

COTTON, CLIMATE, AND COLONIALISM IN DHARWAR, WESTERN INDIA,
1840-1880.

In this article, I use a political ecology approach coupled with the insights of critical environmental history to explore the state-directed cotton improvement projects in Dharwar, western India, in the nineteenth century, the climatic assumptions and processes that influenced them, and the responses of local peasant cotton producers. Political ecology's fundamental concern to unravel the political and economic forces at work in environmental change, its interest in the production of nature by human and non-human actors, and its sensitivity to the perspectives and agencies of local producers, provide a fruitful framework for connecting and analysing these interacting histories of cotton, climate, and peasants in colonial India.¹ Political ecology's primarily geographical register is complemented by critical environmental history's emphasis on the significance of historical-colonial processes as expressed in specific colonial projects, policies and discourses related to the management of tropical environments, the impacts of which often endured into the postcolonial era.²

While evidently embedded in broader historical-geographical fields, the focus on local processes – on Dharwar during the specified chronology - enables a careful situating of the time and place specificities of cotton imperialism in the nineteenth century, in a way that brings out the diverse nature of the cotton plant and the complexity of its interactions with climatic conditions and human interests. This indicates a potentially fruitful approach to the study of agricultural commodities during the colonial era. Cotton was not a monolithic substance but was (and is) characterised by a diverse range of species, plants and fibres. Cotton 'difference' was in fact the primary motive underlying plant experiments launched by the colonial state following the conquest of western India by 1818. The aim was to 'improve' the quality of the cotton grown in India through the eventual mass cultivation of the 'right' species of plant that would produce larger yields and longer fibres (better suited to weaving into fine cloth) than existing Indian cottons. In Dharwar, this involved the attempt to supersede the local, indigenous cotton known as *Kumta* by introducing and acclimatising on Indian soil a new foreign variety imported from America, *New Orleans*. It is this colonial-engineered botanical contest, the limitations and contradictions of colonial power it revealed, and the responses of peasant producers it elicited, that provides the central narrative of this article.

The need to acclimatise the imported American variety therefore meant that there was a great deal of 'climatic thinking' amongst colonial officials responsible for the cotton improvement projects. Dharwar and the wider region of the Southern Mahratta Country were imagined as possessing the ideal climate for the New Orleans variety to flourish. The Collector of Dharwar claimed that the local climate was very similar to that of the cotton districts of the American south; indeed, the experiments in New Orleans were premised on Dharwar's seemingly amenable climate rather than on its soil which was not seen as markedly superior to any other cotton producing region of India. While recognising its occasional capriciousness, colonial officials also tended to view climate as essentially stable and predictable. Dharwar, however, comprised three different rainfall zones and the main cotton growing lands were located in the dry north and east of the district. These climatic nuances were never fully appreciated by cotton officials during this period. Moreover, as this article shows, the local climate was also undergoing significant change as a result of widespread deforestation in the region, caused by the colonial appetite for timber.

The colonial cotton projects were not only confronted by climate variabilities. Difficulties also arose in relation to the ginning (cleaning) of transplanted New Orleans cotton that, similarly, had not been envisaged and which were not fully overcome during this period. Most significantly, cotton officials faced the refractory responses of local peasants, accustomed to growing indigenous Kumta cotton as one aspect of a diverse, risk-averse cropping system aimed at ensuring food security. This cotton had its local uses and was also important as a cash crop, particularly when prices were high. However, more aware of climatic vicissitudes than their colonial rulers, local peasants tended to prioritise the growing of a range of *jowar* (Indian millet) food crops that would ripen at different times of the year and ensure an adequate supply of food in the villages. Attempts to foster the privileged cultivation of New Orleans cotton thus confronted the existing material culture of peasant life in Dharwar and involved the deployment of 'a whole series of specific governmental apparatuses' to persuade peasants to embark on the path of cotton 'improvement'.³ In a colonial context, however, 'governmentality' did not entail the liberal assumptions of its original Foucauldian usage, but rested on an ideology of indigenous deficiency that required the intrusion of the state in virtually all areas of social life. Ranajit Guha has rightly emphasised the coercive and authoritarian dimensions of the colonial state, but his fixed characterisation of colonialism as 'dominance without hegemony' does not quite do justice to the flexible and situated registers of the Gramscian concept of 'hegemony' which allows for a varied, time-

and place-specific, range of responses to colonial domination.⁴ As this article shows, colonial hegemony involved the use of power in ways that produced countervailing forces in both the social and natural worlds that frustrated, subverted, and transformed the designs of cotton 'improvement'.

In spite of the formidable array of resources it could muster, it is the limitations and fragilities of colonial power that are highlighted in this study. It therefore offers a somewhat different perspective from the otherwise valuable works on the colonial cotton/environment interface by Laxman Satya, Mike Davis, and Sven Beckert that have appeared in recent years.⁵ These authors tend to present a singular, generic understanding of 'cotton' as well as a monolithic view of the power of the colonial state in India. They perceive 'state power' as having been able to coerce cultivators to 'dedicate themselves single-mindedly to the production of cotton' for the colonial export economy with the onset of the American Civil War in the second half of the nineteenth century.⁶ As a result, these works convey little sense of the frailties of colonial cotton imperialism due both to the state's lack of coherence in implementing improvement programmes and to the contradictory effects of coercion. Moreover, their predominant focus on colonial designs for cotton export neglects consideration of local social processes that were crucial for actual cotton outcomes.⁷ They provide little indication of the agency of Indian peasant cultivators, made possible by the function of cotton in the local economy and by peasants' accumulated knowledge of the possibilities of indigenous plants in the context of dry soils and local climatic conditions. Local indigenous perspectives are also absent from Matthew Schnurr's interesting recent paper on scientific cotton experiments in twentieth-century Africa. The view put forward here is that colonial scientists were at least partially successful in breeding a new variety of cotton as a result of their sensitivity to diverse local ecological conditions, but it relies entirely on the arguments and claims made by the 'experts' themselves and remains silent about the wider impact of these colonial projects on the African environment.⁸

COLONIAL COTTON DESIGNS

'It is one of the most remarkable features of our present mercantile position that one foreign nation supplies almost the whole of the Cotton used for British

manufactures, while our own empire contains resources which might be readily brought to relieve us altogether from foreign dependence'.⁹ This statement by the Court of Directors of the East India Company in August 1840 came in the wake of yet another of the periodic crises caused by the shortfall of American raw cotton supplies to the mills of Lancashire, echoing similar sentiments expressed by Lancashire and Scottish manufacturers. Meanwhile, in India itself, a complementary set of factors gave 'cotton imperialism' additional impetus. The potential of raw cotton as a generator of revenue was second to none, and George Arthur, Governor of Bombay, referred to it as 'our great staple', the improvement of which was vital 'to the commercial and agricultural interests of this Presidency' as well as 'to the public revenue'.¹⁰ Indeed, the entire structure of colonial rule in India at local rural level was organised around the levy and collection of land revenue which comprised the colonial state's primary source of income.¹¹ Tellingly, districts were administratively delineated as 'Collectorates', i.e. according to their revenue functions, and headed by 'Collectors' assisted by village-level indigenous revenue officials known as *mamlatdars*.

The 'will to improve', as Tania Murray Li has shown, is central to colonial hegemony. The capacity to diagnose deficiencies in the world of the peoples subjected to colonial rule, and to identify remedies for them, is a characteristic feature of the cultural superiority inherent in colonial hegemony.¹² 'The natives are mere children', wrote the Collector of Dharwar, A.N. Shaw, to the Government of Bombay in 1843, 'with the disadvantage of being full of prejudice and suspicion, but by placing before their eyes a few small experimental farms as schools and examples, and then reasoning and leading them to adopt the improvement, something might be done'.¹³ A form of agricultural 'trusteeship' based on the myth of the backward and unenterprising cultivator, cotton improvement involved three inter-related dimensions: first, it meant importing into India, acclimatising, and experimenting with, a variety of foreign or 'exotic', primarily American, cotton plants that were believed to offer superior yields and 'qualities' to indigenous cottons; second, it meant introducing improvements in cultivators' traditional ways of gathering and cleaning Indian cotton so as to eliminate the 'impurities' which were alleged to determine its poor value in the British market; and third, it implied securing an extension, over time, in land under 'improved' cotton cultivation, which was to be held under new individualised modes of tenure within a reformed cash crop based agricultural sector.

Western India remained the primary home of Indian cotton production, and small-scale experiments involving the distributing of foreign seeds to the cotton growing lands of Gujarat and the Southern Mahratta Country were initiated in the early years of the nineteenth century. These experiments gathered further pace in the 1820s and 1830s and involved Brazilian (Pernambuco) and Egyptian varieties as well as the American Bourbon, Sea Island, and New Orleans cottons.¹⁴ The Court of Directors specifically instructed the Bombay government to conduct these experiments, less as a result of pressure at this stage from Lancashire commercial bodies, than from a desire to re-invent its own mission in India as one of 'enlightened government', in the face of growing political hostility to the Company at home. The focus of enlightened government was to be on 'improving' agriculture which would be facilitated by the new science of botany.¹⁵ The Company began, via its local Presidency governments, to develop a network of botanic gardens in India, relying on the expertise of an emerging group of 'surgeon-naturalists' who threw themselves enthusiastically into organising mass plant transfers from various parts of the world. Employed by the Bombay (and other Presidency) governments, many of these naturalists came to be at the heart of the cotton experiments, effectively ensuring a symbiotic relationship between the new science of botany and the agendas of colonial rule.

Initial experiments were, however, largely unsuccessful as the various foreign plants 'were found to degenerate rapidly and to yield thin unsatisfactory crops'.¹⁶ Nor were local *ryats* (peasant cultivators) persuaded to change their modes of cultivation, gathering and cleaning. Discouraged by lack of progress, the Bombay government closed the cotton experimental farms in 1836, just as the Court of Directors in London were about to commit themselves to a radically more ambitious experiment in 'improving' agriculture. This involved the hiring of technical expertise through the employment of twelve American cotton planters, recruited from the state of Mississippi. In both India and Britain, botanists and cotton promoters alike were impressed by the spread, in just a couple of decades, of cotton culture across the American south, making the raw cotton so prized by Lancashire the most valuable American export by the mid-1820s.¹⁷ This, they solely attributed to the knowledge of the planters rather than to the skilful labour of the enslaved cultivators.

On their way to India, some of the planters stopped over in Manchester visiting the Chamber of Commerce and several cotton mills where 'the deficiencies of India cotton, particularly in reference to its cleanliness and the irregularity of its staple' were pointed out to them.¹⁸ Under the supervision of the local governments, the

Americans were to work with colonial botanists to secure gradually the mass, India-wide cultivation of American cotton by, once again, 'instructing the natives in the cultivation and proper mode of cleaning cotton'.¹⁹ Arriving in India in 1840, the planters brought with them 'large quantities of the best cotton seed, American ploughs and hoes, saw-gins, and presses for packing the cotton after cleaning'.²⁰ As a governmental programme, cotton improvement now reached an entirely new level, characterised by substantial funding designed to support interventions from these technical experts. In contrast, interest in the world of 'the natives' was limited to the issues relating to their 'deficient' modes of cotton cultivation, to the exclusion of any broader engagement with their overall livelihoods and agricultural systems within which cotton was merely one element.

[Fig 1 here]

CLIMATIC IMAGINARIES AND INTER-COLONIAL RIVALRIES: THE AMERICAN COTTON EXPERIMENT IN 1840s DHARWAR.

Dharwar was the pre-eminent cotton producing district of the Southern Maharashtra Country, with 184, 237 acres under local Kumta cotton (named after the small port on the west coast) in 1842.²¹ It had been chosen as the site for the main government cotton experimental farms in the 1830s, trialling amongst others, the American New Orleans variety. Forming an 'irregular wedge-shaped figure', Dharwar comprised an area of 4500 square miles which were distributed over eleven *talukas* or subdivisions.²² This area was covered by three different climate zones: local people defined the western part of Dharwar as the *mallad* (damp) zone as it was characterised by abundant rainfall and red soils that grew rice and sugarcane; the narrow central section of the district was referred to as the 'transition' zone comprising a blend of red and black soil, and had a lesser though still fair distribution of rain; the largest area, however, was the *yerinad*, i.e. the pure black soil *desh* (country) that stretched over the extensive eastern and northern plains.²³ The primary crop of this black soil country was *jola* or *jowar* (millet) which generally occupied about double the cotton acreage and formed the basic food staple of the majority of the population. Here, however, rainfall was 'uncertain and scanty'; whereas the *mallad* and transition zones could rely on the south-west monsoon (June-August) and to some extent on the north-east monsoon rains (September-November) as well, the *yerinad* were almost entirely dependent on the latter. 'If it were not for the north-east or Madras monsoon', observed the Dharwar Gazetteer, 'much of the country would be liable to famine'.²⁴ Although pre-colonial eastern Dharwar had a sophisticated system of river dams, ponds and reservoirs for the

harvesting and storing of monsoon rain, which were also used to irrigate crops, the long period of social strife and wars leading up to the British conquest by 1818 appears to have resulted in the breakdown of this network.²⁵ The colonial government investigated various river irrigation schemes, but none was acted upon, and the expenditure on irrigation works (including the repair of reservoirs and wells) in the decade 1840-50 amounted to just over one per cent of receipts from land revenue over the same period.²⁶

In spite of these climatic variations, colonial officials constructed a general and wishful rather than a nuanced and realistic model of the climate of Dharwar, focusing on 'the unusual advantage of two rainy seasons'.²⁷ Anxious to assert the claims of Dharwar and the Southern Maratha Country against what he perceived to be the Bombay government's bias in favour of the hitherto premier cotton district of Broach in Gujarat, and to secure the services of one of the American planters for Dharwar, Collector Shaw suggested that uniquely within western India, the Dharwar climate closely resembled that of the cotton growing districts of the American south. In particular, he emphasised the lingering atmospheric moisture from the successive monsoon rains which, he asserted, would enable the New Orleans plant to mature properly.²⁸ Shaw's case appeared to be strengthened by the initially disastrous failure of the American experiments elsewhere in the Bombay Presidency including Broach, as well as in other parts of India, causing the Bombay government to abandon the cotton project after just one year. This led to a prompt, strongly-worded rebuke from the Court of Directors in London who ordered an immediate resumption of the cotton experiments. The Court accused the Bombay authorities of a 'want of due interest' in a subject of utmost importance, and of failing to understand that the Americans 'had much to learn with respect of the soil, climate and agriculture of the country'.²⁹

As Dharwar had been initially excluded from the experiments, Shaw now seized his opportunity, securing the endorsement of the Superintendent of Cotton Experiments in Broach, Dr Burn. Burn agreed that Dharwar had some distinct climatic advantages over Broach in that 'there are frequent showers so early as April and May, and these advantages ought to be taken if possible, so as to get the American cotton seed to spring'.³⁰ Shaw was himself an enthusiastic naturalist, and began experimenting with New Orleans cotton well before the arrival of the American planter, W.R. Mercer. As events were to show, there was little love lost between colonial botanists such as Shaw and the American planters whose confidence, moreover, was rather undermined by the initial failure of their initiatives. During his stay in Dharwar,

Mercer, it appears, had difficulties making sense of the local climate. Although he initially concurred with Shaw that 'the climate of Dharwar was like that of the Mississippi', by the time he left, in 1846, he came to believe that 'there was not rain enough in Dharwar to enable the plants to be sown until August and September'.³¹

Mercer followed the blueprint of previous experiments by locating them on special government farms away from the main cotton growing areas, where he attempted to change the seasonal timing of the sowing process and to introduce the essentials of the 'American' method of cultivation. He instructed the local cultivators employed on the government farm to begin planting New Orleans cotton, together with some other varieties of both foreign and indigenous seed, in June instead of their usual practice of sowing Kumta in late August or early September.³² Moreover, in place of the Indian method of thick, broad cast sowing, with the plants closely huddled together, the American cotton was planted in rows up to five feet apart, with the soil subjected to frequent ploughing and hoeing from expensive imported implements; and in a further departure from the local cultivating pattern, there was an emphasis on intensive mono-cultivation without crop rotation during the initial experimental years (1843-45).³³

At Shaw's prompting, the experiment was extended to include some of the cultivators in the vicinity of the government farms who were supplied with New Orleans seed to sow in their own fields, according to their 'traditional' methods. The results were a significant setback for Mercer. In the first year, 'constant high winds' rather than the expected June-July monsoon rainfall disrupted the early growth of the American plants, while the following year, sowed on the same soil, they 'were attacked by field bugs and caterpillars and yielded poorly', two-thirds down on the previous year.³⁴ In contrast, the neighbouring fields of the local cultivators produced a good crop of American cotton, which both Shaw and Mercer admitted to being far superior to the produce of the government farm.³⁵

Shaw and Mercer now clashed on the value of the experimental farms, with Shaw advocating their immediate closure on the grounds that they had proved to be 'an exemplary failure to be avoided'.³⁶ The Bombay government concurred, dealing Mercer's confidence a further blow; however, Shaw's two-year absence (1844-46) from Dharwar on sick leave gave him and his assistants an opportunity to rectify the course of the cotton experiments. He now attempted to secure the mass cultivation of New Orleans by offering contracts to local peasants to grow the cotton in their own fields. In view of the scale of the operations envisaged and the cultural negotiations required, Mercer and the Acting Collector, Mansfield, decided to

employ local merchants as intermediaries or contractors who would act on behalf of government, backed up by indigenous revenue officials. The intention was to demonstrate to the peasants the superior potential value of New Orleans in relation to Kumta and 'to gradually remove the prejudices which always exist in the mind of every native peasant against whatever is new'.³⁷

The aim then was to re-configure peasant beliefs, habits and aspirations in relation to cotton by educating desires. Under the contract system, the ryats duly grew the New Orleans cotton which the Bombay government then bought from the merchants. However, the experiment also threw up the contradictions of colonial governmentality as an enterprise of persuasion. In the first place, the peasants experienced the system as an authoritarian imposition rather than as benevolent 'education'. Mansfield issued instructions to the mamlatdars, 'to take much pains and cause the ryats to sow as much of the seed of the American cotton as possible, and you are to report to me how many acres and how much seed has been sown in each village'.³⁸ Under constant pressure to maximise revenue, the mamlatdars saw it as their duty to take whatever measures necessary to improve the cultivation of crops.³⁹ They went round the villages of Dharwar prescribing the times of sowing, weeding and picking the American cotton. Revenue officialdom tended to be perceived as oppressive at the best of times, and these injunctions further alienated the ryats', threatening their accustomed seasonal patterns of cropping which were primarily oriented towards food production. Peasants who stuck to their established modes of cultivation found themselves subjected to interrogations and fines by revenue officials. By early 1847, they were expressing their distaste for the contract system to the new Dharwar Collector, Bell, referring to it as 'upaddrav' (physical molestation).⁴⁰

Secondly, the ryats had to submit to a post-cultivation regime which they experienced as a significant loss of agency. They could not clean the American cotton themselves, as the *hattigadda* or foot roller they used to gin Kumta cotton, was not able, in the case of New Orleans, to separate the wool from its seed to which it tended to cling tenaciously. They found that the seed of the American staple was softer than that of Kumta and liable to break and injure the cotton in the ginning process.⁴¹ The American variety could only be cleaned by the expensive imported saw-gins which the government had left in the hands of the small number of contracted merchants. The peasants complained that they had to travel a long way with their produce as the gin owners were not local. They then found that these people dealt with them unscrupulously, often under weighing the produce and

refusing to purchase the cotton immediately. They were kept waiting, sometimes for days, until they agreed to the price offered by the dealers, who clearly had an overriding interest in securing 'the greatest quantity of cotton for the least amount of money'. As a result of suffering losses for several seasons, they became reluctant to sell to them, preferring instead to spin the cotton themselves into thread to sell to local weavers. The ryats observed that in contrast, they had more control over the Kumta production process, as the cotton was cleaned by women and children from their own families; they also had a greater choice of potential purchasers for the commodity who tended to be local traders known to them.⁴²

Thirdly, in the haste to establish the American variety, the colonial authorities had paid insufficient attention to the supply of saw-gins so that cultivation far outstripped the capacity to clean the cotton. There were only 13 saw-gins in use in 1845, and it would have required at least treble that number to clean cotton harvested from over 20,000 acres of sown New Orleans seed.⁴³ As a result, the entire crop of 1845-6 was only cleaned in February 1847, resulting in a significant loss in quality.⁴⁴ Moreover, the perceived superior technology of the saw-gin failed to perform as expected and damaged New Orleans cotton during the cleaning process, cutting the staple and rendering it 'weak and uneven'.⁴⁵ The cotton authorities were faced with a ginning crisis which threatened the entire experiment, and it led to feverish attempts to secure immediate improvements in the saw-gin itself. This included instructions to Mansfield and Mercer to make use of Dharwar's 'skilful native mechanics' and quickly come up with an improved and cheaper ginning machine, the organising of cotton cleaning machine competitions in India, as well as urgent requests to British inventors and manufacturers to produce saw-gins specifically adapted to Indian conditions. The most promising practical upshot was the establishment of a cotton gin factory in Dharwar itself in 1848, funded by the Court of Directors.⁴⁶

Finally, during these years, there was the frequent dashing of production hopes arising from reliance on the imaginary 'two-monsoon' construction of the climate of the *yerinad*. This led to a prescriptive pattern of sowing New Orleans cotton a couple of months earlier than Kumta, in the belief that the extra moisture provided by the early rains would ensure optimum plant growth. However, these rains were liable to be very scanty in eastern Dharwar, and their scarcity had seriously disrupted the initial year of Mercer's experiment. In the 1847-48 season, the south-west monsoon rains stayed away completely, causing 'almost a complete failure' of the New Orleans crop, while Kumta cotton, benefiting from the usual later north-east

monsoon rainfall, grew to be 'very luxuriant'. The Collector of Dharwar expressed his fear that this would simply confirm 'the prejudices of the ryots in favour of their own plant'. Soon afterwards, a survey of cultivators carried out by the mamlatdars of the leading cotton-growing talukas of Navalgund and Gadag, confirmed this view. The ryats pointed out that, in their experience, the American plant 'did not thrive' in comparison with Kumta. Moreover, they had greater difficulty in picking and cleaning it than in the case of the indigenous cotton, and its seed was less valuable as food for their cattle.⁴⁷

A project which had aimed at winning over peasants' hearts and minds to a new cotton species and a different mode of cultivation had secured precisely the opposite outcome. The immediate result was an intensification of inter-colonial discord about the best way forward. The returning Shaw laid into Mercer's contract system which he warned, could only lead to the ruin of the American cotton experiment as it was based on 'governmental monopoly'. This regime, he asserted in a letter to the Bombay government,, was 'bound to fail' as the principles of contract and compulsion under which it was carried out 'prevented the real market value of the cotton being known' to merchants, nor was there any real incentive for contract peasants to exert themselves, particularly as they were subject to the dictates of the contractors. Shaw roundly condemned the Americans who, he observed, had come to Dharwar at his official request, but had proved to be 'neither good agriculturalists nor mechanics'.⁴⁸

The Bombay government duly instructed Collector Bell to abolish the contract system in February 1847, convinced by reports reaching them that village-based revenue officials had indeed used various methods of compulsion to 'persuade' the ryats to grow American cotton.⁴⁹ This was undesirable and had simply resulted in reinforcing their 'prejudices' against it. Mercer had resigned a few months earlier but before leaving the country, he got back at Shaw by radically questioning not only the contract system which he had himself largely devised, but the entire colonial project of introducing American cotton in India. He now asserted that neither Dharwar nor anywhere else in India possessed the right climate for the introduction of American varieties; these cottons would not be sustainable and would not provide any 'lasting benefit'.⁵⁰ By the mid-1850s, with little to show for their expenditure of £100,000 on the project, the Court of Directors brought the state-directed American cotton experiments in India to a close, concluding that only in Dharwar did New Orleans still have some hope of success, but proposing to leave its further extension and future prospects there to private enterprise.⁵¹

THE POLITICAL ECOLOGY OF PEASANT COTTON CULTIVATION

American planters and colonial naturalists were meant to embody superior European botanical knowledge that would, in collaboration, modify and improve peasant practices of cotton cultivation in India. Here, the definition of British colonial rule as an enterprise of 'improvement' went hand in hand with conceptions of indigenous botanical inferiority, and of the Indian natural environment as a landscape to be transformed for capitalist commercial use. However, one of the unintended consequences of the improvement project was the conflict that arose between Mercer and Shaw. Their rivalry punctured, albeit temporarily, the paternalistic discourse of European knowledge superiority, by revealing peasant practices of cotton growing in an unheralded favourable light. In the bitter rivalry between the two men, Dharwar peasant modes of cultivation emerged as positive alternatives to erroneous approaches that each believed the other to be responsible for.

By the end of his stay, Mercer was in fact quite prepared to condemn the entire colonial improvement enterprise, including his own part in it. He asserted that 'the American system of cultivation was not suitable to India and...the natives were, from their knowledge of the climate and capabilities of the soil, able to cultivate better than any European...the skill exhibited by the ryots in their agricultural operations was very superior and their economical system enabled them to obtain much larger returns on the capital invested'. As a result, he concluded, 'little change or improvement' was required in the system of Indian agriculture which was 'well adapted to the circumstances of the country and of the climate'.⁵²

The ryats had obtained better results with New Orleans cotton on their own fields around Hubli than Mercer had on the government experimental farm in 1843-45, primarily by maintaining their customary modes of cultivating. This involved the usual cotton-millet crop rotation so that New Orleans was not planted on any field successively over the two years; deep ploughing of the seeds to enable the free absorption of moisture followed by thick, close sowing so that when fully grown, the plants covered virtually all of the ground. This provided considerable shade to the soil, keeping it cool and preventing evaporation, enabling the plants to yield well. This botanical success notwithstanding, they quickly understood over the next few years, in comparing the growth rates of New Orleans and Kumta, that the American plant required much more moisture during its early stages of growth. In an area of deficient rainfall, this consideration would always make New Orleans more susceptible to crop failure than Kumta. Thus, when the contract system was

terminated in 1847, quickly followed by the failure of the south-west monsoon rains, the peasants responded by radically reducing the area under American cotton cultivation from 20,500 acres in 1847-48 to a mere 3,350 acres in the 1848-49 season.⁵³ Simultaneously, they increased Kumta cultivation from 179, 229 to 201, 578 acres.⁵⁴ They now admitted that they had only grown New Orleans in the belief that there were under a mandatory government order to do so, but having 'annually suffered loss', they 'gladly abandoned it when they were given to understand that the cultivation of this cotton was optional'.⁵⁵

The ryats' decision to move away from the cultivation of New Orleans represented a sophisticated integration of economic, botanical and climatic understandings that lay at the heart of their flexible, risk-reducing approach to agriculture. From experience, they were well aware that the deep black soils of the Southern Mahratta Country were capable of hosting the two major crops of millet and cotton in a complementary pattern of rotation. Both Kumta and jowar were well adapted to the local climate as they were 'rain-prudent' crops, growing under varied conditions of rainfall and sustained by the deep moisture-holding capacity of the black soil; the cotton plants, moreover, thrived on the residual manure applied to the previous season's millet crop. However, millet, of which no less than eighteen different varieties were grown in Dharwar, was the main priority crop. It not only provided the peasants' staple food, but also supplied the best cattle fodder, which also meant that there was always a remunerative local market demand for it. Unlike the annual cotton crop which matured at a specific time late in the agricultural season (usually March), there were both early (*khari*) and late (*rabi*) varieties of millet so as to maximise crop output throughout the season.⁵⁶ Contemporaries noted the contrast between the care and attention lavished by the peasant on his millet and wheat fields and the comparative neglect of his cotton plantation, often left 'to take care of itself'.⁵⁷

The fortunes of millet largely dictated the extent of the area under Kumta cotton cultivation. If food stocks were plentiful in local villages, there would theoretically be more land available for cotton; however, exactly how much cotton was actually sown was determined in practice by demand, weather prospects, and by the availability of labour.⁵⁸ Hence, less cotton would be planted if large quantities of unginne Kumta remained in stock from the previous season. This also meant that, generally, peasants were able to set aside some cultivable land so as to ensure the maximum accumulation of moisture in the under-soil. Consideration of the prospects of different crops based on the timing of monsoon rainfall was also

important. If the north-east monsoon rains held off until October, cotton would be seen as less viable and would often be replaced by *gram* (pulses) and wheat.⁵⁹

Nonetheless, Kumta was important to both the rural household and the regional economy of the Southern Mahratta Country, with over one-third of its annual produce normally retained for local spinning and weaving.⁶⁰ 'Each landholder', observed the Dharwar Gazetteer, 'is careful to put on one side part of his best cotton for home spinning'; this cotton was 'cleaned with much greater care than cotton to be packed for export'.⁶¹ The cotton was ginned by the foot-roller worked only by women and children, out in the open in front of the house.⁶² It was then spun in the home by the women of the villages who often spent more than five hours a day on this painstaking work, and the yarn produced was then sold to the weavers of the taluka as well as to merchants on the open market in the district's main commercial town of Hubli. Cotton was thus always readily convertible into cash which ryats could use to meet their land revenue payments as well as other agricultural expenses.⁶³

Outside agriculture, handloom weaving (and the associated trades of dyeing and printing on cotton cloth) remained significant to the local economy, with weavers still able, in the 1840s, to rely on an abundant supply of cheap yarn spun from Kumta cotton grown in their immediate environment, which had yet to be supplanted by British yarns.⁶⁴ They produced a wide variety of cloths and clothes for local inhabitants that were, in addition, exported westwards to the coast as well as south to Kanara. Besides clothes, a range of cotton products derived from Kumta was also pervasive in the daily lives of the people; in homes, beds, pillows, and curtains were padded with cotton, and cushions, awnings, and carpets were also made of it. On everyday transport conveyances, the coverings of carriages and the halters of horses were both cotton-based.⁶⁵ Much of the strength of local feeling in favour of Kumta, which colonial observers never quite understood, was based on the cultural and emotional meanings embodied in its products. It was part of the region's identity and belonged to the people.

Colonial hegemony did, however, bring increased pressure to trade across wider geographical spaces and to devote a growing share of Indian cottons to the export sector, i.e. in order of importance, the China, continental Europe and British markets. Indeed, one of the main objectives of the *ryotwari* land revenue system established in the 1820s and 1830s by the first Revenue Commissioner, Pringle, was to achieve just that. In cotton growing regions such as the Southern Mahratta Country, revenue charges, raised directly from the individual peasant cultivator, were fixed at

significantly higher levels than pre-colonial rates, amounting to 55 per cent of the value of an average crop.⁶⁶ Based on 'potential' rather than actual returns from cultivation, this tax was designed to discipline the ryats into increasing cotton production for the export market which, it was believed with very little evidence, would yield higher returns than local sales. In colonial calculations, this would enable peasants to accumulate capital, invest in improvements and meet their revenue payments to the colonial state.

In reality, local merchants generally offered a higher price for Kumta cotton as its seed could also be used for cattle fodder, than dealers who purchased for export and who were keen to obtain the produce at a low price.⁶⁷ This was an additional incentive for cultivators to grow the indigenous variety.⁶⁸ The colonial attempt to 'make petty capitalist yeomen' out of risk-averse peasants failed rather disastrously, leading to an agricultural depression that thwarted all initial hopes of an extension in cultivation.⁶⁹ As Pringle's successor, Wingate, admitted in 1846, when surveying the Bankapur taluka of Dharwar, cultivation in this important cotton growing tract was now 'more limited than at any former period of our rule, instead of exhibiting the increase that might naturally have been looked for from 30 years of peace and security'.⁷⁰

Peasants had no intrinsic interest in extending cotton cultivation during this period. They tended to cultivate their lands fully only when seasonal weather prospects were favourable, and already over-assessed, they feared that further cash crop cultivation would simply increase their land revenue charges. Dharwar Collector Shaw himself observed that the high revenue assessment was one of the main reasons that 'have tended to retain waste many thousand acres of land capable of cultivation'.⁷¹ Although the Dharwar peasantry did include a significant minority of 'very substantial cultivators' who also doubled up as village moneylenders, two-thirds of the Kanarese Lingayat peasantry were described as having 'little or no credit'.⁷² They were smallholders with little economic autonomy, usually having to borrow from the better off landholders and village *bantias* (moneylenders who, in Dharwar, dealt mainly in cotton) to meet crop production costs.

Land revenue charges greatly increased their dependence on these moneylenders, dramatically raising levels of borrowing which led to an accumulation of debt. The *bantias* were involved in a complex chain of moneylending, deriving their funds at high rates of interest from local merchants or from *sawkars* (bankers) who often acted as agents for the big Bombay merchants. In turn, they loaned money at even higher rates of interest to the ryats enabling them to buy cattle and sow their cotton as well

as to pay their assessment, in return, 'purchasing the produce before it is gathered, more frequently before it is ripened, often before it is even sown'.⁷³ As a result, the small peasant cultivator had, by the early 1840s, sunk into deep levels of debt and poverty.⁷⁴

In fact, colonial intrusions in their agrarian world worked to alienate peasants' interest in the export fate of their cotton crop. This is conveyed by the fact that cotton was gathered last of all the dry season crops, at the end of April. The ryats ensured that they first gathered and took care of their millets, and then the wheat, before finally turning their attention to cotton. This seemingly anodyne fact had significant repercussions for colonial hopes of cotton expansion. Once gathered and packed, the cotton then made the difficult journey from Dharwar to the west coast ports of Kumta and Vingurla. This took at least a fortnight by bullock during which the convoy was 'frequently overtaken by the monsoon', leading to a deterioration in quality from exposure 'to the dews and to accumulated dirt'.⁷⁵ Even more significantly, as coastal transport to Bombay from these ports shut down in early May at the onset of the south-west monsoon, the cotton did not usually reach the port-city until November, i.e. after the passage of the north-east monsoon: the consignments bound for Europe reached their destination over a year after the cotton had been picked.⁷⁶

Such slow communications between Dharwar and Bombay meant high transportation costs, adding 20 percent to the price of one candy of local cotton.⁷⁷ Without state investment in improving communications to the coast, as advocated by the Bombay Chamber of Commerce, the colonial ambition to secure the profitable trading of Dharwar crops across wider markets remained premature.⁷⁸ With none of the classes possessing a fair amount of capital, i.e. merchants, sawkars and superior cultivators, able to make any serious money purely from the Dharwar cotton export trade, government hopes of private Indian investment geared to expanding cultivation failed to materialise. Thus, in 1849, Dharwar merchant Alapa Naik decided against buying any of that season's cotton, having failed to make any money at all on his previous year's consignments to Bombay where they remained unsold for months. Although then advised to send the merchandise to England, which he did through a Bombay-based British merchant, he still did not know the fate of this cotton more than a year later.⁷⁹

COTTON IMPERIALISM IN FULL FLOW: THE DECADE OF 'NEW ORLEANS',
1860-1870.

In the 1850s, there arose a number of conjunctures that reversed some of the negative factors that had earlier worked against the take-up of New Orleans by the various groups with an interest in cotton cultivation. With the withdrawal of the State from the arena, Lancashire, at the personal instigation of John Bright (always a fierce critic of the Company), began to take a much more direct interest in Indian cotton, alarmed by insufficient supplies from America to meet growing industrial consumption. Back in Britain, Shaw reiterated his views on the potential of American cotton cultivation in India in a pamphlet that was widely read by commercial bodies, *The Cotton Crisis and How to Avoid It*.⁸⁰

Manchester textile manufacturers had sampled Dharwar American cotton in the 1840s and were now keen to invest in renewed efforts to procure a large supply from the district. The Manchester Chamber of Commerce and the newly set up Cotton Supply Association despatched agents to Bombay to link up with British Agency Houses, some of which, like Brice & Company and Nicol & Co., proceeded to set up purchasing agencies in Dharwar, offering remunerative prices for American cotton. With Bombay's raw cotton export trade to Europe also boosted by the Crimean War,⁸¹ Indian and European merchants both competed and collaborated in the setting up of overlapping export-oriented networks stretching from Dharwar to Liverpool and Manchester via the ports of the west coast and Bombay. At the same time, again at the instigation of Lancashire, some progress was made in improving road communications between Dharwar and the western coastal ports, culminating in the opening of the full length of the Dharwar-Kumta road to cart traffic in 1861, thus ending the slow, cumbersome carriage of cotton on pack-bullocks.⁸² Unlike other cotton districts, however, there was still no sign of the arrival of the railways.

Meanwhile, Wingate's recognition that the initial land revenue settlements had been counter-productive had led to their downward revision, based on actual tillage; by the mid-1850s the land tax burden on peasants had been significantly eased, and this, in conjunction with the positive market signals outlined above, contributed to an extension of cultivation throughout the Bombay Presidency – and the swelling of government revenue coffers.⁸³ However, perhaps the single most significant factor in the revival of the fortunes of New Orleans was the Dharwar Gin Factory's success, under the superintendency of the surgeon-naturalist G.F Forbes, in manufacturing and repairing an increasing number of saw gins specifically adapted to cleaning the American variety.⁸⁴ The Factory expanded into a number of subsidiary establishments in the 1860s.

Forbes worked with local mechanics in manufacturing a new ginning machine, which he patented as 'Forbes's Saw Cotton Gin', in 1856.⁸⁵ Consequently, the decade 1851-1861 saw land under cotton cultivation increase from 254, 983 to 425, 478 acres, within which the acreage under New Orleans rose six fold, from 31, 668 to 191, 026.⁸⁶ This was the highest growth rate for Dharwar American cotton of all subsequent decades in the nineteenth century, and it occurred before the outbreak of the American Civil War. The extension of New Orleans cotton acreage was spearheaded by substantial peasants in the southern talukas of Bankapur and Ranebennur which were part of the district's transitional climate zone, with higher levels of rainfall and atmospheric moisture than the main north-eastern cotton tracts.

Thus, when the American Civil War broke out, interrupting the supply of raw cotton to British factories, Lancashire's renewed campaign to secure the required shortfall from India was able to draw on an existing internal momentum favourable to cotton exports to Britain. Moreover, although it was recognised that American cotton production in India was not at a level to be able to provide all of the required supplies, the crisis gave Manchester cotton interests an ideal opportunity to press once more for a radical transformation of Indian cotton landscapes that would privilege the cultivation of American over indigenous cotton. In this scenario, Dharwar remained pivotal to Lancashire strategy, as it was seen as providing the model of successful New Orleans acclimatisation, a prerequisite for its spread to other parts of India. The India Office now came under immense pressure to facilitate a new cotton improvement programme, primarily focused, once again, on the Bombay Presidency. The main outcomes were the setting up of a Cotton Department, headed by Forbes, and the passing of the Cotton Frauds Act, by the Bombay government in 1863.⁸⁷ The Act made the intentional mixing of cotton varieties and the adding of any foreign matter so as to increase weight illegal, and was to be policed by a team of inspectors operating in each district of the Presidency and responsible to Cotton Commissioner Forbes.⁸⁸

These developments certainly signalled a more coercive and interventionist mode of organising colonial power than the generally indirect norms of governmentality practiced by the East India Company. Accentuated colonial authority over the lives of peasant cotton producers drew on new governmental technologies for monitoring populations and their environment, including censuses, crop surveys, and weather and rainfall reports. In each district of the Bombay Presidency, annual rainfall was now officially recorded through the introduction of pluviometers. Dharwar had fourteen designated weather stations in its various talukas, and mamlatdars were

instructed to record the monthly rainfall at each station and forward their findings to the Collector.⁸⁹ Compared to Shaw and Mercer twenty years earlier, Forbes had a vastly superior array of state resources at his disposal, and he enthusiastically took on Lancashire's objective of making Dharwar the centre of the American cotton revolution in India. Under his leadership, the Bombay government's Cotton Department certainly bore all the hallmarks, as Marx might have put it, of an objective structure of administrative functions interlocked with (Lancashire) capitalist economic interests.

However, this apparently reinforced 'will to improve' was once again, as in the 1840s, undermined by inter-colonial dissensions on the appropriateness of state intervention both in peasant cultivating practices and in the cotton trade itself. In formally approving Forbes's appointment, the new Government of India, no doubt mindful of the mass rebellion against British rule only a few years before, warned the Bombay government that 'any interference, direct or indirect, on the part of the public servants with the free agency of the ryot would be productive of more harm than good'.⁹⁰ Local business groups affiliated to the Bombay Chamber of Commerce also gave Forbes a frosty reception, the firm of Campbell, Mitchell & Co. greeting his appointment and proposed plan of action with devastating sarcasm:

Dr Forbes, the gentleman whom Government has just appointed to be the nursing mother of the cotton trade in this presidency, *and to encourage, not to force*, a better system of cultivation, proposes to initiate his office by going to the ryots of the Southern Mahratta Country, and giving them 2 alternatives, either to root up half their crop, or to pick the produce of each variety separately after the crop has ripened. In the event of them doing neither – and the second alternative is impossible – the crop is to be forfeited and destroyed. We can scarcely believe that such a proposal could come from the Government Cotton Officer, endorsed by the Revenue Commissioner; so outrageously arbitrary and tyrannical.⁹¹

The reference here was to Forbes's initial plan of 'persuading' the ryats to alter their traditional methods of cultivation by using the new legislation to compel them both to plant and to pick the American and indigenous cotton varieties separately. Forbes was in effect attempting to take advantage of the favourable economic climate generated by the American Civil War, coupled with the coercive power of the Cotton Frauds Act, to try and secure the maximalist version of Lancashire's cotton desires. This not only meant privileging 'Dharwar-American' (or 'saw-ginned Dharwar' as New Orleans was now known) over Kumta cotton, and achieving a revolutionary

extension in its cultivation, but ensuring the production of as 'pure' a commercial article as possible, i.e. unmixed with Kumta or other indigenous cotton varieties. Forbes was dismayed by the customary peasant practice of mixing the *kapās* (seed and lint) of the American and Kumta varieties during the picking of the crop and he now threatened to confiscate all mixed cotton produce under the terms of the new law. However, as the firm of A.C. Brice & Co. pointed out, the Cotton Frauds Act could not supersede rights enshrined in the ryats' existing thirty-year land leases 'by obliging them to grow unmixed cotton, any more than (it can) oblige them to grow enough of it for the rest of the world'. It further observed that there now was a widespread belief that, grown on the same fields and with the wind carrying the pollen from the flowers of one variety to those of the other, all the plants of the district had become 'hybridized' and ryats could not really be punished for these 'freaks' of nature.⁹² It was only half a century later that the potential of naturally occurring plant hybridisation would come to be seen in a more positive light, when some colonial agriculturalists in Bombay began to advocate the deliberate crossing of different cottons so as to obtain, by careful selection, the most desirable characteristics of each in the hybrid plant.⁹³

In May 1864, the Bombay government was forced to clarify the intent of the Cotton Frauds Act, admitting that the mixing of cotton seed had been happening 'without any fault on the part of cultivators', and that the Act would not therefore 'penalise as fraudulent the packing of two varieties of cotton in one bale, as cultivators in some cases do'.⁹⁴ This represented a setback for Forbes and worse was to follow. Although lists of persons successfully prosecuted for the offence of 'cotton adulteration' feature prominently in every annual report of the Cotton Department during the 1860s and 70s, it is clear that Forbes and his officials were hugely disappointed by the practical working of the Act. The number of convictions obtained in court was far from impressive, and mostly secured in cases of fraudulent weight increase rather than in cases of cotton mixing. The wording of the Act put the onus on inspectors to prove a dishonest intention on the part of the accused person himself, and this was usually difficult as the cotton was accessible to a wide range of people in ginning establishments. In 1869, for instance, the Dharwar district magistrate acquitted the dealer Hussain Sab from the taluka of Ranebennur on cotton fraud charges, even though a large amount of mixed cotton had been found in his ginning-house. The sub-inspector, however, had been 'unable to prove that Hussain Sab himself had mixed the different varieties of kapas'.⁹⁵ Forbes admitted that the new legislation was increasingly unsuccessful in checking cotton adulteration as

even when complained to, the Cotton Inspectors are naturally unwilling to incur the odium of prosecuting offenders against whom no conviction can be secured, feeling, as they must, that every fresh instance of failure can only have the effect of exposing the weakness of the authority on which they are acting .⁹⁶

Forbes's efforts to secure the maximalist version of Lancashire's cotton objectives failed rather dismally, nor were attempts to export Dharwar-American cotton cultivation to other parts of India any more successful than they were in the 1840s. However, Manchester's minimal aim of securing (primarily indigenous) cotton supplies from India to replace the shortfall from America, was largely achieved. Lancashire may not have got all it wanted from India, but it got most of what it needed. By the mid 1860s, India was supplying 71% of the cotton imported into Britain, compared to just over 12% before the outbreak of the Civil War, and the Southern Mahratta Country played its full part in helping to relieve Lancashire's 'cotton famine'.⁹⁷

In Dharwar, however, the sudden, explosive and short-lived international demand for just one crop, cotton, led not so much to the 'commercialisation' of local agriculture as to its distortion and unsustainability.⁹⁸ The trebling of the local price of New Orleans was not only due to demand for this particular variety from Lancashire between 1860 and 1864, but more fundamentally to speculative practices on the part of sawkars and dealers who, 'backed by Bombay speculators paid as much as £10 (Rs.100) the acre for planted cotton fields' in advance, a grossly extravagant sum in relation to prevailing prices.⁹⁹ In these circumstances, the pressure on peasant cultivators to plant 'every available patch' with cotton was immense, with adverse consequences on the cultivation of jowar food crops for domestic consumption.¹⁰⁰

The frenzied gamble on profits that governed, particularly, American cotton cultivation in Dharwar during this period, appears to have disrupted the ecology of peasant crop production, with an observed drop in previous patterns of sustainable farming through crop rotation.¹⁰¹ Dharwar-American cotton acreage virtually doubled between 1860-61 and 1862-63, i.e. in just two seasons, and cotton officials began to express concern that the land was 'now fully up to the maximum of what it ought to bear'.¹⁰² Among the ryats, those who benefited the most from this cotton boom were the elite of substantial cultivators generally holding over fifty acres of farming land, who were able to purchase saw-gins and to employ the extra labour needed to pick the increased cotton crop. Moreover, the cotton boom led to an increase of over 40 percent in land revenue assessments, once again subjecting poor

peasants to the dictates of moneylenders.¹⁰³ The cotton bubble, however, burst as abruptly as it began, an interaction of climatic and economic processes heralding its demise in 1865.

Inadequate rainfall affected the north eastern talukas of Dharwar over two consecutive seasons, 1864-65 and 1865-66, in the middle of which the American Civil War also came to an end. All crops yielded poorly, and this, combined with a dramatic fall in cotton prices at the end of the war, immediately put peasants under economic pressure and led to a substantial fall in cotton cultivation.¹⁰⁴ Crop failure was however particularly crucial in the case of jowar food crops whose cultivation had dropped significantly in the early 1860s, resulting in over a fourfold increase in their prices. One rupee could buy 90 lbs of millet in 1860, but only 20 lbs in 1866.¹⁰⁵ With food grains both expensive and scarce, eastern Dharwar was hit by famine in the summer of 1866, a prologue to the more severe outbreak of 1876-77.

It is significant that the most afflicted localities were the main cotton growing talukas of Navalgund, Ron, and the Dambal area of Gadag, which, hardly coincidentally, had just two years earlier been the showcase of Forbes's one-season experiment in 'pure' Dharwar-American cotton.¹⁰⁶ Many poorer peasants and labourers were 'reduced to beggary' while a larger number opted to migrate in search of food, even though this meant putting their smallholding leases at risk.¹⁰⁷ Famine is of course a political economic, not a climatic, event, but a detailed examination of the 1866 outbreak (as that of 1876-77) is beyond the scope of this article. Nonetheless, its occurrence serves to highlight the extreme limitations of any agrarian 'prosperity' that the rise in cotton prices during this period is held to have ushered into the Southern Mahratta Country. More importantly, perhaps, famine signalled a rupture in the mixed and diverse local cropping system that peasants had carefully built up to guard against the risks of climatic catastrophes. The exacerbated cotton imperialism of the 1860s had culminated in a subsistence crisis for otherwise traditionally well-adapted peasant communities in the eastern talukas of Dharwar.

CLIMATE CHANGE AND THE DEMISE OF DHARWAR-AMERICAN COTTON

The climatic crisis of the mid-1860s in Dharwar was not a sudden, unexpected and unheralded event but the realisation of a chronicle foretold. In 1846, at the height of the original experiment with American cotton, Alexander Gibson, Superintendent of the Dapoori Botanic Garden in Poona, had submitted a report to the Bombay government on the state of the forests of south Konkan, North Kanara, and Soonda, located on the western and southern borders of Dharwar. A 'Humboldtian' botanist

conversant with most of the languages of western India, Gibson had closely observed the evolution of local climates since his arrival in India in the 1820s.¹⁰⁸ The major clearance of forests in the southern Konkan in particular, he pointed out, had caused 'the climate to become drier, the seasons more uncertain, and the land less fertile'. This was confirmed by his conversations with local inhabitants. But the really important message he sought to convey was that

such a change of climate would not be limited to the district in which the clearance actually takes place. Take for example all the Southern and Western portion of Dharwar. This fertile country abounds in moisture insomuch that it has been rather inaptly I think been compared to the valley of the Mississippi. At all events, American upland cotton grows there which it will hardly do in other parts of the Bombay Presidency. I think it is not too much to say that much of this moisture depends on the wooded country forming its western border, and that with the complete removal of this, the climate would greatly change.¹⁰⁹

Five years after Gibson's report, the Medical Board, effectively the Health Department of the Bombay government, was concerned enough to press the Revenue Department to release funds 'for improving the climate of Dharwar through the planting of trees'. This was now urgent as

on the authority of the old native inhabitants, the climate had undergone very considerable deterioration during the last 10 or 15 years, and the reason mentioned is the clearing away of the forest and brushwood which once closely approached the station to the south and west. The effect upon the climate is said to be a diminution of moisture as regards night dews and passing showers. This as a matter of course has affected the temperature and, natives say, the healthiness of the station.¹¹⁰

Embedded in the colonial archive we find in this passage, however muted and indirect, the voices of the people of Dharwar as authentic witnesses of a changing climate, their local knowledge and longer experience of place convincing more temporary colonial officials of the veracity of their views. Of course, such testimonies were now sought out by a group of surgeon-naturalists of which Gibson was the most prominent, seeking to convince the colonial state to adopt new conservation policies that would protect forests, and who were connected to an international, networked world of scholars inspired by Humboldtian climate science.¹¹¹

Throughout the 1840s, Gibson penned a succession of reports on the dire state of

local forests, but it was his 1846 report referred to above, in which he spelt out the potential climatic implications for American cotton in Dharwar, that moved the Court of Directors in London and the Bombay government to act. In March 1847, Gibson was appointed Conservator of Forests of the Bombay Presidency, heading an establishment committed to ensuring the 'well-being' of local forests.

'State conservationism', however, did not mean that forests would henceforth be managed on sound ecological principles, and in his new role, Gibson had to adjust quickly to the continued primacy of revenue considerations. In practice, it meant 'conserving' forests as a privileged source of income for the colonial state via the newly created Forest Department, at the expense of customary rights of access of rural communities to forest produce.¹¹² Forest conservation was, once again, premised on an ideology of indigenous deficiency, and the new legislation involved erasing local knowledge of forests.¹¹³ This was in spite of clear evidence of tree preservation activities carried out by local people, as indicated by approving colonial observations of the 'spontaneous growth of sandalwood trees in the Dharwar Collectorate between 1845 and 1848' which was ascribed to 'the exercise of common care' by the people.¹¹⁴

Following the model of the land revenue system, the ever increasing value of teak and firewood, particularly as a result of growing demand from the new railway companies as from the 1850s, enabled the Department to draw profitable revenue from a carefully graduated levy of duties on the different types of forest wood in the various Bombay Collectrates. Their 'imperial' importance also meant that railways were granted privileged access to the forests of North Kanara and Soonda bordering Dharwar.¹¹⁵ Teak from these forests was also supplied at a profit to various government departments and to the Dharwar Cotton Gin Factory, thus further contributing to the depletion of teak trees.¹¹⁶ In the same year, Forbes, who was then in charge of the Factory, felt obliged to warn the Bombay government that 'having very recently paid a visit of inspection to that part of the Canara Forest from which timber has hitherto been procured for the Factory, it is necessary to bring to notice that the supply has become all but exhausted'.¹¹⁷ Forbes had previously attempted to secure the reservation of an area of the North Kanara forest solely for the Factory, but the Madras authorities had turned down the request made on his behalf by the Bombay government.¹¹⁸

Dharwar itself had 426 square miles of forest, but by the 1850s, the covering of teak, firewood, and bamboo trees was thinning fast.¹¹⁹ The cutting of teak and seesoo trees in these forests was now forbidden and 'reserved as government wood'.¹²⁰ The

Indian Forest Act of 1865 consolidated the colonial state's virtual monopoly by enshrining in law government control over 'reserved forests' and 'protected forests'. The Forest Department now admitted that in Dharwar, the ryats had 'no forest resources of their own', the government enjoying 'a complete monopoly'.¹²¹ Denying free access to local people was justified on the grounds of 'scientific' management and proper regulation so as to ensure forest regeneration, but in the 1860s conservancy played second fiddle to revenue objectives. In 1861, for instance, Gibson's successor as Conservator, N.A. Dalzell, admitted that 'my assistant, Mr Wagner, has this year cut no less than 19,000 teak rafters in the Dharwar and part of the Belgaum forests; this was a mistake, and is much to be regretted'.¹²²

By the 1860s, therefore, deforestation was rampant both in Dharwar and in the adjoining and more substantial forest belts of Soonda and southern Konkan. At this time, the concern about its climatic impact initially voiced by Gibson and other surgeon-naturalists employed by the East India Company had gathered considerable momentum through articles in European scientific journals and through public interventions by a travelling network of naturalists linked to institutions such as the Royal Geographical Society and the Linnean Society. Drawing on these, Dalzell himself published, in 1863, his 'Observations on the influence of forests', and he was in favour of 'shutting up the Dharwar jungle for many years to come' as its existence was 'a matter of great importance in preserving the moisture of the climate and keeping up the stream of water in the rocky villages'.¹²³

The cotton boom also exercised a wider impact on deforestation by vastly increasing the demand for timber of all kinds, not only for consumption by the expanded Cotton Gin Factory and for railway sleepers and fuel, but also for the construction of carts and carriages and for the building of new houses as merchants, saukars and large landholders invested some of their cotton riches in urban housing.¹²⁴ The boom also presented the Forest Department with new opportunities for increasing revenue by selling timber on the open market which was described as sometimes being more profitable than doing business with the railway companies.¹²⁵ The apparent ideological differences between the Cotton and Forest Departments – between 'cotton' and 'green' imperialisms as it were – the former promoting the expansion of cultivation, the latter calling for restrictions in the interests of forest conservation, were reconciled at a superior level of colonial governmentality, that which sought the maximisation of revenue.

The thinning of the forest belts of southern Konkan and Soonda, and the decimation of Dharwar's own forest cover, affected the climate of its eastern talukas in a

number of ways during the 1860s and 70s. First, there was an overall drop in rainfall that was particularly pronounced during the years of the cotton boom, and a more consistent fall in atmospheric moisture over a longer period. This put the people of the eastern plains, already 'badly off for water', under increased pressure, particularly in a region lacking in water storage facilities such as ponds and wells, much neglected during the first half-century of colonial rule.¹²⁶ Secondly, rainfall for agricultural purposes, that could in other words be productively utilised by crops to support their seasonal growth, became more unpredictable. Here the timing of the rain was all-important, and the absence of showers until September, following a number of seasons of deficient rainfall, precipitated the food crisis of 1866; conversely, unseasonal or excessive rainfall could also have a destructive impact on crops, as in 1868, when 'losses in cotton production after initial optimistic forecasts' were partly attributed to rain falling in December and 'dark and cloudy weather instead of sunshine which is always indispensable for cotton after the ground has been well soaked'. Thirdly, the loss of protective regional forest and local tree and shrub cover adversely affected soil fertility in Dharwar's eastern plains. Soils under fallow were now subject to intense direct heat from the sun, reducing their moisture storage capacity and increasing their susceptibility to wind erosion. Moreover, unchecked by tree cover, the post-monsoon winds were now free to exercise unprecedented effect.

Dharwar's hot easterly winds gained in intensity as well as, with the fall in atmospheric moisture, in dryness, with dramatic effect on the cotton plants. In 1869 Cotton Commissioner Forbes gave the following explanation to the Bombay government for the reduction in that season's cotton crop:

A plentiful fall of rain towards the end of September gave a great impetus to the young plants so that during the next three months they continued to maintain a strong and promising appearance, which gave rise to anticipations of a better crop than any that had been realised for many years.

Unfortunately, however, at the beginning of January, dry, searching easterly winds set in, the pernicious effects of which are well known and dreaded by the cultivators; and as early as the 4th of that month, their first bad effects began to appear in the shape of a species of blight, which very soon became general.¹²⁷

A year later, Forbes was again reporting on the destructive effect of this 'wind blight', describing it as 'the bane' of the Southern Mahratta Country. Moreover, he observed,

of late its recurrence has been more frequent and its influence more severely felt. It may be described as the effects of a hot wind, more injurious from its peculiar dryness than from the heat that accompanies it. Its action on the cotton plant is direct and speedy and no amount of moisture in the soil will avert it.¹²⁸

Another consequence of the accentuated dry climate was that 'exposed to the fierce rays of the sun' during the fallow period, the upper surface of the soil became 'baked and hardened into a crust, which is about as inaccessible to the plough as if it were a pavement'.¹²⁹ Forbes added that in his view, increasing cotton crop losses were due to 'climatic influences, the nature of which we are as yet but very imperfectly acquainted'.¹³⁰

Both varieties of cotton clearly suffered from the effects of climate change. However, the greater moisture requirements of Dharwar-American cotton at crucial stages of plant growth, meant that it became particularly vulnerable to the drier and increasingly unpredictable weather conditions. The American variety continued to be the main focus of the Cotton Department's 'improvement' programme for a full decade after the end of the cotton boom, but with increasingly diminishing returns. It became clear that the seed of New Orleans was deteriorating but neither a careful selection of local acclimatised seed nor the importing of pure fresh seed provided by the Cotton Supply Association, seemed able to arrest the loss of germinating power.¹³¹

At a loss to explain this situation, Forbes, dramatically departing from previous views, including his own, began to suggest that much of the soil was in fact 'quite unsuited' to the cultivation of American cotton.¹³² He was not quite able to make the link between his own observations of climatic changes and the deterioration of the black soils of the eastern plains that had previously acclimatised New Orleans successfully. Already over-cropped during the cotton boom years, these soils additionally lost moisture and fertility as a consequence of deforestation, and with 'bad seasons' recurring more frequently, all of this combined to take their toll on Dharwar-American cotton. Its plants had lateral roots that tended to spread close to the surface, i.e. the driest levels of the soil beyond the initial stages of growth, in contrast to Kumta whose long tap-root enabled it to draw moisture and sustenance from greater depths.¹³³

By the 1870s, New Orleans had reportedly 'declined in staple and lost its silkiness'.¹³⁴ This was confirmed by ginning experiments carried out in Dharwar, Broach and

Manchester which found that the acclimatised plant had 'deteriorated considerably'. It had become the most difficult to gin of all cottons grown in India due to 'a greatly increased attachment of the fibre to the seed' consequent upon drier climatic conditions. In contrast, 'the undoubted merits of its fibre as regards strength and freedom from short staple' led to the conclusion that 'the Kumta or Dharwar indigenous cotton tested at the trials must be placed considerably above the Dharwar American cotton tested with them'.¹³⁵ Interestingly, having both started out as medium staple cottons, it was Kumta that now possessed the longer fibres. Even the Manchester spinners involved in the experiments pronounced in favour of Kumta which was now valued by Liverpool brokers at 2 pence per pound above the American variety.¹³⁶

The Cotton Inspector for the Southern Mahratta Country reported that local prices for 'machine-ginned' (American) cotton had also dipped below those at which 'fair foot-rolled' (Kumta) cotton were selling at.¹³⁷ Dharwar-American had lost its leading position amongst Indian cottons in the market. As it dropped in yield, quality, and price, the dealers and large landholders who had championed its expansion began a drastic cut back of cultivation. In 1880, the Cotton Department reported that 'much of the land formerly devoted to exotic (American) cotton was turned to the cultivation of the indigenous fibre' amid 'a general disinclination' to cultivate this cotton which was now perceived as 'unremunerative'.¹³⁸ Kumta was back with a vengeance, its cultivated area comprising in that year a record 439, 251 acres compared to Dharwar-American's mere 77, 121 acres, effectively pulling the latter back to its mid-1850s position.¹³⁹

Indeed, climatic factors interacted with economic, technological, and political processes to shape another reversal of fortune in the stories of indigenous and American cotton. Kumta had coped with the local decrease in moisture levels far more robustly than New Orleans, and unlike the latter, it was not prone to complete crop failure in adverse weather seasons.¹⁴⁰ Synchronistically, the emergence of the Bombay cotton textile industry in the 1870s led to a new and 'very large' demand for the Indian variety from its steam-spinning and weaving factories as well as a subsidiary demand from spinning mills now emerging in the Madras and Bengal Presidencies. In Dharwar itself, a steam-spinning mill was established in 1881 in the town of Hubli. The increased Kumta cultivation was geared to meeting the demand for local weaving and the requirements of the Bombay and other Indian mills. Virtually none of it went into the export market. In contrast to Kumta's resurgence, Dharwar-American cotton lost favour with Lancashire as supplies from the United

States recovered towards the end of the 1860s; while the appearance of another cheap and abundant variety from the States known as 'middling New Orleans', deprived it of even a role as an efficient substitute.¹⁴¹ This was part of a wider picture that saw Indian cotton exports to Britain drop by 60 percent by the end of the 1870s, a prelude to the UK's virtual disappearance as a market by the mid 1890s.

Finally, interacting with these adverse climatic, economic and technological processes for Dharwar-American cotton was a perceptible shift in the political ideology of colonial governmentality. The global recession that set in by 1873 caused a slump in Lancashire's fortunes, resulting amongst other things in the winding up of the Cotton Supply Association. With a pre-existing fiscal crisis in India, government spending also now became subject to economy and cutbacks with a simultaneous emphasis on increased land revenue charges and on free market activities able to furnish surpluses for the imperial system.¹⁴² This was accompanied by a change in the political climate which reinforced *laissez-faire* doctrines hostile to state involvement in cotton experiments and 'improvement' programmes, the more so as these had failed to yield the desired outcomes.

With the demise of the Cotton Supply Association coupled with Forbes's retirement in 1872, the winding down of the cotton improvement programme in the Bombay Presidency was signalled by the abolition of his post of Cotton Commissioner in 1873.¹⁴³ The Cotton Department lived on borrowed time for another decade, sending its final report in October 1883. Two months later, it ceased to exist. Likewise, the Cotton Frauds establishments were closed in 1880, a prelude to the repeal of the Act itself in 1882.¹⁴⁴ Meanwhile, the decrease in Dharwar-American cultivation coupled with the revelation that the Forbes saw-gin was now inferior to the best gins on the market, led to the shutting down of the main Dharwar Cotton Gin Factory in 1876. The remaining factories, now simply oriented towards repairing working gins, continued to operate at a loss in the vain hope that they would be taken over by private enterprise. They were eventually closed in 1892.¹⁴⁵

In spite of the setting up of forest conservancies, the Dharwar environment continued to deteriorate in the decades following the initial identification of the link between forest depletion and local climate deterioration in the late 1840s. As the Dharwar Gazetteer observed in the early 1880s:

In 1857, within three miles of Dharwar, many parts of the country were thickly covered with dense forests, the haunts of tiger, bison, and other wild animals. Now the cover is hardly enough for jackals, and some parts are

under tillage. The black soil sub-divisions in the north and east have few trees of any kind and depend upon the western forests for building timber and fuel.¹⁴⁶

These increasingly drought-prone eastern landscapes prompted the Governor of Bombay to send out a circular to Collectors and engineers in the Southern Mahratta Country, inviting their views on the feasibility of irrigation works. Back in the 1840s, Alexander Gibson had observed that extending some of the irrigation schemes that watered the rice lands in the west to the eastern soils would help the Lingayat peasantry make their lands productive and plentiful again.¹⁴⁷ Selective irrigation would reduce the effects of rainfall variability. The response from officials, however, was downbeat and negative. Colonel Playfair, the Superintending Engineer for Irrigation, praised the 'very fine' dams (*bandaras*) built 'by our native predecessors' with natural blocks of stone thrown across the Tungbhadra river, most of which, he nonetheless admitted, were now in ruins. However, the restoration of the dam that could provide more water to the southern talukas of Dharwar would be of greater benefit to the neighbouring territories of Raichur Doab and Bellary (outside the Bombay Presidency), so 'no attention need therefore be paid to it by the Dharwar Executive Engineer'. Flowing through the cotton and jowar growing lands of the north, the Bennihalla river carried water 'only in the rains' and would not, he went on, 'repay a survey even'. Moreover, as they possessed 'the finest cotton soil', the peasants 'have never seemed to desire anything further in the shape of irrigation'. Above all, such major irrigation works would involve 'vast expense' which would be difficult to justify.¹⁴⁸

Such official thinking also accounts for the once 'very fine' Dambal lake in the east having being allowed to become 'greatly silted'; its low water storage capacity meant that it 'usually ran dry in December' with the result that much of the land in Dambal, the driest part of Dharwar, was only able to bear crops for half the year. It was only after the great famine of 1876-77 that improvements were hastily undertaken by the Bombay government, involving the raising of the water level by six feet which provided an increase in the lake's storage capacity from 14.75 to 108 million cubic feet.¹⁴⁹ Water scarcity in northern and eastern Dharwar was compounded by the inadequate number of ponds and reservoirs to harvest the monsoon rainfall. With streams drying even earlier in the hot season as a result of climate change, and with no access to water on private lands, poorer cultivators now had 'to fetch their water two or three miles', with many forced to move with their cattle to the banks of the rivers.¹⁵⁰

Thus, while the severity of the 1876-77 famine in northern and eastern Dharwar was triggered by the exceptional failure of all agriculturally relevant rainfall in 1876, the vulnerability of poor cultivators, (as well as of labourers and artisans) to such climate events was produced by specific practices of colonial governmentality that were set in motion long before the 1870s. This included an unbalanced, resource wasteful promotion of a specific type of cotton which ultimately contributed to accelerating the rate of local deforestation, thus amplifying existing drought-prone conditions.

CONCLUSION

This article has sought to extend the reach of the existing literature on cotton in colonial contexts by revealing the actual diversity of cottons and their complex interactions with climatic and environmental conditions. It has shown how this posed some particularly acute challenges to cotton imperialism in western India, and specifically to the colonial state's attempts to secure cotton 'improvement' in the spatial context of nineteenth-century Dharwar. Neither cotton nor climate were passive objects simply waiting to be harnessed and controlled by the hegemonic desires of colonial governmentality, but active, dynamic forces that constantly defied the expectations of officials.

Once the colonial will to improve was translated into practical programmes, in the first instance through the technical 'expertise' of American planters and colonial botanists in the 1840s, erroneous assumptions, flaws and contradictions began to emerge in the paradigms of colonial governmentality. The climate of the cotton growing lands proved to be much drier than envisaged for the growth of the New Orleans variety, experiments on government farms were a costly failure, and initial success in acclimatisation was primarily due to the cultivating skills of the local peasants. Peasants too, therefore, defied colonial expectations, and the American planters' recognition of their superior knowledge of climate and soil already gestured to the flawed rationalities underlying the cotton improvement project. At the same time, inter-colonial discord, partly based on professional jealousies, also thwarted the objectives of the programme. In any case, attempts to persuade local peasants of the superior benefits of growing New Orleans as opposed to Kumta ran directly counter to their experience of cultivating and selling the two cottons, and they strongly resented the coercive means employed to secure changes in their cultivating choices and practices. Kumta was integral to their diverse, risk-reducing cropping system, and local demand for this cotton was strong. Moreover, it also

functioned as the junior rotational partner of millet cultivation which comprised the bulk of the peasants' agricultural efforts and was designed to ensure food security.

For a brief period during the 1860s, it seemed as if lucrative market demand for 'Dharwar-American' cotton consequent upon the American Civil War, coupled with reinforced modes of governmental authority such as the Cotton Department and the Cotton Frauds Act, would secure the predominance of the 'exotic' cotton over the indigenous variety in Dharwar. However, largely based on the interests of Lancashire, this second phase of the colonial project proved, in the end, no more successful than the first. No real lessons were learnt from the failure of the experiments of the 1840s, and in spite of coercive legislation, the colonial state never really spoke with one voice on the issue of cotton improvement. Moreover, the restoration of American supplies to Lancashire by the end of the decade drastically reduced international demand for Dharwar-American cotton while, virtually simultaneously, climatic changes affected the continued viability of the 'exotic' cotton plants. The trajectory of cotton expansion now converged spatially with that of the equally momentous colonial project of timber extraction to produce widespread deforestation in the Dharwar region. This exacerbated local drought-prone conditions and increased rainfall unpredictability. Requiring greater inputs of moisture for growth than Kumta, Dharwar-American cotton began to degenerate, providing an additional rationale for peasants to cut back cultivation. In contrast, Kumta proved far more resistant to changes in the local climate and its cultivation was further boosted by a new pattern of demand from the emerging Bombay cotton textile industry. The repeal of colonial cotton legislation and the demise of the institutions set up to promote improvement crowned the failure of cotton imperialism in nineteenth-century Dharwar.

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