

Chapter 2:

Climate and Empire

Introduction

Histories of climate and imperialism reveal the entwined arguments used to explain both the climatic determinants of empire and imperial aspirations towards climatic control. In the imperial debates we highlight, climate rarely represents a described natural force. Rather, in this chapter, we argue that climate is a philosophical and political category as much as it is a material category, one that was deployed by a diversity of actors in changing and sometimes conflicting ways throughout the British Empire and beyond. Studies of climate have been produced by a wide range of individuals from foresters and medical practitioners, to ships' captains and religious authorities. Understanding the relations between climate and empire has taxed the minds of both imperial authorities and those working and living under imperial oversight, yet postulating the precise relationship between climate and imperial control, however, has been far from straightforward. Work exploring the relationships between climate and empire must account for the complexity of this relationship by examining the ways in which imperial authorities both constructed and legitimated climate knowledges and by investigating the power of climate as a concept to shape imperial ideas and material practices. This chapter recognises the ever changing relationship between empire-making, climatic impacts and climate perceptions.

To explore this argument, we first critically review the historical importance of climate in empire through examination of climatic determinism. Next, we discuss four key themes that are of particular importance to understanding the connections between climate and empire: imperial ambitions for climate control; the use of climatic factors to explain away political or economic failings by imperial authorities; the development and legitimation of particular forms of climate knowledge; and the emergence of medical expertise in assessing and reducing the risks of hazardous climates on imperial projects. In each case, there is no unitary imperial position, but there is a degree of reflexivity; indeed, we

demonstrate that local climate knowledge could enable resistance to imperialism. We suggest that through these four areas of interest, climate and empire became intertwined in important ways, helping to frame eco-cultural networks drawing in new understandings of the environment, new ways of mobilising labour and new kinds of political and economic systems.

Recently, environmental historians have postulated that climates have directly or indirectly determined the fate of empires and societal relations, as, for example represented in the popular books of Brian Fagan.ⁱⁱ According to such accounts, periods of cooling and warming, together with alterations in precipitation patterns, cause episodes of crop failure and famine, which then lead to revolutions and wars. This style of writing harks back to older European traditions exploring the impacts of climate on human society. One frequently made assertion of the nineteenth century was that between the industrious dweller of temperate climates and the indigent resident of the tropics. Historically, these kinds of narratives frequently relied on geographical and latitudinal understandings of climate, especially of similarities among climates of the same latitudes. When Europeans discovered that North American climates were dissimilar to those of their birthplace, a variety of explanations were offered to explain such variety, as well as provoking debate on whether such climates were typical.ⁱⁱⁱ Authorities and settlers in new regions also explored and experimented with an array of responses to climatic differences, while it was thought that with medical insight travellers might be able to avoid any hostile climatic traits. Today, determinists veer between pessimism about humanity's future in the face of inevitable climatic changes and optimism that humans can adapt to mitigate those risks. Given the influence of such historical arguments on imperialism, it is worthwhile elaborating on these in more detail.

In the eighteenth century, Baron du Montesquieu, constructed theories of climatic determinism based on a latitudinal approach to delineating climate and its influence on the

moral and intellectual capacity of humans.^{iv} Montesquieu's work inspired significant numbers of followers amongst colonial governors and generated significant debate, particularly during the seventeenth and eighteenth centuries about the relationship between nature and civilization. Rigorous, scientific and methodical approaches in line with the Baconian tradition of scientific method made nature more amenable to human actions, and led to fresh interpretations of differences between civilized and uncivilized parts of the world. Differences among peoples now could not simply be explained by nature, but rather by the use humans made of nature's raw materials.^v Increasingly, Europeans came to believe that a country's populace should be industrious, especially where, as the demographer Davenant pointed out, natural resources (and land in particular) were abundant. Where scarcity reduced humanity's reliance on nature, excess land tempted people into laziness.^{vi} Although some recognized that humans could have an impact on climate, as through forest clearance, most later, writers acknowledged that agricultural development relied on nature's capacities, and was limited in its power to overcome them. Climates could determine the fate of empires, even if civilization acted to ameliorate or mediate that relationship.

During the later eighteenth century, and into the nineteenth, environmental determinists were challenged in several ways, especially from the perspectives of climatology and medicine.¹ Perhaps the most empirically detailed critique of climate determinism came from the geographer, Alexander von Humboldt, who traced human environmental impacts in South America and, later, in other parts of the world.^{vii} In von Humboldt's reasoning, humans could cause climatic changes, an argument later adopted by another geographer, George Perkins Marsh, perhaps most famously in his 1864 book *Man and Nature*. In arguing against environmental determinism, Marsh stressed that humans were the ones who modified and thereby re-created the environment rather than the other way around. Debates about the

¹ There are of course earlier precedents of the argument that climates were affected by cultivation e.g. David Hume.

domestication of nature would prove to be an important objective for imperial administrations, whereby humans could re-create environments in economically or politically conducive ways to empire, rather than merely responding to encountered climates and civilizations. As environmental historian Richard Grove notes, human-caused environmental degradation could have unforeseen consequences for empire-building through its perceived promotion of climatic deterioration through drought and flooding.^{viii} In this period, environmental determinism was also coming under serious challenges from medical and anthropological authorities, who increasingly rejected environmental explanations of race in favour of arguments that humans could^{ix} manage or mitigate the challenges of living in a tropical climate.

Climatic determinism made a reappearance at the end of the nineteenth century and into the next. Its most noteworthy twentieth-century representative was the geographer Ellsworth Huntington. His *Civilization and Climate* (1915) was renowned for its postulation that climate significantly influenced the emergence of civilizations. To illustrate this, Huntington drew maps of climatic energy zones and allied these with ‘expert opinions’ on the zones of the most and least advanced civilizations.^x As an example of his research into climate and productivity, in 1943 Huntington discussed the importance of the geographical distribution of physical vigour by highlighting that New Zealand workers were twice as vigorous as Indian workers.^{xi} Studies focusing on the influence of climate on society, however, became controversial, for the Geographical community at least, whose science would fall “on hard times” as a result of the re-interpretation of deterministic work in extreme racist ideologies in the early to mid-twentieth century.^{xii}

The re-emergence of climatic determinism has had relatively little academic prominence until recently, in part because of these concerns. Contemporary fears about anthropogenic climatic changes however have led some authors to draw on historical

analogies to illustrate the fragility of civilization under climatic threat. Zhang et al. have recently reprised this thesis quantitatively, suggesting that climatic changes are the ‘ultimate cause’ of the collapse of civilizations historically.^{xiii} The thesis has also been re-articulated several times, with fewer or greater caveats, by more popular science authors such as Jared Diamond and Fagan, even emerging again in explanations of economic competitiveness,^{xiv} though such work has faced considerable criticism for being overly simplistic and has led to increasing anxiety over the possible re-emergence of racialised, deterministic arguments.^{xv}

Simplistic environmental determinist stories still fail to account for why in some places at some times climate seems to matter and at other times matters much less. Robert Marks’ account, for example, shows that technological developments in southern China reduced the impacts of climatic changes from any necessary cycle of declining harvests and enhanced mortality. The creation of, for example, ‘ever normal’ granaries to maintain stocks and manage prices is one such intervention.^{xvi} Donald Worster, among several others, have also advanced more balanced approaches to considerations of climate and society.^{xvii}

But in themselves these analyses do not go quite far enough in explaining the cultural importance and significance of climate as an idea or philosophy alongside its materiality. Hence, we next explore some of the guiding ideas that informed philosophical debates about climate and empire, of which we pursue four particularly significant themes: firstly, the ideas that imperial authorities wished to domesticate or control climate; secondly, the use of climate to explain away economic or political causality; thirdly, that climatic research was developed to legitimate or serve imperial or counter-imperial interests; fourthly, that the role of medical authorities, particularly in the tropics, helped to demarcate practices of everyday life for both the colonized and colonizer. In reflecting on these points, we aim to draw out how perceived climatic similarities and differences not only tied together different parts of

empire, but also fostered new eco-cultural networks through the establishment of shared research interests, and the movement of labour and capital in response to perceived climatic deficiencies.

Domesticating climate and deforestation

A key theme of this chapter is how various attempts to control climates have paralleled histories of imperial expansion. This has been through both intentional and unintentional effects, in which deforestation, desiccation and health have probably been the most prominent filters in these discourses. Justifying deforestation for either military or agricultural purposes became an important focus of study, not least because it was one of the most visible environmental impacts of imperialism.

Making climates safe for empires was an important component of imperial strategy, and fostered lively debates focused on questions of health, race, and conduct. We discuss health in more detail later, but here the important connection is the aim of making climates amenable to imperial ambitions, and especially to white colonization. In writing about the United States, Hugh Williamson in the late eighteenth and early nineteenth centuries argued that cultivation could reduce forest coverage and thereby the noxious savage airs that were corrupting the complexions of the brunettes (whites).^{xviii} In the tropics, the climatic risks to the European or American body could be controlled through careful governance of the body, by maintaining a moral life that would ensure high productivity rather than laziness, and through an active management of the environment.^{xix} Managing the transition of the body through different climates represented one of the key challenges to Europeans, as they sought to make tropical climates safe for white settlement.^{xx} Climates could also be domesticated, and thereby permit European residence, through the design of buildings and infrastructure tailored to a tropical climate. Practitioners schooled in acclimatization theory argued for

particular types of tropical housing design to enable bodies to adapt to new thermal regimes, a feature of especial importance to companies with large numbers of overseas workers.^{xxi}

These stories of domestication contrast with stories of perceived climatic changes, particularly of deforestation leading to unwanted social and environmental impacts. Not all climates could be easily domesticated, while interventions to enhance political or social security could equally backfire. Richard Grove has demonstrated the connection between colonial debates on deforestation and climatic change in European empires. Bernardin de Saint-Pierre, for example, who was trained in the physiocratic theses of the missionary and naturalist Pierre Poivre, argued that deforestation would haunt humanity through its disruptive impact on the interdependent relationship between humans and nature.^{xxii} Indeed, on colonial island dependents like Mauritius about which Saint-Pierre was concerned, deforestation affected naval wood supply and the agricultural sustainability of those islands. Conserving forests was not just about economic interests, but also preventing further climatic deterioration in the interests of settler societies.^{xxiii} Climates could shape forests and vice-versa according to the developing scientific arguments of the period.

Fears of desiccation also prompted imperial concern, questioning the extent and provenance of imperial environmental changes as well as informing state responses to them – very often through forestry policies. Desiccation narratives inspired conjoint moral, political and scientific projects that sought to domesticate imperial climates. Authorities sought to make local communities adhere to European moral norms, and use the land in ways Europeans thought appropriate. This meant in some cases striving for the sedentarisation of previously nomadic groups, encouraging agricultural investment while simultaneously allowing for the subjugation of local people by colonial authorities. The developmentalist agendas of imperial states used the excuse of an apparently deteriorating climate to legitimate intervention towards ‘modern’ agricultural development. Vast landscape alterations, in

particular afforestation or reforestation projects, were also instituted by imperial authorities to ‘restore’ environments.^{xxiv} The clarion calls for state forestry management to preserve health and protect agricultural productivity and settlements reinforced a narrative of state redemption from threatening environments.^{xxv} If climatic changes risked political stability, they also opened up possibilities for enhancing state control. Ambitions to domesticate imperial climates were an admixture of different kinds of political, social, and scientific ambition reliant on different kinds of political, social and scientific expertise.^{xxvi}

Domesticating climates shored up imperial power by ensuring a continual supply of natural goods and resources, while protecting and maintaining the living conditions of whites living in the colonies. This was not, however, just about the material influence of climate, but was also about making climates safe medically, economically, politically, and socially. A wholesome climate safe for civilization was one that was protected from fears of revolt and the corrupting influences on the citizenry. The very idea of climate was to be worked with to ensure imperial ambitions, whether through deploying it to enforce particular policies or to encourage modes of self-governance amongst the population. Climates did not make empires, but rather empires made the climates that were then enrolled in support of particular objectives, although not always successfully.

The economy of climate

Discussions of climate and empire frequently invoke the imperial ambition of maximizing economic productivity, an aim that raises questions of worker commitment and the optimal climates required for production. Inasmuch as the tropics could hinder productivity and morality, it could also provide new sources of financial, social and sensory opportunities. Here we identify the ways in which climate is cast as a resource and a hazard by, for, and through empire.

While many debates of the seventeenth century focused on identifying the optimal climates for producing particular goods and explaining economic success in this way, Jean-Pierre Purry, writing in the early eighteenth century after his experience travelling with the Dutch East India Company, suggested that there was an optimal climate for maximising production from a colonial outpost that was distinct from a specifically geographical, latitudinal rendering of climate.^{xxvii} For Purry, the best climate was that which rendered particular economic policies acceptable, not necessarily that with a perceived best natural climate. A climate deficient in providing resources for production could be improved through labour and effort. Imperial ambition thus could enhance the productivity of each colony's climate, effectively domesticating climatic resources and risks within appropriate economic management: for 'air', as Purry declared 'is ever best where most Money is stirring, for poverty and want will render people unhealthy in all climates.'^{xxviii}

The perceived economic costs of the deficiencies of productivity in the tropics and the failings of Europeans to adapt did not outweigh the many economic benefits of resources and products that could be grown in the region and which were useful to empire. New products and sensory experiences for consumers at home and abroad encouraged the expansion of agriculture to meet these new demands. Control over territories in the tropics meant that what had been previously traded as a good with foreign partners could now be directly produced in the colonies. Large-scale agricultural plantations appeared in the late nineteenth and early twentieth centuries, but the rush to provide goods to the home nation precipitated sets of environmental changes that were often detrimental to the colony (see chapters 4 and 7). For example, the clearance of jungles for agriculture often created ideal conditions for the spread of malaria, which reinforced a vision of the tropics as dangerous and led to a set of imperial interventions designed to restrict the impact of the disease on plantation workers' health.^{xxix} In addition, while the tropics had been perceived as dangerous and unhealthy, from the mid-

nineteenth century, the tropics--as a homogenised region--was transformed into a tourist commodity through its presentation as a healthy and desirable tourist destination. Mark Carey demonstrates that the Caribbean climate swiftly became re-made as a commodity during this period, being marketed as a new alluring sunny destination.^{xxx} Latitudinal climatic theories were insufficiently precise as many Caribbean islands were marketed through specific, local weather factors as well as by appeals to imperial associations, such as the marketing of Barbados as 'Little England'.^{xxxi} Tropical climates, although they offered distinct disadvantages, offered important economic advantages through their productive and tourist potential.

While climates were being actively domesticated, they retained sufficient agency in popular and political discourse to be enrolled as reasons for the failure of imperial ambitions or local economic policies. Climate, in this sense of its meaning, came to stand in as the primary causal factor when things went wrong, even if the blame might be more accurately apportioned to imperial political or economic factors. Mike Davis' classic work exploring late-nineteenth-century El Niño events and famines suggests that famines resulted as much from political and economic policies as they did from changes in precipitation and its distribution.^{xxxii} As thousands were dying in India from starvation in 1900, the British sold India's remaining grain on export markets, a situation obscured by the rhetoric of British colonial officials. One official, quoted by Davis, suggested that the problem of famine was one of climate-induced apathy: 'The Gujurati is a soft man... accustomed to earn his good food easily. In the hot weather, he seldom worked at all and at no time did he form the habit of continuous labour.'^{xxxiii} In other words, the climate's material effect on Indian civilization was the ultimate cause of the disaster.

If populations rebelled against imperial policies, then these political uprisings and discontent could likewise be blamed on climatic rather than imperial misrule. For example,

British coverage of uprisings in China after flooding might focus on the turmoil of the flood event rather than the fact the rebels primarily attacked foreigners and ruling officials.^{xxxiv} While Davis' claims may be over-stretched, his general argument is important as it reflects on the work that climate does in legitimating imperial ambitions and protecting authorities. An incommensurable climate for imperial authorities was therefore one that presented the greatest challenges for governance even as climatic events really did change the experienced climate. The economic climate is thus at the core of discourses on empire and climate: In material, cultural and political terms, climates could be both resourceful and hazardous.

Climate and scientific knowledges

There have been myriad ways of arriving at legitimate climate knowledge, and in this section we discuss some of the mechanisms through which imperial climate knowledge was produced and co-produced. In a western context, climate and weather had been the subjects of private narratives, diaries, chronicles and sermons since the later seventeenth century. As Lorraine Daston has demonstrated, a very diverse group of people were involved in observing and recording weather in this period, either in networks or independently, including “gentlemen, physicians, sea captains, peripatetic Jesuits, erudite abbots and naturalist curates, university professors and academicians, travellers...”^{xxxv} In the earliest records, emphasis was often placed on local weather and on the “qualitative and narrative framing of ‘important’ weather,” such as on the unusual or extreme event that disrupted everyday life and which was often explained as portentous and as manifestations of divine retribution.^{xxxvi}

From the mid- to late-eighteenth century, more quotidian recording practices were adopted whereby people collated daily local weather records based on their own personal observations. To some extent, this constituted part of an endeavour to collect and organise local natural histories. The emphasis placed on the “accumulation of ‘prerogative instances’,

and the sifting of textual information--all as a means of collecting weather” also represented a form of distinctly local scholarship that arguably played an important role in the cultivation of Enlightenment science.^{xxxvii} The nineteenth century, in witnessing further standardization of information, marked the rise of the modern science of meteorology.^{xxxviii}

There were numerous interpretations of what science, and by descent, climate science, constituted, and in this sense, Western science was but one genre among many.^{xxxix} Scientific theories about climate and weather phenomena continued to co-exist with more traditional popular beliefs.^{xl} Many folk and rural genres which expressed “knowledge regarding the full range of weather and climatic conditions,”^{xli} was based on familiarity with long-term climate variability or weather knowledge, something Katherine Anderson calls “weather wising”. Such folk knowledges were “widely respected” as giving “the best advice available.”^{xlii} Wolfgang Behringer, for example, uses the phrase ‘sin economics’ to describe the religious significance attached to meteorological events recognisable across various cultures.^{xliii} Examples of this include attribution of the revenge of an animate universe against humanity’s sins prevalent among the twelfth-century Zuni tribe of southwestern United States and the purging of sins through the execution of witches in the Little Ice Age, right through to attempts to stop climatic cooling or the contemporary attribution of climatic changes to carbon sins.^{xliv} Exhortations to better behaviour or to establish different relationships with nature created modes of governance that pinned responsibility on individuals to be watchful and careful in their behaviour. Religious discourses endured and were translated by, and within, emergent scientific arguments.

Scientific and folkloric understandings and predictions of climate co-existed in many colonial contexts. As historians of science David Chambers and Richard Gillespie have argued, Eurocentric models charting the introduction of science to a non-European, non-scientific audience implied that “localities peripheral to the European centre would

progressively ‘receive’ the ideas of Western science, slowly establishing their own scientific organisations and personnel.”^{xlv} Such Eurocentric diffusionist models seemed to be at least superficially applicable in countries where European settlers predominated in the nineteenth-century and where the “destruction of the indigenes and their traditional cultures had been ruthlessly accomplished.”^{xlvi} Wherever they were, however, local populations were not merely “distant recipients” or “passive receptacles of European genius.”^{xlvii} Climatic variability was a cause for concern for both settlers and indigenous groups. Both comprehended and responded to this variability within the frameworks of their own ‘climatic philosophies.’ Indeed, in many situations, settlers encountered an existing body of folkloric knowledge, practice and custom, which tempered the spread of imperial scientific knowledge, and subverted the transfer of information from colonist to subject.

Nineteenth-century encounters between British missionaries and the Tswana in central southern Africa, for example, instance the co-existence of different climatic understanding of the same weather events and demonstrate how physical and cultural contact could establish new eco-cultural networks. Missionaries positioned the climate of the region within what David Livingstone has referred to as a ‘moral economic’ perspective, particularly apparent in the association of drought with heathen practices and belief systems.^{xlviii} In contrast, indigenous societies in this region conceptualized and responded to climatic variability within their own ethno-climatic frames of reference, something that is also discussed within the same sources. Rainmaking ceremonies, for example, together with a host of climate-related beliefs, represented key responses to drought among indigenous communities.^{xlix} As was typical of many colonial contexts, these local forms of knowledge were often initially nullified or re-inscribed as non-knowledge by colonial settlers.^l Over time, however, missionaries borrowed from the indigenous climatic portfolio, adopting the local terminology in order to better understand and influence their subjects.^{li} Colonial spaces

might, therefore, in the terminology of historian of science Stephen Shapin, be considered ‘scenes’ in which existing geographical knowledge was applied but where new knowledge was collected, exchanged and developed to help shape the co-evolution of both European and indigenous climatic philosophical ideologies and knowledges.^{lii}

Settlers thus attempted to monitor, manage, map, measure and control their exposure to particular climates.^{liii} Some indigenous groups, meanwhile, maintained and developed various ‘traditional’ means of prognostication, of coping with changes in weather patterns. Whether through instrumental means or not, climatic knowledges emerged that were both adaptive, enabling societies to manage weather risks, and often predictive, determining what might or would happen. These developed within, and alongside, scientific enterprises as in the case of deforestation debates.^{liv} Contentions over the scientific understanding of climate and its effects were central to imperial ambitions. Indeed, the development of networks of meteorological observers in the late nineteenth century followed the clear geographical patterns of imperialism.

Climate, health and tropical medicine as agents of empire?

Europeans had long associated intemperate climates with disease, ill health and pestilence. The supposed excessive heat of such places was cited as a major reason for “southern sickliness,” but throughout much of the nineteenth century, a key debate for geographers, medical practitioners, colonial administrators and naturalists, among others, centred on whether Europeans could ‘acclimatize’ to life in tropical regions.^{lv} In this section, we explore the dynamics of this debate and demonstrate how climatic concerns fostered eco-cultural networks that fostered comparative scientific investigation of healthy and unhealthy climates, and corresponding recommendations for lifestyle changes to accommodate to climatic differences. Before the 1830s, most experts held that races could adapt to new environmental

contexts, for example, by adopting local customs. Medics of the eighteenth and early nineteenth centuries recommended that colonists living in the tropics should don clothing appropriate to the climate, including topsis, spine pads, and tinted glasses, while also taking particular precautions with their diet and activities, all in an effort to render the climate threat less potent,^{lvi} but they also recommended the emulation of indigenous customs in order to facilitate acclimatization in the tropics. According to health historian Mark Harrison,^{lvii} for example, the medic James Johnson, writing in 1815, had suggested that, amid the “strange medley or ludicrous and ridiculous customs,” Europeans might usefully pay attention to local knowledge and practice, including to those associated dress, to strengthen their resistance to exotic diseases.^{lviii}

By the middle of the century, however, such beliefs were being replaced by polygenic theories, which held that races were suited to their own particular regions, or ‘native’ climates.^{lix} There were “profound anxieties” that prolonged residence by Europeans in tropical colonies could only result in change for the worse--that is, to say physical, spiritual and moral degradation, and it was thought that settlement in new territories could even prove fatal in some circumstances.^{lx} With the growing adherence to polygenic arguments by the second half of the nineteenth century, medical practitioners emphasised the need to both establish greater distance between European and local populations and to maintain European lifestyles overseas to ensure sound constitutional, mental and moral health.^{lxi} For Europeans, self-governance of lifestyle became particularly important in the tropics to prevent a descent into the moral ineptitude of living in a warm climate.

These anxieties and ideologies informed and framed many of the anticipatory geographies of European travellers and colonists. But beyond such homogenized, negative tropical stereotypes, it was often the case that very little was actually known about the geography of different tropical regions, their climates or relative suitability for European

settlement. As the geographer Victor Savage has highlighted, only with lived experience within tropical regions was this homogenized view of the tropics challenged.^{lxii} Certain locations began to be identified as favourable or unfavourable, healthy or unhealthy, to reside in, distinctions commonly drawn on the basis of relative similarity to, or variance from, more ‘familiar’ temperate conditions.^{lxiii} Indeed, it was through this comparative lens that settlers comprehended apparent climatic salubrity (or otherwise) and judged how they might cope with those areas that were perceived to be less favourable. Trips to coastal regions or to elevations offering more temperate climatic conditions were particularly encouraged. Hill stations in India, for example, became temperate climate retreats for European bodies otherwise exposed to climates deemed to be overly hot and decidedly unhealthy.^{lxiv} Constitutional restoration was also encouraged through travelling or a therapeutic “change of air.”^{lxv} Imperial expansion into the tropics, then, produced new kinds of eco-cultural connections, as colonists encountered new climates and adjusted their behaviours accordingly.

Towards the turn of the twentieth century, germ theory began to challenge predominantly climatological explanations of tropical disease.^{lxvi} The two theories did not necessarily contradict each other as environmental and meteorological disease aetiologies continued to co-exist with emerging germ theories well into the late nineteenth and early twentieth centuries.^{lxvii} The shift to a new scientific understanding of disease may have in fact also have enhanced the particularity of the tropical threat. The identification of diseases specific to the tropics and sub-tropics, for example, including malaria, yellow fever and leprosy, served to highlight the pathological specificity of the tropics and also helped establish tropical medicine as a distinctive arena for medical research.^{lxviii} Nevertheless, this emergent science slowly began to lessen fears of European vulnerability in tropical environments. Now vulnerability and susceptibility to disease became something that could

be controlled or at least managed through drugs and personal behaviour rather than by recourse to climatic explanations.^{lxi}

Of course, whether it related to climate or germ theories of disease, or any other, Western medicine at no time operated in a cultural void. There are many occasions when western medicine was confronted, and challenged, by indigenous medical knowledge, giving rise to a medical pluralism.^{lxx} Moreover, for some diseases, and as historian of medicine Michael Worboys has illustrated for leprosy in the African and Asian colonies of Britain in the first half of the twentieth century, indigenous remedies were embraced as part of the “European pharmacopeia.”^{lxxi} For the most part, however, identifiably tropical diseases became symptomatic of a “moral and social sickness” in need of address, and better understating of germs and contagion effectively upheld the need for maintaining a supposedly ‘healthy’ distance between settler and indigene, promoting, in some scenarios, racial segregation, and justifying, in most, western medical intervention.^{lxxii} Tropical medicine in this way became another tool of empire.^{lxxiii}

Conclusion and future trends

As David Livingstone has argued, climate represented a versatile “hermeneutic resource” of empire for much of the later eighteenth and nineteenth centuries.^{lxxiv} Climate was deployed to account for racial, cultural and environmental differences in various parts of the world and represented a key philosophical influence on colonial ideologies, imaginaries and experiences.^{lxxv} Medical topographies or pathological geographies were created on the basis of apparent climate healthiness or un-healthiness. Certain places came to be recognized as “the white man’s grave” while others offered opportunity for “climate therapy.”^{lxxvi} Climate provided the dominant lens through which to identify, or indeed construct, opportunities for colonial settlement and investment. The construction of morally, spiritually and economically

wanting environments, but which were nevertheless ripe for economic development and which offered potential climatic salubrity for British, and more broadly European, settlement helped to justify European colonial intervention, while solutions were sought to change or control other less favourable climates to improve them or in some way make them safe for settlement. In these ways, climate became an agent of empire.

Philosophies of climate have changed over time. Scholarship investigating the direct influence of climate on human societies has most definitely moved on from the reductionist, racially oriented environmental and climatic determinism associated with the age of Empire. Yet climate maintains an important place in contemporary environmental discourse and continues to have potent political agency. Climate change, of course, currently represents, and is being represented as, a significant threat to humanity and as such ranks among the most serious of contemporary global anxieties. In some former imperial territories, in former African and Indian colonies in particular, media images of drought, floods, famine, and warfare in effect continue to encourage western intervention, albeit in the form of humanitarian aid.^{lxxvii} Moreover, as noted in the introduction to this chapter, in recent decades climate has once again been invoked in a deterministic way in a swathe of scientific and popular scholarship.

This is particularly evident in three sets of work. Firstly, determinism is evident in research that seeks to link climate change with conflict, especially where increased weather extremes and reduced food and water availability are predicted to lead to local or national uprisings and wars. Secondly, it is apparent in what Jon Barnett has referred to as the ‘securitisation’ of climate discourse in which potential climate threats inspire new state projects to patrol borders and national resource control strategies. Thirdly, scientific work associating catastrophe and civilisation collapse has explored significant periods of climate change in the past to draw lessons for humanity’s future.^{lxxviii} Such claims about climate are

often made with little evidence and without direct correlation between events and climates. As Karl Butzer highlights, much of this new environmentalism, particularly in the popular arena, displays a “continuing failure to appreciate the complexity of such interrelationships.”^{lxxix}

It is perhaps not surprising, that the resurgence in neo-environmental deterministic writing has thus been paralleled by emerging efforts to explore and highlight this complexity and to demonstrate how human societies have coped with, and responded and adapted to environmental stresses via multiple pathways, including innovation and adaptation as well as societal disintegration. There is increasing recognition that time and place specific cultural, social, political, economic and demographic parameters together combine to construct a mediating context for climate-society interactions. Moreover, in a material sense, this context not only influences how livelihoods in a region may be vulnerable to disruption, and the way in which environmental change or an environmental or climate event is experienced, but also informs the extent to which, and by what means, different social systems and groups are able to respond.

Recent multidisciplinary research projects in various parts of the world are affording new insights on the importance of complexity, resilience, adaptability and social transformations in history, demonstrating how various institutions and cultural coping strategies have been developed to deal with the impacts of climate change at a range of temporal and spatial scales.^{lxxx} They are also revealing how vulnerability to, and experience of, environmental and climatic change, in turn, are contingent upon both temporal and spatial contexts, and can lead to an improved knowledge of risk among affected communities, contributing to improved knowledge. Such work should be seen as a pivotal counterbalance to the simplistic, mono-causal, neo-deterministic explanations of climate-society relationships. It should also be noted that in a more conceptual sense, there is important work

being conducted on the changing conceptualisations of climate and shifting climate narratives over time. This has most recently been seen in work by Hulme and Livingstone amongst others.^{lxxxi}

Notwithstanding these recent trends, this chapter has demonstrated that climate is as much a philosophical concept as a material entity, one resonant with cultural, economic or political meanings in eco-cultural networks which have variously justified, legitimated, contradicted or frustrated imperial ambitions. Climates have been domesticated, economically organized, the subject of scientific and indigenous wisdom, and a core part of debates within the field of tropical medicine, in ways that are not just about the effects of climate on something, but rather on how empire helped re-make the very meaning of climate as an external actor. Environmental history scholarship has much to offer in terms of investigating climate's changing significance, ideologically, conceptually and materially, over time and in different places. The lived experiences under empires shaped, and were shaped by, discourses about the climate and its physical manifestations.

ⁱ Mike Hulme *Why We Disagree About Climate Change* (Cambridge: Cambridge University Press, 2009)

ⁱⁱ Brian Fagan *The Little Ice Age: How Climate Made History 1300-1850* (New York: Basic Books, 2000)

ⁱⁱⁱ Karen Ordahl Kupperman "The Puzzle of the American Climate in the Early Colonial Period". *The American Historical Review*, 87, 5 (1982): 1262-1289.

^{iv} James R. Fleming *Historical Perspectives on Climate Change* (New York: Oxford University Press, 1998)

^v Lars Herlitz "Art and Nature in Pre-Classical Economics of the Seventeenth and Eighteenth Centuries," in *Nature and Society in Historical Context*, ed. Mikuláš Teich et al (Cambridge: Cambridge University Press, 1997): 163-175.

^{vi}Herlitz, “Art and Nature”.

^{vii} Gregory T. Cushman “Humboldtian Science, Creole Meteorology, and the Discovery of Human-Caused Climate Change in South America,” *Osiris* 26 (2011): 19-44.

^{viii} Richard H. Grove *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism, 1600-1860* (Cambridge: Cambridge University Press, 1995)

^{ix} Katharine Anderson “Looking at the sky: the visual content of Victorian Meteorology,” *British Journal for the History of Science* 36, no. 3 (2003): 301-332.

^x Fleming, *Historical Perspectives on Climate Change*.

^{xi} Ellsworth Huntington “The Geography of Human Productivity,” *Annals of the Association of American Geographers* 33, no. 1 (1943): 1-31.

^{xii} James Blaut, ‘Environmentalism and Eurocentricism’. *The Geographical Review* 89 (3) (1999), pp. 391-408.

^{xiii} David D. Zhang et al., “The causality analysis of climate change and large-scale human crisis,” *Proceedings of the National Academy of Sciences*, 108, no. 42 (2011): 17296-17301.

^{xiv} Jared Diamond *Guns, Germs and Steel: the fates of human societies* (New York: W.W. Norton, 1999); Jared Diamond *Collapse: How societies choose to fail or succeed* (New York: Viking, 2004); Fagan, *The Little Ice Age*; Andrew D. Mellinger, Jeffrey D. Sachs and John L. Gallup “Climate, coastal proximity, and development,” in: *The Oxford Handbook of Economic Geography* ed. Gordon L. Clark et al. (Oxford University Press, New York, 2001).

^{xv} Paul Coombes and Keith Barber Environmental determinism in Holocene research: causality or coincidence?, *Area*, 37 (2005): 303–311.

^{xvi} Robert B. Marks *Tigers, Rice, Silk, and Silt: Environment and Economy in Late Imperial South China* (New York: Cambridge University Press, 1998).

^{xvii} Donald Worster *Dust Bowl: The Southern Plains in the 1930s* (New York: Oxford University Press, 1979)

^{xviii} Fleming, *Historical Perspectives on Climate Change*.

^{xix} Anderson, “Looking at the sky”.

^{xx} Fleming, *Historical Perspectives on Climate Change*.

^{xxi} Jiat-Hwee Chang and Anthony D. King “Towards a genealogy of tropical architecture: Historical fragments of power-knowledge, built environment and climate in the British colonial territories,” *Singapore Journal of Tropical Geography* 32 (2011): 283-300.

^{xxii} Grove, *Green Imperialism*.

^{xxiii} James Beattie “Environmental Anxiety in New Zealand, 1840-1941: Climate Change, Soil Erosion, Sand Drift, Flooding and Forest Conservation,” *Environment and History*, 9 (2003): 379-392.

^{xxiv} James Beattie *Empire and Environmental Anxiety: Health, Science, Art and Conservation in South Asia and Australasia, 1800-1920* (Basingstoke: Palgrave Macmillan, 2011); Diana M Davis “Desert ‘wastes’ of the Maghreb: desertification narratives in French colonial environmental history in North Africa,” *Cultural Geographies*, 11 (2004): 359-384.; Georgina H. Endfield and David J. Nash “Drought, desiccation and discourse: missionary correspondence and nineteenth-century climate change in central southern Africa,” *The Geographical Journal*, 168, no. 1 (2002): 33-47.; James Fairhead and Melissa Leach “Desiccation and Domination: Science and Struggles over Environment and Development in Colonial Guinea,” *The Journal of African History*, 41, no. 1 (2000): 35-54.

^{xxv} Beattie, *Empire and Environmental Anxiety*

^{xxvi} James Beattie “Climate Change, Forest Conservation and Science: A Case of New Zealand, 1860s –1920,” *History of Meteorology*, 5 (2009): 1-18.

^{xxvii} Vladimir Jankovic “Climates as commodities: Jean Pierre Purry and the modelling of the best climate on earth,” *Studies in History and Philosophy of Modern Physics*, 42 (2011): 201-207.

^{xxviii} Old England, 1745, Cited in Jankovic, “Climates as commodities,” 201

^{xxix} Chang and King, Towards a genealogy of tropical architecture.

^{xxx} Mark Carey “Inventing Caribbean climates: How science, medicine, and tourism changed tropical weather from deadly to healthy,” *Osiris* 26 (2011): 129-141.

^{xxxi} Carey, “Inventing Caribbean climates”.

^{xxxii} Mike Davis *Late Victorian Holocausts: El Niño Famines and the Making of the Third World*. (London: Verso, 2002).

^{xxxiii} Davis, *Late Victorian Holocausts*, 172.

^{xxxiv} Davis, *Late Victorian Holocausts*.

^{xxxv} Lorraine Daston “Unruly weather: natural law confronts natural variability” in *Natural law and law of nature in early modern Europe. Jurisprudence, theology, moral and natural philosophy* ed. Lorraine Daston and Michael Stolleis (Ashgate, Surrey, 2008): 233–248; Vladimir Jankovic *Reading the Skies. A Cultural History of the English Weather, 1650-1820* (Manchester: Manchester University Press, 2001); Angela Rusnock “Correspondence networks and the Royal Society, 1700-1750”. *The British Journal for the History of Science*

32, no. 2 (1999): 155-169; Jan Golinski “Putting the weather in order: narrative and discipline in eighteenth century weather diaries”, Paper delivered at the William Andrews Clark Memorial Library, UCLA, Los Angeles, May 16, 1998.

^{xxxvi}Jankovic, *Reading the Skies*, 9.

^{xxxvii}David N. Livingstone “Reading the heavens, planting the earth.Cultures of British science”. *History Workshop J* 54(2) (2002):236–241, 237 .

^{xxxviii} Simon K. Naylor “Nationalising Provincial Weather: Meteorology in Nineteenth-Century Cornwall”, *British Journal for the History of Science*, 39 (2006): 407-433, 411 .

^{xxxix}Masakata Ogawa “Beyond the tacit framework of ‘science’ and ‘science education’ among science educators”*International Journal of Science Education*, 11, no. 3 (1989): 247- 250, 248.

^{xl} Jan Golinski*British Weather and the Climate of Enlightenment* (Chicago: Chicago University Press, 2007), 80.

^{xli} Sarah Strauss and Benjamin S. Orlove “Introduction”, in: Sarah Strauss and Benjamin S. Orlove (eds) *Weather, Climate, Culture*, (Oxford: Berg, 2003), 7.

^{xlii}Golinski, *British Weather*, 43; Anderson, “Looking at the sky”.

^{xliii} Wolfgang Behringer*A Cultural History of Climate* (Cambridge: Polity, 2010).

^{xliv} Gregory Nagy “As the World Runs out of Breath: Metaphorical Perspectives on the Heavens and the Atmosphere in the Ancient World,” in*Earth, Air, Fire, Water: Humanistic Studies of the Environment* ed. Jill Kerr Conway et al. (Amherst: The University of Massachusetts Press, 1999) 37-50; Behringer, *A Cultural History of Climate*.

^{xlv} David Wade Chambers and Richard Gillespie “Locality in the history of science: colonial science, technoscience and indigenous knowledge”. *Osiris*, 2nd Series, 15 (2000): 221-240, 224.

^{xlvi}Chambers and Gillespie, “Locality in the history of science,” 225.

^{xlvii} Warwick Anderson “Where is the postcolonial history of medicine?” *Bulletin of the History of Medicine* 72, no. 3, (1998): 522-530, 522 and 525.

^{xlviii} David N. Livingstone “The moral discourse of climate: historical considerations on race, place and virtue,” *Journal of Historical Geography* 17 (1991): 413-434.; David N. Livingstone “Tropical climate and moral hygiene: the anatomy of a Victorian debate,” *British Journal for the History of Science* 32 (1999): 93-110; David N. Livingstone “Race, space and moral climatology: notes toward a genealogy,” *Journal of Historical Geography* 28 (2002):159-180; Endfield and Nash, “Drought, desiccation and discourse”.

-
- ^{xix} P.S Landau, “When rain falls: rainmaking and community in a Tswana village c. 1870 to recent times”. *International Journal of African Historical Studies* 26 (1993): 1-30, 3.
- ⁱ Clive Barnett “Impure and worldly geography: The Africanist discourse of the Royal Geographical Society, 1831-73,” *Transactions of the Institute of British Geographers*, 23, no. 2 (1998): 239–251, 244.
- ⁱⁱ Endfield and Nash, “Drought, desiccation and discourse”.
- ⁱⁱⁱ First quote from Stephen Shapin “The house of the experiment in seventeenth century England”. *Isis* 79 (1988): 373-404, 373.
- ⁱⁱⁱⁱ Mart A. Stewart,. ““Let us Begin with the Weather?”: Climate, Race, and Cultural Distinctiveness in the American South,” in *Nature and Society in Historical Context*: ed. MikulášTeich et al. (Cambridge: Cambridge University Press, 1997): 240-256.
- ^{iv} Beattie, “Climate Change, Forest Conservation and Science”.
- ^v Karen OrdahlKupperman “Fear of host climates in the Anglo-American Colonial experience.” *William and Mary Quarterly* 41 (1984): 213-240; Mark Harrison *Climates and constitutions. health race, environment and British imperialism in India* (Oxford: Oxford University Press, 1999).
- ^{vi} Dane Kennedy “The perils of the midday sun. Climatic anxieties in the colonial tropics.” in *Imperialism and the Natural Worlded*. John M. MacKenzie (Manchester: Manchester University Press, 1990): 118-140, 125.
- ^{vii} Mark Harrison, “The Tender Frame of Man’: Disease, climate, and racial difference in India and the West Indies, 1760-1860,” *Bulletin of the History of Medicine* 70 (1) (1996): 68-93.
- ^{viii} James Johnson *The influence of tropical climates on European constitutions: being a treatise on the principal diseases incidental to Europeans in the East and West India, Mediterranean and coast of Africa*. (London: J. Callow, 1815), 417.
- ^{lix} Anderson, “Where is the postcolonial history of medicine”.
- ^{lx} Kupperman, “Fear of host climates,” 213.
- ^{lxi} Nancy L. Stepan *Picturing tropical nature* (London: Reaktion Books, 2001); Harrison, “The tender frame of man”.
- ^{lxii} Victor R. Savage “Tropicality imagined and experienced. A commentary on Felix Driver’s ‘Imagining the Tropics: Views and visions of the Tropical world’ ”. *Singapore Journal of Tropical Geography*, 25(2004): 26-31.
- ^{lxiii} Felix Driver and Luciana Martins *Tropical visions in an age of empire* (Chicago: University of Chicago Press, 2005), 143.

-
- ^{lxiv} Beattie, *Empire and Environmental Anxiety*; Judith Kenny “Climate, Race, and Imperial Authority: The Symbolic Landscape of the British Hill Station in India”, *Annals of the Association of American Geographers* 85, no. 4 (2005): 694-714.
- ^{lxv} Chjae Chard “Lassitude and revival in the warm south: relaxing and exciting travel, 1750-1830” in *Pathologies of Travel* ed. Richard Wrigley and George Revill (Amsterdam: Wellcome Institute for the History of Medicine, 2000): 179-205, 182.
- ^{lxvi} Stepan *Picturing tropical nature*, 157; Morag Bell “The pestilence that walketh in darkness: Imperial health, gender and images of South Africa, 1880-1910,” *Transactions of the Institute of British Geographers* 18 (1993): 327-341, 329; Livingstone, “Race, space and moral climatology”.
- ^{lxvii} Harriet Deacon “The politics of medical topography: seeking healthiness at the Cape during the nineteenth century”. In Richard Wrigley and George Revill (eds) *Pathologies of Travel*. (The Wellcome Institute Series in the History of Medicine, Amsterdam, 2000): 279-297, 281; Kennedy, *The perils of the midday sun*; Stepan, *Picturing tropical nature*; Livingstone, “Race, space and moral climatology,” 168.
- ^{lxviii} David N. Livingstone “Tropical hermeneutics: fragments for a historical narrative. An afterword”, *Singapore Journal of Tropical Geography*, 21(2000): 92-98.
- ^{lxix} Mark Jennings “This mysterious and intangible enemy’. Health and disease amongst the Early UMCA Missionaries, 1860-1918”. *The Society for the Social History of Medicine*, 15 (2002) 65-87, 68.
- ^{lxx} For example Frederick Chilube “The Clash between Modern and Indigenous Medicine,” *Makerere Medical Journal*, 9 (1965): 36.; Helen Lambert “Plural traditions: folk therapeutics and ‘English’ medicine in Rajasthan,” in *Western Medicine as Contested Knowledge* ed. Andrew Cunningham and Bridie Andrews (Manchester: Manchester University Press, 1997): 191-211.
- ^{lxxi} Michael Worboys “Colonial Medicine as Mission and Mandate: Leprosy and Empire, 1900-1940.” *Osiris*, 15 (2001): 207-220, 215.
- ^{lxxii} David Arnold “Introduction: Disease, medicine and empire,” in *Imperial medicine and indigenous societies* ed. David Arnold (Manchester: Manchester University Press 1988) 1-26, 7.
- ^{lxxiii} David Arnold “Introduction: Disease, medicine and empire,” in *Imperial medicine and indigenous societies* ed. David Arnold (Manchester: Manchester University Press 1988) 1-26.
- ^{lxxiv} Livingstone, “Tropical hermeneutics,” 93.
- ^{lxxv} David Arnold “‘Illusory Riches’: Representations of the Tropical World, 1840-1950,” *Singapore Journal of Tropical Geography* 21, no. 1 (2000): 6-18, 7.

^{lxxvi} Jennings, “The mysterious and intangible enemy”; Bell, “The pestilence that walketh in darkness”; Georgina H. Endfield and David J. Nash “‘Happy is the bride the rain falls on’: climate, health and ‘The Woman Question’ in nineteenth-century missionary documentation,” *Transactions of the Institute of British Geographers*, New Series 30, no.3 (2005): 368-386.

^{lxxvii} Bell, “The pestilence that walketh in darkness,” 328.

^{lxxviii} Thomas Homer-Dixon, *Environmental scarcity and violence* (Princeton: Princeton University Press, 1999); Norman Myers *Ultimate security: the environmental basis of political stability* (Washington: Island Press, 1994); Diamond, *Collapse*; critique by Jon Barnett “The prize of peace (is eternal vigilance): a cautionary editorial essay on climate geopolitics,” *Climatic Change* 96, no.1-2 (2009): 1-6.

^{lxxix} Karl. W Butzer, “Collapse, Environment and Society”. *Proceedings of the National Academy of Sciences* 109 no. 10 (2012): 3632-3639.

^{lxxx} For example Andrew J. Dugmore et al. “Cultural adaptation, compounding vulnerabilities and conjunctures in Norse Greenland”. *Proceedings of the National Academy of Sciences* 109 (2012): 3658–3663. and Nicholas P. Dunning et al. “Kax and kol: collapse and resilience in lowland Maya civilization”. *Proceedings of the National Academy of Sciences* 109 (2012): 3652–3657.

^{lxxxi} Hulme, *Why We Disagree About Climate Change*; David N. Livingstone “Reflections on the Cultural Spaces of Climate,” *Climatic Change* 113 (2012): 91-93; David N. Livingstone “Changing climate, human evolution and the revival of environmental determinism,” *Bulletin of the History of Medicine* (in press).