Nataraja: India's Cycle of Fire

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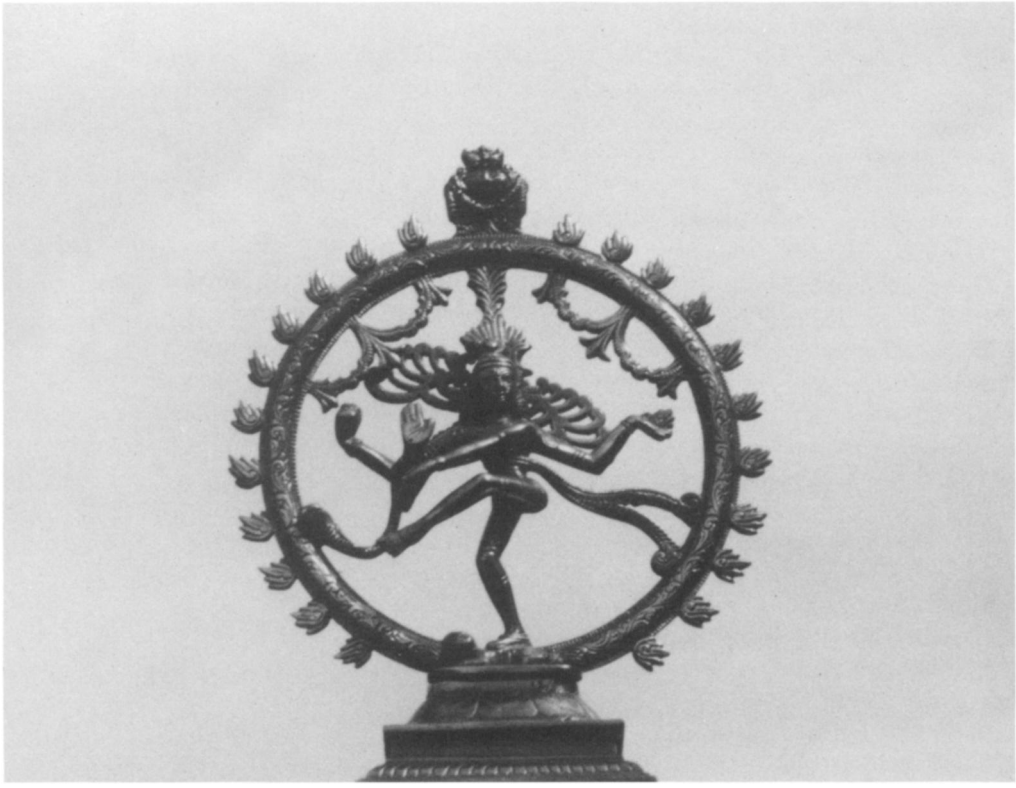
In the center dances Shiva, a drum in one hand and a torch in the other, while all around flames inscribe an endless cycle of fire.

This—the *nataraja*, the Lord of the Dance—is more than one of Hinduism's favored icons. It is a near-perfect symbol of Indian fire history. The drum represents the rhythm of life; the torch, death; the wheel of flame, the mandala of birth, death, and rebirth that fire epitomizes and makes possible. In this confrontation of opposites the dance replaces the dialectic; Shiva holds, not reconciles, both drum and torch. Considered ecologically the *nataraja* thus expresses in graphic language the great polarity of India, the annual alternation of wet and dry seasons by which the monsoon, with faint transition, imposes its opposing principles on the subcontinent. India's biota, like Shiva, dances to their peculiar rhythm while fire turns the timeless wheel of the world.

Perhaps nowhere else have the natural and the cultural parameters of fire converged so closely and so clearly. Human society and Indian biota resemble one other with uncanny fidelity. They share common origins, display a similar syncretism, organize themselves along related principles. Such has been their interaction over millennia that the geography of one reveals the geography of the other. The mosaic of peoples is interdependent with the mosaic of landscapes, not only as a reflection of those lands but as an active shaper of them. Indian geography is thus an expression of Indian



history, but that history has a distinctive character, of which the *nataraja* is synecdoche, a timeless cycle that begins and ends with fire.

The cycle originated with the passage of India as a fragment of Gondwana into a violent merger with Eurasia. The journey northward, through the fiery tropics; the violence of the great Deccan basalt flows and of the immense collision with Asia; the installment of seasonality in the form of the monsoon—all this purged the subcontinent of much of its Gondwana biota, and tempered the rest to drought and fire. The populating of India came instead by influx from outside lands, followed by varying degrees of assimilation. Here, in the choreography of the *nataraja*, east met west, Eurasia confronted Gondwana, wet paired with dry, life danced with death.[1]

What endemics remained were, like India's tribal peoples, scattered or crowded into hilly enclaves. Only 6.5% of India's flowering plants are endemic, compared with 85% in Madagascar and 60% in Australia. The residual biota thrived most fully to the south; Peninsular India holds a third of the subcontinent's endemic flora. Some species, Asian in character, entered from the northeast. A diffuse array emigrated from the eastern Mediterranean, the steppes, and even Siberia, the Himalayas serving less as a barrier than a corridor. More recently weeds, largely European, have established themselves. The composition of its biota thus recapitulates the composition of its human population—the tribal peoples, their origins obscured; the Dravidians who persevered on the Deccan plateau and to the south; the Southeast Asians, migrating through Assam and Bengal; the Aryans, Huns, Turks, Persians, Pathans, Mongols, and others, entering from the northwest; and Arabs and Europeans, mostly Portuguese and British, arriving by sea.[2]

The geographic ensemble that emerged from this vast convergence was both familiar and unique. Of course there were broad divisions, Asians here, Dravidians here. Of course there were mosaics of field, grassland, and forest, in part because of human influence. But even beyond such matters, this syncretic biota assumed the character of something like a caste society. It is probable that this was no accident. The organization of Indian society impressed itself on the land, with ever greater force and intricacy. Tribal people gathered into disease-ridden hills, better shielded genetically from malaria and other ills. They then reworked those hills in ways that conferred on them a biotic identity. It is no accident that the species most commonly found in habited areas are those most abundantly exploited by the human inhabitants, and are often those best adapted

to fire. European weeds, like forts and factories, gathered into specially disturbed sites, then spread along corridors of travel or secondary disturbance. The intricate division of Indian society by caste ensured that different peoples did particular things at particular times, and this was reflected in the landscape of India, not only between regions but within areas that different groups exploited at different times in different ways for different purposes.[3]

The intensity of the monsoon assured—demanded—a place for fire. The sharper the gradient, the more vigorous the potential for burning. Some of the wettest places on Earth, like the Shillong Hills, could paradoxically experience fire and even fire-degraded landscapes. The biota, already adapted to rough handling by India's passage north, responded to fire readily. The flora and fauna that humans introduced, or that migrated into India coincidental with them, also had to be fire-hardened because humans added to and often dominated the spectrum of environmental disturbances and they certainly exploited fire. Explorers and ethnographers reported the practice among southern tribal groups (and in the Andaman Islands) of habitually carrying firesticks, a practice relatively rare outside of Australia and a few other regions. Probably Radcliffe-Brown's peroration on fire and the Andaman Islanders could stand for most tribal peoples on the subcontinent. Fire, he concluded,

> may be said to be the one object on which the society most of all depends for its well-being. It provides warmth on cold nights; it is the means whereby they prepare their food, for they eat nothing raw save a few fruits; it is a possession that has to be constantly guarded, for they have no means of producing it, and must therefore take care to keep it always alight; it is the first thing they think of carrying with them when they go on a journey by land or sea; it is the centre around which the social life moves, the family hearth being the centre of the family life, while the communal cooking place is the centre round which the men often gather after the day's hunting is over. To the mind of the Andaman Islander, therefor, the social life of which his own life is a fragment, the social well-being which is the source of his own happiness, depend upon the possession of fire, without which the society could not exist. In this way it comes about that his dependence on the society appears in his consciousness as a sense of dependence upon fire and a belief that it possesses power to protect him from dangers of all kinds.
>
> The belief in the protective power of fire is very strong. A man would never move even a few yards out of camp at night without a firestick. More than any other object fire is believed to keep away the spirits that cause disease and death.

A veteran Conservator of Forests, G.F. Pearson, noted that even the Ghonds, a long-enduring tribe of Indian central forests, "never go

into the jungle now, where tigers are supposed to live, without setting it on fire before them, so as to see their way." Almost certainly tribal peoples in India used their firesticks as Australia's Aborigines did. The prevalence of anthropogenic burning in the tropical north of Australia, where the Asian monsoon also dictates wet and dry seasons, is another likely analogue.[4]

But more than aboriginal fire practices from India's "tribal" peoples shaped the land. Agriculture needed fire for clearing, converting, and fertilizing. In India, as throughout monsoonal Asia, slash-and-burn agriculture (*jhum*) became dominant outside of floodplains, ensuring that routine fire would visit even remote sites. Where insufficient forest fallow existed, alternatives were found in *rab* cultivation by carrying wood to the site for burning, or mixing it with other refuse and manure prior to conversion into ash. Some peoples fired the hills "with almost religious fervor," observed one disbelieving Briton, in the hope that the ash would wash down to waiting fields. By all these means (and others) a subcontinent of extreme wetness switched, when the polarity reversed, into a land of ubiquitous fire. The *nataraja*'s drum became a torch.[5]

The coming of the Vedic Aryans is an event of special interest. Beyond their role in establishing hierarchy as an informing principle of Indian society, beyond their heroic literature, beyond their infusion of Indo-European language and customs into the subcontinent, they introduced two items of special consequence to Indian fire history. They imported livestock, and they installed Agni, the god of fire, as first among the pantheon of Vedic deities. Fire and livestock interacted like a self-reinforcing dynamo. Together flame and hoof reshaped the landscape into grasslands and savannas sufficient to sustain the herds. Where *jhum* was also practiced, its abandoned fallow could be made to evolve into grass and browse through repeated burning. Without fire the process of reducing jungle and reordering landscapes was slow if not prohibitive.

It is no accident that the *Mahabharata*, part of the Hindu canon, describes the burning of the Khundava forest. It has been argued further that the story is an allegory of Vedic colonization. It begins when a Brahman appears to Krishna and Vamuna, then enjoying the forest. They grant his plea for alms, and he immediately shows himself as Agni and requests that he be allowed to feed himself on the forest. They grant this desire too; Agni rewards them with a chariot and weapons; and together they consume the Khundava and its creatures. The city of Delhi rises from the site today. The Brahman, presiding over his fire ceremony, was in fact an important pioneer

into new lands, provoking by broadcast and ceremonial fire a new order.[6]

Thus the special status granted to Agni went beyond coincidence. Agni was the originating god, and it is to Agni that the *Rig Veda* opens its invocation; Agni of the two heads, one harmful, one helpful; Agni of the three arms, the manifestation of fire in the heavens as the sun, in the sky as lightning, and on the earth as flame; Agni, the medium between the gods and humanity, the mediator between humans and the earth; Agni, the Indian avatar of the hearth god (Atar) fundamental to other Indo-European peoples, best known through the vestal fire of Rome. Soon, however, Agni was supplemented by Indra, the king of the gods, and eventually absorbed into that bewildering genealogy of deities and heroes, as overgrown as jungle fallow, that is the wonder and curse of Hindu theology.[7]

But the special status that Agni lost within a proliferating Hindu pantheon, he retained through rite. For the Vedic Aryans the fire ceremony remained at the core of ritual existence. It was to Agni that they sacrificed, and through Agni, as burnt offerings, that sacrifices to other deities became possible. Fire accompanied birth, marriage, and death, if possible flame from the same fire serving all through the liturgical life cycle. Agni was thus both means and end, beginning and end, a continuous ring around the affairs of the world.

> Agni, the all-knower, the first one
> Looked out over the beginning of the dawns,
> Out over the days,
> And out in many ways alone, the rays of the sun,
> He spread over sky and earth.

Through the centuries the ceremony mutated, and Agni's unique standing declined before its many challenges. Buddhism confronted it directly, demanding a less violent and extravagant practice, prefering useful gifts (*dana*, or donations) in place of burnt offerings. At Gaya the Buddha, perhaps inspired by the fires that annually burned along the flanks of the Vindhyan Mountains, identified fire as a central metaphor of life. "Everything, brethren, is on fire." Passions and desires afflicted human life as flames did the land. They had to be quenched, the Buddha declared, just as the fire ceremony had to be replaced by a less extravagant rite. Nirvana literally meant extinguishing, the blowing out of fire. Hinduism responded by tempering the fire ceremony, relocating it to indoor temples, and granting it a more symbolic, less consumptive role.[8]

Fire remained fundamental, however, as it does yet today. The *puja*, the central ritual of Hindu life, revolves around a fire that

stands for the gods, carries sacrifice to them, and purifies the supplicant. Fire begins the day, as it does the world. It ends life in the form of cremation, as the world will end upon Vishnu's final return. Until then fire powers the cycling of birth and death that is the essence of the *nataraja.*

It is no surprise to learn that, for India, the spiritual interacts with the practical and that what organizes society also organizes nature. The installment of Agni and the Vedic fire ceremony, and the way this acted on Hindu society, had its parallel in the way by which Aryan fire worked on the Indian environment. Fire ordered the landscape as caste did people. The sacrifice to Agni took the form of burning India's forests, or rather of reworking them in somewhat newer ways to support an economy dependent on livestock. The slashed-and-burned Ghats of Karnataka were thus the environmental equivalent to the corpse-burning ghats at Benares. Interestingly the Buddhist revulsion against the fire ceremony had its counterpart in a reaction against the destruction of trees and animals, particularly through fire. The Buddhist king, Ashoka the Great, thus decreed that forest fires should not be lit "unnecessarily" or with the intention of killing or sacrificing living beings.[9]

The new fire practices folded into the old, much as immigrant peoples and ideas enfolded into India's caste-layered society and its mosaic-wrought landscapes. By the time Enlightenment Europeans began studying India fire was so prevalent that it merged seamlessly with the natural history of the subcontinent. Writing retrospectively in 1928, E. O. Shebbeare recalled that "every forest that would burn was burnt almost every year." Worse, the fires were chronic throughout the dry season, seizing whatever cured fuel presented itself. Joseph Hooker described how, during his descent from the Himalayas in the early 1850s, he saw the plains of Bengal immersed in smoke, the product of fires "raging in the Terai forest" and elsewhere, and observed particles of grass charcoal descending like black snow around him. F.B. Bradley-Birt marveled in 1910 how the "hills round Gobindpur form a wonderful line of light every night during the hot weather," the outcome of native-set fires that smolder for days, and "creep on in zigzag lines from end to end of the hills, invisible by day, but standing out clear and distinct, a brilliant line of light, by night." Benjamin Heyne explained that the "hills here are all on fire, and present a spectacle, the magnificence of which is easier conceived than described." Less enchanted, Inspector-General Ribbentrop fumed in a treatise published in 1900 that the profusion of fire was matched

by a "most marvellous, now almost incredible, apathy and disbelief in the destructiveness of forest fires."[10]

A summary of fire causes for the Ghumsur Forest in Orissa tabulated by "Mr. S. Cox," the District Forest Officer, nicely captures the spectacle, and the disbelieving outrage with which the British witnessed it.

> All the State forests on the borders of the taluk are subject to fires crossing from the numerous surrounding zamindari forests. The latter, if they are in a condition to burn, are always burnt, and the boundary lines are so extensive and run over such difficult country that it is out of the question for us at present to protect them all. Then in the large hill forests frequented by the Khonds the jungle is fired as a matter of course to facilitate tracking and for other well-known objects. In the lower hills and more accessible country bamboo cutters and permit-holders generally are responsible for a great deal of the mischief. Wherever a hill is frequented for bamboos there are always constant fires. Other causes are the practice of smoking out bees for honey—a very common origin of fire—of burning under mango and mohwa trees to clear a floor for the falling fruit and flowers; the roasting of Bauhinia seed; the burning of under-growth round villages and cultivation which might harbour tigers and panthers—this will probably prove one of our most serious obstacles to restocking the sal forests; and the spread of fire from banjar lands under clearance for cultivation.... The long list of causes is almost complete if to the above are added the burning of forest by graziers, and for driving out game or finding a wounded animal.

Not least perplexing (and infuriating) was the fact that out of 53 cases of illegal fire investigated within the protected forests, "no less than 27 were caused by the protective staff itself." The native staff recognized, if their baffled masters did not, that the proper use of fire was the best protection against its misuse.[11]

It was in fact the British who did not understand. It was their belief in fire's necessary destructiveness that was, within the context of India, incredible. The indigenous people knew how fire supported *jhum* cultivation, converted organic residues into fertilizer, kept woodlands and prairies in grass, assisted hunting, cleansed soil of pathogens, and supported foraging for flowers, bees, tubers, and herbs. Fire sustained metallurgy. Fire kept tigers away from villages and opened sites that might otherwise hide cobras. Fire structured the intricate ensemble of biomes that was made by, and that in turn made possible, Indian society. Alone among the elements fire illuminated the complex choreography that bound life with death, the human with the natural. Fire framed the *nataraja*.

The dance missed beats as British rule extended over more and more of Greater India. The British raj imposed not only imperialism but industrialism. Britain linked India with lands beyond the reach of monsoon winds, connected it with economic cycles greater than the rhythms of annual growth and decay, and shrank the encircling fire into the combustion chamber of steam engines. The tempo of the *nataraja* picked up. A ceaseless cycle wobbled, then spun uncertainly into a spiral.

British influence extended piecemeal, as opportunity and necessity presented themselves. Change became serious—and reform deliberate—after the Revolt of 1857 when the Crown replaced the British East India Company as the governing authority. Britain then applied to colonial India the same processes that had restructured Britain over the preceding century. Industrial capitalism and a global market began redesigning the Indian economy. Land reform, or at least the rationalization of land ownership, exploitation, and tax-collection, inspired a kind of enclosure movement or revenue "settlement" that gradually spread over the newly acquired lands. "Forest settlement" was a part of this process, and quickly brought European-style forestry into conflict with traditional, communal exploitation of Indian woodlands.

The new ruling caste brought their laws, their language and literature, and their sciences. Agronomists sought to modernize Indian agriculture, as political theorists sought to modernize Indian government. Hydraulic engineers erected dams, dug canals, and designed irrigation works. Mining engineers explored for geologic wealth. Cartographic engineers surveyed the subcontinent, imposing a mathematical order on the land, even measuring the anomalous gravity of the Himalayas. Above all civil engineers laid out the grid that would be the means and symbol of Indian industrialization, the railroad. From 32 km laid down by 1853, the system exploded to 7670 km by 1870, and then continued to grow. Each reform demanded others, however, if it was to succeed. The railroad, for example, was inextricably dependent on wood—for construction, particularly ties ("sleepers"), for fuel, for cargo. The rationalization of India through the railroad required the rationalization of India's forests.

Indian forestry became one of the great sagas of British rule, however improbable its origins. Britain, after all, had no tradition of forestry and precious little of anything that could be called a forest. But it was clear that the reconstruction of India was doomed without some deliberate intervention. Without forests railroads would run down, agriculture would suffer from drought and flood, soil would

degrade, and a timber economy based on the export of teak would collapse. Even by the mid-19th century it was clear that economic and political forces were, like an acid, dissolving the grout that held together the Indian mosaic. If something did not reglue them, nothing would remain but a pile of broken tiles. Besides, the rationalization of the "jungle" (as the uncultivated wildlands were called) was an ideal symbol of liberal reform. If India's jungle could be reordered according to scientific principles, so could the rest of India.[12]

Britain went to the heartland of European forestry for help. In 1856 it appointed Dietrich Brandis as Conservator of Forests for Burma. A botanist subsequently educated in forestry in the grand European manner, Brandis was the archetype of the transnational forester, Humboldtean in ambition, an indefatigable agent of empire, a Clive of natural resource conservation in Greater India. Two years later Brandis became Inspector-General of Forests for all of British India, a dominion that grew dramatically not only as Britain added more provinces to its Indian domain but as the practice of reserving forests proceeded in conjunction with the reorganization of the Indian landscape through revenue settlement.

Brandis pushed for the establishment of the Indian Forest Service, achieved in 1864, one of the compelling institutions of British rule and the centerpiece for forestry throughout the British empire. Cadets received formal instruction in Franco-German forestry at Nancy, France, then served field apprenticeship in India. From there they might proceed to Sierra Leone, Cape Colony, or Tasmania. This was the same regimen experienced by the founders of American forestry, men like Gifford Pinchot and Henry Graves. In 1906 the facility relocated to Cooper's Hill at Oxford, and later a separate school and research institution were established for India at Dehra Dun. The Indian Forest Service, meanwhile, became a part of the civil service and after critical conferences in the early 1870s assumed its modern form. On the recommendations of the conferees the IFS in 1875 launched the *Indian Forester*, for 50 years probably the premier forestry journal in the world.

Enthusiastic foresters—Sir David Hutchins reminded them that they were "soldiers of the State, and something more"—entered into the reconstruction of India, attempting to regulate timber harvesting, to control traditional forest uses by pastoralists and villagers, to regenerate felled or degraded woodlands, and to suppress fire. They as much as anyone pioneered the shock encounter between Britain and India, between the institutions of the West and the environments of the East. The encounter mixed in equal proportions

high drama, absurdity, grit, the irony of noble purpose and practical stupidity. Rudyard Kipling captured something of all this in his story "In the Rukh," a sequel to *The Jungle Books*. "Of all the wheels of public service that turn under the Indian Government," he intoned, "there is none more important than the Department of Woods and Forests." On it depended the reforestation of India. And it is to the Indian Forest Service that Mowgli, now grown but still conversant with his brothers the wolves, goes as a forest guard. Among his duties are "to give sure warning of all the fires in the *rukh*." Those fires needed to be suppressed. The globe-encircling fire engines of the British raj would replace the encircling flames of the *nataraj*.[13]

Here was something new. While over the centuries forests had ebbed and flowed with wars and population pressures, fires had come and gone with the monsoons. Fire practices had changed, but fire had endured. Some years Shiva's drum beat louder than the torch, some years not; the ring of fire expanded and contracted; but always the circle held. It was unimaginable that fire could cease. Without fire the land was inaccessible, India uninhabitable, and life unknowable. Without fire the cosmos faced extinction. Without the encircling fire the *nataraja* would end.

The pioneers of Indian forestry, Shebbeare recalled, saw fire as "their chief, almost their only enemy." The extravagance of fire that seeped, simmered, probed, flared, and raged annually throughout India made a shambles of any presumption to reorder those forests along European models. Fires infested the land like malaria or packs of wild dogs. But the challenge went beyond their damage to pasture and woods, beyond the wanton sacrifice of India's immense wealth of forests. Those fires appeared as an environmental superstition, a taunt that mocked the possibility of remaking India in ways that would serve Britain and serve to legitimate British rule. Britain could justify redirecting India's forests to new purposes only if those purposes had higher standing, if they were part and parcel of a more rational order. It had to remake India's "irregular" forests—its tangled "jungles"—into "rational" institutions. It could harvest forests only if it demonstrated how to regenerate and protect them according to some larger principles.[14]

So in addition to the compelling economic reasons that linked forest to rail, and to the political logic that demanded the subordination of rural villages to a central, industrial authority, the British added the symbolism of science to their justification for fire control. The power to control village life resided in the power to control forest and

range, and that depended on the power to control fire. Because Britain's claim to impose a modern ecological rule on India relied on its sanction by scientific silviculture, the British had to oppose "primitive" practices with a "rational" agriculture and a scientific forestry. In European agronomy the divide between the primitive and the modern was fire. Fire had to go.[15]

The experiment began in 1863 when Brandis urged Colonel Pearson of the Central Provinces to try to stop the burning. No one believed it was really possible. "Most Foresters and every Civil Officer in the country," Pearson observed, "scouted the idea." Edward Stebbing recalled matter-of-factly that in every province "the officers of the Department had to commence the work of introducing fire conservancy for the protection of the forests in the face of an actively hostile population more or less supported by the district officials, and especially by the Indian officials, who quite frankly regarded the new policy of fire conservancy as an oppression of the people." Even forest officers, Stebbing noted, however much they approved of fire control in principle, "were openly sceptical" of its practical possibility. Had his attempt failed, Pearson affirmed, "any progress in fire protection elsewhere would have been rendered immeasurably more difficult." Pearson shrewdly selected a site protected by natural barriers, a biotic counterpart to the fortresses at Ranthambore and Jaipur. He then laid out fuelbreaks, sent out patrols, exhorted locals to give up burning, and enjoyed a couple of exceptionally wet seasons. To everyone's astonishment, the experiment succeeded. The Bori Forest became a showcase of fire conservancy. At the Forest Conference of 1871-72, based on these experiences, Pearson declared that "there can be no doubt that the prevention of these forest fires is the very essence and root of all measures of forest conservancy." Brandis added his imprimatur. "There is no possible doubt," he wrote, as to its "immense value and importance." Fire conservancy was, not accidentally, the first topic addressed by the first conference on forest administration.[16]

Not completely, not without considerable debate and second-guessing, but thanks to militant enthusiasm and patience and favorable weather, this improbable experiment in fire control evolved into a demonstration program, and then into a prototype suitable for dissemination throughout Greater India. At the seminal Forest Conference of 1875 Brandis reaffirmed that for the improvement of Indian forests "there is no measure which equals fire conservancy in importance." It is, he continued, "the most important task of the Forest Department in most provinces of the empire, and for that

reason was awarded first place in conference discussions." Pearson's successor, Captain J.C. Doveton, detailed the ways and means of fire conservancy and observed sourly that these measures were only necessary because "nearly the whole body of the population in the vicinity of forest tracts have, or imagine they have, a personal interest in the creation of forest fire." Not least of all because of that hostility, three classes of state forests evolved, each committed to a different level of use and protection.[17]

Once confirmed the idea spread, promulgated from the top down. As with the native principalities, so with the native forests; more and more were reduced to British rule by fire protection, for to control fire was to control the native populations. Regardless of the legal status of forests, without fire the local populace had no biological access to the resources of those reserves. By 1880-81 the Indian Forest Service had reduced some 11,000 square miles to formal protection; by 1885-86, some 16,000 square miles; and by 1900-1901, an astonishing 32,000 square miles that spanned the spectrum of Indian fire regimes, from semiarid savanna to monsoonal forest to bamboo groves and montane conifers. Fire control grew as rapidly as the railroads with which it was indissolvably linked. Fire protection targeted particularly the great timber trees of the subcontinent, sal, teak, chir pine, and commercial bamboo. What emerged was a robust exemplar, an adaptation of European techniques to exotic wildlands and colonial politics.

But skeptics were not easily stilled. Pearson spoke dismaying that "it is strange how slow even some, who possess very considerable practical acquaintance with the forests, are to recognize" the intrinsic merit of fire exclusion. In the *Report on the Administration of the Forest Department for 1874* B.H. Baden-Powell echoed and scorned that disbelief.

> Strange to say, that, obvious as the evils of fire are, and beyond all question to any one acquainted with even the elements of vegetable physiology, persons have not been found wanting in India, and some even with a show of scientific argument (!), who have written in favor of fires. It is needless to remark that such papers are mostly founded on the fact that forests *do* exist in spite of the fires, and make up the rest by erroneous statements in regard to facts.

On the matter of fire conservancy science admitted no doubt, and neither did colonial administrators bent on imposing a new order on a very old and complex land.[18]

Like a fire in a punky log, however, the matter would not go out. Soon field men voiced ever greater doubts about the wisdom of "too much fire protection." In wet forests fire protection seemed to retard natural regeneration, and it allowed fuels to accumulate that, once dried, exploded into all-consuming conflagrations. In drier forests, years of seemingly successful protection would be wiped out by massive fires during exceptional years. Exhortations and bribes with goats could not extinguish all the native firebrands who knew from daily experience what burning meant. Villagers refused to resettle or remain in unburned sites for fear that tigers, hiding in the tall grasses, would seize child herders. (Unlike the American or Australian experience, Indian natives would not melt away, vastly outnumbering the ruling caste, and their fires could not be banished into the past or sequestered onto reservations.) Hunting clubs in the Nilgiri Hills noted the deterioration of game where fires had been excluded. In the absence of suitable fire regimes natural regeneration failed in sal, teak, bamboo, pine—and failed consistently, particularly in wetter sites. Field officers began posting querulous memos about increases in diseases, pests, weeds, and other signs of a forest going feral. An agronomic memoir on Indian grasses noted how "an unforseen result of the policy of non-interference with the vegetation" was the accumulation of dead straw that defiantly withstood "rotting" and eventually had to be burned, an act which quickly yielded a variety of useful results. Forest guards surreptitiously burned surrounding lands, including the lower grade forests, to improve their chance of fire control on class I sites. Upon his retirement in 1952 a native Indian forester commented that in his 41 years of service he had never known a forest to withhold fire for more than three years.[19]

In what might serve as a cameo, an Anglo forester who signed himself "An Aged Junior" described for the *Indian Forester* the puzzling situation in which, through more or less successful fire protection, the forest had acquired a tiger problem. It is apparent that fire had not been random and ravenous, as it appeared to the British, but had been applied to particular sites at particular seasons for particular purposes by particular peoples. Those selective burns had ordered the landscape. Thanks to fire fresh browse appeared at the proper place at the proper time; deer migrated to those sites; tiger followed the deer; and hunters knew where to find rogue tigers. But eliminating fire, or smearing it, affected that land as the abolition of caste would Indian society. Boundaries blurred. The ecological order became confused. Tigers no longer kept to their place—their place being scrambled and overgrown.

They began to menace local communities, follow rangers, and generally make themselves "disagreeable." The forest now had "much fire conservancy and many tigers." Whether successful or not, the *attempt* at fire control was sufficient to unbalance the Indian biota. Changing from small fires set annually to large fires that came every three or four years did not preserve the old order. It was not simply fire that India needed but its syncretic order of fire regimes.[20]

It was not so easy to reconcile European principle with Indian reality. Critics argued for a hybrid program in which controlled burning could supplement fire suppression. In 1897 Inspector-General Ribbentrop, Brandis' successor, had to intercede. To protect regeneration and forest humus (the twin obsessions of European forestry)—to say nothing of saving imperial face—he ruled for the further expansion of systematic fire protection. Edicts, however, did not suppress fires, or doubts. By 1902 the debate rekindled within the pages of the *Indian Forester* and the annual reports of the provincial conservators. In 1905 a compromise was proposed by which controlled burning could be brought into working plans. Meanwhile *sub rosa* burning in Bengal, Burma, and elsewhere scorched the landscape like a people's rebellion.

In 1907 protest boiled over into a Burmese revolution. In the absence of traditional fire—slash-and-burn cultivation, routine underburning—teak simply refused to regenerate. Fire control had drained away the economic lifeblood of the Asian monsoon forest; foresters had prescribed a harsh cure where there had been no disease. Faced with a choice between excluding fire and excluding fire protection, the Inspector-General began withdrawing fire control from prime teak forests. One after another working circles that had subscribed to fire protection now withdrew it—Pyu Chaung and Pyu Kun in 1906, Kan Yutkwin in 1910, Bondaung, Kabaung, and Myaya Binkyaw four years later. By 1914 conservators of sal forests likewise recognized that regeneration "had ceased throughout the fire-protected forests of Assam and Bengal and that no amount of cleanings and weedings would put matters right." They tried to reintroduce fire, but fuels had so changed that it was no longer possible to run benign light fires through the understory; the *taungya* system by which swidden fields were restocked with planted timber trees evolved as a partial compromise. Chir pine, too, was found to be reliant on routine fire, so that nearly everywhere field foresters introduced some form of "early" (that is, spring) burning of grassy understories for fire protection, and integrated regeneration burns into silvicultural cycles. Whatever the causes for the failure of natural regeneration, Shebbeare

concluded for an audience of foresters drawn from the British empire, "fire appears to be the only real cure."[21]

By 1926 the cycle of fire practices had come full circle. Imperial resolve retreated before an unscorched earth, the passive disobedience of Indian silviculture. A conservator's conference amended the rules of the *Forest Manual* to make early burning the general practice and to extend complete protection only to special sites on a temporary basis. With nice irony that new regime included the Central Provinces. Some critics wanted even more. Writing from Siran Valley, E.A. Greswell noted that "up to 1922 the [chir] forests had been subjected from time immemorial to periodic summer firing," probably burned once every three to four years. The cessation of those fires damaged regeneration and put the forest at risk from wildfire. The reintroduction of fire was "merely re-establishing a modified form of the environment to which the forests owe their origin." Greswell knotted practice to philosophy when he concluded that "we talk glibly about following nature and forget that the nature we are visualising may be an European nature inherited from our training and not an Indian nature." The fire of Europe was not the fire of India.[22]

But by this time Britain, never fully recovered from the wastage of World War I, was receding in imperial power and enthusiasms, its hold on India becoming steadily more tenuous. Protests increased, often focused on forestry and typically assisted by outbreaks of incendiarism. In 1916 and again, with even greater force, in 1921 political protest in Kumaon inspired a wave of woods arson that brought the regional administration to its knees. Administrators openly admitted their helplessness before the protest of incendiarism, another argument in favor of co-opting burning. But such spectacular outbreaks paled besides the relentless insurgency of small firings. Writing in 1926 M.D. Chaturvedi observed that "prosecutions for forest offences, meant as deterrents, only led to incendiarism, which was followed by more persecutions and the vicious circle was complete." Inevitably, grudgingly concessions followed. Compromises remained compromises, however, the best one could do under troubled circumstances. With few exceptions—but among them some of the best minds in Indian forestry like R. S. Troup—foresters continued to insist that fire was intrinsically bad. They saw it, as they did the native elites, as a necessary evil, not as a powerful ally. Fire remained an impermeable divide in the worldview of European agronomy and silviculture. If a system used fire, it was by definition primitive; if it found surrogates for fire, it could qualify as rational.[23]

In India there were few surrogates possible. Where officialdom approved fire it did so reluctantly, with some embarrassment, and only because fire was seemingly part of an ineffable (and exasperating) East. Fire reduced rational plans to a kind of ecological astrology, and the practices of a scientific forestry to a flame-lit *puja*. Fire persisted as an untouchable caste within the society of silviculture. The Indian Forest Service burned because it was forced to, not because it wanted to. Where fire was used, it was often not sanctioned, and where sanctioned, often not used properly. As British rule met further resistance, that split widened; theory and practice diverged; the landscape was neither old nor new nor some workable compromise between them. The cycle of fire broke.

What had been a circle became a spiral. The process began well before Independence, and it has continued after the British were expelled. What Britain had done with imperial arrogance, independent India claimed it would do with a social conscience; but whatever their sanction the practices continued, and then accelerated; and this acceleration was itself quickly exceeded by a horrific explosion in the subcontinent's population. However incomplete or mismatched, the reforms of the British raj had initiated a population rise that continues its exponential growth to the present day. In 1800 the estimated population of India was 120 million; in 1871, 255 million; in 1950, 350 million, despite the upheaval of partition; in 1990, 890 million. Until the 1970s the numbers of livestock swelled in almost equal proportion. Much of the human increase gathered into cities; a substantial fraction was absorbed by industry; but the rest (over 70%) remained on the land, and one way or another, this maelstrom of peoples and beasts sucked down the Indian environment in its vortex.

The upward spiral of human numbers powered a downward spiral in land abuse. Some 16% of the world's population crowded into 2% of its landmass. India's forests felt the pressures keenly, particularly the *terai* and hill forests that had, because of endemic diseases like malaria, been shielded from use other than by those tribal peoples who had acquired some degree of immunity. Disease control, the construction of dams and roads, intensive logging, clearing for additional farmland, and a redefinition of reserves to serve the tenets of "social forestry" eroded away India's woodlands, and often their soils. The commitment to industrial forestry that British rule had established, the Indian state reaffirmed; previously unexploited indigenous forests were opened by roads, logged, and often replaced by exotics like eucalypts that provided pulp but little of the other

products India's woods had supplied Indian society. Although the Indian constitution stipulated that 25% of India should remain forested in some form (and the Forest Law of 1952, 33%), the reality was closer to 19%, and critics thought even that number too high; much of the reserved jungles were too degraded to classify as productive woodland. Once placed under state care, forests had required the coercive power of the state to survive. As further political unrest threatens the nature of the Indian polity as a secular state, that power promises to recede and to leave India's forests exposed to everyone's grasp and no one's care.[24]

The intensity of use has disturbed the character of Indian fire. There remains plenty of burning of course. Agricultural fire is common where cotton, sugar cane, and wheat are grown, and among the crop residues of hill farming. *Jhum* cultivation persists in the northeast, the Ghats, the outer Himalayas, and among tribal peoples in Andhra Pradesh, Orissa, and elsewhere. An estimated 122,000 km^2 of permanent pasturage is burned annually. Among reserved and protected forests controlled burning assists the regeneration of chir pine, sal, and teak; fuelbreaks are burned early each dry season; particularly where forests plantations are at risk, underburning is practiced to reduce fuels and prevent against wildfire. Altogether this amounts to 5-6% of the reserved forest area. Still wildfire, either from "accidental" or incendiary causes, affects an estimated 10,000 km^2 yearly, as officially reported. Satellite inventories, however, calculate that 80 times this amount burns annually, some 33% to 99% of the protected forests in different states. These numbers do not account for forests subject to less strict regulation. The forest area affected by fire may reach 37 million ha. Even so the biomass burned as firewood in villages and urban centers exceeds that of all these other sources combined. Increasingly India's woods are being burned in its stoves.[25]

The quest for a suitable regimen of fire continues. It is pointless to argue for a restoration of traditional practices—the circumstances are too much changed to allow them. What had once rested as forest fallow for 30 years is now slashed and burned in five years, and sometimes as little as two. What formerly experienced small fires that percolated through the jungle over the course of five or six months now suffer from no fire or fire that crowds into short, violent events. Even traditional burning no longer recycles nutrients through a subsistence economy but siphons them off into a global market; where tribals had traditionally burned once under *mowah*, they now burn twice, and the harvested flowers do not go to the village but the

metropolis. The complex of fires that once fused the human and the natural together through the layered intricacies of a shared caste is gone. More and more India's fire regimes are defined by a global economy in which the forest exists as cellulose and wood is valued as an export commodity; less and less, by the traditional usage of the forest as a medley of usable plants and animals. The beat of pistons, powered by fossil-fuel combustion, replaces the rhythms of seasonal growing, curing, and burning. Artificial fertilizer replaces *rab*; the tractor and electric pump, the long fallow of *jhum*; autorickshaws, the bullock cart. Some time around 1980 India crossed an industrial threshhold of sorts when deaths from traffic accidents exceeded those from snakebites.

Yet no surrogate complex of fire practices has fully replaced it. To the extent that Indian scientists receive training from Europe or look to European scholarship for guidance, they continue to distrust burning, as though it were still a stigma of primitiveness, a leprosy on the landscape. No one has transformed India's unique experience into a new exemplar for "Third World" firepowers, a model of non-alignment in the dialectic between those who would base fire management on fire control and those who base it on fire use. India's elite still viewed fire as an inevitable if necessary evil, like cobras. If were possible to escape from the endless cycle of fire, to lay down the burden of burning, they would. That would be release, forestry's nirvana. But the cycle has not vanished: it has become a more vicious spiral.

Instead with assistance from the U.N. Food and Agriculture Organization (FAO) India launched a "modern forest fire control project" in 1984 that sought to install an integrated fire management system in two demonstration areas, Chandrapur (Maharashtra State) and Haldwani (Uttar Pradesh). The first contains extensive natural and planted teak forests; the second, hills dominated by sal and chir pine. Both projects, that is, intend to apply fire control to support the ambitions of industrial forestry. Incorporated into India's Eighth Five-Year Plan, Phase Two will expand the technologies into ten states and 40,000 km^2. Whether the project becomes a latter-day Bori Forest, a misinterpreted experiment; or whether it evolves into another showcase of international aid with airtankers and helicopters taking the place of high dams and nuclear reactors; or whether it begins the process of reconciliation between new and old, fusing a uniquely Indian style of fire management, all remains to be seen.[26]

It may be that reconciliation is impossible, that as in the *nataraja* India must simply hold and live with the opposites. This

time, however, fire is not part of a cycle of endlessly reincarnating landscapes, but a spiral, propelling the biota to one extreme or another at an ever-quickening tempo. Without those encircling flames, the boundaries are broken, drum and torch no longer link, their rhythms no longer balance, and the dance must end in either frenzy or exhaustion.

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[1] For an introduction to the ecological background of the subcontinent, see M.S. Mani, ed., *Ecology and Biogeography of India* (Dr W. Junk Publisher, 1974), 2 vols. A quick synopsis of the principal biomes is available in F. R. Bharucha, *A Textbook of the Plant Geography of India* (Oxford University Press, 1983). For forests, consult G.S. Puri et al, *Forest Ecology*, 2nd ed (Oxford & IBH Publ. Co., 1990), 2 vols. Regrettably no digest of fire practices or summary of Indian fire ecology exists.

[2] See M.P. Nayar, "Changing Patterns of the Indian Flora," *Bulletin of the Botanical Survey of India 19*(1-4) (1977, 145-155.

[3] For the influence of caste on shaping the environment, see Madhav Gadgil and Ramchandra Guha, *This Fissured Land. An Ecological History of India* (University of California Press, 1992); Madhav Gadgil, "Deforestation: Problems and Prospects," 13-85, in Ajay S. Rawat, ed., *History of Forestry in India* (Indus Publishing Company, 1991); and for an interesting case study, Madhav Gadgil, "Ecology of a Pastoral Caste: The Gavli Dhangar of Peninsular India," *Human Ecology 10* (1982).

[4] To my knowledge there is no systematic survey of Indian tribal fire practices. The evidence is scattered among travel and ethnographic accounts and especially among reports by British foresters as recorded in working plans and in submissions to the *Indian Forester*. Quotation from Alfred Radcliff-Brown, *The Andaman Islanders* (Free Press, 1948), p. 258. (Radcliffe-Brown was wrong about the ability of the Andamanders to make fire; they could, but like most aboriginal peoples chose to preserve what they had.) Pearson from "Progress Report of Forest Administration in the Central Provinces, 1863-64" (Calcutta, 1865), 27. For Australian fire practices, see Stephen Pyne, *Burning Bush* (Holt, 1991).

[5] The literature on *jhum* cultivation is enormous. For historical references, see H.H. Bartlett, *Fire in Relation to Primitive Agriculture and Grazing in the Tropics. Annotated Bibliography*, 3 vols. (University of Michigan Botanical Gardens, 1955-1961). For a contemporary survey, see P.S. Ramakishnam, *Shifting Agriculture and Sustainable Development*, Man and Biosphere Series Vol. 10 (Parthenon, 1992).

[6] See Gadgil and Guha, *This Fissured Land*, 79-82.

[7] Agni is everywhere in Vedic theology. A massive inquiry into the fire ceremony is Fritts Staal, *Agni*, 2 vols. (Asian Humanities Press, 1983).

[8] Citations from Clarence H. Hamilton, ed., *Buddhism* (Bobbs-Merrill, 1968), 40-41.

[9] See Ajay S. Rawat, "Indian Wild Life Through the Ages," 134, in Rawat, ed., *History of Forestry in India*.

[10] E.O. Shebbeare, "Fire Protection and Fire Control in India," *Third British Empire Forestry Conference* (Canberra, 1928), 1; Joseph Hooker, *Himalayan Journals*, Vol. 2 (London, 1855), 3; F.B. Bradley-Birt, *Chota Nagpore* (London, 1910), 184; Benjamin Heyne, *Tracts, Historical and Statistical, in India* (London, 1814), 302; Ribbentrop, *Forestry in British India*, 150.

[11] Cox quoted in A.A.F. Minchin, "Working Plan for the Ghumsur Forests, Ganjam District" (Madras, 1921), 38-40.

[12] For overviews of British forestry, see Edward Stebbing, *The Forests of India*, 3 vols (Bodley Head, 1928), a fourth volume coming later under the editorship of Harry Champion and F.C. Osmaston (Oxford University Press, 1962); Rawat, ed., *History of Forestry in India*; Gadgil and Guha, *This Fissured Land*; and Richard Haeubaer, "Indian Forestry Policy in Two Eras: Continuity or Change?," *Environmental History Review 17(1)* (Spring 1993), 49-76.

[13] D.E. Hutchins, *A Discussion of Australian Forestry* (Perth, 1916), 45; Rudyard Kipling, "In the Rukh," *The Jungle Books* (Oxford, 1987), 326-327, 343.

[14] Shebbeare, "Fire Protection and Fire Control in India," 1.

15 For a revealing illustration of how critical fire was in European thinking, see G. Grotenfelt, *Det primitive jordbrukets metoder i Finland under den historiska tiden* (Methods of primitive agriculture in Finland during historical times) (Helsinki, 1899). Even the legendary Linneaus was forced to delete favorable comments on slash-and-burn agriculture in Småland from his Skåne travels, such was the urgency with which intellectuals argued against fire and in favor of manure; see Lars J. Larsson, "Svedjebruk i Varend och Sunnerbo," 84-86, in Olof Nordstrom et al., *Skogen och Smålanningen*. Historiska foreningens i Kronobergs lan skriftserie 6 (SmpTRYCK AB, 1980). Quotation from C.K. Hewetson, "Fires and Their Ecological Effects in Madhya Pradesh," *Indian Forester 80(4)* (1964), 238.
16 Pearson quoted in Shebbeare, "Fire Protection and Fire Control in India," 1; Lt. Col. G.F. Pearson, "Report on the Administration of the Forest Department in the Several Provinces Under the Government of India, 1871-72" (Calcutta, 1872), 9; Dietrich Brandis, Memorandum No. 263, *Forest Conference of 1871-72*, 5.
17 Brandis, *Forest Conference of 1875*, 4; Capt. J.C. Doveton, *Forest Conference of 1875*, 5.
18 Pearson, *Forest Conference of 1871-72*, 9; B.H. Baden-Powell, "Report on the Administration of the Forest Department in the Several Provinces Under the Government of India 1872-73," Vol. 1 (1874), 67.
19 W. Burns et al, "A Study of Some Indian Grasses and Grasslands," *Memoirs of the Dept. of Agriculture in India, Botanical Series 14* (1928), 1-57.
20 An Aged Junior, "Some Remarks on Titles and Tigers," *Indian Forester 16* (1-3) (1890), 182-184.
21 Shebbeare, "Fire Protection and Fire Control in India". The details of the story unfold over many years in the *Indian Forester* and are best understood in sequence.
22 E.A. Greswell, "The Constructive Properties of Fire in Chil (Pinus longifolia) Forests," *Indian Forester 52* (1926), 502-505.
23 Political incendiarism, particularly in Kumaon, is well described in Ramachandra Guha, *The Unquiet Woods: Ecological Change and Peasant Resistance in the Himalaya* (Oxford India Paperbacks, 1991). M.D. Chaturvedi, "The Progress of Forestry in the United Provinces," *Indian Forester, XI* (1925), 365. For Troup's ecological analysis, see R.S. Troup, "Pinus Longifolia Roxb.: A Silviciltural Study," *The Indian Forest Memoirs*, Silvicultural Series, Vol. 1, 1 (Calcutta, 1916).
24 For an environmentalist critique of Indian forest policy, see Centre for Science and Environment, *The State of India's Environment 1984-85. The Second Citizens' Report* (New Delhi, 1986), and for a critical review of the policy of state-based resource management, Gadgil and Guha, *This Fissured Land*. The official assessments are available in the Forest Survey of India's "State of Forest" reports, issued annually.
25 Statistics based on Veena Joshi, "Biomass Burning in India," in Joel Levine, ed., *Global Biomass Burning* (MIT Press, 1991), 185-193.
26 R. Saigal, "Modern Forest Fire Control: the Indian Experience," *Unasylva 162*(41) (1990), 21-27.