480 (from 8,040 in 1891-2 and 7,987 in 1893-94 before the epidemic

⁹⁴ *Daily Telegraph*, 4 May 1888, cites 3 cwt. (336 lbs) for a cremation in Calcutta; Ghosh, *Treatise*, 339, quotes 5 maunds (410lbs).

⁹⁵ *Times of India*, 11 Jan. 1884, 4.

⁹⁶ *Administration Report of the Municipal Commissioner for the City of Bombay, 1897-98* (Bombay: Times of India Steam Press, 1898), 64; *Report of the Municipal Administration of Calcutta, 1917-18* (Calcutta: Corporation Press, 1918) 1: 86.

⁹⁷ Sen, *Death*, 267.

struck): this translates, in terms of the weight of wood consumed, to nearly 6,400 tons.⁹⁸ Moreover, the practice of open-air cremation was on the increase—as urban populations grew (in the case of Bombay and Calcutta to around one million by 1914), as municipalities tried to restrict other means of corpse disposal and used cremation for the unclaimed pauper dead, and as low-caste communities began, as part of the process of social reform, ritual change and upward mobility, to adopt cremation in place of the burial they had previously practiced. By the 1930s the number of cremations in Bombay and Calcutta was far higher than it had been in the 1870s: in the almost complete absence of modern crematoria, virtually all this increase had to be accommodated by means of the fuel-hungry funeral pyre.

Conclusion

In an article published twenty years ago Sanjay Subrahmanyam urged historians to engage with the ‘connected histories’ of early modern Eurasia.⁹⁹ The notion of ‘connected histories’ is an appealing one that encourages us to think conceptually across time, space and culture, and about various forms of connectivity and the mobility of things as well as people. In this discussion, fire, as a relatively, neglected element in the environmental historiography of South Asia, has been used to suggest a connected ecological and social history that combines forests, the wood trade, cities’ fuel consumption, innovative fire technology, urban lighting

⁹⁸ *Administration Report of the Municipal Commissioner for the City of Bombay, 1891-92* (Bombay: Times of India Steam Press, 1892), 423; *Administration Report of the Municipal Commissioner for the City of Bombay, 1893-94* (Bombay: Bombay Gazette Steam Printing Works, 1894), 514; *Administration Report of the Municipal Commissioner for the City of Bombay, 1900-01* (Bombay: Times of India Press, 1901), 660.

⁹⁹ Sanjay Subrahmanyam, ‘Connected histories: Notes towards a reconfiguration of early modern Eurasia’, *Modern Asian Studies* 31 (1997): 735-62.

and conflagration, cremation and pollution. As recent scholarship has underscored, India's anthropogenic fire history reaches across the millennia, but the claim here is that the period from the 1840s to 1930s was one of particular importance—as state forestry wrestled on an unprecedented scale with the issue of fire in the forest, when (through the under-utilization of fossil fuels) vast quantities of wood were extracted from the countryside to meet growing urban and industrial needs, when new forms of lighting and heating (like kerosene) transformed the cities and made them modern, when fire became a vehicle for protest and a metaphor for patriotic fervour. Each of these topics might merit discussion in its own right, but this article has tried to suggest that there is still greater value in looking at these aspects of fire as forming part of an interconnected history in which society and ecology coexist and interact in almost equal parts. Perhaps what has been shown is not only direct connectivity as a series of analogies and correspondences: fire burns in the kerosene-rich city much as it does in the tinder-dry forest; urban cremation pyres call for accommodation and regulation in much the same way as do anthropogenic fires in the forest. The 'spectacle' of fire blazes alike in woodland conflagrations, in urban protests and municipal cremation grounds. But fire, forest and city are also connected materially and culturally, as fuelwood journeys from forest to city, as the regulatory mechanisms of colonial rule extend from forests to burning ghats. Fire travels—from one place to another, from one cultural context to another, from one time to another.

Pyrocentrism extends the existing forest narrative, but it also directs us away from more familiar forest scenarios. Fire complicates the picture, transporting us from the colonized countryside to the urban environment; it gives fresh emphasis to the social, political and technological dynamic behind environmental change. Alone among the classical elements, Pyne notes, fire 'is not a substance... Fire is what its environment makes it.'¹⁰⁰ Fire

¹⁰⁰ Stephen J. Pyne, *Fire* (London: Reaktion Books, 2012), 13.

makes the human actors in this story environmental victims as well as knowing (if at times incautious) users, and it helps propel environmental history away from the congenial world of scientists, officials and policy-makers and closer to the everyday lives of the people who lived, worked and all too often died in a fire-fashioned environment and culture. The point is not to suggest that fire operates in elementary isolation: clearly, the working of one element supports or elides into another. The wood destined to fuel fires was heavily reliant on water for its transportation—floated down Himalayan streams, carried on canal barges, shipped by riverboat and seagoing craft to its final, urban destination. From the funeral pyre, itself an alternative to committing human remains to the soil or, like Parsis, exposed to the air, smoke was borne aloft by winds to be dispersed into the atmosphere or to add to the pollution haze, already thick from factory emissions and burning bratties, hanging over the city. Ashes from the pyre were thrown into rivers and streams, becoming a further cause of water pollution. And yet, for all its interconnectedness, fire retained a distinctive role of its own—spectacle and necessity, a source of heat, light, comfort and danger, atavistic yet modern. It has for too long been a neglected element in the environmental history of South Asia.